

FOCUSING ON STUDENT MINDSETS

*Developing Information Literacy Dispositions in
First-Year Calculus*

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OVERVIEW

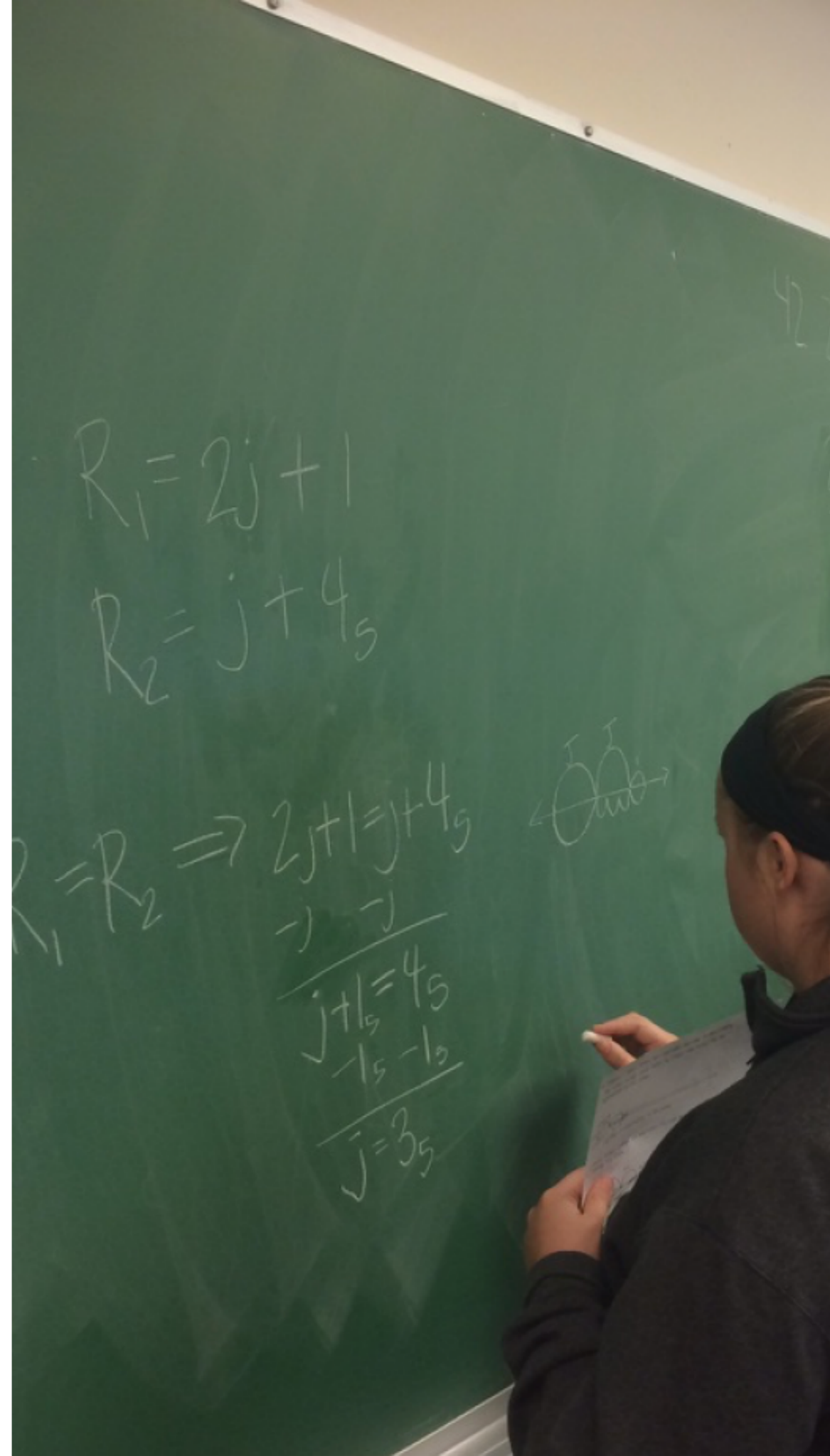
-
- Presentation of Case Study
- Q & A
- Crowd Sourcing Activity
- Wrap-up Discussion



“LEARN BY DOING” ETHOS

CASE STUDY

*Integrating Information
Literacy Mindsets
in an IBL Calculus Course*



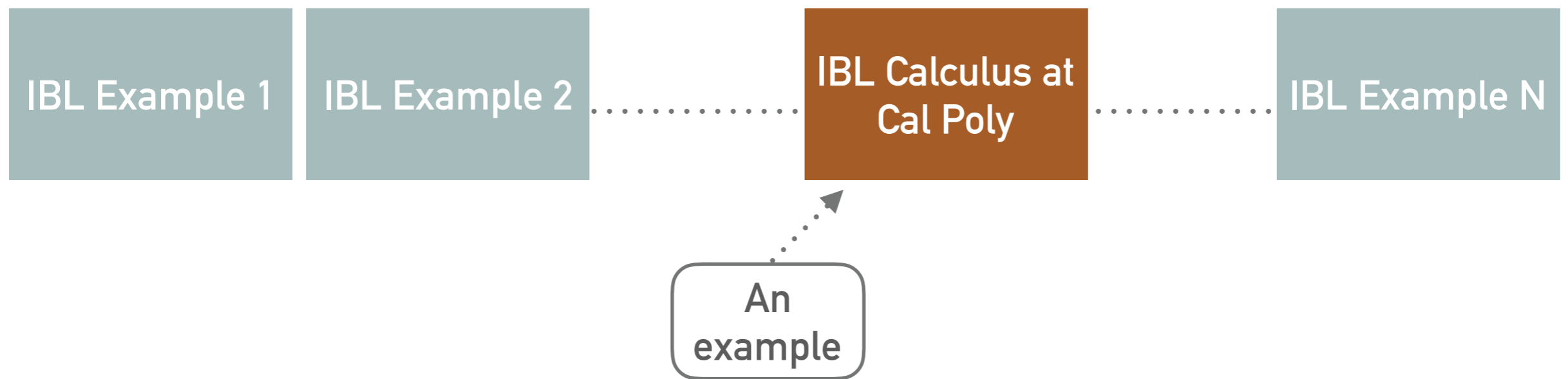
INQUIRY-BASED LEARNING (IBL) IN MATHEMATICS

- Inquiry-Based Learning is an active, student centered method of teaching that minimizes traditional lectures and increases student engagement and collaboration.
- IBL is research validated (highlights)
 - Mitigates the gender gap
 - Students have improved problem-solving, sense-making, conjecture, experimentation, creation, and communication
 - Consistent with brain research and education research results from other disciplines

MANY VARIATIONS OF IBL IN MATHEMATICS

A large number of variations of IBL exist to accommodate variation in classes, content, student population, and institutional environments.

IBL Calculus presented here is AN example and not THE example of IBL.



IBL CALCULUS 1: FALL QUARTER 2015 FIRST-YEAR CALCULUS

2 *Mathematics Faculty*

35 *Students per section* \times **4** *Sections* = **140** *Total Students*

50 MINUTE CLASSES

4x *per week*

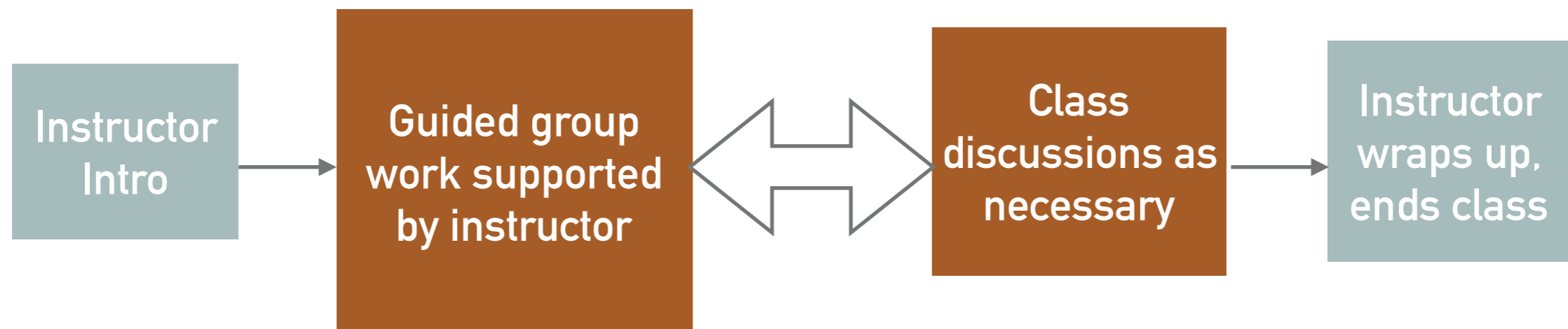


1 Textbook
for all sections of Calculus

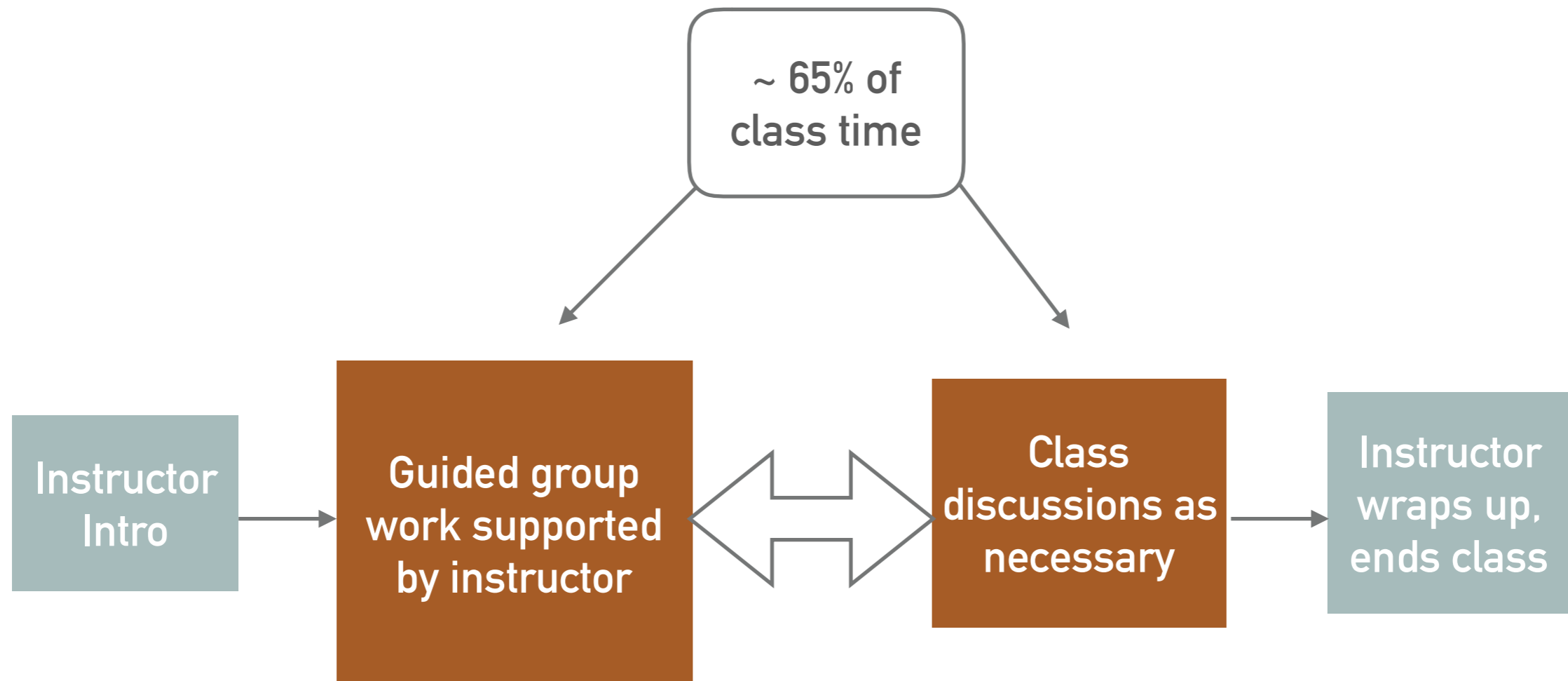
Fixed List of Topics

TYPICAL DAY IN IBL CALCULUS 1

- (1) Instructor starts class by introducing the topic of the day. Students bring a handout on that topic, which was written by the instructor. The handout contains a list of math tasks/problems to be done in class.
- (2) After a brief introduction, students work in groups on problems. Instructor visits groups to provide guidance and assist.
- (3) As needed, whole group discussions led by the instructor are used to address common issues, general solution strategies, and techniques.
- (4) Instructor wraps up the class discussion.



TYPICAL DAY IN IBL CALCULUS 1



COURSE CONTENT



“Learn by Doing”
Assignments

All three components + IBL instruction work together as a system!

LEARN BY DOING ASSIGNMENTS

Productive Failure/
Growth Mindset

Information Literacy

Math
Autobiography

 The
5
Elements
of
Edward B. Burger
Michael Starbird
Effective
Thinking
Reading
Reflections

Productive Failure

It's Okay to Be
Stuck!

Library Resources 1 -
Group Study

Library Resources 2 -
Identify Course-Related
Books

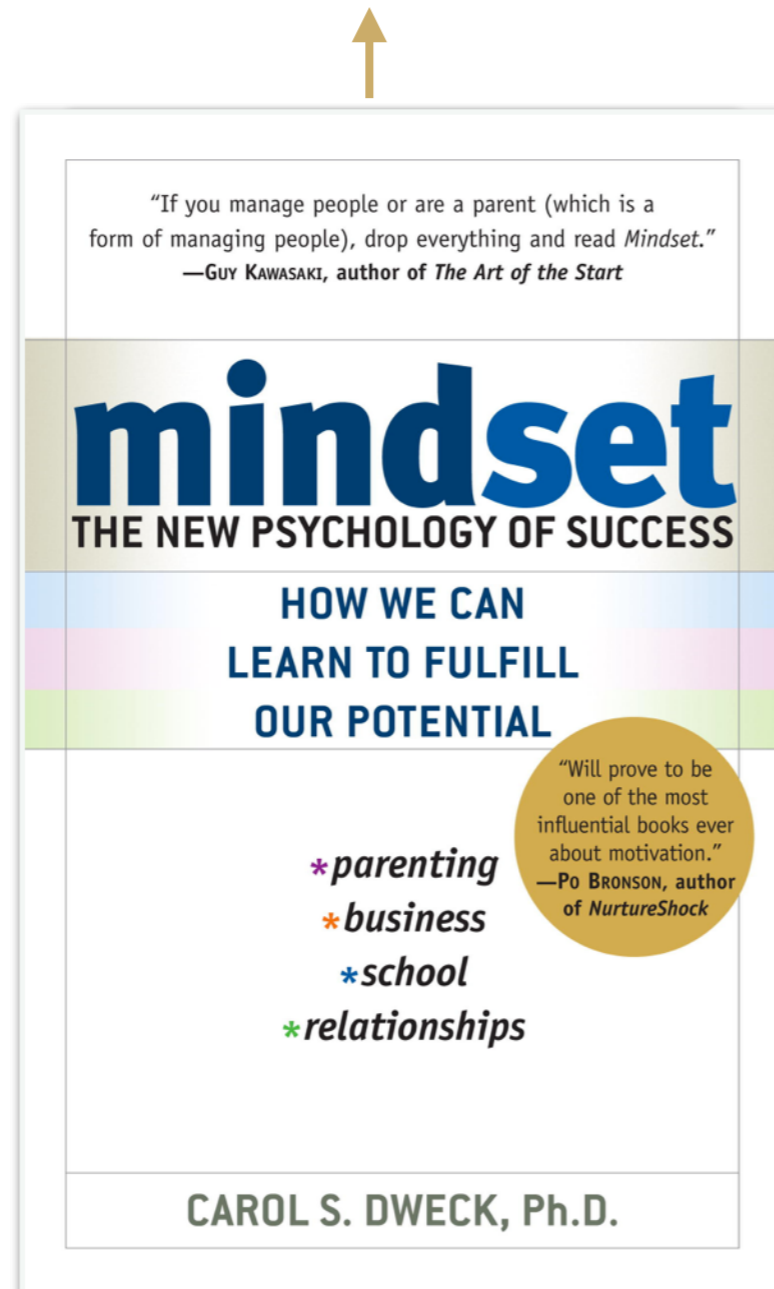
Library Resources 3 -
Research in the Google
Era

Looking Back Reflection

LEARN BY DOING ASSIGNMENTS

Productive Failure/
Growth Mindset

Information Literacy



What Kind of Mindset Do You Have?



I can learn anything I want to.
When I'm frustrated, I persevere.
I want to challenge myself.
When I fail, I learn.
Tell me I try hard.
If you succeed, I'm inspired.
My effort and attitude determine everything.



I'm either good at it, or I'm not.
When I'm frustrated, I give up.
I don't like to be challenged.
When I fail, I'm no good.
Tell me I'm smart.
If you succeed, I feel threatened.
My abilities determine everything.

Productive Failure/ Growth Mindset

Math
Autobiography

The
5
Elements
of
Edward B. Burger
Michael Starbird
Effective
Thinking

Reading
Reflections

Productive
Failure

It's Okay to Be
Stuck!

Write a 1-2 page Math
Autobiography. Comment on your
math experiences in your school
days (K-12).

- What kind of math experiences did you have?
- Do you like Math?
- Explain
- Do you feel you can be successful in Math classes?

Productive Failure/ Growth Mindset

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Productive Failure/ Growth Mindset

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Autobiography

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Thinking

Reading
Reflections

Productive
Failure

It's Okay to Be
Stuck!

Write about a problem you were stuck recently in Math 141, and include a description of the problem and 1-2 paragraphs about what you learned from the mistake.

Discuss two strategies for using mistakes (#PF) in the future to enhance your learning.

Productive Failure/ Growth Mindset

Math
Autobiography

The
5
Elements
of
Effective
Thinking

Reading
Reflections

Productive
Failure

It's Okay to Be
Stuck!

Identify a problem (or type of problems) you have been stuck on this quarter in Math 141. Describe the problem here (without a solution) and what you were stuck on.

Discuss new strategies (to you) that you will employ when you are stuck in the future.

LEARN BY DOING ASSIGNMENTS

Productive Failure/
Growth Mindset

Information Literacy



Information Literacy

Big Mindsets

- Value the role of the library as a contributor to academic success
- Seek guidance from experts, e.g. librarians, professors, and professionals
- Think critically and reflectively about the research process
- Seek out scholarly conversations on a topic

Library Resources 1 -
Group Study

Library Resources 2 -
Identify Course-
Related Books

Library Resources 3 -
Research in the
Google Era

Information Literacy

Library Resources 1 — Group Study in the Library

Math 141 LBD Assignment #2: Library Resources 1

First Name:
Last Name:
Section: 04 or 07

Log your math study hours for the week. Think 25-35!

Sun	Mon	Tu	Wed	Th	Fri	Sat

Instructions: The Kennedy library has a portfolio of support programs to help students succeed. In this assignment, you will focus on collaborative study spaces at the library. Visit the library and learn how to reserve a “fishbowl.” Form a study group of classmates from your section of Math 141. Your group must reserve a “fishbowl” with 2-4 other classmates for at least 1 hour. After your study session, all students should complete the following

1. List the names of the other students who attended the “fishbowl” study session.

2. Describe in a paragraph the topics you worked on together, and what you personally worked on.

3. Attach/embed a photo of the group study session as proof here:

[Paste a Photo]



Information Literacy

Library Resources 2 — Identify Course-Related Books

Assignment 5: Library Resources 2

First Name:

Last Name:

Section: 04 or 07

Log your math study hours for the week. Think 25-35!

Sun	Mon	Tu	Wed	Th	Fri	Sat

Instructions:

This assignment has two parts. Part 1 is to use the Mathematics section of the library to learn about the resources available to you related to this course. Part 2 is to study with a group of students from Math 141, as you did in the first library resources assignment.

1. Visit the Kennedy library and find the Mathematics section of the library. Visit <http://lib.calpoly.edu> to get acquainted with the services and resources available to you.
2. Find an alternative textbook for Calculus that you could use as an additional resource.
 - a. Title:
 - b. Author(s):
 - c. Publication Date:
 - d. Explain what makes this calculus book useful to you:
3. Find another college-level book related to your major. List the
 - a. Your major:
 - b. Title of math book related to your major:
 - c. Author(s):
 - d. Subject:
 - e. What course(s) would you use this book/reference for?

Research 101: Your Research Survival Guide

Get started with essential tools and strategies for successful research at Cal Poly.

Introduction

The Research Cycle

Orientation: Kennedy Library Scavenger Hunt

Choose Your Topic

Develop Keywords

Background Sources

Find the Best Sources

Articles & Databases

Books

Images

Data & Statistics

Historical Primary Sources

Course Reserves

Cal Poly Information

Evaluate Sources for Credibility and Relevance

Cite Sources

Start Your Research Tutorial

How to Use Research 101

Research 101 provides the essential tools, concepts, and strategies you need for successful research at Cal Poly.

If you need help with finding, evaluating, and citing information sources for any type of research assignment, follow the pages of this guide or stop by the library's Research Help Desk. Librarians and LibRATs are here to help!



Research Help

- Come to the Research Help Desk on the 2nd floor of Kennedy Library, where a student LibRAT or librarian can help with any question you have!
- Call the Research Help Desk at (805) 756-2649.
- [Chat online with a librarian or a LibRAT. 24/7!](#)
- Make a personal appointment to meet with your [College Librarian](#).

For help writing your paper you can contact the [The Writing Center](#).

You can call the Circulation Desk for basic library information at (805) 756-5760.

Information Literacy

Library Resources 3 — Finding Credible Information in the Google Era

Assignment 8: Library Resources 3

Finding Credible Information in the Google Era

First Name:

Last Name:

Section: 04 or 07

Log your math study hours for the week. Think 25-35!

Sun	Mon	Tu	Wed	Th	Fri	Sat

Introduction: Sites like Google and Wikipedia are highly useful, but have significant limitations that you should be aware of. When using any search engine, you are relying on the assumptions and algorithms that are embedded in that search algorithm. Important questions come to mind.

- How do we know the search engine found the right kinds sources for our needs?
- Can we be sure that the sources we have found are credible?
- How do we measure the credibility of the sources found by the search engine? What are the “levels of credibility?”
- What are the conflicts of interests between private company search engines, profits, and seeking knowledge?
- What are ways to find sources, such as peer-reviewed journal articles?

The purpose of this LBD assignment is help you become aware of a research process that goes beyond simple internet searches, adding library databases to find sources of information that may not be captured by a simple internet search.

Sample General Research Workflow

Step Zero

Start with Google or Wiki or other to gather basic info

Step One

Use the Cal Poly “Search Everything” feature... lib.calpoly.edu to search a variety of databases and sources, not necessarily covered by Google.

Step Two

Refine your search to match search results to your specific needs. Use the “advanced search” features to add criteria.

Step Three

Download, selections and evaluate their credibility.

Read sources and rerun searches as necessary to collect enough sources for the assignment.

Information Literacy

Library Resources 3 — Finding Credible Information in the Google Era

LBD Assignment #8 Specifics

Choose a Topic

- Who is the first female winner of the Fields Medal? (The Fields Medal in Mathematics is equivalent to the Nobel Prize.)
- Who is the person who cracked the Nazi Enigma Code in World War 2?
- Who is the mathematician portrayed in the movie, "A Beautiful Mind"?
- Learn about the mathematician from UCLA, who appeared on the TV show, *The Colbert Report*.
- Learn about the actress, who majored in Mathematics, who co-starred in the TV series, "The Wonder Years."
- Who is the mathematician that solved the infamous problem, Fermat's Last Theorem?

Assignment

1. Use the research process described above for this assignment. Describe the specific searches, keywords used, and refinements you used to find your sources.
2. Find one **newspaper article** that provides biographical information about the mathematician that answers "Who is this person, and what did they do?"

Newspaper	
Author(s)	
Publication date	
Title of Article	
What is the article about?	

3. Find one **peer-reviewed journal** research article in Mathematics that the person published. Use the library website's "research databases" feature, to find the **MathSciNet** database. **MathSciNet** is one of the premier databases for publications in research Mathematics.

Please start by using the AUTHOR search and use the person's last name. Login to the portal so that you can download the pdf articles.

Click on the "article" link in search result citations to download articles.

Journal Name	
Author(s)	
Publication date	
Title of Article	

4. Discuss in 2-3 paragraphs two (or more) things you learned about the person you researched.

Scholarly, Peer-Reviewed Journal Articles

Purpose: Inform other scholars and students in higher education of new research and findings (research books (book reviews).

Authorship: Experts in their fields: researchers conducting original research, practitioners, professors university presses and scholarly groups.

Accuracy: An editorial board made up of other scholars and researchers reviews the articles. Many, but considered the gold standard of tested information.

Look for:

- long, in-depth articles
- data and evidence, e.g. tables, charts, graphs, images (but no advertisements)
- specialized or discipline-specific language and jargon
- reference lists and in-text citations
- abstract or summary
- author affiliations
- peer-review information: dates of article submission and acceptance (provided in some journals)

See: [Anatomy of a Scholarly Article](#); [What is Peer-Review?](#)

Productive Failure/ Growth Mindset

Information Literacy

Assignment 9: Looking Back

First Name:

Last Name:

Section: 04 or 07

Log your math study hours for the week. Think 25-35!

Sun	Mon	Tu	Wed	Th	Fri	Sat


1. Discuss two things you learned from the Learn by Doing Assignments?
2. University Libraries are more than a stacks of books. Explain what you have learned about the Cal Poly library that you can use in subsequent quarters.
3. Personal Reflection (open topic and graded only for effort): Please share your comments related to one (or more) of the major themes addressed in the LBD assignments.

Looking Back Reflection

Discuss two things you learned from the Learn by Doing Assignments.

University Libraries are more than a stack of books. Explain what you have learned about the Cal Poly library that you can use in subsequent quarters.

Personal Reflection.



The two main things I have learned from the LBD assignments are probably that failing is okay, and can actually be productive, and that the library website has a lot of online capabilities to find credible sources for magazine articles, newspaper articles, journals, etc. Being new to the school it's nice to know that if I need a source for something, I don't necessarily need to trek to the library, because I have so much available right on my computer!

“ I really liked the research assignment where one of the research options was about the German Enigma Machine from World War Two. It was a very interesting topic that was such an important part of history that many people are unaware of. I am still reading more articles on it, learning more about how it worked as well as the extreme difficulty in solving it.

FOR NEXT TIME (FALL QUARTER 2016)

- Be more explicit with students about the meaning of information literacy in connection with lifelong learning mindsets
- Tie “being stuck” in solving math problems to “being stuck” in research (e.g., “Understand that first attempts at searching do not always produce adequate results”)
- Include more supplementary materials and online guidance, e.g., short instructional videos

TAKE AWAYS

- Learning dispositions are important for student success
- Low-barrier integration of information literacy into course curriculum
- Look for opportunities to collaborate with faculty who use active learning
- Look for places to “mash up” existing library instruction in programs, courses, and assignments that emphasize critical thinking, problem-solving, and lifelong learning skills
- Calculus (and Mathematics) is likely an “extreme example”

QUESTIONS

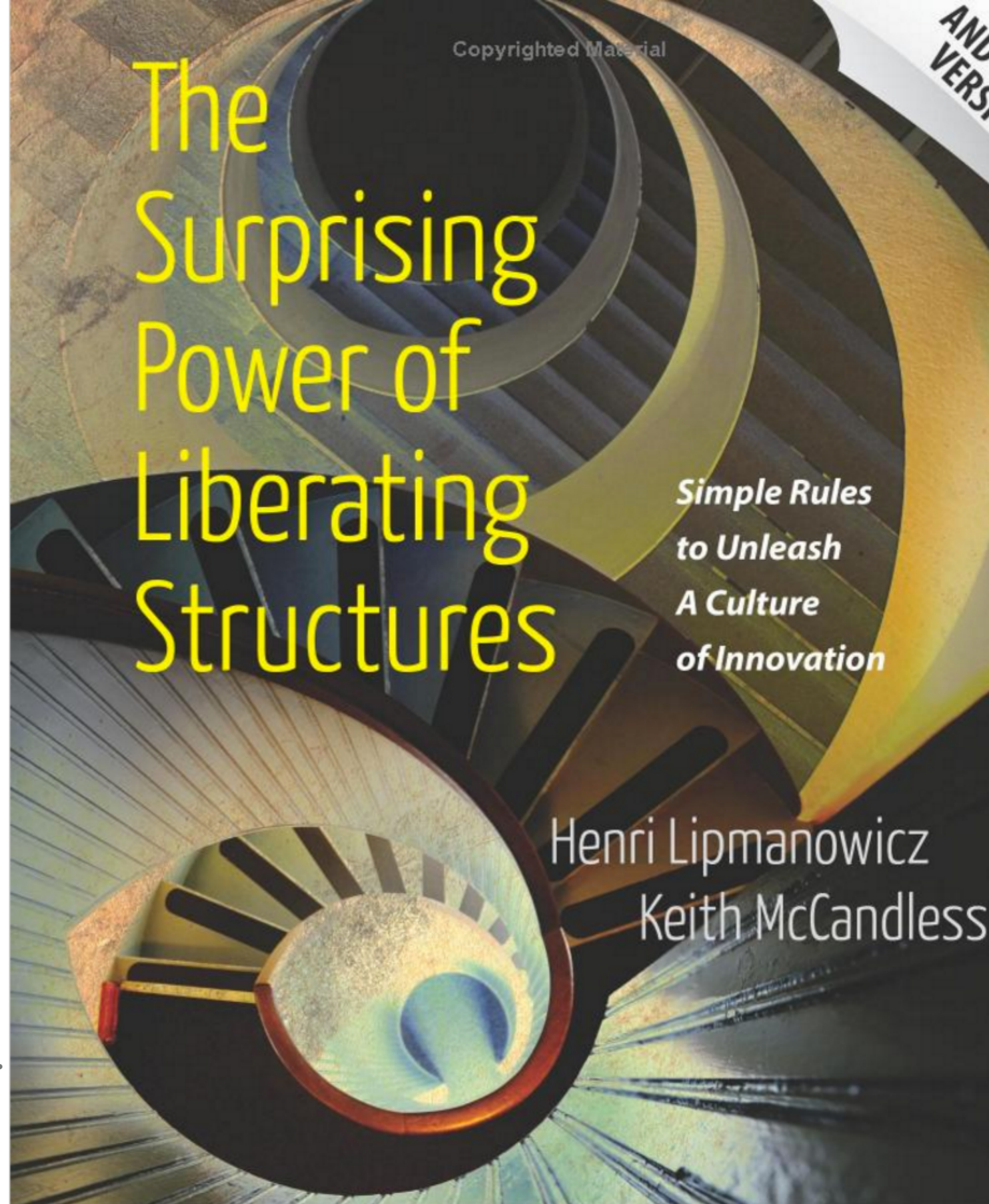
5 minutes



*Milosevic, Milos. [sensitive noise/obvious 2](#).
Flickr. CC BY 2.0.*

CROWD SOURCING ACTIVITY

25 minutes
























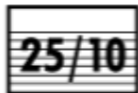












"A treasure trove of simple, practical methods to stimulate critical conversations and liberate the full potential of any group, from the frontline to the C-suite."

-Cheryl M Scott Global Programs Senior Advisor, Bill and Melinda Gates Foundation
Copyrighted Material

CROWD SOURCING ACTIVITY

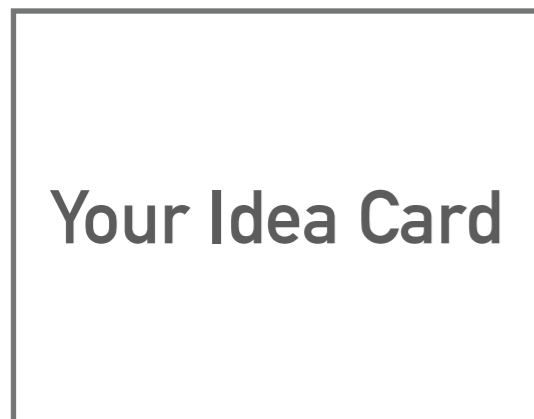
30 minutes

LS Menu 	Wicked questions 	What ³ debrief 	Min specs 	Heard, seen respected 	What I need from you 	Integrated autonomy 
Design elements 	Appreciative interviews 	Discovery and action dialog 	Improv prototyping 	Drawing together 	Open space 	Critical uncertainties 
1-2-4-All 	TRIZ 	Shift & share 	Helping heuristics 	Design storyboards 	Generative relationships 	Ecocycle 
Impromptu networking 	15% solutions 	25 : 10 crowdsourcing 	Conversation café 	Celebrity interview 	Agree/certainty matrix 	Panarchy 
9-whys 	Troika consulting 	Wise crowds 	User experience fishbowl 	Social network webbing 	Simple ethnography 	Purpose to practice 

 The menu

HOW IT WORKS

Start



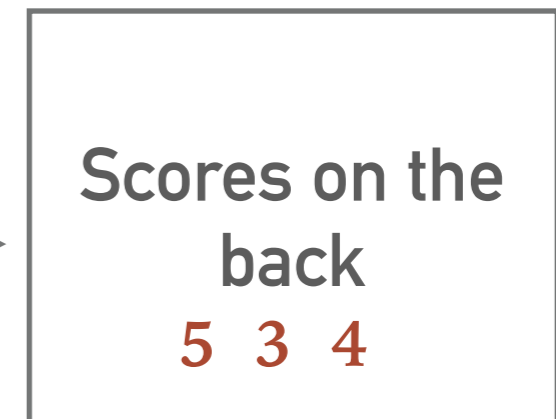
Write a big idea and first step on your card.
(5 min.)



Exchange and score cards
(9 min.)



Finish



Add up scores
e.g., 12

Top ideas



Your Idea:

If you had all the time and money in the world...

(a) What is one bold idea to enhance or reframe information literacy instruction at your institution?

(b) What first step would you take to get started?

THANK YOU!

Kaila Bussert
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RESOURCES

- Google Shared Folder: <http://tinyurl.com/LBDassignments>
- Burger, Edward B., and Michael Starbird. *The 5 Elements of Effective Thinking*. Princeton University Press, 2012.
- Dweck, Carol S. *Mindset: The New Psychology of Success*. Ballantine Books, 2007.
- Lipmanowicz, Henri and Keith McCandless. *The Surprising Power of Liberating Structures*. Liberating Structures Press, 2014.