

# Dollars and Sense

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## Stay in the Black: Saving and Spending

### LESSON 4

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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.

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## **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)

The 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!**

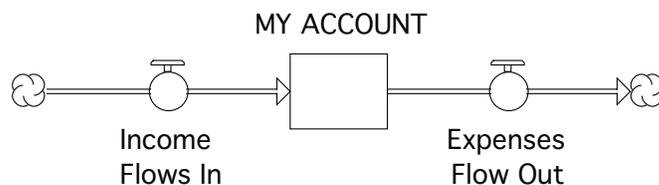
Sounds simple, but when money flows in and out in different amounts and at different times... it is not nearly so simple! Yet our experience shows that 5th to 7th graders, working with mathematical tables, graphs, and computer simulations, can (and do!) “get it”!!

## 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.



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

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#### NOTES

- 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](http://www.clexchange.org).

Lesson	Math Standards (NCTM)	Economics Standards (CEE)	System Dynamics Objectives (CLE)
<p><b>Lesson 1: Can I Manage My Money and My Music?</b> Saving for a GOAL (an mp3 player and tunes), and spending “wisely” to make that savings last.</p> <p><b>Lesson 2: Can I Reach a Personal Saving and Spending Goal?</b> Pursuing saving and spending PLANS to reach a personal goal.</p> <p><b>Lesson 3: Can I Make Money with a Lemonade Stand?</b> Running a business, with income, expenditures, and profit.</p> <p><b>Lesson 4: Can I Successfully Run the Local Food Bank?</b> A non-profit maximizing the “good” it does (rather than profits!) while needing to be sustainable.</p> <p><b>Lesson 5: Can I Help a Responsible Teen Buy a Car?</b> Role of “trade-offs” (short-term vs. long-term gratification, sacrificing free time for work) to pursue a “big” financial goal.</p> <p><b>Lesson 6: How Does Interest Grow My Savings?</b> Introducing the “miracle” of compound interest and its power for generating long-term savings.</p> <p><b>Lesson 7: Can Compounding Interest Make Me a Millionaire?</b> Putting all of the pieces together—saving, spending, and earning interest—to see if an “average” person can become a millionaire!</p>	<p><b>CONTENT STANDARDS</b> <b>Number and Operations</b></p> <ul style="list-style-type: none"> <li>Understand meanings of operations and how they relate to one another.</li> </ul> <p><b>Algebra</b> (includes some Grade 6–8 standards)</p> <ul style="list-style-type: none"> <li>Understand patterns, relations, and functions.</li> <li>Use mathematical models to represent and understand quantitative relationships.</li> <li>Analyze change in various contexts.</li> </ul> <p><b>Data Analysis and Probability</b></p> <ul style="list-style-type: none"> <li>Formulate questions that can be addressed with data; collect, organize, and display relevant data to answer questions.</li> <li>Develop and evaluate inferences and predictions that are based on data.</li> </ul> <p><b>PROCESS STANDARDS</b> <b>Problem Solving:</b> Build new mathematical knowledge; apply/adapt a variety of strategies to solve problems; reflect on process.</p> <p><b>Reasoning and Proof:</b> Make/ investigate mathematical conjectures; develop/evaluate mathematical arguments; use various types of reasoning and methods of proof.</p> <p><b>Communication:</b> Organize and consolidate thinking; communicate coherently and clearly to peers, teachers, and others; analyze and evaluate thinking/strategies of others.</p> <p><b>Connections:</b> Recognize and use connections among mathematical ideas; recognize and apply mathematics in contexts outside of mathematics.</p> <p><b>Representation:</b> Create/use representations to organize, record, and communicate mathematical ideas and to model and interpret physical, social, and mathematical phenomena.</p>	<p><b>Standard 1:</b> Students will identify what they gain and what they give up when they make choices.</p> <p><b>Standard 2:</b> Students will make effective decisions as consumers, producers, savers, investors, and citizens.</p> <p><b>Standard 3:</b> Students will evaluate methods of allocating goods and services, by comparing the benefits and costs of each method.</p> <p><b>Standard 4:</b> Students will identify incentives that affect people’s behavior and explain how incentives affect their own behavior.</p> <p><b>Standard 8:</b> Students will predict how prices change when the number of buyers or sellers in a market changes.</p> <p><b>Standard 12:</b> Students will explain situations in which they pay or receive interest.</p> <p><b>Standard 13:</b> Students will predict future earnings.</p>	<ol style="list-style-type: none"> <li>Systems are dynamic, meaning that they are characterized by change over time (familiarity with Behavior-over-Time Graphs).</li> <li>Dynamics in systems are a result of the interaction of stocks and flows (ability to create a simple one-stock stock/flow diagram).</li> <li>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).</li> <li>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).</li> <li>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).</li> </ol>

# Can I Successfully Run the Local Food Bank?

**NOTE** — 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 options for “successfully” running a local Food Bank for 10 weeks. “Success” involves balancing weekly food donations with weekly demands for food while trying to maximize the “good” the food donations can do (defined in terms of the number of families being assisted and the amount of food distributed to each family). In learning the basics of how non-profit organizations such as Food Banks operate, students learn to think about different strategies for sustaining these efforts.

### At the Lesson’s End:

- Students will have completed a structured exploration of managing the financial health of a Food Bank by learning to balance food donations (the inflow of food) with food assistance (the outflow of food) to those in need.
- Students will have designed and tested a variety of PLANS for achieving dual objectives of sustaining the Food Bank and maximizing the good it does for the community.
- 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 Worksheet for more details.)

## Overview

In Lesson 4 students use a computer simulation to explore options for managing a non-profit organization. As in the case of a personal account, managing a non-profit Food Bank involves balancing inflows and outflows, but the Flows consist of food (Donation and Distribution) rather than money (Saving and Spending). A second and perhaps more significant difference exists between managing a non-profit (such as a Food Bank) and managing personal finances. In personal finance, the GOAL is to maximize inflow to the STOCK (MY ACCOUNT). In a non-profit Food Bank, the GOAL is to maximize (sustainably!) the outflow (Food Distributed Weekly) from

## MATERIALS

- Computer Simulation (available on-line at <http://clexchange.org/curriculum/dollarsandsense/lesson4.asp>).
- Worksheet to record plans and results.

the STOCK (TOTAL FOOD IN FOOD BANK) to maximize the good the Food Bank can do. The opportunity for students to use this lesson to explore this real-world challenge adds powerful hands-on learning in the following ways:

- Recognizing and challenging preconceptions;
- Explicitly identifying choices; and
- Evaluating outcomes.

The simulation's Control Panel, reproduced below, provides an illustration of how these learning elements are developed as students explore and tailor a variety of PLANS. The illustration compares two PLANS that differ only in the "Pounds of Food per Family Each Week": PLAN #1 is set at 30 "Pounds of Food per Family Each Week," and PLAN #2 is set at 25 "Pounds of Food per Family Each Week."

## Can I Successfully Run the Local Food Bank?

Name:

My/Our *GOAL* is to -  
 Feed this number of families:  
 Give each family this many pounds of food each week:  
 Get this many pounds of food donated each week:

Total Food Donations (lbs.)

TOTAL FOOD IN FOOD BANK (lbs.)

Total Food Distributed (lbs.)

Define your PLAN using the Sliders below. Run for 2 weeks at a time to 10 weeks total.

Number of Families Served Weekly

Pounds of Food Per Family Weekly

Pounds of Food Donated Weekly

1: Page 1

TOTAL FOOD IN FOOD BANK: 1 - 2 -

Comparing Plans for Managing the Food Bank

Run/Resume

Print

Reset Sliders

Clear Graphs & Table

Graph Options

Exit Back Intro

For another "look" at the same simulation, click here for a Table.

Table

To more fully understand what is happening over time and why, the students' management PLANS reflect a conceptual system, in which the following takes place.

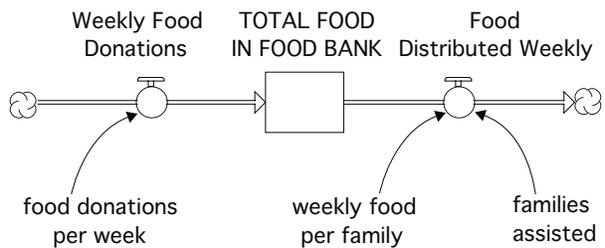
1. Weekly Food Donations flow into the STOCK of TOTAL FOOD IN FOOD BANK, causing that STOCK to grow; and
2. Food Distributed Weekly flows out of the STOCK of TOTAL FOOD IN FOOD BANK, causing the STOCK to decline.



## Lesson Structure

### 1. Developing a Conceptual Understanding of the “System”

Running a Food Bank requires understanding how the system works. In the worksheet, students are given a conceptual map that introduces them to the key elements of the system. Students are



shown that Weekly Food Donations (cans, boxes, etc., all adding up to some total pounds of food given to the Food Bank each week) Flow into the Food Bank (the STOCK of **TOTAL FOOD IN FOOD BANK**). Food Distributed Weekly (the outflow from that STOCK) depends on two factors:

1. The amount of food (again, in pounds per week) given to each family, and
2. The number of families being served each week.

### 2. Making Plans and Observing Outcomes—The Main Exploration

A second challenge is to wrestle with a particular scenario—specifically to be responsible for running the Food Bank for a 10-week period. In this simulation, students learn the following:

- The local Food Bank starts with 600 pounds of food on its shelves.
- 12 families have been getting food from the Food Bank each week.
- Each family gets 30 pounds of food per week.
- Donations of food have averaged 300 pounds per week.

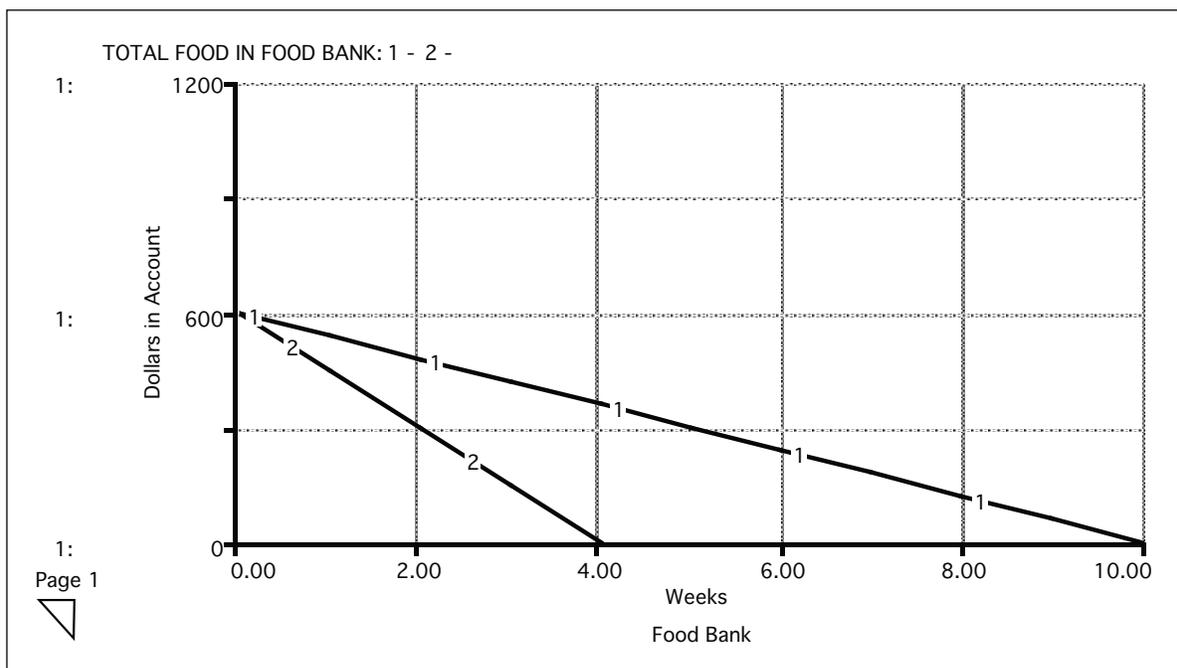
#### A. What will happen, if current patterns continue?

Students will use the simulation to answer that question. As shown below, the Table presented in the simulation shows that the Food Bank will have run out of food by the end of their ten-week management! Similar insights can be achieved with the Graph provided by the simulation.

The GOAL of a Food Bank is to maximize the outflow of food (Food Distributed Weekly) to those in need. Unlike the STOCK of SAVINGS, the GOAL is NOT to maximize the STOCK of TOTAL FOOD IN FOOD BANK.

Week #	TOTAL FOOD IN FOOD BANK	Food Distributed Weekly	Weekly Food Donations
0	600	360	300
1	540	360	300
2	480	360	300
3	420	360	300
4	360	360	300
5	300	360	300
6	240	360	300
7	180	360	300
8	120	360	300
9	60	360	300
Final	0	----	----

**B. A second option is then presented:** Families served increase from 12 to 15 each week. This reveals an even greater problem, as shown in the Graph produced by the computer simulation. The more dramatic fall of the red line (#2 for the second situation) signals that the Food Bank would run out of food even faster—in a mere 4 weeks. Similar insights can be achieved with the Table provided by the simulation.



### C. Making Alternative Plan(s) and Observing Outcomes

Having thus recognized the problem, students are asked a simple question: **What can you do about it?**

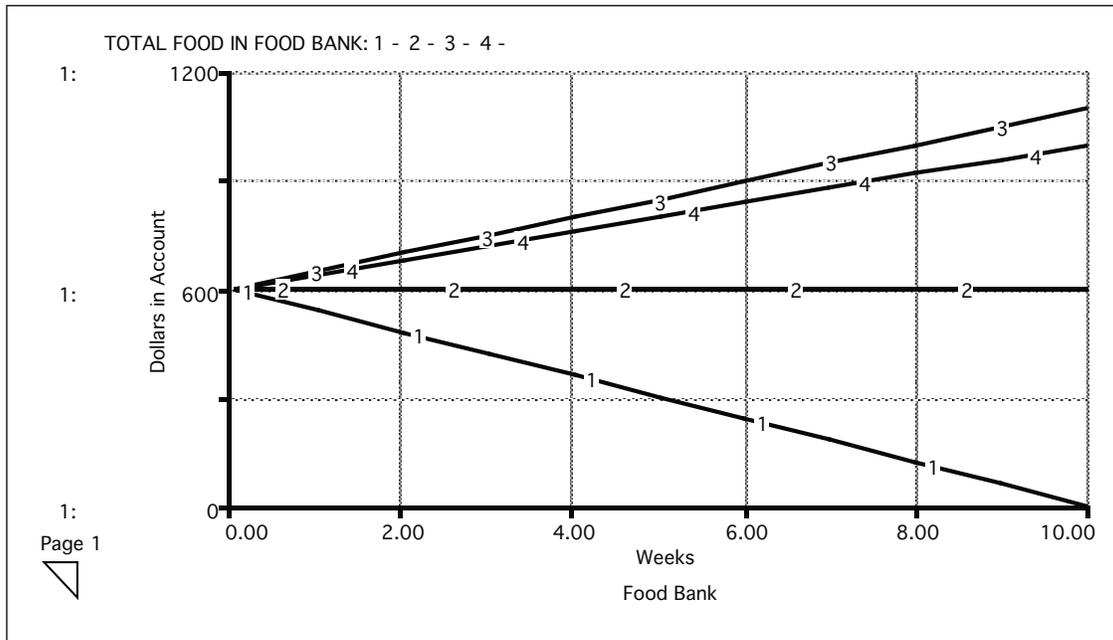
Using the simulation to explore different PLANS, the challenge is to manage the Food Bank's inflow (donations) and outflow (distribution to families) of food in a responsible and sustainable manner. **The GOAL is to do the most good possible while keeping the Food Bank in operation.** Running out of food means the Food Bank will have to close down.

Students will use the simulation to explore different PLANS and to record their results. Four PLANS (of many possible options) are illustrated below.

	PLAN 1	PLAN 2	PLAN 3	PLAN 4
Food Donated (Pounds per week)	300	300	350	400
Number of Families Served	12	10	12	12
Food Distributed per Family (Pounds per week)	30	30	25	30
TOTAL FOOD IN FOOD BANK at end of 10 weeks (Pounds)	0	600	1100	1000

### 3. Using Tables and Graphs

Students will work with Tables and Graphs to describe and communicate the patterns of change that they observe over time in the Food Bank. Tables and Graphs can be printed from the simulation or created by the students themselves using the last page of the worksheet. 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 TOTAL FOOD IN FOOD BANK each week (illustrated here with the four PLANS recorded above; colors correspond).
- The Table records TOTAL FOOD IN FOOD BANK (starting with 600 pounds), Food Distributed Weekly (outflow), and Weekly Food Donations (inflow) *for a single PLAN*. Illustrated below is PLAN #4.

Week #	TOTAL FOOD IN FOOD BANK	Food Distributed Weekly	Weekly Food Donations
0	600	360	400
1	640	360	400
2	680	360	400
3	720	360	400
4	760	360	400
5	800	360	400
6	840	360	400
7	880	360	400
8	920	360	400
9	960	360	400
Final	1,000		

#### 4. Putting the Pieces Together

Students are responsible for ANALYZING and DESCRIBING what happened and why; for evaluating and discussing several different PLANS they explored to keep the Food Bank running sustainably; and, finally, for explaining which PLAN they like best.

- Using the conceptual (Stock and Flow) map, students should be able to identify three options or “leverage points” for changing how the Food Bank operates.
  - Change (increase or decrease) the amount of food each family receives weekly.
  - Change (increase or decrease) the number of families served each week.
  - Change (increase!) the amount of food donations you receive from the community.
- Each option involves costs and benefits experienced (1) by food recipients; (2) by the Food Bank workers (or volunteers) who are responsible for soliciting the food; or (3) by the larger community asked to support the Food Bank.
- Students should be able to use their Graph(s) to compare and evaluate the effectiveness of different options for sustaining the Food Bank and maximizing the good it does.

- D. Students should be able to use their Table(s) to evaluate how weekly contributions and weekly distributions together define the changing TOTAL FOOD IN FOOD BANK.
- E. Finally, working with and communicating with others, students should be able to compare observations and to recognize how the pieces of the puzzle work together. In that process, they discover there are a number of ways to sustain the system, each with its own set of costs and benefits. But there is no single right answer.

## Where and When Will Students Need Guidance?

1. This simulation is designed to help students learn to ask better questions as they think about how to maximize the good they can do in managing a Food Bank (or any non-profit). The following concepts can encourage such questioning:
  - A. Understanding the three different options or “leverage points” for managing the Food Bank.
  - B. Recognizing “costs” and “benefits” of those different options that would be borne (1) by food recipients; (2) by the Food Bank workers (or volunteers) who are responsible for soliciting the food; or (3) by the larger community asked to support the Food Bank.
2. Many schools are engaged with local social service providers such as Food Banks. Connecting this exercise to such ongoing or potential real-world activities is likely to strengthen learning from both.
3. The structure of the Tables produced by the STELLA software may need some explanation. The best way to read the Tables is to recognize that the TOTAL FOOD IN FOOD BANK values for each week represent the *ending* value for that week. So, the Table above at Week 4, can be read as: at *the end of Week 4* we have 760 pounds in the Food Bank. We then (during week 5) distribute 360 pounds and take in 400 pounds, so that at *the end of Week 5* (the start of the next row) we have 800 pounds in the Food Bank, a net increase of 40 pounds during the 5th week.
4. Interpreting Graphs: The Graphs that we present to the students in this simulation provide students with two ways to look at these dynamics. On Page 1 of the Graph Pad, they can compare the overall impacts of several different PLANS. Page 2 of the Graph Pad presents both the STOCK and the two Flows for a given PLAN.
5. Understanding WHYs: Here, it may be appropriate to slow students down, and ask them initially to focus ONLY on food donation strategies or ONLY on food distribution. The worksheets provide teachers with a means to follow and evaluate student progress or problems with each of these elements and their combination into an overall PLAN.

## Bringing the Lesson Home

### What is the important student-learning from this simulation?

- *Interpreting and working with Tables and Graphs: Students work with and learn from Tables and Behavior-over-Time Graphs. Recognizing how to work with each, in addition to recognizing the value of each, comprises an important element of learning here.*
- *Understanding and appreciating the importance of math skills in running a non-profit such as a food bank.*
- *Being successful in exploring different strategies or PLANS.*

## Extending the Learning

Expanding the application of the simulation beyond this specific illustration: This simulation offers a template for students to use in considering a variety of non-profit operations. They can use the knowledge gleaned in this exercise to ask how other non-profit entities strive to maximize the good they do while wrestling with real-world challenges.

**Connecting this  
exercise with local  
service projects  
students are doing  
can strengthen  
learning from both.**

Name \_\_\_\_\_

## Can I Successfully Run the Local Food Bank?

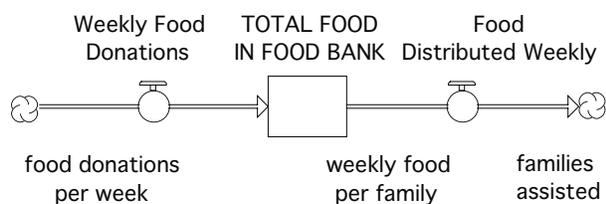
**Student Challenge:** *You are being given the responsibility to manage the Food Bank within your community for the next 10 weeks. Can you do it? The computer simulation will help you test your PLANS and explore options.*

Here is what you need to know about your challenge.

- At the moment, the Food Bank has 600 pounds of food on its shelves.
- On average, 12 families have been getting food from the Food Bank each week.
- Typically, each family gets 30 pounds of food per week.
- During the past several weeks, donations of food have averaged 300 pounds per week. However, weekly donations previously averaged 350–400 pounds, so donations have decreased.

**1. Start by understanding how a Food Bank works in the “real world.”** The Food Bank’s Director identifies three factors (food donations, food given to each family, and number of families assisted) that control what is happening each week, as they take in donated food and give it out again to needy families.

In the figure below, connect to the inflow VALVE the factor (or factors) that control the amount of the Weekly Food Donations (the inflow); then connect to the outflow VALVE the factor(s) that control the amount of Food Distributed Weekly (the outflow).



Use that information to explain (in words) the definitions of the following.

A. Weekly Food Donations =

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B. Food Distributed Weekly =

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C. TOTAL FOOD IN FOOD BANK =

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Name \_\_\_\_\_

## Can I Successfully Run the Local Food Bank? Using the Simulation

**1. Making PLANS. Remember,** the Food Bank currently has 600 pounds of food on its shelves. The Manager advises you of TWO possible situations (described below) that may arise over the next 10 weeks. Use the simulation to explore what will happen to the amount of FOOD IN FOOD BANK over the next 10 weeks in each situation.

SITUATION 1:	What Will Happen to the Food Bank? Describe below.
Weekly Food Donations (300 pounds of food donated per week to the Food Bank) and Food Distributed Weekly (30 pounds per family each week to 12 families) remain the same.	

SITUATION 2:	What Will Happen to the Food Bank? Describe below.
Weekly Food Donations remain the same for the next 10 weeks, BUT the number of families receiving food increases from 12 to 15.	

**2. Now, use the simulation to explore different ways to deal with these situations. Remember,** your challenge is to manage the Food Bank's donations (inflow) and its distribution of food to families (outflow) in a responsible and *sustainable*\* manner. Keep track of your PLANS and their results on the table below so that you can explain to your classmates, parents, or teacher what you tried and how it worked.

***Your GOAL is to do the most good possible while keeping the Food Bank in operation.*** If you run out of food, you will have to close down. Keep in mind that each action that you take will have costs and benefits for someone in your community. Keeping costs and benefits in mind is part of your planning process.

	PLAN 1	PLAN 2	PLAN 3	PLAN 4
Food Donated (Pounds per week)	300	300	350	400
Number of Families Served	12	10	12	12
Food Distributed per Family (Pounds per week)	30	30	25	30
TOTAL FOOD IN FOOD BANK at end of 10 weeks (Pounds)	0	600	1100	1000

\* "Sustainable" means the Food Bank will keep a continuous supply of food on its shelves to allow it to keep operating.

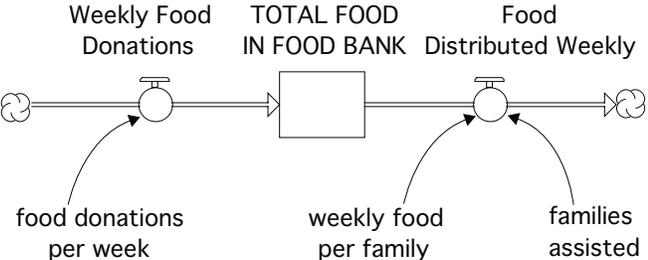
Name \_\_\_\_\_

3. Which of these PLANS do you like best? \_\_\_\_\_ Explain why below.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. Analyze your results.

A. What 3 different actions could make the Food Bank sustainable? (Hint: You may want to refer to the Stock and Flow Map at right to remind yourself how the “system” works!)



- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_

B. Which of these actions did you use in the PLAN you liked best? \_\_\_\_\_

C. Prepare a Graph and a Table (next page or print from the simulation) that shows your favorite PLAN. You will use these in Step 5 where you discuss and compare PLANS with others.

D. Each action has costs and benefits to different people in your community. For the PLAN you like best, indicate the following:

- 1. What are the benefits and who will receive them? \_\_\_\_\_  
\_\_\_\_\_
- 2. What are the costs and who will pay them? \_\_\_\_\_  
\_\_\_\_\_

5. Be prepared to discuss your favored PLAN and its results (costs and benefits) with your teacher and your classmates.

# 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 listserv, and provides system dynamics training materials and programs for educators. Information is available at [www.clexchange.org](http://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.

**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](http://www.clexchange.org)

978-635-9797

[milleras@clexchange.org](mailto:milleras@clexchange.org)

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

**Lesson Title(s):**

*Dollars and Sense*, Lesson 4: Can I Successfully Run the Local Food Bank?

**Overview:**

The simulations in *Dollars and Sense* introduce 5<sup>th</sup> – 7<sup>th</sup> 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.

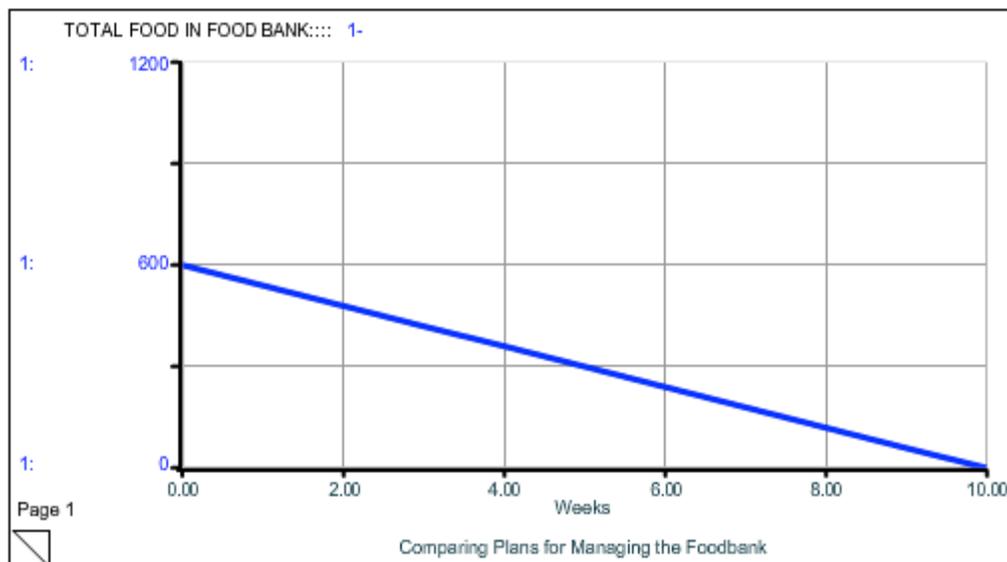
**Related Characteristic(s) of Complex Systems:**

Conflicts arise between short-term and long-term goals.

**Ideas and Examples for Connecting to the Characteristic:**

Lesson 4 of the *Dollars and Sense* series allows students to explore options for managing a non-profit organization, in this case, a food bank. The goal is to maximize the amount of food distributed to families each week, without running out of food (thus closing the food bank). These goals, to do the most good in the present and stay open indefinitely, are inherently in conflict with one another. To help students understand this conflict:

1. Ask students to describe the short-term pressures they may have experienced while running the virtual food bank. They may have wanted to increase the amount of food they could give to each family or increase the number of families they could serve. How did they reconcile these trade-offs?
2. What can be the result of the actions described in question 1? The graph below illustrates the food bank running out of food by the end of the simulation. Such a result is undesirable, but it can occur by people making compassionate (but short-sighted) decisions.



3. Help students brainstorm similar situations. Some examples could be:
- a. Cutting down trees to make houses for people – how can people ensure that no one will be homeless and there will also be enough trees for future generations?
  - b. Using water from a dam or reservoir – how can people make sure everyone has enough water, but also that the water lasts through the dry season until rain comes again?
  - c. Grazing animals on a large grassy field – how can people make sure there will be enough grass for all the animals to eat as well as enough to regenerate next year's grass?
  - d. For each situation, what are the short-term pressures which, if chosen, give rise to a worse situation in the long run?

**Resource(s)**

*Dollars and Sense* by Jeff Potash

Video to help kids understand what a food bank is and how it functions:

<http://www.youtube.com/watch?v=Khwiuu1CjCM>