STEAM and EI: Role of Occupational Therapy

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1.5 PDUs
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Course Description

- Occupational therapy early intervention services can be enhanced using science, technology, engineering, arts, and math (STEAM).
- An OT-led STEAM program will be described along with suggestions for implementation in early intervention services.

Course Objectives

- Identify the unique differences between science, technology, engineering, arts, and math (STEAM) and science, technology, engineering, and math (STEM) programs
- Describe the benefits of STEAM for early intervention (EI) services
- Examine the unique contributions of occupational therapy in providing STEAM in EI services

GUIDING QUESTION

What is the role of science and engineering in OT services for young children?



What can we take from this to incorporate into our own OT practice?

SCIENCE'S ROLEIN OT

Understanding the definitions of **STEAM** and **STEM** provides context for how OTs can use interactive and sensory science to model ways to support regulation, participation, and curiosity to caregivers in real time so they can bring it home to use in everyday life.



STEAM and STEM

Similarities and Differences

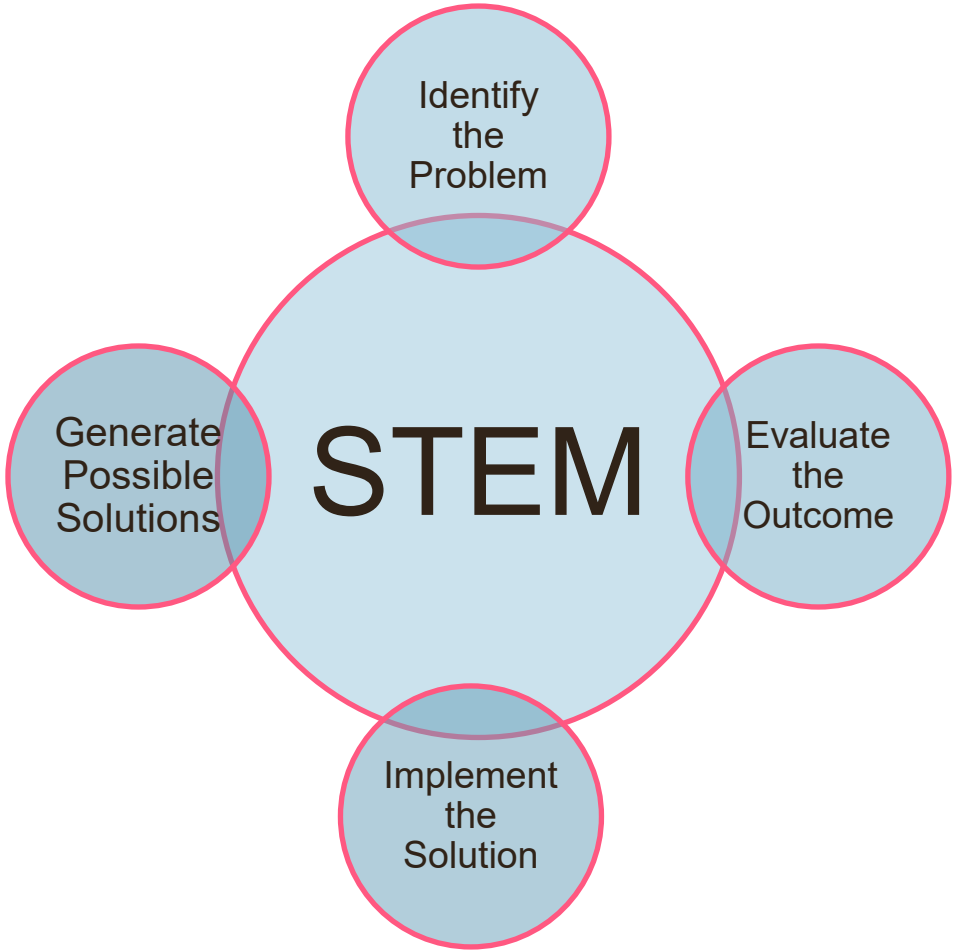
STEM

Science, Technology, Engineering and Mathematics

- STEM educational programming has been used in elementary schools for several years. The focus is on inquiry, observation, experimentation, reasoning, and reflection.
- STEM provides learners an opportunity to understand how knowledge applies to real-life contexts (Zhou et al., 2019).
- STEM provides children with opportunities to connect ideas across disciplines and to explore the world as a meaningful whole (English, 2017; Siregar, 2025).

STEM
Science, Technology, Engineering and Mathematics

- STEM in the early grades is not simply about teaching science early; it is about cultivating lifelong habits of mind asking questions, testing ideas, revising one's thinking, and seeking meaning in the connections between disciplines. By helping children see learning as a coherent journey rather than a set of separate lessons, STEM builds a foundation for creativity, resilience, and curiosity that extends far beyond the classroom (Ismael et al., 2026).



The STEM process is interconnected; typically beginning with a problem but then works on the potential outcome along with implementing a solution This process may reveal a new problem

Ismael et al., 2026

Small Group Activity!

Tying shoes would not be a toddler task but consider the steps involved in learning to tie shoes

In a small group describe the “Technology” & “Engineering” aspect of tying shoes

What ***“discovery process”*** could support mastery of this skills?

What OT strategies have you used to help a child tie shoes?



***Identifying the Problem*:** Recognizing the presence of a problem in a given situation; distinguishing between relevant and irrelevant information; expressing the problem verbally in simple terms; understanding the goal or desired outcome; and asking clarifying questions to ensure comprehension.

***Generating Possible Solutions*:** Suggesting multiple ways to solve the problem; Drawing on prior experiences to propose solutions; Using imagination or analogy to generate ideas; Predicting the potential outcomes of each solution; Collaborating with peers to refine ideas; and Demonstrating flexibility in thinking.

***Implementing the Solution*:** Selecting the most appropriate solution strategy; demonstrating persistence in applying the chosen approach; using available materials or resources effectively; and adjusting the plan when encountering difficulties.

***Evaluating the Outcome*:** Reflecting on whether the chosen solution achieved the goal; identifying what worked and what did not; expressing satisfaction or dissatisfaction with the result; suggesting improvements for future situations; explaining lessons learned from the experience.

STEM Investigation with 46 children ages 6-8 in school
Pre-test/post-test quasi-experimental design

Identifying the Problem

The ability to recognize a problem, distinguish key information, and express the challenge in one's own words.

Generating Possible Solutions

The capacity to suggest multiple ideas or strategies, drawing on imagination, previous experiences, and reasoning.

Implementing the Solution

The ability to choose a suitable strategy and apply it practically or verbally explain the steps for solving the problem.

Evaluating the Outcome

Reflecting on whether the chosen solution worked, what could be improved, and what was learned from the experience.

Assessment tool used to detect changes in skills following STEM

The child is shown a picture of a broken toy and asked: “Your favorite toy stopped working. What is the problem, and what might have caused it?”

A picture of a classroom with scattered crayons is shown. The child is asked: “How can we organize the crayons so everyone can find their colors easily?”

The child is presented with a task: “You have three blocks and need to make a bridge for a toy car to cross. What will you do first?”

After solving the block construction task, the child is asked: “Did your bridge work as you wanted? What would you change if you could build it again?”

Intervention: Nine specific lessons were developed using principles of STEM education
All children completed pre-test/post-test assessment of oral problem-solving skills

RESULTS: All children made significant improvements in all 4 areas of STEM
Interpretation: Gains seen with STEM programming, but this was not a RCT

STEM compared to STEAM

The STEM approach uses an interdisciplinary approach to problem-solving to equip learners with skills such as critical thinking, creativity, problem-solving, self-direction, initiative, collaboration, effective communication, and morals. It also aims at providing them with the opportunity to apply these skills through the practices, contexts, and processes of hands-on activities. These are targeted at understanding science and viewing science differently, which might enable them to participate in a STEM-career pathway.

STEAM is grounded in a transdisciplinary approach to science teaching and learning. It explores the application of the arts in science teaching and learning. This is aimed at improving the confidence, attitudes, and interests of learners in science through new approaches to problem-solving which might strengthen positive attitudes towards science.

Okwara & Pretorius, 2023

Limitations Identified in STEM Programs

- STEM does not explicitly encourage self-expression in the learner
- STEM encourages discovery and solutions through experimentation but does not focus on creating novel options

Okwara & Pretorius, 2023

Advantages of STEAM

- The creative and engaging aspect of the arts enhances the learner's interaction with the process
- Research has shown that STEAM curricula can lead to increased motivation, engagement, and academic achievement (Becker & Park 2011; Lin & Tsai 2021; Quigley et al. 2020).
  - The process can be as simple as using the “clean-up” song when working on visual spatial organizational concepts of returning toys to “cubbies” of different sizes or returning toys of various sizes to shelves of different heights
  - Using primary finger paint (red, blue, yellow) to create green or purple

Infants and toddlers are young scientists conducting research to find out how the world works.



(Bucher & Pindra, 2020)



Infants and toddlers understand concepts, such as cause and effect, that help them build sophisticated reasoning skills and conceptual knowledge

(National Research Council 2000; USDHHS 2015; Bucher & Hernández 2016).

Developmental skills	Observable infant and toddler behaviors
Executive function	Persists; develops confidence; approaches new experiences and takes risks; maintains focus and sustains attention
Initiative and curiosity	Shows eagerness and curiosity as a learner; initiates actions with materials
Creativity and inventiveness	Experiments with different uses for objects; is flexible in actions and behavior
Exploration and discovery	Uses senses to explore; observes; makes things happen, watches for results, repeats; uses understanding of causal relationships
Memory	Recalls and uses information in new situations
Reasoning and problem solving	Uses a variety of strategies, imagination, and creativity to solve problems; uses spatial awareness to understand properties of objects and their movement in space; applies knowledge to new situations

(Bucher & Pindra, 2020)

A quasi-experimental study with 5th graders in SoCal compared a STEAM curriculum to a STEM curriculum

The study revealed that the integration of Arts as an instructional tool to teach science education played a pivotal role in enhancing the overall learning experience among students. Arts integration stimulated motivation, invigorated conceptual understanding, and offered unique avenues to help students learn complex scientific concepts.

Corrigan et al., 2025

Toddlers benefit from using creative media in discovering how the world works!

Su et al., 2025





Role of Occupational Therapy in Early Childhood STEAM



Regulation and Connection

Adapting tools and the environment so that children can follow their curiosity to play and learn in new and different ways.



Autonomy

Planning open-ended play, **inquiry**, and openly honoring different ways of participating while holding boundaries around safety and respect.



Caregiver partnership

Teaching caregivers about sensory seeking, defensiveness, grading, and regulation strategies

Allowing children to lead and make mistakes and coaching caregivers to do the same

Assumed Benefits of an Occupational Therapy STEAM Program for Toddlers

- Sensorimotor challenges adjusted to meet the toddler's level
- Psychosocial and relationship building activities provided with the inclusion of creative (Arts) activities (STEAM)
- Critical thinking fostered by providing exploratory opportunities that have variable outcome – the outcome does not need to be PERFECT!
- Designing the lab for regulation means that every child can participate. When children are regulated, they are capable of learning amazing things.

Small Group Activity

1. Form a small group of 2-3
2. What area(s) of Science, Technology, Engineering, Arts, and/or Math (STEAM) could be addressed at a sand table with toddlers?
3. Pick one area and what goal would you write for the child?



DESIGN PRINCIPLES for Bright Sparks

What to consider when designing OT STEAM experiences:

REGULATION

- Big body play for big energy
- Safe, familiar activities for kids who need a gentle entry

CHILD-LED

- There are many ways to explore
- Grade activities to build confidence, inquiry, and curiosity
- Permission to leave and come back

SENSORY/ EMBODIED

- Sensory on purpose
- Variety of sensory input
- Learning by DOING, MOVING, TOUCHING, and FEELING

CONNECTION

- Community bonding
- Caregivers experience their children as learners

Regulation Supports Exploration

Different children, different paces

“Sometimes, observation is the science.”

Options for movement and effort

Make room for explosive big body movements.

Responsive support

Adjust sensory demands, adapt the challenge, and support co-regulation through caregiver connection.

Re-defining “participation” to families

Allowing children to leave and return. Watching from the swings is still participation.

Designing for Inclusion (Universal Design)

A shared water flow/gravity investigation

Children can approach the same exploration in different ways.

Different points of entry

Watch beside a caregiver, use the water pump to fill the bucket at the top, pour from a watering can, or play in the water sensory bin.



Making Sensory Play Accessible



BIG Bubbles

Bubble fan



Bubble Whisk



Bubble Soup

Bubble SPLAT





Bubble Painting

Bubble Car Wash



Exploring Together in Community

Children
Watch another approach, try an idea, or contribute in their own way.

Caregivers
Observe ways to support exploration and exchange ideas.

Carry Over
Children and families meet in familiar places in their communities

Connection
Create opportunities for discovery alongside others.



OT IN THE COMMUNITY

Children’s Volition: Whose Idea Is It?

Follow interest

Honor a child’s curiosity to build trust

Different sensory experiences

Provide meaningful choices and room for unexpected uses of materials.

Change of direction

Make space for repetition, refusal, and withdrawal.





Let them PLAY!

Boundaries are simple:

1. We respect bodies

2. We respect materials

We don't need to teach children how to play... They already are experts!





STEAM creates an opportunity for young children to learn how to think like scientists.

Through shared exploration, children can act on their curiosity, connect with others, and discover what they are capable of doing .

OT helps to make those opportunities accessible to children and meaningful to families.

Implementing STEAM Into OT Practice

Start with everyday play.	Explore ramps, water, shadows, sound, or building using familiar or found materials.
Follow the child's lead.	Leave room for choice, repetition, and unexpected discoveries.
Adapt for participation.	Consider the fit between the child/caregiver, the activity, and the environment.
Make room for expression.	Use movement, music, storytelling, or art to explore and communicate ideas.
Coach caregivers in the moment.	Model how to notice, pause, and support exploration, then identify a simple way to try it at home.

How Does OT -informed STEAM Play Translate to Family Life?

Caregiver partnership helps connect STEAM exploration with everyday opportunities for play, regulation, and participation.

To understand what families valued and what made exploration at home easier or harder, we started by asking parents about their experiences.

Parent Perspective

The Preliminary Study

Pilot Project at Bright Sparks

Qualitative pilot investigation with caregivers (all parents) whose toddlers attended Bright Sparks STEAM OT program
Bright Sparks program developed by Jen Godin, MS, OTR/L
Research Questions:

1. **What are parents'/caregivers' perceptions of an occupational therapy (OT)-led STEAM (Science, Technology, Education, Art, and Mathematics) lab for toddlers?**
2. **What benefits and challenges did parents experience participating in the occupational therapy STEAM program with their young child (children)?**
3. **What benefits and challenges did parents experience when using the information/activities from the occupational therapy STEAM program at home with their young child (children)?**

Study Design

- Graduate Occupational Therapy students conducted semi-structured interviews with 3 parents in this pilot investigation
- Students also participated in select Bright Sparks sessions held with parent/caregiver and child in a small group setting
- Sessions conducted outside in a neighborhood park
- Focus not just to have a “playdate” but to provide parents with the tools to continue some of the STEAM activities at home and embed STEAM into everyday life

Data Collection & Analysis

1
Consent

Obtained approval from the SJSU Institutional Review Board

2
Semi-Structured Interviews

Students completed single session interviews

3
Transcription

Verbatim transcription of interview with additional content identifying emotional inflections

4
Thematic Analysis

Independent coding of transcript followed by development of a code directory



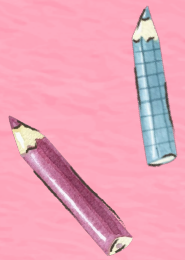
“Why did my phone drop?
And [child] was like, Gravity!
And I was like whoa!”

–Parent quote



Results!

24 codes derived from transcript data and analyzed, through an iterative process, into 7 themes


Themes

Benefits of OT -led STEAM Lab

“He knows how this works now, like, this is great.”

Challenges to Implementation at Home

“Chemicals and [the] mess are challenging.”



Availability of STEAM for Toddlers

“I felt like there weren't any classes like this for such a young age.”

Perception of Outdoor Setting

“Oh, thought it was great.”

Themes cont.



Recommendations for STEAM Lab Improvements

“Two different concepts are being combined there … which is complex enough for a toddler.”

Perceptions of OT - led STEAM Lab

“I enjoyed the community aspect of it.”

Prior Knowledge of STEAM

“When he goes to daycare, they often set up a table of sensory items”

Important “Take -Aways”

Creative Opportunities

Provide activities that are open-ended along with structured tasks

Structured Sensory

Add analysis of the sensory, not just the experience of the sensation

Collaborate with Parents

Provide additional support to help parents with the application of STEAM at home

Evidence

Advantages of STEAM in various group s





Evidence

Lage et al., 2023

Key Points for Occupational Therapy

1. Collaborate with parents across all stages of the program
2. Support family routines to enhance development of child and family
3. Create opportunities for shared discovery

Advantages using STEAM

Luton, 2021

Using STEAM with early elementary children had several benefits:
When children are actively engaged they learn better
Retention improved with this active engagement
As an OT we can:

- Prepare but be flexible
- Identify a “back-up” plan
- Add a STEAM component to our pediatric sessions!



Advantages and Challenges STEAM in Early Childhood Education

Su et al, 2025 – scoping review

Advantage s

- Children gained knowledge and skills compared to STEM or traditional classrooms
- Early childhood educators enjoyed the creative nature of STEAM



Challenge s

- Materials and limited resources impacted implementation of STEAM
- Techniques to include STEAM in the curriculum was limited

STEAM and Student C ompetence and Learning Motivation

Lin & Tsai, 2021

Quasi-experimental investigation with both quantitative and qualitative data

Quantitativ e

High school students – 57 in STEAM curriculum and 57 in regular curriculum

All students in the STEAM group displayed better project completion and learning motivation when compared to a comparison group

Qualitative

Interviews conducted with students in both groups

Students in the STEAM curriculum were able to apply skills across educational content

This was not reported from students in the comparison curriculum

STEAM building blocks

Lin & Tsai, 2021

Scaffolding

Provided by teachers or experts to support students' inquiry-based learning

Engaging

Students participate in student-centered curricula such as hands-on and collaborative activities.

Argumentation

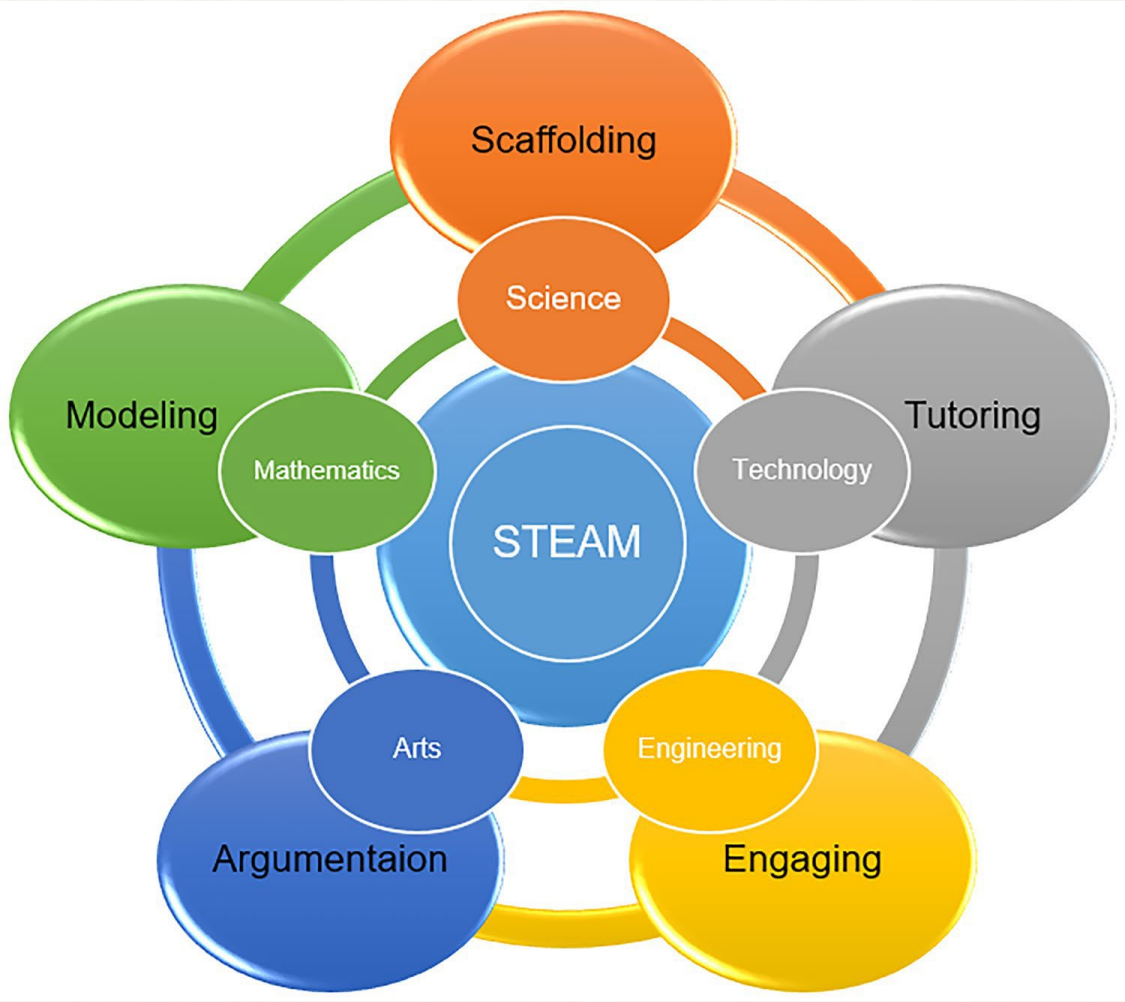
Covers socio-scientific issues, and helps develop positive attitudes toward science.

Tutoring

Important in small group learning, as teachers can provide important support for students during the process of problem solving

Modeling

Involves the creation and refinement of specific models to provide explanations for observations Modeling is an important skill that is challenging for students to learn



STEAM Benefits

The STEAM approach builds on each part and enhances the knowledge base for differing areas of the curriculum

Lin & Tsai, 2021

Reflective Exercise

Small Group or Individual



What part of STEAM do you currently use in your OT practice?

How would use of STEAM enhance and support your current OT practice?

What goal could you set for yourself in OT practice to incorporate concepts of STEAM?

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THANKS!

Questions?

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References:

Becker, K. H., and K. Park. 2011. “Integrative Approaches Among Science, Technology, Engineering, and Mathematics (STEM) Subjects on Students' Learning: A Meta-Analysis.” Journal of STEM education: Innovations and Research 12, no. 5: 23–37.

Corrigan, M. W., Wong, J. T., Grove, D., Andersen, S., & Hughes, B. S. (2025). enhancing elementary students conceptual understandings of scientific phenomena: the impact of STEAM-First and STEM-First approaches. *Science Education*, *109*(5), 1336-1364. https://doi.org/10.1002/sce.21942

Graham, N. & Brouillette, L. (2016). Using arts integration to make science learning memorable in the upper elementary grades: A quasi-experimental study. *Journal for Learning through the arts, 12*(1). https://files.eric.ed.gov/fulltext/EJ1125147.pdf

Lin, C. L., and C. Y. Tsai. 2021. “The Effect of a Pedagogical STEAM Model on Students' Project Competence and Learning Motivation.” Journal of Science Education and Technology 30: 112–124. https://doi.org/10.1007/s10956-020-09885-x
.

Luton, C. (2021). Coaching preservice teachers to integrate the arts in STEM content. *International Journal of Education & the Arts*, *22*(5). Retrieved from http://doi.org/10.26209/ijea22n5

Okwara, V. U. & Pretorius, J. P. H. (2023). The STEAM vs STEM Educational Approach: The Significance of the Application of the Arts in Science Teaching for Learners' Attitudes Change. *Journal of Culture and Values in Education*, 6(2), 18-33. https://doi.org/10.46303/jcve.2023.6

Quigley, C. F., D. Herro, E. King, and H. Plank. 2020. “STEAM Designed and Enacted: Understanding the Process of Design and Implementation of STEAM Curriculum in an Elementary School.” Journal of Science Education and Technology 29, no. 4: 499–518. https://doi.org/10.1007/s10956-020-09832-w

Sousa, D. A., & Pilecki, T. (2018). *From STEM to STEAM brain-compatible strategies and lessons that integrate the arts*. California, CA: Corwin.

Su, J., Yim, I. H. Y., Wegerif, R., & Wah Chu, S. K. (2025). STEAM in early childhood education: a scoping review. *Research in Science & Technological Education*, *43*(2), 495-511. https://doi.org/10.1080/02635143.2023.2296445