Dollars and Sense

Stay in the Black: Saving and Spending

LESSON 3

Jeff Potash and John Heinbokel

All 7 lessons, including simulations, of *Dollars and Sense* as well as the book with simulations on a CD are available from the Creative Learning Exchange.
www.clexchange.org
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Acton, Massachusetts
2011

DEDICATION

From Mitch Julis of the Julis Foundation

My enthusiastic support for this project is in loving memory of my father
Maurice Ralph Julis and in honor of my mother Thelma Rabinowitz Julis.

My parents were inspirational teachers throughout their careers
in New York with a strong interest in finance and economics. I am sure they
would have embraced this book with great enthusiasm.

Dollars and Sense

Additional copies of the book are available from:
The Creative Learning Exchange
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978-635-9797 in Acton, Massachusetts

Dollars and Sense

Stay in the Black: Saving and Spending

Nothing is constant except change
Heraclitus of Ephesus (c. 535–475 BCE)

he materials provided here use systems thinking and mathematical tools and exploratory computer simulations to challenge students and teachers to develop a realistic and personal understanding of the dynamics of the economic system in which we live. With their resulting knowledge and understanding, they should be better able to control their financial futures, minimize the chance for future pain, and maximize the chance for fostering a prosperous future.

Personal finance, at its core, involves relatively few working parts. However, managing our finances is hard, because change is ever present and none of those parts ever stay the same for long. With money flowing in and out, our funds grow or shrink at different rates, at different times, and for different reasons. Without observing, analyzing, and understanding the patterns of change in money accumulations over time and without recognizing the connections that exist between all the parts of the system, adults frequently pay a real and heavy price.

As teachers, we can help our students prepare to deal with that critical but ever-changing system of personal finance. The innovative tools of *systems thinking* and *dynamic simulations* presented in these materials offer young students (5th–7th grade) a unique opportunity to develop a better understanding of the mathematics of change; to learn constructively and collaboratively; and, over a lifetime, to successfully manage their personal finance. The activities in the seven lessons of this Module 1 utilize a series of computer simulations and their accompanying worksheets, which are designed to help young students explore how (and why) their personal finances change over time. As students explore the diverse set of financial situations, they will learn in four different ways.

- *Learn by doing (constructivism)*: asking open-ended "what if's" and using meaningful real-world examples.
- *Learn by building a conceptual foundation* that connects critically important mathematical tools (tables, graphs) and skills with a systems thinking conceptual framework that visually represents the dynamically changing financial systems (e.g., a personal savings account).
- *Learn by challenging preconceptions*, and using computer simulations to discover that there is more than one right answer or way to successfully manage one's finances.
- *Learn by sharing, comparing, collaborating, and applying lessons learned* to meaningful personal financial problems.

**The core message for success: Spend less than you earn!**

Sounds simple, but when money flows in and out in different amounts and at different times… it is not nearly so simple! Yet our experience shows that 5th to 7th graders, working with mathematical tables, graphs, and computer simulations, can (and do!) "get it"!!

How Is This Module Organized?

Module 1 (Personal Finance) focuses on "saving" and "spending." (Subsequent modules will deal with investment and credit.) As in each module, Module 1 is open-ended. It allows for and encourages students to create and share mathematical approaches, tables, and graphs in order to explain and discuss personal finance goals, plans, and choices with peers, teachers, or parents. These activities are supported by the worksheets provided here and by the simulations that are available on-line.

Module 1 includes seven lessons, each of which contains a computer simulation with at least one challenge. The lessons are organized into three sections, each section progressively building on the foundations of the earlier section(s).

The core systems thinking building blocks that guide student understanding of the structure of change also drive the computer models underlying the simulations.

MY ACCOUNT

Income
Flows In
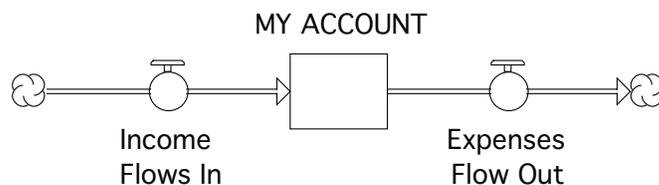
Expenses
Flow Out

- Money accumulates in MY ACCOUNT (we call that a "STOCK").

- An "inflow" into MY ACCOUNT—which can be wages, other deposits, or interest earned on the account—adds to that stock.

- An "outflow" from that stock—expenses—reduces or drains MY ACCOUNT.

Section 1: Introduction to Personal Saving and Spending

Section 1 provides an introduction to linear (constant) saving, linear spending, and simultaneous saving and spending. We STRONGLY RECOMMEND it as a prerequisite for subsequent lessons.

- **Lesson 1: Can I Manage My Money and My Music?**

Section 2: Extended Saving and Spending Illustrations

Section 2 moves the understanding of simultaneous inflows and outflows forward by guiding students in choosing their own personal financial goals, running a business, operating a public service, or helping a friend plan to purchase a car. We provide simulations of each of these four illustrative scenarios.

- **Lesson 2: Can I Reach a Personal Saving and Spending Goal?**
- **Lesson 3: Can I Make Money with a Lemonade Stand?**
- **Lesson 4: Can I Successfully Run the Local Food Bank?**
- **Lesson 5: Can I Help a Responsible Teen Buy a Car?**

Section 3: Growing Savings through Interest and Compounding

In Section 3, the lessons move into compounding growth (rather than linear growth) to explore the role of interest on savings. We provide an introduction to compound interest and then a more ambitious illustration of long-term planning that brings together earning, spending, and saving with compounded interest.

- **Lesson 6: How Does Interest Grow My Savings?**
- **Lesson 7: Can Compounding Interest Make Me a Millionaire?**

Each individual lesson offers the following:

1. An open-ended and meaningful question or problem for the students to explore or solve.

2. Support for that learning through a set of System Dynamics conceptual and simulation tools to help students structure, improve, and communicate their understanding of these issues and processes.

3. Encouragement to expand that understanding by identifying and exploring "better questions" and other contexts in which those dynamics also apply.

4. The challenge and the tools with which to address problems of students' own creation.

5. Opportunities to share and communicate what they have learned with peers, teachers, and parents.

Frequently Asked Questions

Will this be fun as well as educational?

Students love this approach. It is fun to play hands-on games and learn through experience. Students can work in teams, share ideas, talk with and listen to each other, not just respond to the teacher. Often something surprising happens and discovering the reason is eye-opening.

When students are active, cooperating, and solving their own problems, their level of engage-

ment is high and the learning sticks with them. In addition, students who have struggled with more typical academic tasks often have a new opportunity to "show what they know" using new learning tools.

Will this be complicated for me to teach?

Teachers are provided with concise supporting materials that include an overview and context for the student activities. Each lesson begins with a brief summary so that teachers can see what is covered. Background information is succinct and procedures are laid out step by step. Student worksheets are at the end of each lesson, ready to photocopy.

Can my students actually do these lessons?

Although the activities in this book have been written with a focus on 5th–7th grade capabilities, they may be used with a wide range of student ages. Lesson 1 was designed to serve as a foundation for later lessons (2–6); those later lessons can be pursued in whatever way best suits the needs and interests of the teacher. Lesson 7 assumes the knowledge and understanding developed in Lesson 6.

What benefits do the students get from these lessons?

- *Students acquire new learning tools and work independently and together to apply them. Each individual lesson fosters constructivist learning.*
- *Teamwork gives rise to better thinking through dialogue, motivation to tackle tougher problems together, mutual respect, and fun.*
- *All the lessons are structured to build cooperative learning.*
- *Finally, each lesson is designed to provide practical opportunities for students to experience by doing, by making different choices, and by comparing and evaluating relative outcomes.*

How do these activities interact with recognized 5th–7th grade content and standards?
(See also "Meeting Standards" table below.)

The challenges presented in these activities take on big ideas that are central to the 5th–7th grade curriculum and that are transferable to other topics.

1. Module 1 lessons align with the National Council of Teachers of Mathematics (NCTM) Content AND Process Standards.

- *Content standards include skills for Number and Operations, Algebra, and Data Analysis and Probability.*
- *Process Standards apply to all areas (Problem Solving, Reasoning and Proof, Communication, Connections, and Representation).*

2. The lessons also address several of the Economics Standards advocated by the Council on Economic Education (CEE), including concepts involving opportunity costs; incentives; supply; demand; and price, interest, and earnings.

3. Finally, the lessons support the National Science Teachers Association (NSTA) standards related to the following:

- *Systems, order, and organization;*
- *Evidence, modes, and explanation; and*
- *Change, constancy, and measurement.*

Curriculum Connections

The tool-sets and mind-sets developed here have application far beyond *just* an understanding of personal finance. As students use graphs to understand how money accumulations (STOCKS) change over time, they also find that similar patterns of behavior arise in other places in the real world. And their practical application of the systems thinking tools taught here to represent change can be applied to a wide variety of "systems," ranging from populations (of people, animals, plants, etc.) to resources and even to emotions about people and events. All of these systems in the real world are subject to factors that increase and decrease the overall STOCK in variable ways.

Meeting Standards

The simulations and worksheets that are part of each lesson are designed to use personal finance challenges to address age-appropriate CONTENT and PROCESS standards in Mathematics, as well as emerging national standards in Economics, the NSTA standards identified above, and the transferable tool- and mind-sets of System Dynamics that support wide-ranging critical thinking and collaborative skills. The following table provides a more detailed breakdown of how Module 1 relates to these standards.

Dollars and Sense	
• Hands-on Activities	• Accommodation to different ability levels
• Teamwork	• Sophisticated content
• Reflection	• High-level critical thinking
• Dialogue among students	• Agreement with goals of national standards
• Constructivism and inquiry	• Simple preparation and easy directions

N O T E S

1   The Waters Foundation uses these questions in its teacher training workshops—a good way to maintain focus on the central purpose of system dynamics in education. Students delve beyond surface events to question their causes and broader implications.

2   Gayle Richardson framed these questions as a way to help students understand and graph change. For more information, see "Getting Started with Behavior Over Time Graphs: Four Curriculum Examples," 1998, available from the Creative Learning Exchange at www.clexchange.org.

Lesson	Math Standards (NCTM)	Economics Standards (CEE)	System Dynamics Objectives (CLE)
Lesson 1: **Can I Manage My Money and My Music?** Saving for a GOAL (an mp3 player and tunes), and spending "wisely" to make that savings last. *Lesson 2:* **Can I Reach a Personal Saving and Spending Goal?** Pursuing saving and spending PLANS to reach a personal goal. *Lesson 3:* **Can I Make Money with a Lemonade Stand?** Running a business, with income, expenditures, and profit. *Lesson 4:* **Can I Successfully Run the Local Food Bank?** A non-profit maximizing the "good" it does (rather than profits!) while needing to be sustainable. *Lesson 5:* **Can I Help a Responsible Teen Buy a Car?** Role of "trade-offs" (short-term vs. long-term gratification, sacrificing free time for work) to pursue a "big" financial goal. *Lesson 6:* **How Does Interest Grow My Savings?** Introducing the "miracle" of compound interest and its power for generating long-term savings. *Lesson 7:* **Can Compounding Interest Make Me a Millionaire?** Putting all of the pieces together—saving, spending, and earning interest—to see if an "average" person can become a millionaire!	**CONTENT STANDARDS** **Number and Operations** • Understand meanings of operations and how they relate to one another. **Algebra** (includes some Grade 6–8 standards) • Understand patterns, relations, and functions. • Use mathematical models to represent and understand quantitative relationships. • Analyze change in various contexts. **Data Analysis and Probability** • Formulate questions that can be addressed with data; collect, organize, and display relevant data to answer questions. • Develop and evaluate inferences and predictions that are based on data. **PROCESS STANDARDS** **Problem Solving**: Build new mathematical knowledge; apply/adapt a variety of strategies to solve problems; reflect on process. **Reasoning and Proof**: Make/ investigate mathematical conjectures; develop/evaluate mathematical arguments; use various types of reasoning and methods of proof. **Communication**: Organize and consolidate thinking; communicate coherently and clearly to peers, teachers, and others; analyze and evaluate thinking/strategies of others. **Connections**: Recognize and use connections among mathematical ideas; recognize and apply mathematics in contexts outside of mathematics. **Representation**: Create/use representations to organize, record, and communicate mathematical ideas and to model and interpret physical, social, and mathematical phenomena.	**Standard 1**: Students will identify what they gain and what they give up when they make choices. **Standard 2**: Students will make effective decisions as consumers, producers, savers, investors, and citizens. **Standard 3**: Students will evaluate methods of allocating goods and services, by comparing the benefits and costs of each method. **Standard 4**: Students will identify incentives that affect people's behavior and explain how incentives affect their own behavior. **Standard 8**: Students will predict how prices change when the number of buyers or sellers in a market changes. **Standard 12**: Students will explain situations in which they pay or receive interest. **Standard 13**: Students will predict future earnings.	1. Systems are dynamic, meaning that they are characterized by change over time (familiarity with Behavior-over-Time Graphs). 2. Dynamics in systems are a result of the interaction of stocks and flows (ability to create a simple one-stock stock/flow diagram). 3. Altering inflows and outflows can create many patterns of change in stocks (understanding different graph patterns and the underlying data and dynamics to which they are linked). 4. Inflows and/or outflows are controlled in many ways to achieve a desired size of stock (ability to manipulate a simple one-stock model to achieve desired outcomes). 5. Reinforcing feedback loops (e.g., compound interest) are powerful and often non-intuitive in their effects (familiarity with the concept of reinforcing feedback and how it influences stocks and flows).

Can I Make Money with a Lemonade Stand?

N O T E The material developed in Lesson 1 is strongly recommended to familiarize students with the basic concepts that are used and further ex-panded in this lesson.

Instructions for Teachers

Student Challenge:

Use a computer simulation to explore the real-world challenges of running a business (a virtual lemonade stand), with the GOAL of maximizing total profit (income minus expenses). Students make important choices (how much lemonade to make and what price to charge per cup) and learn about basic economic principles (price affects sales, purchase volume lowers unit expenses), and how they affect business income, expenses, and profits. In addition, students are encouraged to reflect upon balancing the amount of time spent working (making and selling) and total profits earned.

At the Lesson's End:

- Students will have completed a structured exploration of how Income and Expenses combine to control their ability to achieve a simple business financial GOAL.

- Students will have designed and tested a variety of PLANS for achieving that GOAL.

- Students will have used tables, graphs, and systems thinking concepts to share their results with classmates (and parents!) by doing the following:

  - Comparing successful (and unsuccessful!) PLANS, and

  - Exploring the underlying "values" they brought to this challenge.

(See the following Instructions and the Worksheets for more details.)

Overview

M A T E R I A L S

- Computer Simulation (available on-line at http://clexchange.org/curriculum/dollarsandsense/lesson3.asp).

- Two worksheets (use as needed) to record plans and results.

In Lesson 3 students use a computer simulation to explore the real-world challenges of running a business—in this case, a lemonade stand on a busy street corner on a warm summer's day. Building on the background of Lesson 1, where we introduced the idea of personal savings being controlled by contributions to saving and reductions of spending, students will operate a virtual lemonade stand for five days. Their challenge is to maximize their total profit (income minus expenses). In making and exploring the impact of important choices (how much lemonade to make and what price to charge per cup), they learn about basic economic principles (price affects sales, purchase volume lowers unit expenses), and how these principles affect business income, expenses, and profits.

The simulation's Control Panel, reproduced below, illustrates how choices influence income and expenses and the ultimate profit that results. Line 1 is from a simulation in which 2 batches of lemonade were made each day, with a price per cup set at $0.75. Line 2 is from a simulation where 3 batches were made and the price per cup set at $0.65.

Can I Make Money with a Lemonade Stand?

NAME:

Total Cups Sold: 935
Total Cups Discarded: 190

Final
MY ACCOUNT ($)
283.75
81.00

INITIAL COST OF INGREDIENTS ($)

TOTAL PROFIT ($)
202.75
40.55
Daily Profit ($)

TOTAL INCOME ($)
607.75
405.00
TOTAL EXPENSES ($)

Make your Business PLAN.

How Many Batches Will I Make Each Day (75 cups per batch)?

1 [slider] 4
U 3

How Much Will I Charge per Cup ($0.50–$1.50)?

0.50 [slider] 1.50
U 0.65

Now Run the simulation.

MY ACCOUNT: 1 - 2 -

[Graph: Dollars in Account (y-axis) vs Days (x-axis), with lines labeled 1 and 2. Y-axis values 50, 200, 350. X-axis values 0.00, 1.00, 2.00, 3.00, 4.00, 5.00]

Page 1

My Account

Run | Print | Reset Sliders | Clear Graph & Table | Exit | Back | Main Intro | For more information on what is happening, click "Table." | Table

Managing a business is similar to managing your personal finances. Your business has a STOCK of money called MY ACCOUNT. Each day that your lemonade stand operates, two things happen: (1) money flows into MY ACCOUNT in the form of Daily Income (based on sales); and (2) money flows out of MY ACCOUNT in the form of Daily Expenses (based on supply costs).

Where Income and Expenses are both happening at the same time, maximizing one's profits depends on finding ways of boosting Income and/or reducing Expenses.

Daily Income → MY ACCOUNT → Daily Expenses

Lesson Structure

1. Understanding the Lemonade Business

Working on paper to develop a conceptual understanding of the system

Running a business requires an understanding of how the system works. In Worksheet A, students are introduced to the basic concepts needed to operate this business profitably.

Students are provided with a map that introduces the basic concept of how the Flows of Daily Income and Daily Expenses control how their LEMONADE STAND ACCOUNT changes over time, and the four key factors that affect those Flows. Here, students learn that Income is defined by the price they set per cup and the total number of cups they sell. Expenses are defined by the cost of each "batch" they make (cost of all the raw materials—lemons, sugar, cups, ice, etc.) and the number of batches they make. Two of these (price and batches made) are fully under the control of the students.
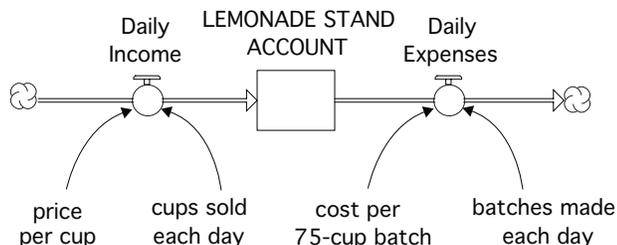
Two conceptually challenging real-world factors (Cost per Batch; Cups That Could Be Sold), not fully under the students' control are then graphically presented. Students are then required to interpret two different types of Graphs (a bar Graph for Cost per Batch, and a line Graph for Cups That Could Be Sold).

A. EXPENSES. The more batches of lemonade you make daily, the cheaper will be the ingredients for each batch. (Good questions to ask the students might be "Do you think this is a reasonable assumption?" "Why?")
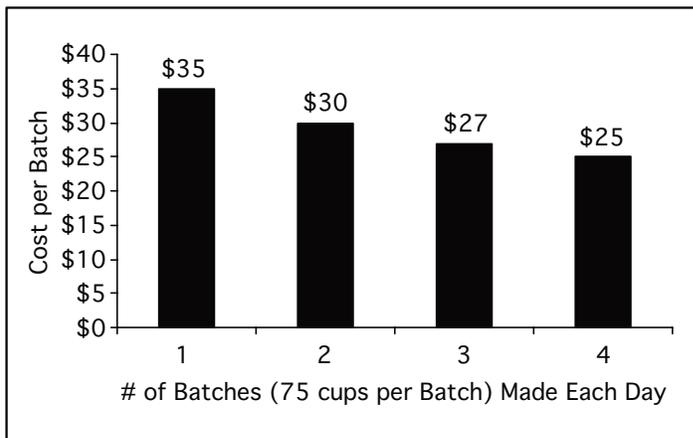
How much will it cost to make the following?

Per Batch		Total Cost
1 Batch	*$35*	*$35*
2 Batches	*$30*	*$60*
3 Batches	*$27*	*$81*
4 Batches	*$25*	*$100*

B. INCOME. The number of cups you can sell depends on the price you charge. (Good questions to ask the students might be "Do you think this is a reasonable assumption?" "Why?")
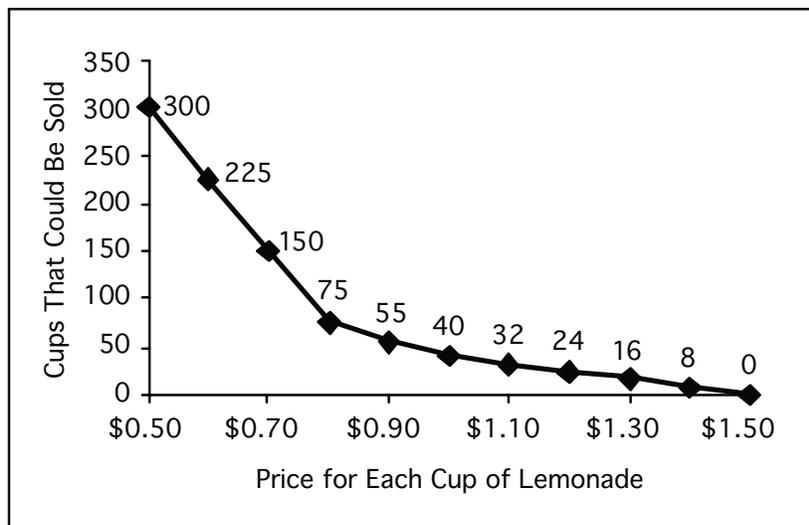
How many cups could you sell, if you charged the following per cup?

Price per Cup	Cups Sold
$0.50	**_300_**
$0.70	**_150_**
$0.90	**_55_**
$1.10	**_32_**
$1.30	**_16_**
$1.50	**_0_**

This Graph illustrates a general principle and has been tailored to the conditions defined in the Overview. The number of cups that could be sold at a given price could vary depending on location, on the weather, on the number of advertising flyers posted, etc. The simulation is not crafted to demonstrate those variations, but they could be a fruitful topic of discussion with the students.

Students are also asked to consider an additional variable: "time." For purposes of simplicity, students are instructed that each batch of lemonade requires 2 hours of work to make and sell. Thus, the more batches produced, the longer one works. This variable offers students an opportunity to reflect on trade-offs involving time and profit: more batches may yield more money (total profit), but less "profit per hour worked."

2. Making PLANS and Observing Outcomes

Students now have the conceptual foundation with which to make and test different PLANS.

A. Each student group begins by making two decisions.

- How much will you charge per cup? (any amount between $0.50 and $1.50 per cup)
- How many batches will you make each day? (75 cups per batch; 1 to 4 batches per day)

See lines 1 and 3 in the illustration Table on the following page.

B. Students then use the simulation to see how well their PLAN performs and they record their results. (Illustrative choices are presented below. The same Table is provided as a blank to be filled in as part of Worksheet B.)

	PLAN 1	PLAN 2	PLAN 3	PLAN 4
Price Per Cup ($0.50–$1.50)	$0.50	$0.75	$0.75	$1.25
Cups Sold [each day] (from the simulation Table)	75	75	112	20
Batches Made Each Day (1–4)	1	1	2	1
Cost per Batch	$35.00	$35.00	$30.00	$35.00
MY ACCOUNT (after 5 days)	$47.50	$141.25	$180.00	$25.00 after 1st day no money left to buy materials
TOTAL PROFIT (MY ACCOUNT minus Cost of 1st Day's Ingredients)	$12.50	$106.25	$120.00	-$10.00 (a loss!)
Profit per Hour Worked (simulation Table)	$1.25	$10.63	$6.00	-$5.00 (a loss!)

3. Using Tables and Graphs

As in the previous lessons, students use Graphs and Tables to describe and communicate the patterns of change that they observe over time in their accounts. Tables and Graphs can be printed from the simulation or can be created by the students themselves. Each has distinct strengths that the students should recognize and be prepared to discuss.

- The Behavior-over-Time Graph is designed to record multiple PLANS by focusing only on the changing amount of money in MY ACCOUNT each month. (Four PLANS from the filled Table above are illustrated here.)
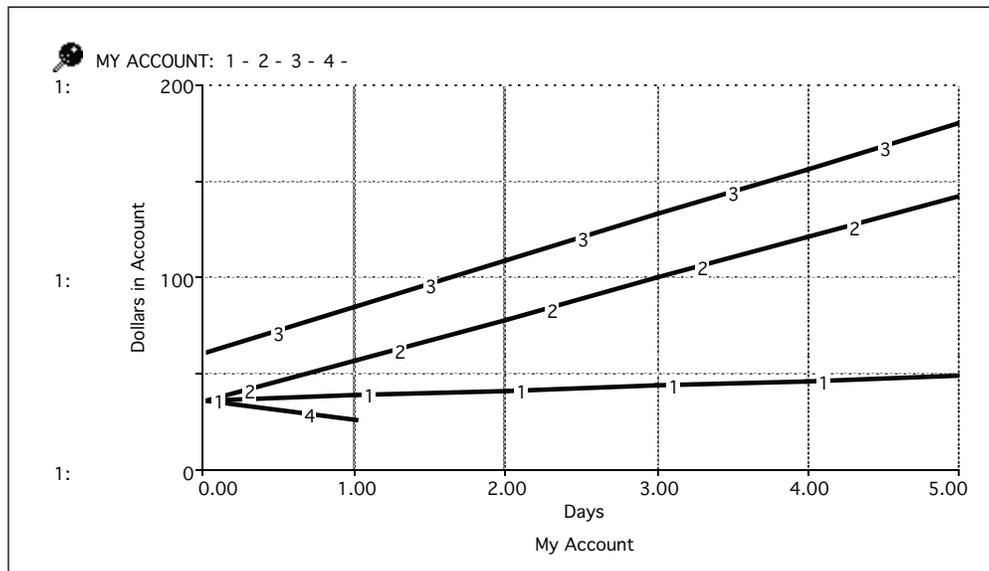
- The Table below illustrates PLAN 2 from the two figures above. The Table records the starting balance of money in MY ACCOUNT each day, Daily Expenses (flowing out of MY ACCOUNT), and Daily Income (flowing into MY ACCOUNT). These Flows define the starting balance of money in MY ACCOUNT on the next day. In addition, the Table records the Lemonade Stand's Daily Profit and both the daily number of cups sold (depending on price, as defined by the bar graph in Section 1) and the daily number unsold (all those made but not sold).

Days	MY ACCOUNT	Daily Expenses	Daily Income	Daily Profit	Cups Sold	Cups Discarded
0	$35.00	$35.00	$56.25	$21.25	75	0
1	$56.25	$35.00	$56.25	$21.25	75	0
2	$77.50	$35.00	$56.25	$21.25	75	0
3	$98.75	$35.00	$56.25	$21.25	75	0
4	$120.00	$35.00	$56.25	$21.25	75	0
Final	$141.25					

4. Putting the Pieces Together

Students now ANALYZE and DESCRIBE what happened and why. Three steps are involved:

1. Using their Graph(s) to compare and evaluate the effectiveness of different options for maximizing profit;
2. Using their Table(s) to explore the details of Income and Expense that generate that profit; and
3. Working with and communicating with each other, to compare the pros and cons of different strategies and to recognize how the pieces of the system work together to produce profits.

Worksheet B is designed to pull these pieces together for the students. In addition to the Table above, Worksheet B challenges the students to be precise in understanding and describing how income and expense are generated. The following illustrates what is requested on Worksheet B, using PLAN #3 from the above Table.

Your students' answers for their best PLANS for Daily Income and Expenses might look like this.

Fill in the blanks below.

Daily Income

Describe below, in words, how you calculate Daily Income.

_____ x _____ = _____
  price per cup   *cups sold each day*   *Daily Income*

Calculate Daily Income below using the numbers from your Best PLAN:

$0.75 x 112 = $84.00

Daily Expenses

Describe below, in words, how you calculate Daily Expenses.

_____ x _____ = _____
  cost per 75 cup batch   *batches*   *Daily Expenses*

Calculate Daily Expenses below using the numbers from your Best PLAN:

$30.00 x 2 = $60.00

Where and When Will Students Need Guidance?

1. While this simulation is designed to help students learn by asking better questions, it is critically important that they understand the core economic concepts that underlie how the simulation works. Their business is not a "black box." To appreciate how it generates certain results (how, for instance, high prices lead to low sales), they need to be comfortable with the Basics.

   – Help them **see** how price affects sales. (Would I be more likely to buy a small candy bar for $1 or $2?)

   – Help them understand the important concept of economies of scale (compare price per ounce of big boxes of cereal versus smaller ones).

2. Interpreting Graphs: We have consciously used two types of Graphs (bar and line) here and have asked students to interpret both. They may not be familiar with both of these graphing styles and may need instruction.

3. Understanding WHYs: Here, it may be appropriate to slow students down, and ask them initially to focus ONLY on their Income strategies or ONLY on their Expenditures. What is the maximum profit possible when making 1 batch? Students could test and evaluate multiple pricing schemes. They could then take that ideal price and see what happens by increasing batches to 2, then 3, then 4. What does this tell them? The worksheets provide teachers with a means to follow and evaluate student progress or problems with each of the financial elements and their combination into an overall PLAN.

4. Computer games focus all too often on "Winning." And while there is a particular set of decisions that will maximize profit, we want students to appreciate that there are different levels of "success." One can, for instance, make a profit without working all day as you must when making 3 or 4 batches. We provide a calculation of 'profit per hour' to help students see that, while profits from multiple batches may be higher, those higher profits come with diminishing returns as the students need to work for more hours than they may prefer. Comparing PLANS allows students to recognize a range of options that may have particular virtues beyond the particular GOAL of 'highest profit.'

Bringing the Lesson Home

What is the important student-learning from this simulation?
- *Interpreting Graphs: Students are challenged to work with bar and line Graphs (showing relationships between two variables, e.g., cost per batch and number of batches made, or price per cup and number of cups sold) as well as another kind of line Graph, the Behavior-over-Time Graphs produced by the simulation. Recognizing how to work with each Graph, and recognizing the value of different Graphs, comprises an important element of learning here.*
- *Understanding and appreciating the importance of math in running a business; being successful exploring different strategies or PLANS; and understanding the utility of Graphs and Tables.*
- *Gaining the means and opportunity to apply learning beyond this particular illustration: Though the simulation does have two "best" answers (there is one particular strategy which yields the greatest total profit here, another that generates greatest profit per hour worked), it is equally important that the student recognize the limits of this simulation by framing "better questions"; e.g., What if there's competition? Hot, or cool and rainy weather? Franchising? Learning may be most powerful when students think outside the box.*
- *Learning about opportunities to create their own business problem. Seeing and applying what they have learned to a personal scenario is, of course, the most meaningful of all options.*

Extending the Learning

We touched on some possible areas for exploration and discussion above.

What is the relationship of price per cup and amount of lemonade that can be sold?
How might that Graph (and your business PLAN) change during a hot spell? During a cool, drizzly period?

What sort of profit per batch (or per unit of time) do the various strategies produce?

The maximum business profit requires making and selling 3 batches (225 cups) of lemonade each day. If you assume that making and selling three batches will take three times as long as a single batch, could a $30 profit for 2 hours of work be better than a $50 profit for 6 hours?

Is there a way to combine the benefit of buying in quantity with the relatively higher profits per hour for smaller quantities?

Could you recruit some additional friends to set up separate stands a couple blocks apart and share the savings for buying 3 batches of ingredients each day?

We want students to appreciate that there are different levels of "success."

Name_____

Can I Make Money With a Lemonade Stand?
Understanding Your Business

You and your best friend decide to open a lemonade stand in your neighborhood and run it for 5 days. Your GOAL is to make as much PROFIT as you can in those 5 days. Sounds simple, but…The computer simulation will help you explore options.

You will need to make two DECISIONS.
- How many batches (75 cups per batch) will you make each day? Bear in mind the following.
    - Unsold lemonade will be thrown away at the end of each day.
    - The more batches you make, the longer it will take to sell them.
- How much will you charge per cup of lemonade (price per cup)?

1. In the "real world," how do you make a PROFIT?
Recognize that money will be moving in and out of your account each day. Your PROFIT is the difference between how much comes in (Income) and how much goes out (Expenses). PROFIT = Income – Expenses.

Your Daily Income and Daily Expenses are affected by four factors.

A. Two decisions you make:

Factor 1: the price you set per cup; and

Factor 2: the number of batches you make each day.

<u>AND</u>

B. Two additional factors that depend on those first decisions:

Factor 3: the cost per batch (enough ingredients to make 75 cups); and
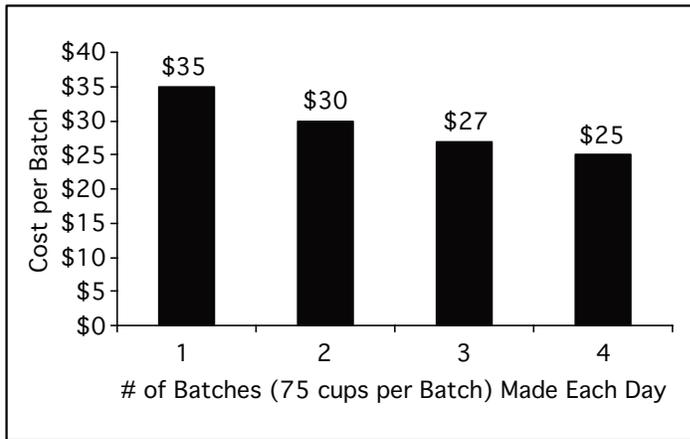
Factor 4: the number of cups sold each day.

In the figure at right, draw lines connecting the Daily Income and the two factors that control it. Connect to the Daily Expenses the two factors that control them.
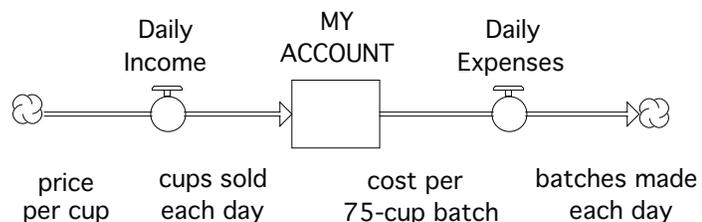
Name_____

Examine the Graphs below to understand how Factors #3 and #4 work.

Factor #3: Cost per Batch: The more batches of lemonade you make each day, the cheaper will be the ingredients for each batch, because you are buying more.

How much will it cost to make lemonade?

	Cost Per Batch	*Total Cost*
1 Batch	_____	_____
2 Batches	_____	_____
3 Batches	_____	_____
4 Batches	_____	_____

Factor #4: Cups Sold Each Day: The number of cups you sell depends on the price you charge.
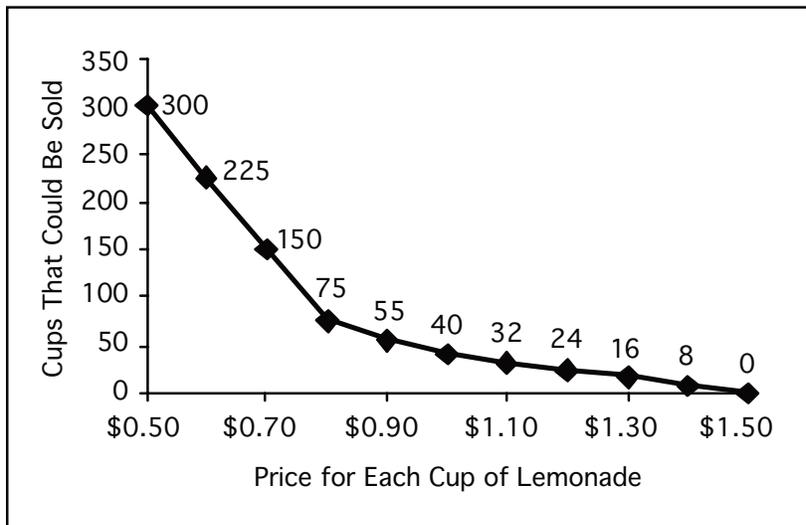
How many cups will you sell, if you charge the following price per cup?

Price Per Cup	*Cups Sold*
$0.50	_____
$0.70	_____
$0.90	_____
$1.10	_____
$1.30	_____
$1.50	_____

Name_____

Can I Make Money With a Lemonade Stand?
Using the Simulation

1. It is time now to make and test a PLAN. You will need to decide the following.
- How much will you charge per cup? (any amount between $0.50 and $1.50 per cup)
- How many batches will you make each day? (75 cups per batch; 1–4 batches per day)

Then, do the following.
- Record those choices in the Table below (lines 1 and 3, **in bold**).
- Enter those decisions into the simulation.
- Run the simulation to see how you did.
- Fill in the rest of the Table with your results from the simulation.

Experiment with different PLANS, repeating the above for each PLAN.

And don't forget, your GOAL is to make as much PROFIT as possible.

	PLAN 1	PLAN 2	PLAN 3	PLAN 4
Price Per Cup ($0.50–$1.50)				
Cups Sold [each day] (from the simulation Table)				
Batches Made Each Day (1–4)				
Cost per Batch				
MY ACCOUNT (after 5 days)				
TOTAL PROFIT (MY ACCOUNT minus Cost of 1st Day's Ingredients)				
Profit per Hour Worked (simulation Table)				

Circle the number of the PLAN in which you made the greatest profit (your BEST PLAN).

2. Use the figure below to help calculate your BEST PLAN's Daily Income and Daily Expenses.
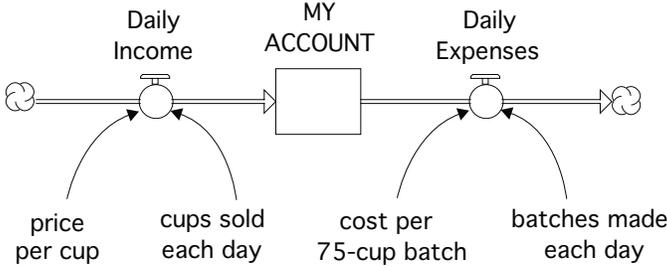
Fill in the blanks below.

Daily Income:
Describe below, in words, how you calculate Daily Income.
_____ x _____ = _____

　　Calculate Daily Income below using the numbers from your BEST PLAN.
　　_____ x _____ = _____

Daily Expenses:
Describe below, in words, how you calculate Daily Expenses.
_____ x _____ = _____

　　Calculate Daily Expenses below using the numbers from your BEST PLAN.
　　_____ x _____ = _____

How does this information explain why you made the greatest PROFIT with a particular set of decisions (price per cup and number of batches made)? _____
_____

You can calculate your PROFIT per hour worked (daily profit divided by hours worked per day). When you think about PROFIT that way, do any of your PLANS look better? Why?

_____

_____

Do you think this is how other businesses work? WHY or WHY NOT? _____
_____

_____

About Us

The Creative Learning Exchange

The Creative Learning Exchange (CLE) is a non-profit organization in Acton, Massachusetts dedicated to promoting learner-centered learning and system dynamics in K-12 education. The CLE disseminates classroom curricular materials developed by teachers, publishes a quarterly newsletter, hosts a biennial conference for educators and interested citizens, maintains a listserve, and provides system dynamics training materials and programs for educators. Information is available at *www.clexchange.org.*

System Dynamics

System dynamics is a field of study and a perspective for understanding change. Using computer simulation and other tools, system dynamics looks at how the feedback structure of systems causes the change we observe all around us. System dynamics was developed fifty years ago by Professor Jay W. Forrester at MIT and is used to address problems in areas ranging from ecology, to business management, economics, and psychology. Under Forrester's guidance, system dynamics is helping teachers make K-12 education more learner-centered, engaging, challenging and relevant to our rapidly changing world.

CLE Curriculum Series

This series of books, *Dollars and Sense, The Shape of Change* and *The Shape of Change: Stocks and Flows,* introduces students and their teachers to some of the basic ideas of system dynamics and systems thinking as a way to observe and understand change.

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These books:
Dollars and Sense
The Shape of Change and
The Shape of Change: Stocks and Flows

can be purchased from the Creative Learning Exchange at:

www.clexchange.org

978-635-9797

milleras@clexchange.org

These and other lessons can be downloaded in PDF format free of charge from the CLE website.

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Lesson Title:
Dollars and Sense, Lesson 3: Can I Make Money with a Lemonade Stand?

Overview:
The simulations in *Dollars and Sense* introduce 5th – 7th grade students to the terminology and basic structures of saving and spending using stocks and flows as well as graphs. Students become aware of the tradeoffs whereby present decisions to save or spend money can affect future financial goals.

Related Characteristic(s) of Complex Systems:
Conflicts arise between short-term and long-term goals.

Ideas and Examples for Connecting to the Characteristic:
Lesson 3 of the *Dollars and Sense* series teaches about profit and loss through running a virtual lemonade stand. While the characteristic describes "goals" as a point of conflict between short and long timeframes, another way to approach this characteristic is to talk about "tradeoffs" between now and some future point in time. One such tradeoff that students face when running the lemonade stand concerns how much lemonade to make each day (the short term). Making too little lemonade each day means they might sell out quickly. Having too much available reduces profits because unsold lemonade is discarded at the end of each day. The total profit for running the lemonade stand for five days (in this case, the long term) is affected by such daily decisions.

Some additional questions to discuss with students are:

1. What happens if the lemonade stand doesn't make a profit? How might real businesses face similar challenges in maintaining profit over time?
   - The simulation stops if the lemonade stand is unprofitable; real businesses may be able to get a loan. Loans can add pressure – in the short term they'd get to stay open, but then they'd have to pay back the loan <u>and</u> cover expenses for supplies.
2. If you were running the lemonade stand to earn money to buy yourself something (a long-term goal) how would that affect how you run the lemonade stand?
   - Profits would have to be high enough to cover "bad days" but also allow for saving for the item. How does that create more short-term pressure to make and sell more lemonade?
3. If your interest was to keep the business running all summer instead of only five days, how could you ensure sustainability in the long run? Would you be able to spend the profits in the short term, or would you need to save some (or all) of them?

Resource(s)
Dollars and Sense by Jeff Potash

"Entrepreneur" video from National Geographic Kids
http://video.nationalgeographic.com/video/kids/cartoons-tv-movies-kids/cha-ching-kids/cha-ching-03-entrepreneur-kids/