PRIMING THE QUANTITATIVE LITERACY COURSE

Session S017

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UTAH VALLEY UNIVERSITY

- Largest university in Utah
- Dual mission
- Community college mission
- Open enrollment

SESSION OUTCOMES

1. Follow the steps of an instructional design model.
2. Consider three potential purposes for non-STEM QL courses.
3. Decide on an appropriate perspective from which to design a QL course.
4. Reflect on the importance of ~~three~~ four important principles for a QL course

Applicable to all but a focus on the non-STEM, general education

Suggest alternative thinking to:

- Designing by textbook
- Designing by topics
- Designing by tradition
- Designing by vague/general notions
- Designing by what is fun/interesting to teach

INSTRUCTIONAL DESIGN MODEL

Background & Introduction

ADDIE

- A: Analyze →
- D: Design
- D: Develop
- I: Implement
- E: Evaluate

Includes:

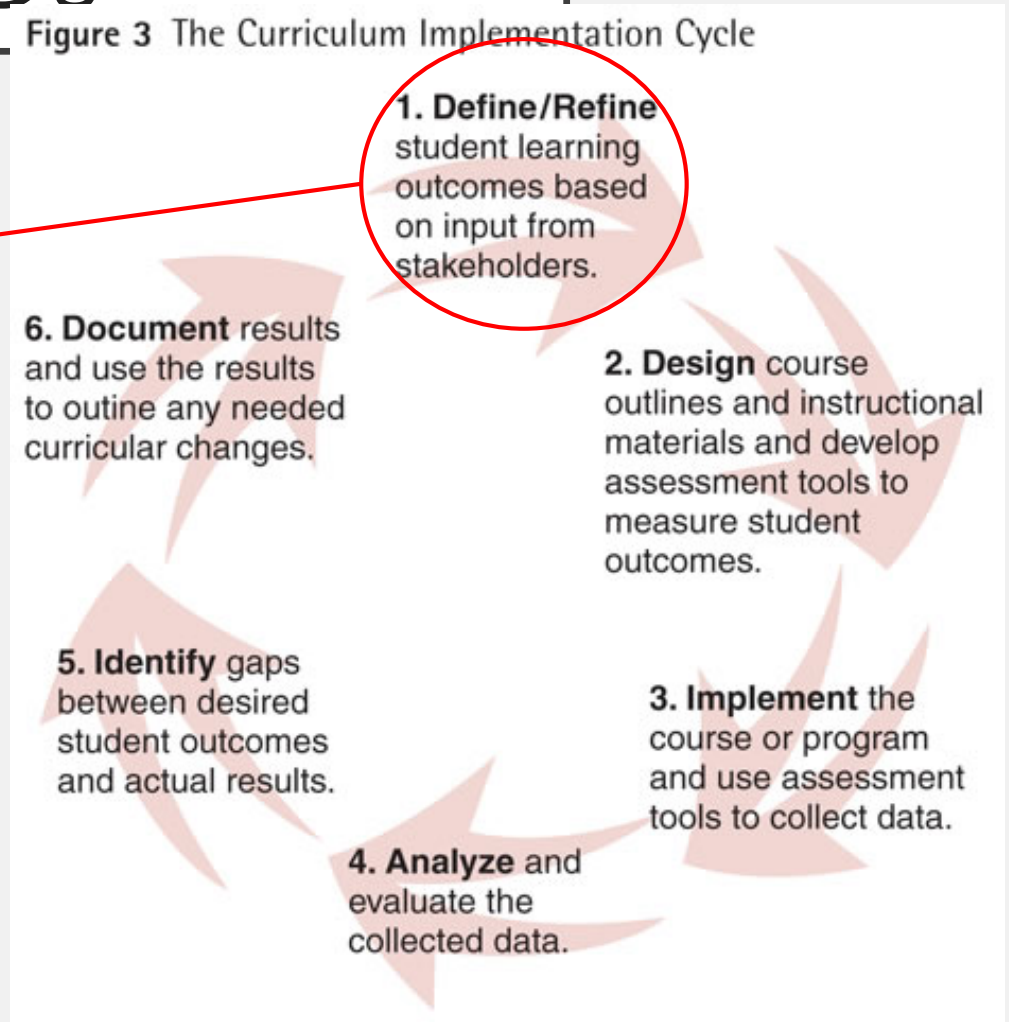
- Who are we teaching?
- What do we want them to know, do and value?
- And why?

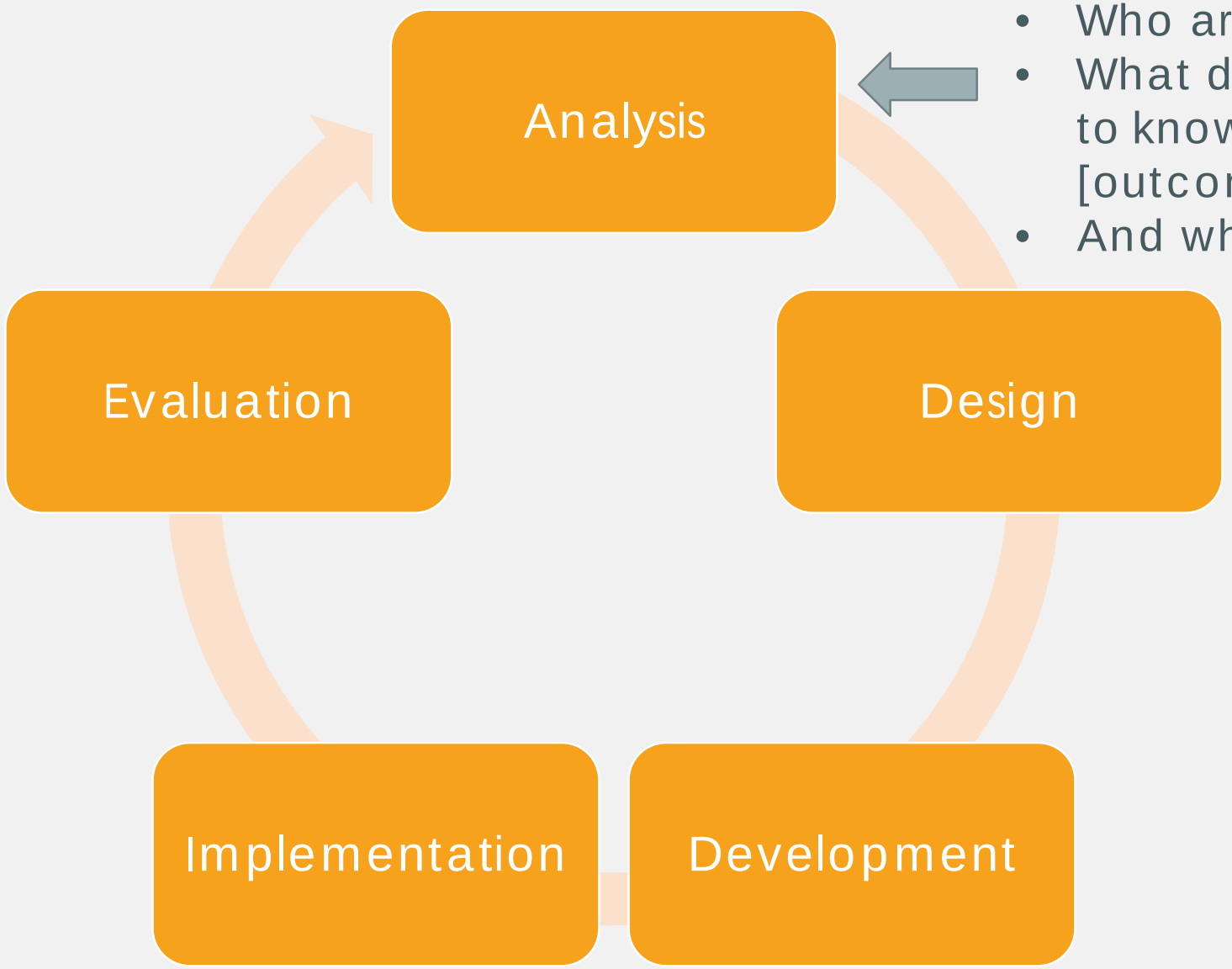
Priming the course!

AMATYC: IMPACT (draft)

AMATYC: *BEYOND CROSSROADS*

1. Define/Refine student learning outcomes based on input from stakeholders





- What is the **purpose**?
- Who are our students?
- What do we want them to know, do and value? [outcomes]
- And why?

WHO ARE WE TEACHING?

EXAMPLE FROM UVU'S QUANTITATIVE REASONING COURSE (MAT 1030). MAJORS:

- Dance
- Music
- Music Education
- Performance (Music)
- Art & Design
- Art & Visual Communications
- Animation & Game Dev
- Mechatronics Engineering Technology
- Theatre Arts
- Theatre Arts Education
- Digital Cinema
- Humanities
- Philosophy
- Deaf Studies
- English
- English Education
- Spanish
- Behavioral Science
- Pre-professional (nursing)
- Community Health
- Construction Management
- Aviation Science
- Political Science
- History
- Hospitality management
- Undeclared

WHAT DO THEY NEED TO KNOW, DO, AND VALUE?

AMATYC: *Beyond Crossroads*

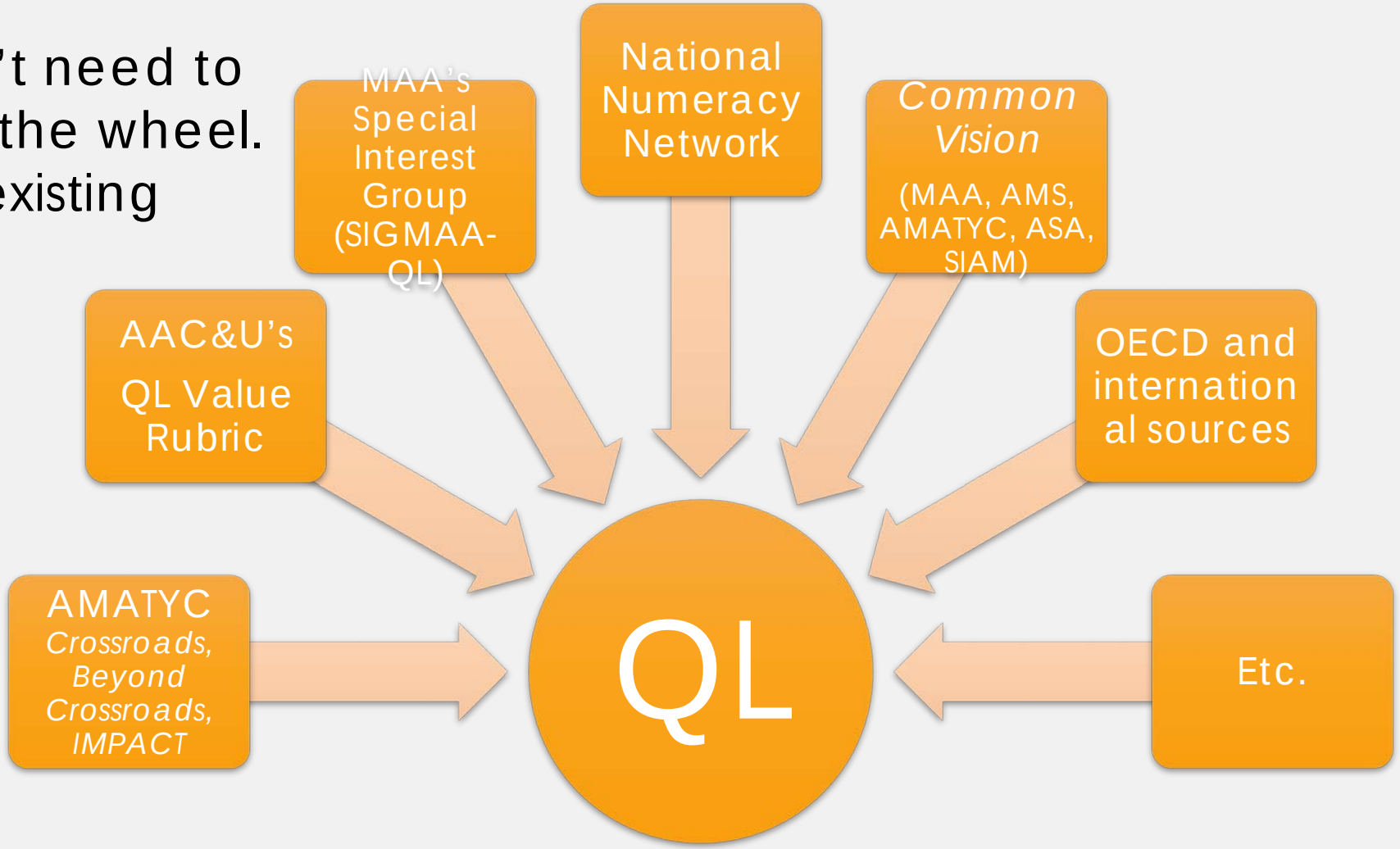
Quantitative literacy includes “five different dimensions of numeracy:”

practical, civic, professional, employment, recreational, cultural

from L.A. Steen, *Why Numbers Count: Quantitative Literacy for Tomorrow’s America*

WHAT DO THEY NEED TO KNOW, DO, AND VALUE?

You don't need to reinvent the wheel. Pick an existing model.



Discussion:

1. Helpful for you to do some thinking before we proceed
2. Introduce yourself (e.g., name, institution, interest in topic)
3. Imagine that you are a committee tasked with developing a new QL course, Math for the Liberal Arts.
4. This is your first meeting, talk about what you would do to begin.

THREE PURPOSES

To prime is to prepare or equip for a particular purpose, or to perform a specific task.

Potential primary purposes:

- General education—Breadth
- General education—Core skills
- Breadth-Core hybrid

GENERAL EDUCATION—BREADTH

- QL course as a distribution course
- Exposure to mathematics
- Defense of mathematics
- To what end? Outcomes fuzzier and harder to

"There have been liberal arts courses required which often covered topics faculty WANTED to teach and/or provided a survey of mathematical ideas while doing little to develop the student's reasoning powers. In fact, they provided a hurdle to jump for degree requirements, but little 'carry away' value."

Linda Sons, "Some historical notes" in Gillman, R. (Ed.). (2006). *Current practices in quantitative literacy*(No. 70). MAA

GENERAL EDUCATION—CORE SKILLS

- QL course as a core skills course
- Develop QL skills they can use:
  - (a) in their major,
  - (b) in future employment, and/or
  - (c) as a citizen
- Specific learning outcomes but harder to develop the outcomes

BREADTH-CORE HYBRID

- Trying to do it all
- Jack-of-all-trades but master-of-none?
- Least intentional?
- Harder to assess with dual purposes

THREE PERSPECTIVES

Philosophy of the course determined by the lens being used:

- Pure mathematician

  "Now's our chance to show the students some 'cool' math."

- Student

  "Just give me some math that I can actually use."

- Smörgåsbord

  "Check out all of the great topics and software, with all of its bells and whistles."

Discussion:

Primarily, do we invite the students into our world
OR
bring math into their world?

SMÖRGÅSBORD

Decide on your purpose and outcomes BEFORE you select a textbook!

Then customize as needed.

- Voting Theory
- Apportionment
- Fair Division
- Graph T
- Gr
- F
- Stat
- Proba
- Sets
- Historical counting systems
- Fractals
- Cryptography

[Lippman *Math in Society]*

nd problem solving

inking Critically

- Approaches to problem

Quantitative Informati eryday life

- Numbers in world
- Mana ev

Probability and statistics

- Statistical reasoning
- Putting statistics to work
- Probability: Living with the odds

M

onential astonishment

- Modeling our world
- Modeling with geometry

Further Applications

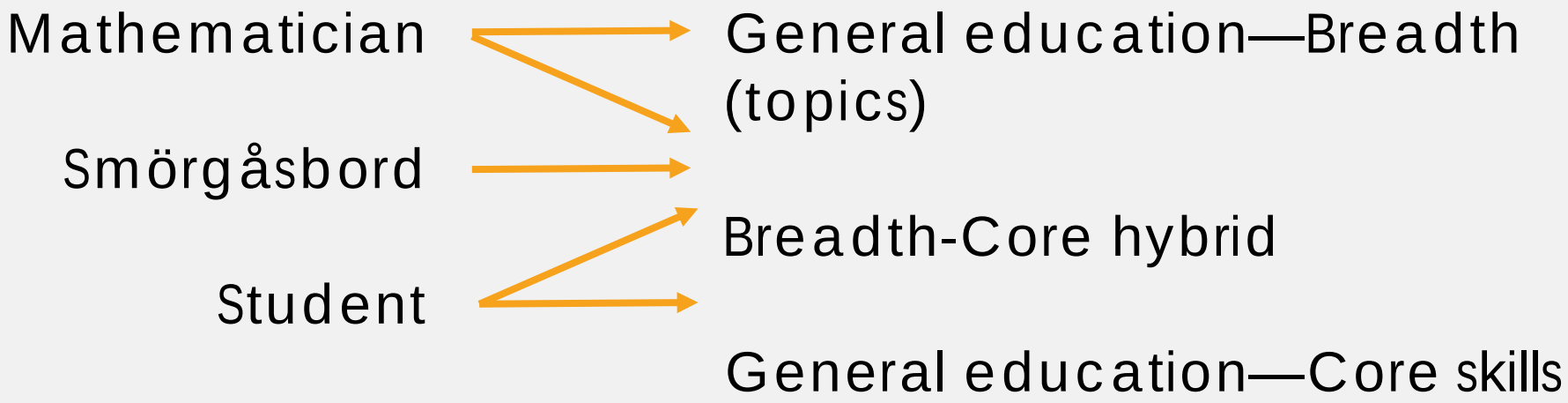
- Mathematics and the arts
- Mathematics and politics

[Bennet & Briggs *Using & Understanding Mathematics]*

MATHEMATICIAN PERSPECTIVE COMPARED WITH STUDENT PERSPECTIVE

With a mathematician's perspective:	With a student's perspective in mind:
What am I going to teach?	What will the students be able to do?
What is the probability of picking a red and a white marble out of the bag?	What is the expected value of buying an extended warranty?
What percentage of values fall between one standard deviation above and two standard deviations below the mean (normal distribution)?	How should students interpret the article they just read about the results of a study?
Write the explicit formula for exponential growth data.	Identify the issues with making predictions with an actual model.

PERSPECTIVES VS. PURPOSES



FOUR PRINCIPLES

For a student perspective

- Rigor is important but it may look different than you are used to.
- We do not know what the students have actually learned (compared to our purpose) unless we bother to check.
- Instructors might have to change their mindset – this is not a “typical” math class.
- Students might have to change their mindset – this is not a “typical” math class

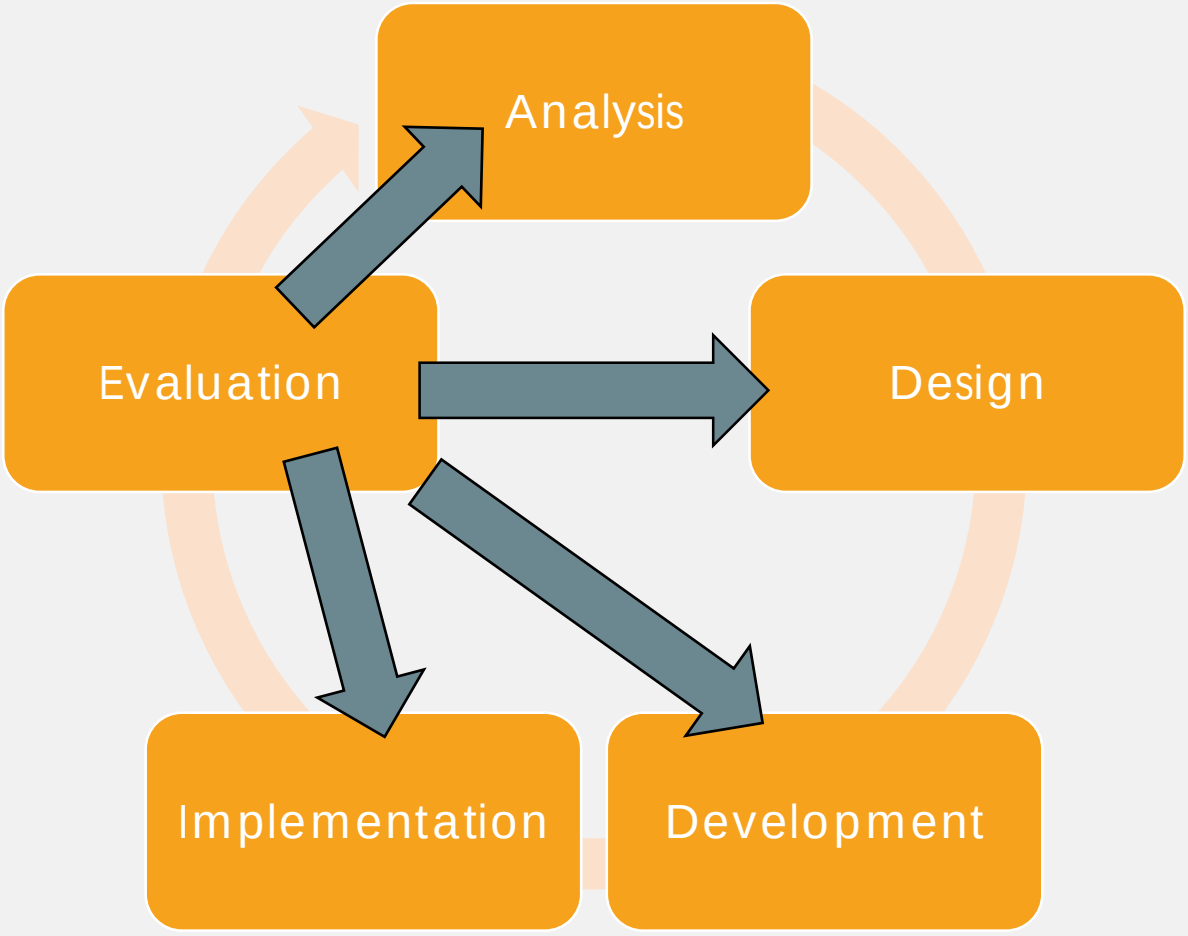
RIGOR

- It is not algebra
- It is conceptual, thinking critically, making assumptions, interpreting, etc.

High school and college faculty may be tempted to think that because the underpinnings of quantitative literacy are middle school mathematics, they are not responsible for teaching it. Nothing could be further from the truth. Although the mathematical foundation of quantitative literacy is laid in middle school, literacy can be developed only by a continued, coordinated effort throughout high school and college.

Hallett, D. H. (2003). The role of mathematics courses in the development of quantitative literacy. *Quantitative Literacy: Why Numeracy Matters for Schools and Colleges, edited by*

ASSESSMENT



FACULTY MINDSET

- It is not about drill and practice.
- It is not about one correct answer
- It is about open-ended questions, assumptions, estimates
- It is about communicating mathematical ideas
- It is current and relevant
- It is time consuming
- It is fun

STUDENT MINDSET

- Students need to know your purpose/perspective OR they may misinterpret what you are trying to do
- They need a warning that they may have to find the information they need, or assume it, or estimate it and they might not have the same exact answer as someone else
- They need to explore some problems with minimal guidance at first
- They need to feel safe concerning how they are graded

UVU'S QUANTITATIVE REASONING COURSE OUTCOMES

OUTCOMES (AAC&U RUBRIC)

1 -Explain real world information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words), including making reasonable predictions of trend data;

2 -Convert relevant information into various mathematical forms …

3 -Perform calculations to solve authentic problems;

4 -Analyze real world data as the basis for competent judgments, …

5 -Make and evaluate important assumptions in estimation, modeling, and data analysis …

6 -Express quantitative evidence in support of an argument or specific purpose

OUTCOMES IN CONTEXT

- Manage personal resources and make financially sound decisions through mathematical analysis.
- Use mathematical models to organize, communicate, and solve problems.
- Students will use logic to analyze situations and make choices.
- Use statistics and probability to make decisions.