



The Exchange

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NEW!! System Dynamics Apps Mini-Lessons!

by Anne LaVigne

The CLE is excited to announce the development of mini-lessons using our new system dynamics apps. These simple, fun and engaging apps are ready for use on phones, tablets, or Chromebooks. They are quick to use and create excellent insight for all ages using system dynamics models. The apps are based on the *Demo Dozen* models created by Jeff Potash and John Heinbokel and developed in a collaboration with the Creative Learning Exchange, the Center for Interdisciplinary Excellence in System Dynamics, and BTN.

RETIRE RICH App – Mini-Lesson Free App download on the Google Play or iTunes Store

Retire Rich is a free, engaging, easy-to-use app for students and others to explore the implications of different plans to save for retirement. Students can change annual savings, interest rates, and the timing of saving to see what happens over the course of a lifetime.



Suggested Instructional Sequence

- Have a brief conversation about what people do when they retire, discussing questions such as: How do people still pay their bills and afford to live without a job? and When should a person start planning for retirement?
- Go through “The Story” in the app.
- Pause and discuss how well Tara’s plan worked.
- Allow students to continue experimenting with “The Model” to create a plan that’s possible and most effective, given their individual situation. After they feel confident that they have a good plan, have them complete the attached handout as they do one final run.
- Discuss students’ reflections from their handouts.

Overview

Materials

- Mobile device(s) able to download free apps.
- Adapter to connect to projector (if using just one device)
- Handout (optional)

Recommended Ages

4th-12th grade

Time Needed

30-60 minutes

Connections to Curricular Standards

State and national Math standards, See article, *“Thinking Systemically About Common Core Mathematical Practice Standards.”*

- National Standards for Financial Literacy – “At the 4th grade level, the primary focus is for students to understand the concept of saving.... At the 8th grade level, ... the mathematics of saving is covered, including the power of compound interest.... At the 12th grade level, more complex concepts are introduced, such as ... saving for retirement.”

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EDITORIAL

As we hit September, the first fall chill is in the air and at the CLE we look forward to the gorgeous fall colors of New England. Many of you started the school year in early August, but here the kids are just going back to school. The new school year is always an exciting and challenging new beginning, both in schools and here at the CLE.

We continue to develop our new *Splash!* software with our partner, BTN. Crowdfunding has contributed a full third of the cost of Version One of the new interactive app, so we are going ahead with it on a fund-as-you-go basis. It is exciting to get started on the real thing after a year of preparation and work by the *Splash!* team.

We look forward to our two big events this year. The first, *DynamiQueST*, will be on March 16th, again hosted by the System Dynamics group at WPI. Once more we will use their lovely facilities and help in coaching our students.

Next, our biennial Systems Thinking and Dynamic Modeling Conference will be held June 29-July 2, again at the Babson Conference Center. We will have a mix of K-12 educators experienced with systems thinking in the classroom and schools, as well as expert system dynamics educators to help us all increase our skill levels in critical thinking. Put both of these opportunities on your calendar!

In this issue, don't miss two little lessons to use our fun apps, available on all the app stores for free. The lessons will be able to be fully integrated using Google Classroom, for those of you who use that platform, as well as being downloadable from our website. These two apps are part of a four-app set created by BTN in conjunction with the CLE, utilizing the ideas behind four of the Demo Dozen models originally created by Jeff Potash and John Heinbokel. In the next newsletter, expect to see lessons for the other two apps, as well as an overview about using their concepts to create synergy for critical thinking.

Have a great fall and, as always, we would love to hear from you.

Take care,

Lees (stuntzln@cleexchange.org)

UPDATES



REGISTER NOW

Systems Thinking Institute, Sept. 27-29

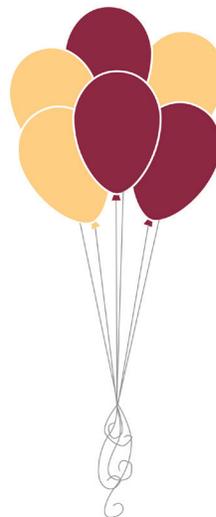
The Waters Foundation is proud to present the Tucson Systems Thinking Institute! The theme of the Institute is *Better Together: Think Big. Think Bold. Think Systems!* The purpose of the Institute is to bring together school districts, businesses and community organizations with the same mission: to provide young people with the tools needed to live full and prosperous lives now and in the future.

A variety of workshops will be offered—whether you're new to systems thinking or interested in its application in classrooms, the environment, business/organizations and more, there is something for everyone. A full list of workshop options can be found [here](#). Take advantage of the team and student discounts. Space is limited!

There are two options for the Institute. Option 1 is a two-day workshop of your choice (Sept. 28-29). Option 2 allows participants to participate in a one-day workshop (Sept. 28) on day 1, combined with a classroom field trip experience on day 2 (Sept. 29).

As an Institute participant, you will be granted complimentary admission to the Systems Leaders Spotlight kick-off event the evening of Wednesday, Sept. 27. You won't want to miss this panel discussion where leaders from around the country will speak candidly about their unique journeys using systems thinking.

Questions? Contact a.littlejohns@watersfoundation.org



DynamiQueST

Showcase of Student Projects

March 16, 2018

9 am-3 pm

Worcester Polytechnic Institute
Worcester, Massachusetts

WPI has again graciously offered their space and expertise for our showcase of the power of simulations and creative student projects that utilize critical thinking skills to analyze complex dynamic systems.

Please plan to join us.

System Dynamics Apps Lessons - *Retire Rich*

continued from page 1

Additional Ideas and Connections

- Algebra I or II: Use the model with resulting graphs to explore the concept of exponential growth and the equation for accumulating interest in a bank account.
- Surface, practice and discuss related mathematical practices.
 1. Make sense of problems and persevere in solving them.
 2. Reason abstractly and quantitatively.
 3. Construct viable arguments and critique the reasoning of others.
 4. Model with mathematics.
 5. Use appropriate tools strategically.
 6. Attend to precision.
 7. Look for and make use of structure.
 8. Look for and express regularity in repeated reasoning.
- Extend student learning with one or more of the optional related resources.

Related Curricular Resources

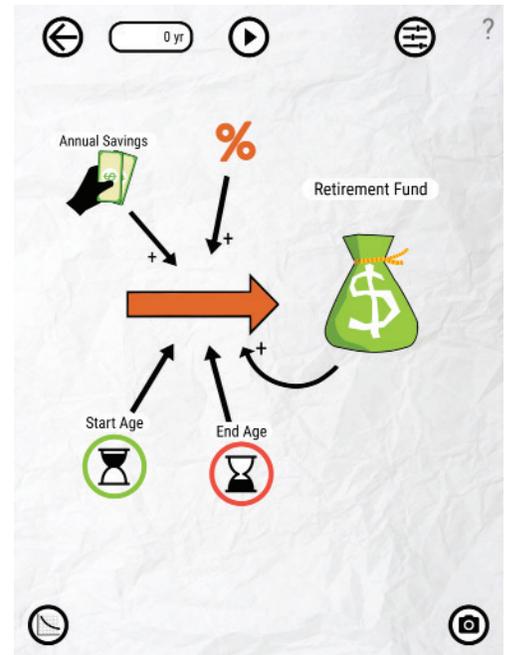
See the Creative Learning Exchange website to download lessons, purchase materials and access additional online simulations for:

Dollars and Sense – A series of lessons and simulations for Grades 5-12. The lessons combine systems thinking and mathematical tools with computer simulations to challenge students to manage their personal financial futures. Available from <http://www.clexchange.org/curriculum/dollarsandsense/default.asp>

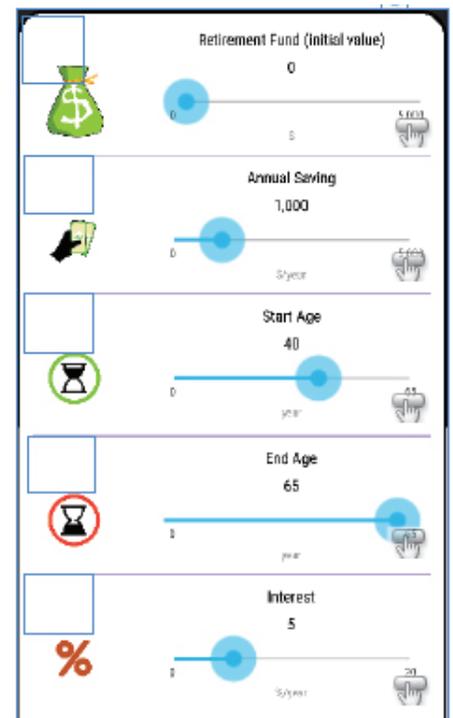
The Shape of Change – The Friendship Game, an exploration of exponential growth. Book available from the Creative Learning Exchange <http://www.clexchange.org/cleproducts/shapeofchange.asp>

Acknowledgments and Sources

- Lessons written by Anne LaVigne for the Creative Learning Exchange, <http://www.clexchange.org>
- BTN, <http://learnwithbtn.com/>
- National Standards for Financial Literacy, <http://councilforeconed>



Retire Rich Model Screen



Retire Rich Controls (sliders)

Splash! A New Kind of System Dynamics Software

What is *Splash!*?

Liquid Physics + System Dynamics = *Splash!*



Whether it's managing your health, planning your retirement or addressing climate change, System Dynamics (SD) can help us tackle the wide variety of dynamic problems we find in the world around us. There are several software products available in the market to create system dynamics models. These highly capable and flexible tools are often designed for advanced users and professionals, but they can end up being intimidating and boring for those who are just starting to learn system dynamics.

There is an evident need for a simple modeling software that's designed with beginners in mind – something that middle and high school students might use to learn system dynamics. If this tool existed, it would make system dynamics accessible to a much broader audience and help catalyze its use.

Splash! is exactly such a software. Designed primarily for tablets and mobile devices, *Splash!* combines liquid physics simulations with system dynamics in a way that emphasizes fun, delight, and ease-of-use as much as it does the core principles of system dynamics.

Invest in *Splash!*

The *Splash!* team is currently looking for funding partners to actualize the vision of this software. Contact [Lees Stuntz](#) at the CLE for more information.

We have raised \$16,000 so far, 1/3 of our \$48,000 goal!

You will notice our Generosity total is up to \$13,710. In addition, the Creative Learning Exchange has received \$2,290 directly. Due to Generosity rules, there is no way of adding to the Generosity site any donations made in cash or checks given directly to the CLE.

We are going ahead with the first 1/3 of the development of *Splash!*

We will keep you posted on how the development of this first third is going as it progresses. We will continue to fundraise for the final 2/3 of the money needed to complete Version 1 of *Splash!*

Help us by passing [this site](#) on to others!

Like us on [Facebook](#) and [Twitter](#)!

Once again, a big THANKS for your generosity in supporting *Splash!*

Take a look at this short demo showing what CO² accumulation might look like in *Splash!*

<https://www.youtube.com/watch?v=1-duz80pU9A&feature=youtu.be>

System Dynamics Apps Lessons - *Retire Rich*

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My Retirement Plan

Name: _____

Retirement Fund: _____
(initial value)

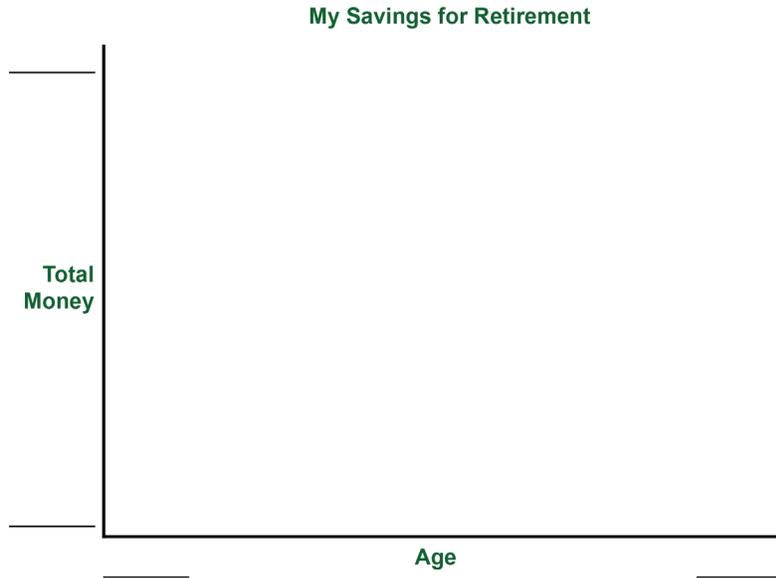
Annual Saving: _____

Start Age: _____

End Age: _____

Interest: _____
%/year

Label and draw your retirement savings on the graph.



Reflection

What worked best and was also realistic, given your age and your ability to set aside money for retirement?

How could you adjust your plan to get better results by the time you reach retirement age (65 years)?

System Dynamics Apps Lessons continued on page 6

System Dynamics Apps Lessons

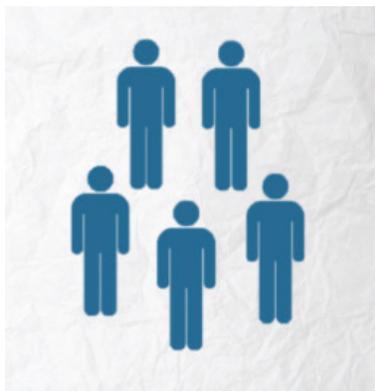
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POPULATION PLANNER App Mini-Lesson

Free App download on the
Google Play or iTunes Store

Population Planner is a free, engaging, easy-to-use app for students and others to explore how populations can grow or decline over time. Students can change the initial population,

death rate, and birth rate to see what happens over 100 years.



Overview

Materials

- Mobile device(s) able to download free apps.
- Adapter to connect to projector (if using just one device)
- Handout (optional)

Recommended Ages

4th-12th grade

Time Needed

30-60 minutes

Connections to Curricular Standards

- National Social Studies Themes: II. Time, Continuity, and Change and III. People, Places, and Environments
- Common Core Math, CCSS. MATH.CONTENT.7.EE.B.3 Solve real-life and mathematical problems using numerical and algebraic expressions and equations
- State and national Math standards, see article, *Thinking Systemically About Common Core Mathematical Practice Standards*
- Next Gen. Science, MS-ESS4-4...how increases in human population and per-capita consumption of natural resources impact Earth's systems

Suggested Instructional Sequence

- Define terms, population, birth rate and death rate.
- Work through “The Story” in the app, either as a class or independently.
- Pause and discuss strategies used to increase the population of the colony to approximately 100,000 people.
- Using the handout, continue experimenting with “The Model” to consider different scenarios for population growth, decline or stability.
- Discuss students’ reflections from their handouts.
- Extend the exploration using the optional extension on the handout to look at trends for different countries’ populations. Discuss questions such as,
 1. How do various population trends in individual countries impact the workforce, the economy, political influence, and availability of resources?
 2. How does the global population impact other Earth systems?

Additional Ideas and Connections

- Algebra I or II: Use the model with resulting graphs to explore the concept of exponential growth or decay and the underlying equations.
- Surface, practice and discuss related mathematical practices.
 1. Make sense of problems and persevere in solving them.
 2. Reason abstractly and quantitatively.
 3. Construct viable arguments and critique the reasoning of others.
 4. Model with mathematics.
 5. Use appropriate tools strategically.
 6. Attend to precision.
 7. Look for and make use of structure.
 8. Look for and express regularity in repeated reasoning.
- Extend student learning with one or more of the optional related resources.

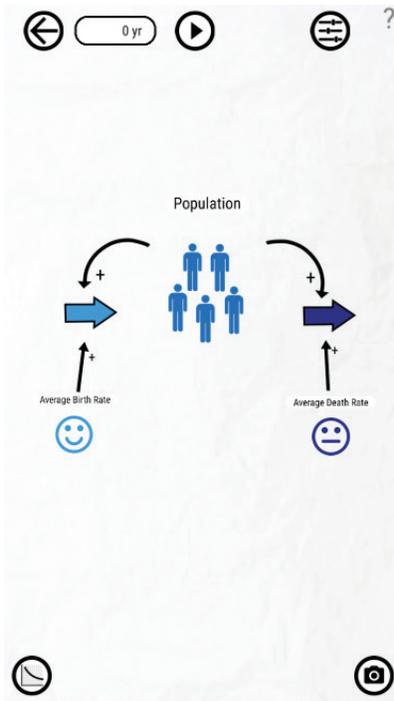
Related Curricular Resources

See the Creative Learning Exchange website to download lessons, purchase materials and access additional online simulations for:

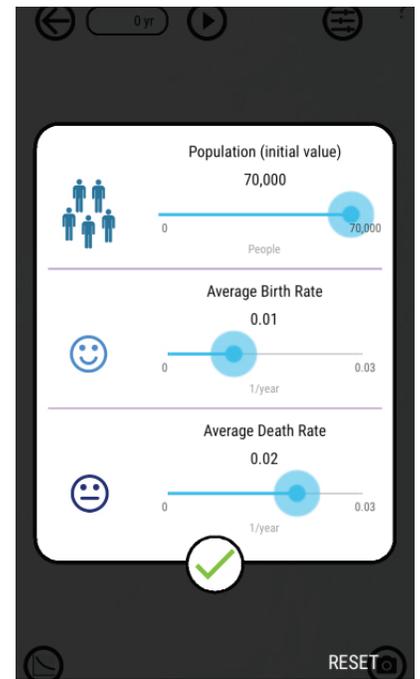
- *The Shape of Change – The Mammoth Game*, an exploration of patterns of extinction. Book available from the Creative Learning Exchange, <http://www.clexchange.org/cleproducts/shapeofchange.asp>
- *Population Dynamics: Connecting Past, Present and Future*, a set of four simulations that examines an important period of development

within American history. Available from the Creative Learning Exchange at <http://www.clexchange.org/curriculum/complexsystems/populationdynamics/>

- Chapter 5, “The Disappeared,” *Model Mysteries*, a lesson to build your own population/resource model to explore population dynamics in a broader context. Available from the Creative Learning Exchange at <http://www.clexchange.org/curriculum/modelmysteries/>
- Japan’s falling birth rate posing serious problems for the economy, <http://www.independent.co.uk/news/world/asia/japans-falling-birth-rate-posing-serious-problems-for-economy-a7770596.html>



Population Planner Model Screen



Population Planner Controls (sliders)

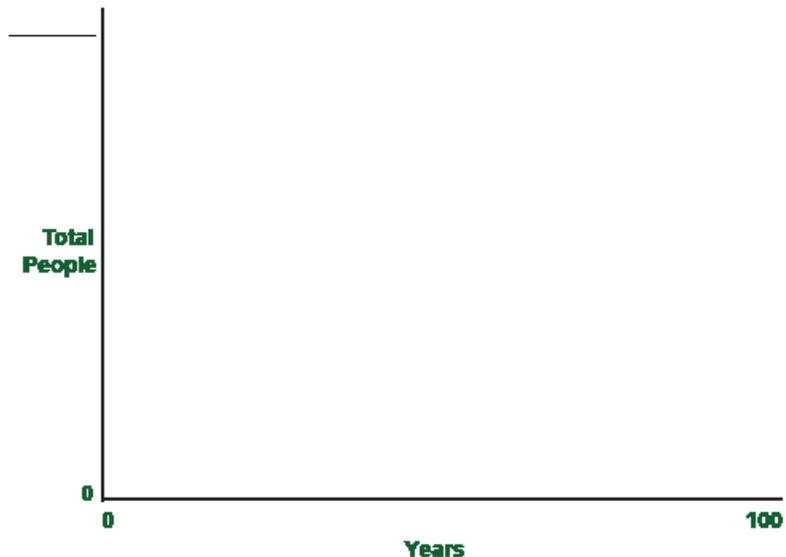
Acknowledgments and Sources

- Lesson written by Anne LaVigne for the Creative Learning Exchange, <http://www.clexchange.org>
- BTN, <http://learnwithbtn.com/>
- Potash, Jeff, *Thinking Systemically About Common Core Mathematical Practice Standards*, http://static.clexchange.org/ftp/documents/implementation/IM2014_CommonCoreMath.pdf

Population Planner – Populations in Space (and on Earth)

Name: _____ Average Birth Rate: _____
 Population: _____ Average Death Rate: _____
 (initial value)

Label and draw your most successful run on the graph.
Population of the Colony



System Dynamics Apps Lessons continued on page 8

System Dynamics Apps Lessons - Population Planner

continued from page 7

Reflection

What worked best and was also realistic to increase the population to the desired level? Why?

What other situations could you study using this app?

Extension

Instructions

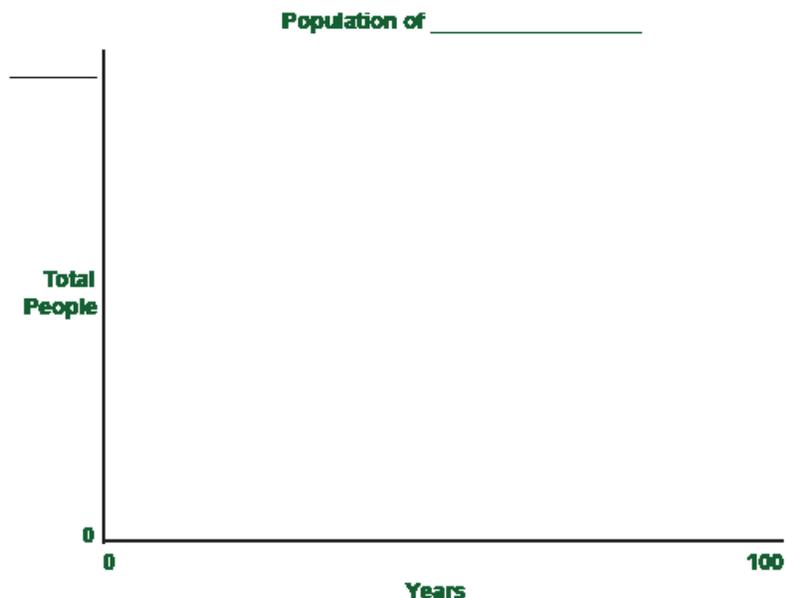
Run the model for each of the scenarios, which are based on current birth and death rates. Then try some of your own ideas. You can find the data for other countries at <http://apps.who.int/gho/data/view.main.CBDR2040>. To keep the numbers small, we'll imagine that one person in the model is really 10,000 people in the population.

Scenario 1: Japan

Crude birth rate: 8.4/1000 or 0.008
Crude death rate: 9.5/1000 or 0.01
Initial population: 127,000,000/10000
= 12,700 model people (input 12,600 for app)

How many people were there at the end? (Remember to multiply the number in the app by 1000.) _____

How might the population trend for this country affect it over time?

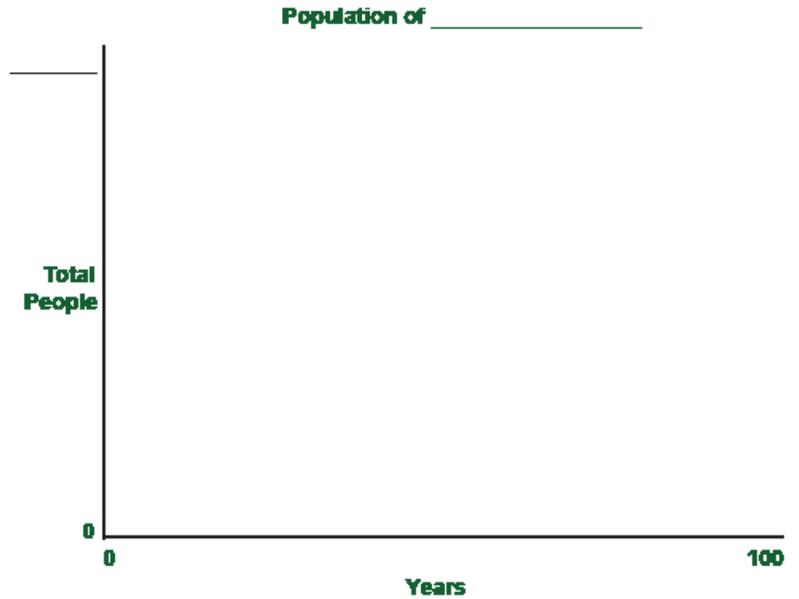


Scenario 2: United States

Crude birth rate: 13.2/1000 or 0.013
Crude death rate: 8.4/1000 or 0.008
Initial population: 323,000,000/10000 = 32,300
model people (input 32,200 for app)

How many people were there at the end? (Remember to multiply the number in the app by 1000.) _____

How might the population trend for this country affect it over time?

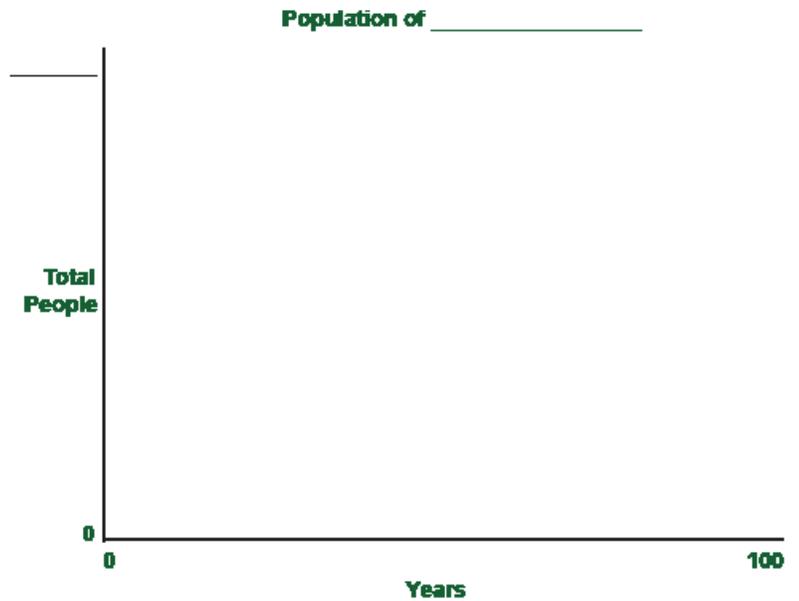


Scenario 3: Rwanda

Crude birth rate: 35.2/1000 or 0.035
Crude death rate: 6.4/1000 or 0.006
Initial population: 11,920,000/10000 = 1192
model people (input 1400 for app)

How many people were there at the end? (Remember to multiply the number in the app by 1000.) _____

How might the population trend for this country affect it over time?

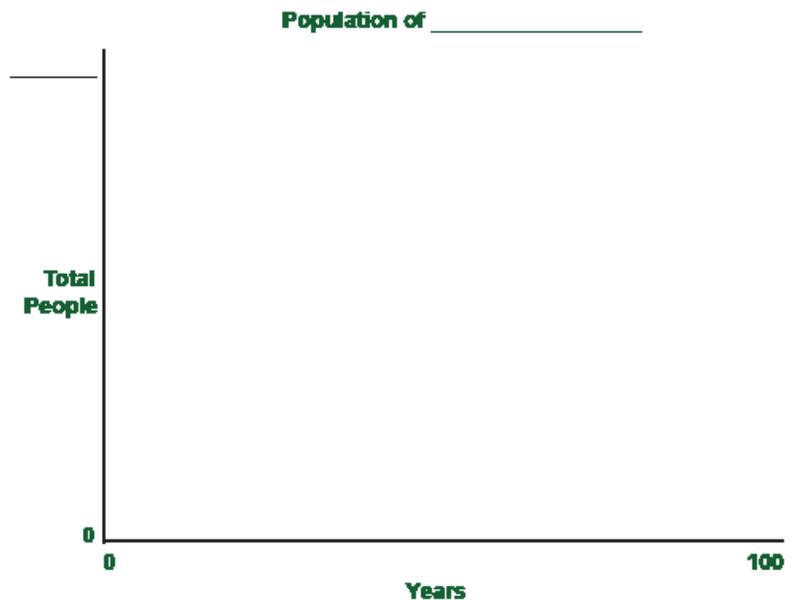


Scenario 4: Choose another country

Crude birth rate: _____
Crude death rate: _____
Initial population: _____/10000 = _____
model people

How many people were there at the end? (Remember to multiply the number in the app by 1000.) _____

How might the population trend for this country affect it over time?



The lessons can be downloaded from the CLE website. Interactive lessons will soon be available.



JUNE 30–JULY 2, 2018

Babson Executive Conference Center
Wellesley, MA

Join us as we explore how to bring our skills to the next level using Systems Thinking and System Dynamics to improve critical thinking in our students.

FEATURED SPEAKERS: Experienced K-12 systems educators, **Saras Chung and Anne LaVigne**, in conjunction with expert system dynamics teachers, **George Richardson and Brad Morrison**

Integrating the Learning Environment for both students and teachers requires more than K-12 education as usual. It requires using techniques and tools that give students deeper understanding through multiple avenues for learning. System Dynamics and Systems Thinking provide such strategies for exploring complexity, interconnectedness, and change over time.

- Workshops with hands-on learning
- Interactive plenary presentations
- Demonstrations of student work and student leadership
- Ample opportunities for informal networking

The conference will run from registration, starting at 8:30 Saturday morning, June 30, to noon on Monday, July 2.

An Introductory Workshop will run all day Friday, June 29, and throughout the conference.

Scholarship applications for educators are available on the [website](#).

Interested In Investing?

If you would like to invest in our effort here at *The Creative Learning Exchange*, your contribution would be appreciated. You may donate any amount you wish; perhaps \$50.00 is a reasonable amount for a year. All contributions are tax-deductible.

Enclosed is _____ to *The Creative Learning Exchange* to help invest in the future of K-12 systems education.

Name _____

Address _____

E-mail _____

THANK YOU!

The Creative Learning Exchange, 27 Central Street, Acton, MA 01720

Newsletter Subscription Information

The Creative Learning Exchange newsletter is available in two formats:

- On the website at www.clexchange.org
- In paper format via US mail (\$15.00 outside the USA)

The newsletter is always on the website for downloading. An e-mail is sent to subscribers when a new issue has been posted. Please feel free to email us at any time.

info@clexchange.org

The Creative Learning Exchange

**27 Central Street
Acton, MA 01720
Phone 978-635-9797
Fax 978-635-3737
www.clexchange.org**

Trustees

Davida Fox-Melanson
J. Bradley Morrison
George P. Richardson
Stephen C. Stuntz

Executive Director

Lees N. Stuntz
stuntzln@clexchange.org

The Creative Learning Exchange works to develop Systems Citizens in K-12 education who use systems thinking, system dynamics, and an active, learner-centered approach to meet the interconnected challenges that face them now and in the future. It is a non-profit educational institution and all contributions to it are tax deductible.