

Field of Life Catapult Challenge (Resource Exchange)

Dr. Melissa Carole Richards, Clarkson University

Dr. Melissa C. Richards is an Assistant Professor and the Director of the K12 Robotics Outreach Program at Clarkson University's Institute for STEM Education. She specializes in problem- and project-based STEM education, experiential learning, outreach, and mentorship.

Dr. Richards holds a Ph.D. in Mechanical Engineering. Her research focuses on theoretical rock mechanics and STEM education. She is dedicated to promoting diversity, equity, inclusion, and a sense of belonging for underserved and underrepresented students, particularly in engineering. Furthermore, since 2018, she has served as a Regional Program Delivery Partner for FIRST LEGO League, inspiring young people to explore robotics and engineering.

Jennifer L. Ball, Clarkson University

Dr. Jan DeWaters P.E., Clarkson University

Dr. Jan DeWaters is an Associate Professor in the Institute for STEM Education with a joint appointment in the School of Engineering at Clarkson University, and teaches classes in both areas. Her research focuses on developing and assessing effective, inclusive teaching and learning in a variety of settings. An environmental engineer by training, Dr. DeWaters' work typically integrates environmental topics such as energy and climate into STEM settings.



FIELD OF LIFE: CATAPULT CHALLENGE (RESOURCE EXCHANGE)

**A flexible, game-based engineering activity
for engagement, teamwork, and SEL**

ACTIVITY OVERVIEW

The Field of Life: Catapult Challenge is a high-impact, low-barrier, game-based engineering activity designed primarily for middle school classrooms (grades 6 - 8), with easy adaptation for all ages, outreach programs, first-year engineering courses, and educator professional development. The activity can stand alone within a single class period or be seamlessly integrated into existing STEM, interdisciplinary, or team-building lessons while still meeting grade-level standards.

At a time when students are increasingly digitally focused, face-to-face learning experiences that support collaboration, communication, and reflection are especially valuable. ***This challenge offers an active, low-screen-time, collaborative learning experience that supports engineering design, mathematical reasoning, and social-emotional learning (SEL) through a meaningful, metaphor-driven framework.***

The “Field of Life” metaphor emphasizes that success—both in engineering and in life—rarely happens in isolation. Students experience how success in life is shaped by teamwork, adaptability, and decision-making within changing conditions. Through varied starting points, resource differences, and unexpected challenges, students are encouraged to adapt, reflect, respond constructively to setbacks, and recognize that learning from mistakes and failures is a critical part of growth.



**CASEL Core Social Emotional Learning (SEL)
Competencies (casel.org)**

Melissa Richards, PhD - richarmc@clarkson.edu

Jennifer Ball, PhD - jball@clarkson.edu

Jan DeWaters, PhD - jdewater@clarkson.edu

INTENDED AUDIENCE

- Middle school students (grades 6 - 8)
- In class, after-school, or STEM outreach programs
- Adaptable for grade levels, first-year engineering courses, Interdisciplinary classrooms or teams, or Educator workshops and professional development

Time Required: 60 - 75 minutes

Group Size: 4 - 7 students per team

Setting: Classroom, or multipurpose space

LEARNING GOALS

By the end of the activity, students will:

- Apply the engineering design process
- Use mathematical reasoning to reach a target score
- Reflect on opportunity, failure, and resilience
- Practice CASEL (Collaborative for Academic, Social, and Emotional Learning) core SEL competencies

SEL AND ENGINEERING INTEGRATION

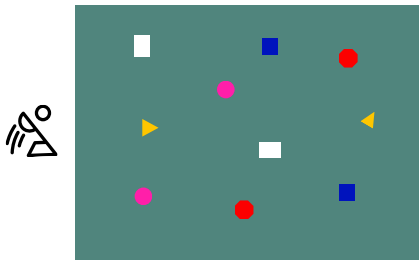
This activity embeds the CASEL core SEL competencies within engineering practice:

- Self-Awareness: Recognizing emotions during success or failure
- Self-Management: Regulating frustration and persisting
- Social Awareness: Recognizing unequal starting conditions
- Relationship Skills: Communication, Shared leadership
- Responsible Decision-Making: Negotiating rules and strategies

MATERIALS NEEDED

- Popsicle sticks (15 - 20 per group)
- Rubber bands (8 - 10 per group)
- Plastic spoons (2 - 3 per group)
- Ping pong balls (5 - 7 per group)
- Plastic or paper cups (varied sizes)
- Colored tape or shape labels
- Artificial grass mat (3' x 4') or tri-fold boards
- Self-adhesive hook-and-loop or Dual Lock dots
- Die/spinner/cards for optional twists

Cup colors, shapes, point values, and layouts are intentionally randomized for each team. See the sample field layout below.



ACTIVITY FLOW

For the Educator Prep and Setup Guide, please visit <https://tinyurl.com/fieldoflifecatapult>, or scan the QR code below.

1. Introduction (5 mins.)

- Explain the catapult challenge goal (e.g., launch ping pong balls into cups so the total score equals a target value such as 100 points).
- Review the materials and the overall activity flow.

2. Rule Negotiation (5 - 10 mins.)

As a class, discuss and decide on rules, i.e.,

- Can balls be removed from negative cups?
- Are there penalties or limits?

Record final rules publicly to reinforce shared responsibility and fairness.

3. Design, Build, and Test (15 - 20 mins.)

- Brainstorm and explore possible catapult designs.
- Teams may build multiple catapults as time and supplies allow.
- All members must participate in planning, design, testing, launching, and ball retrieval.

4. Optional Mid-Activity “Life Event” Twists
To model real-world uncertainty, the facilitator may introduce a randomized twist using a die, spinner, or cards: (choose 1 to 2 max)

- Supply Chain Disruption – One building material must be returned.
- Temporary Injury or Absence – One team member shifts to an advisory role for a round.
- Leadership Transition – The team leader must rotate roles.
- Natural Disaster – One catapult or resource is removed.
- Economic Shift – Resources are redistributed across teams.
- Community Support (Positive Event) – Teams may share or donate a resource.

5. Timed Launch (5 - 10 mins.)

- Teams launch for 2-3 minutes according to the agreed-upon rules.
- Teams retrieve balls as permitted.
- Scores are calculated at the end of the round.

6. Reflection & Debrief (10 - 15 mins.)

- What strategies worked or failed?
- How did your team respond to setbacks?
- What did unequal resources or layouts represent?
- How did your team support one another?
- Why do you think this activity was called the “Field of Life”?
- How can you apply what you learned from this activity to your life?

ACTIVITY ASSESSMENT

The assessment for this activity is intentionally simplified and formative:

- Facilitator observation of teamwork and participation
- Student verbal or written reflection
- Scan QR code for an optional CASEL-aligned pre/post survey (5 mins.)



<https://tinyurl.com/fieldoflifecatapult>