School participation in citizen science as an arena for transformative educational change

Empowering networks of research-practice partnerships through co-creating design knowledge

Keynote presentation at CITERS 2023 by Prof. Yael Kali

אוניברסיטת חיפה
University of Haifa
جامعة حيفا

Taking Citizen Science to School
המרכז לקידום מדע אזרחי בבית הספר


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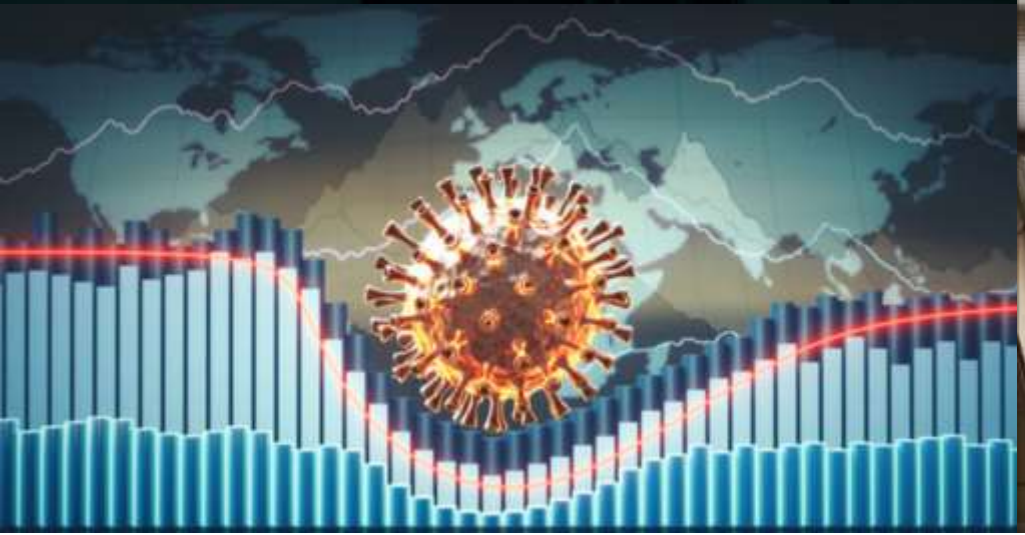
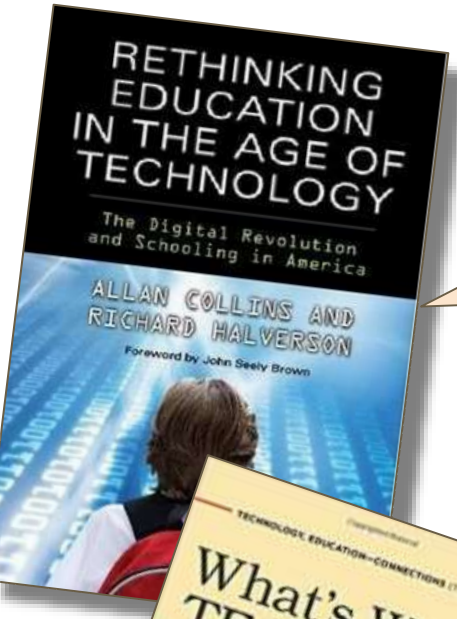
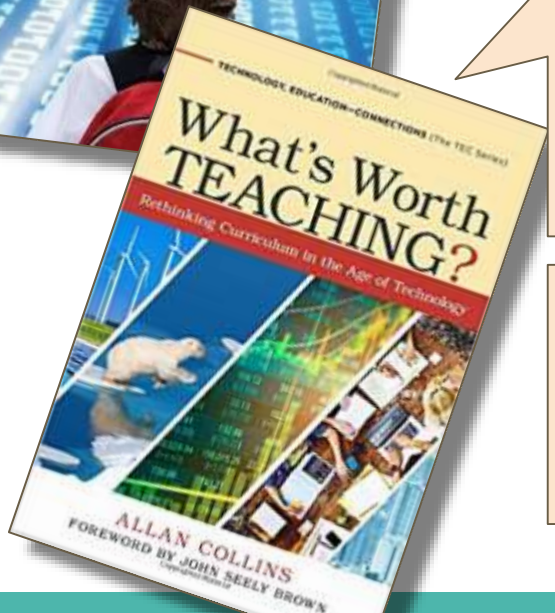


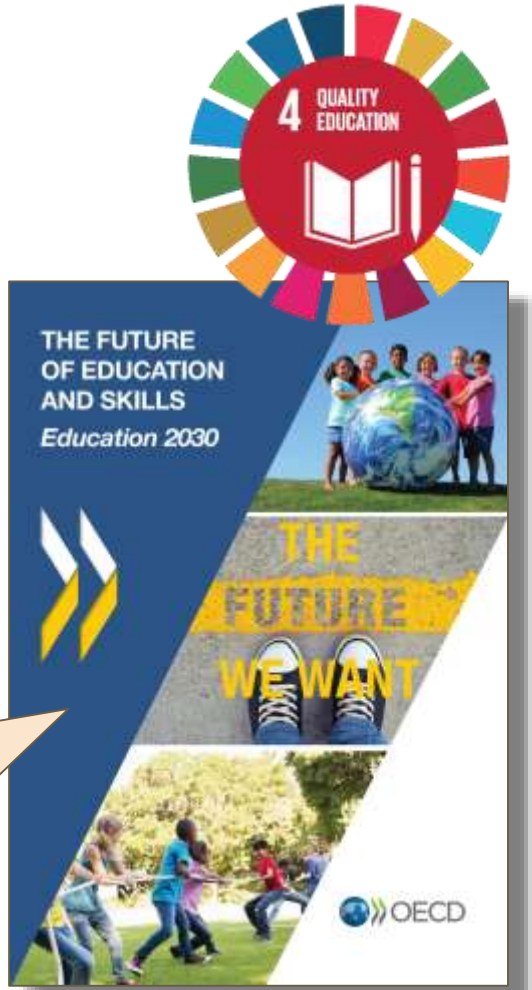




Schools everywhere are anchored in the past…[schools] aren't preparing youth for the complexity of today's world.

What a student should learn is to be a knowledgeable person, a good citizen, a thoughtful worker, a reflective thinker, and a valuable friend in a complex dynamic society.

Education needs to ...equip students with the skills they need to become active, responsible and engaged citizens…



Citizen science projects actively involve citizens in scientific endeavors Meaningful role: contributors, collaborators or project leaders

Citizen science projects have a genuine scientific outcome: Answering a research question, informing policy

Both the professional scientists and the citizen scientists mutually benefit participation: Research publication, social benefits, personal enjoyment

Citizen scientists are acknowledged in project results and publications.

Citizen scientists may, if they wish, participate in multiple stages of the scientific process: Design methods, gather data, analyze data

Citizen science project data and metadata are made publicly available and where possible, results are published in an open-access format.

Citizen science is considered a research approach like any other, with limitations and biases that should be considered and controlled for

Citizen scientists receive feedback from the project: How their data are being used and what the research, policy or societal outcomes are.

Robinson, L. D., Cawthray, J. L., West, S. E., Bonn, A., & Ansine, J. (2018). Ten principles of citizen science. In Citizen science: Innovation in open science, society and policy (pp. 27-40). UCL Press.

Credit to Foldit players

Published in final edited form as:

Nature. 2010 Aug 5; 466(7307): 756–760.

doi: 10.1038/nature09304

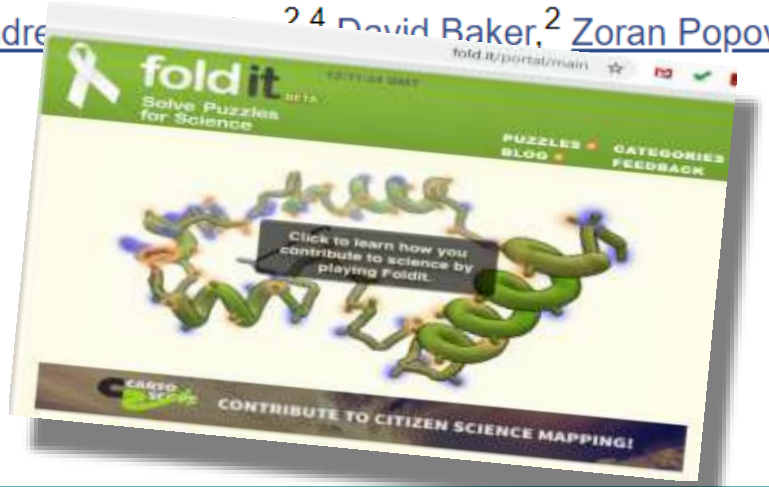
HHMIMSID: HHMIMS218516

PMID: 20686574

Predicting protein structures with a multiplayer online game

Seth Cooper,[1] Firas Khatib,[2] Adrien Treuille,[1,3] Janos Barbero,[1] Jeehyung Lee,[3] Michael Beenen,[1]

Andre[illegible] [2,4] David Baker,[2] Zoran Popović,[1] and >57,000 Foldit players[5]



Journal of Plankton Research academic.oup.com/plankt

J. Plankton Res. (2020) 42(2): 211–219. First published online February 27, 2020 doi:10.1093/plankt/fbaa008

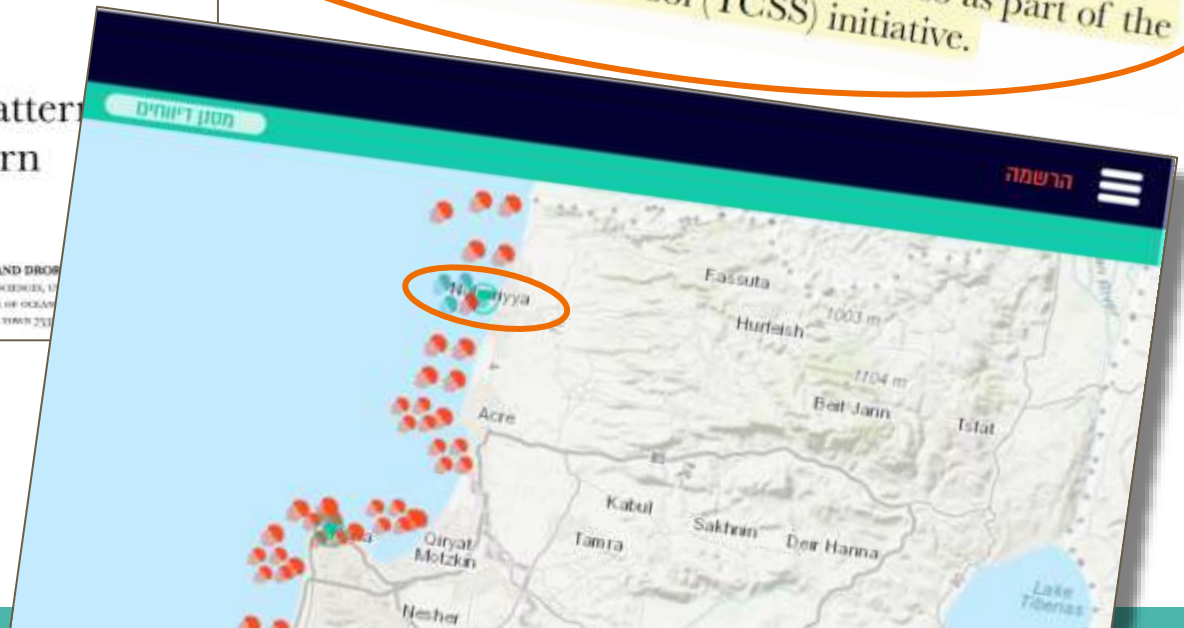
ORIGINAL ARTICLE

Phenological shift in swarming pattern of *Rhopilema nomadica* in the Eastern Mediterranean Sea

DOR EDELIST[1,*], TAMAR GUY-HAIM[2], ZAFRIR KUPLIK[1,3], NOA ZUCKERMAN[2], PHILIP NEMOY[1] AND DROR

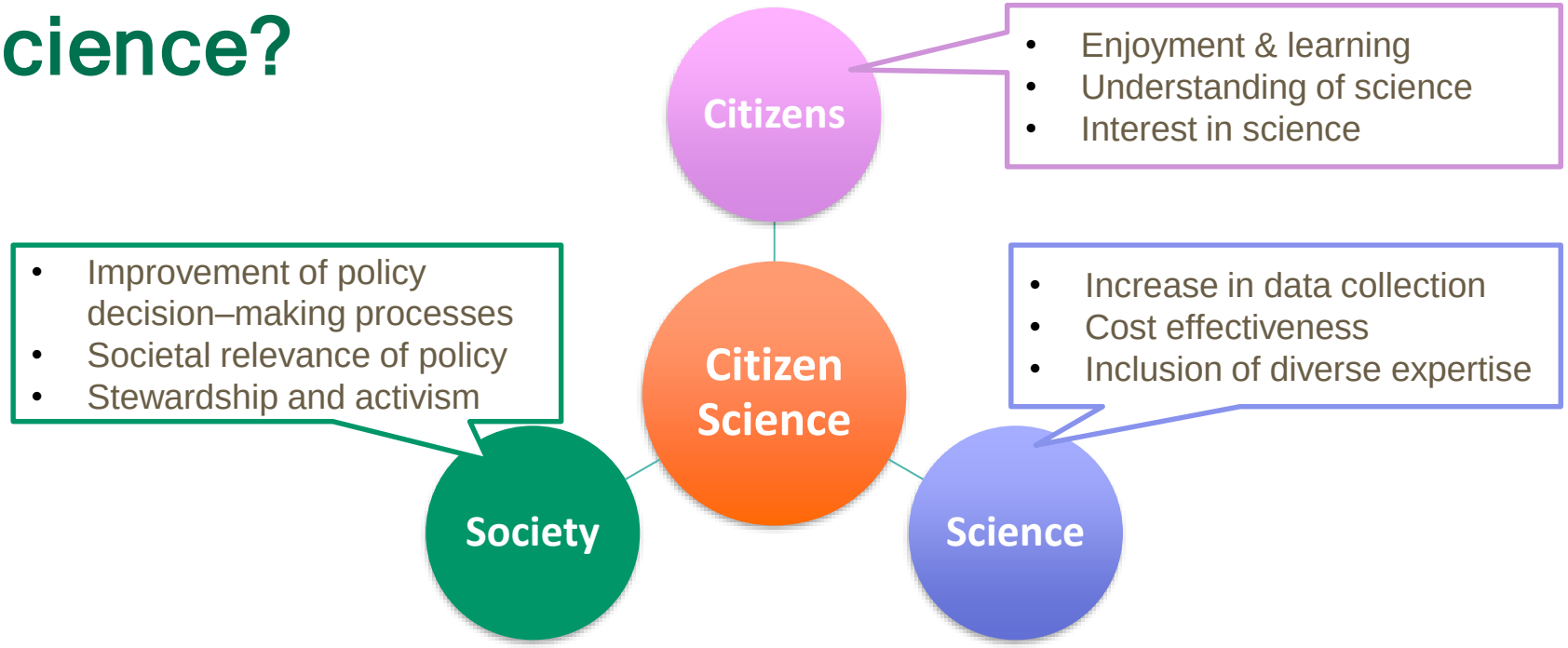
ACKNOWLEDGEMENTS

We would like to thank all the citizens who have contributed jellyfish observations to our website and especially to students in the Rambam School, Nahariya, Israel who did so as part of the Taking Citizen Science to School (TCSS) initiative.



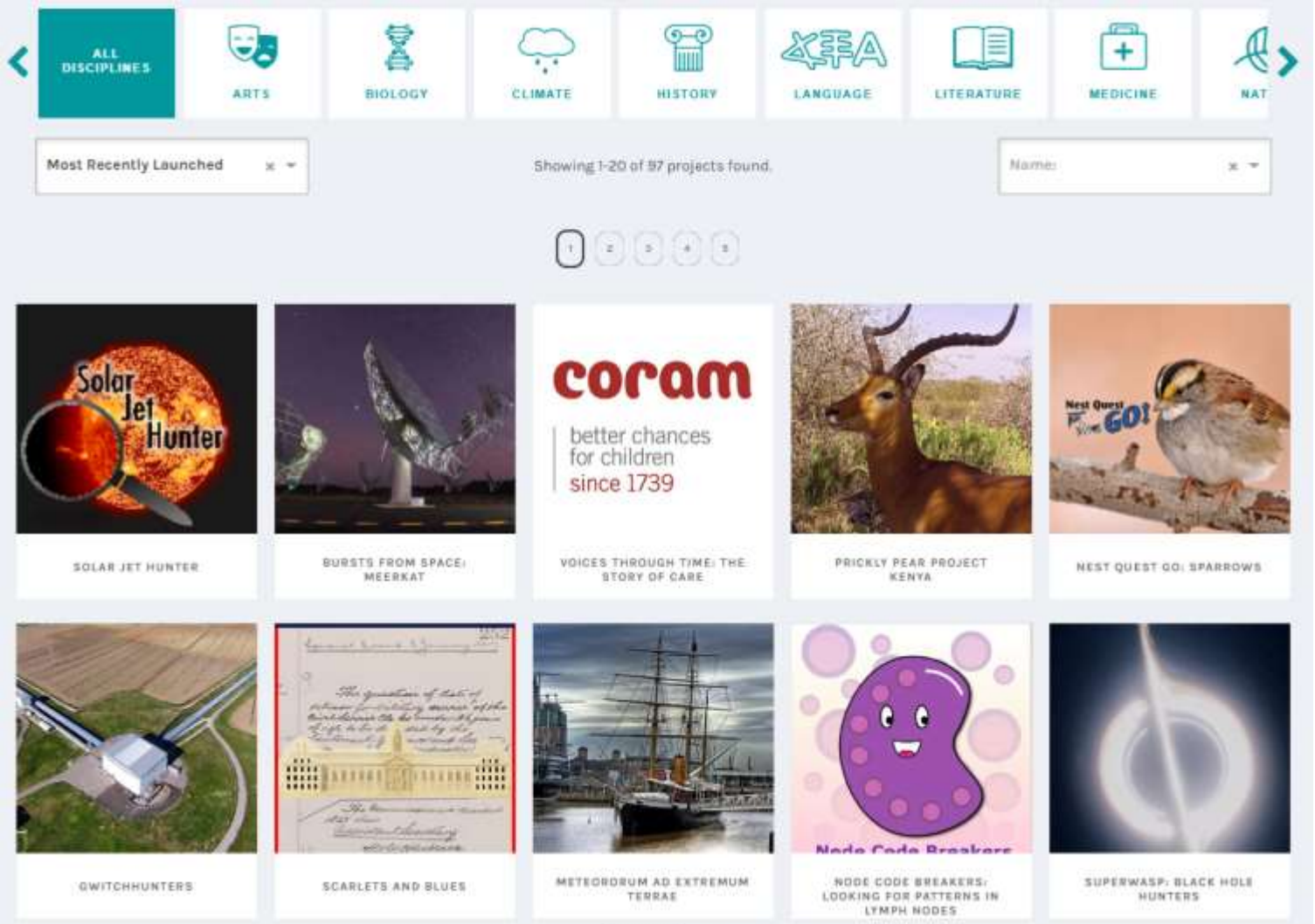
Why citizen science?

Win, win, win…



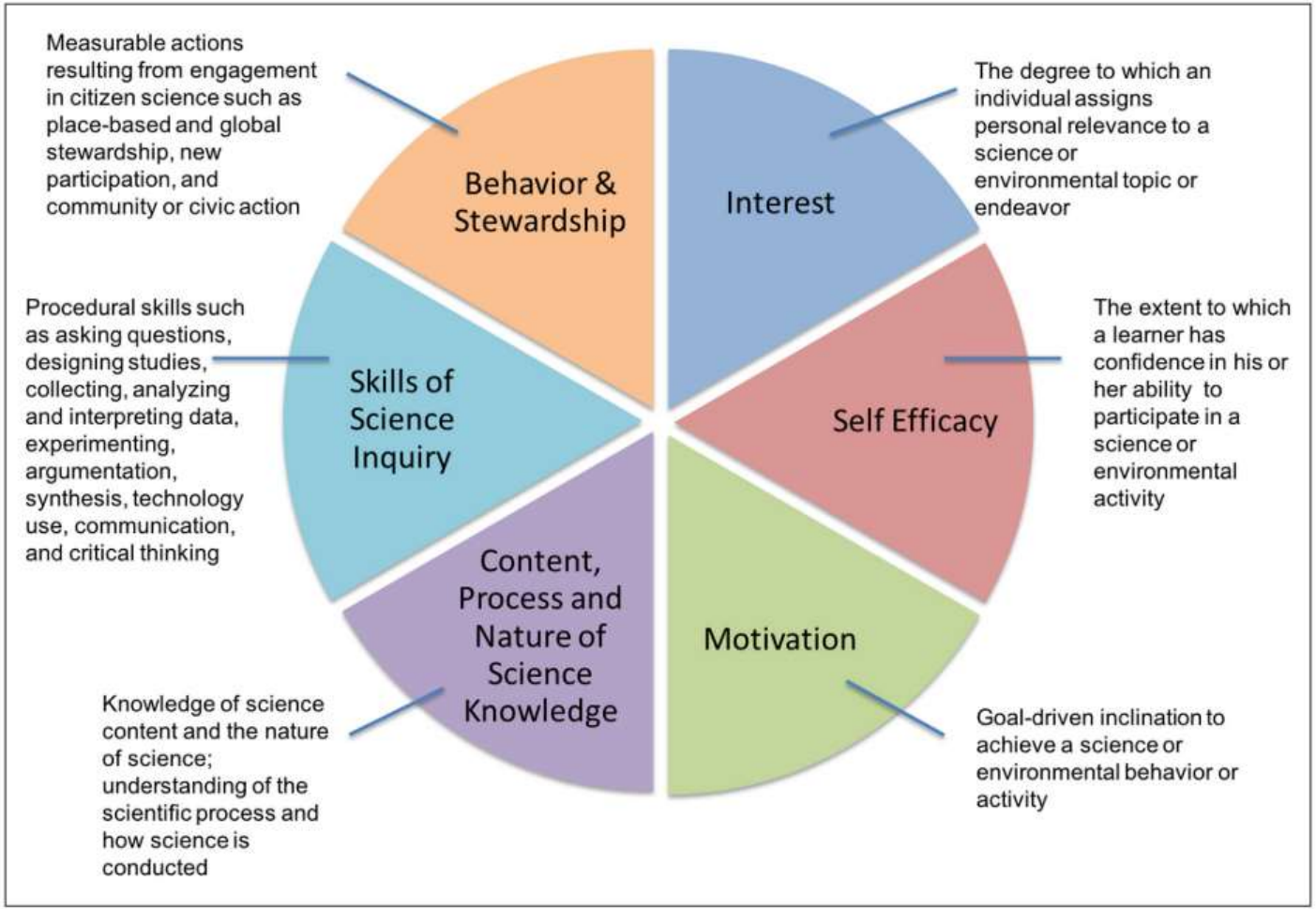
Hecker, S., Wicke, N., Haklay, M., & Bonn, A. (2019). How does policy conceptualise citizen science? A qualitative content analysis of international policy documents. *Citizen Science: Theory and Practice,* 4(1).

Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., … Bonney, R. (2012). Public participation in scientific research: a framework for intentional design. *Ecology and Society, 17*(2), 29.



Myriad projects enabling anyone to become a citizen scientist

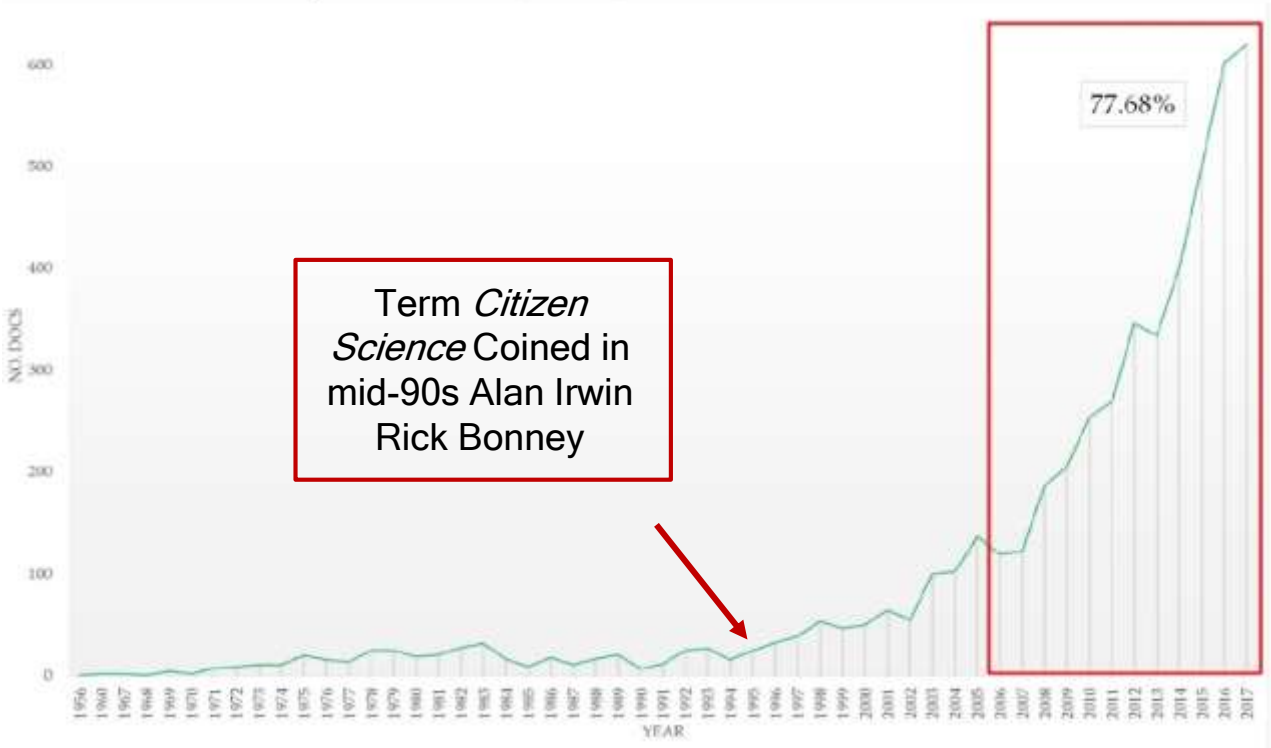
Examples from Zooniverse.org



Potential for learning in citizen science – Typically unrealized

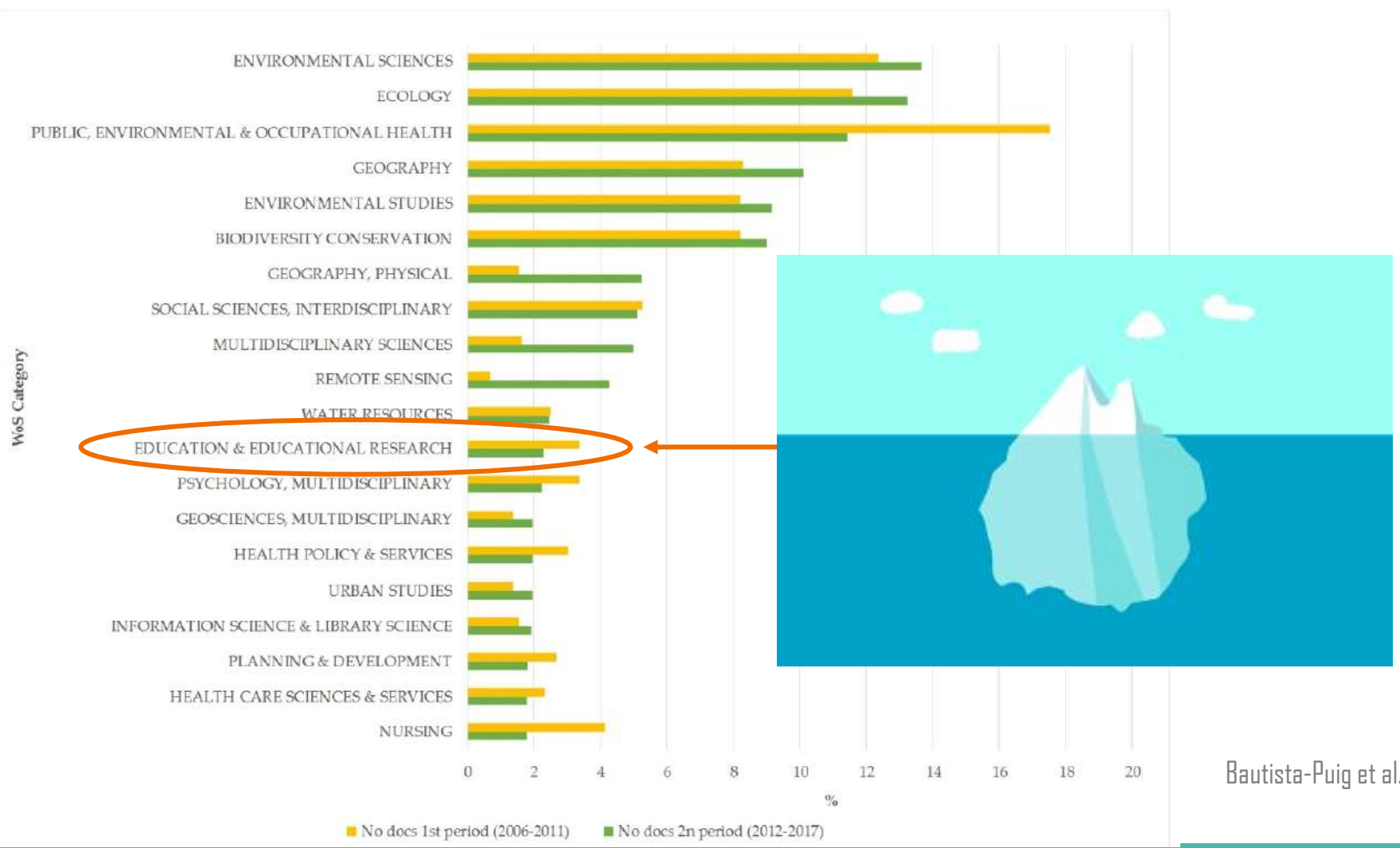
Phillips, T., Porticella, N., Constas, M., & Bonney, R. (2018). A framework for articulating and measuring individual learning outcomes from participation in citizen science. Citizen Science: Theory and Practice, 3(2).

Scientific landscape of citizen science publications



Bibliometric study using the terms:
"crowd science",
"community science",
"participatory research",
"community-based research",
"citizen research",
"science shop", "public-participation",
"citizen observatory",
"citizen science"
"community engagement research"

Bautista-Puig, N., De Filippo, D., Mauleón, E., & Sanz-Casado, E. (2019). Scientific landscape of citizen science publications: Dynamics, content and presence in social media. Publications, 7(1), 1-22.



Bautista-Puig et al. (2019).

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TECHNION
Israel Institute
of Technology

Taking Citizen Science to School
TCSS

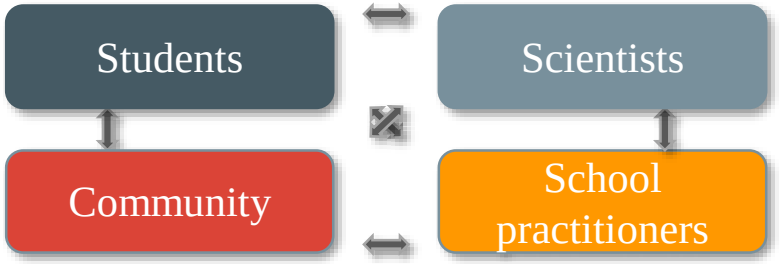






Challenges in school participation in citizen science

- How to maintain the excitement and authentic learning when incorporating CS into schools?
- How to cultivate the development of a learning ecology that fosters mutual benefits for students, school practitioners, scientists, and sometimes the community?
- How to support teachers in adapting the CS curriculum materials to suit their specific educational context?

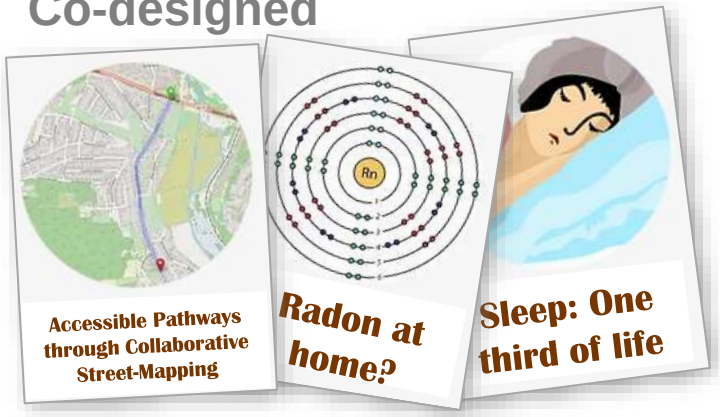


Network of research-practice partnerships (RPPs)

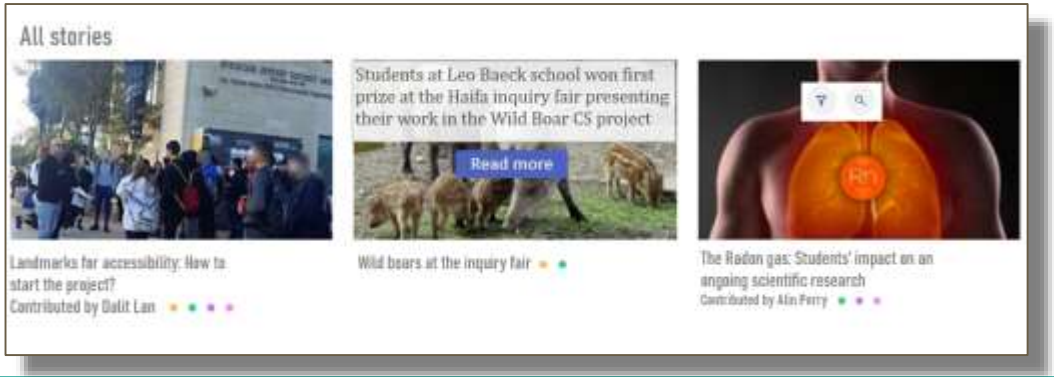
The TCSS modus operandi

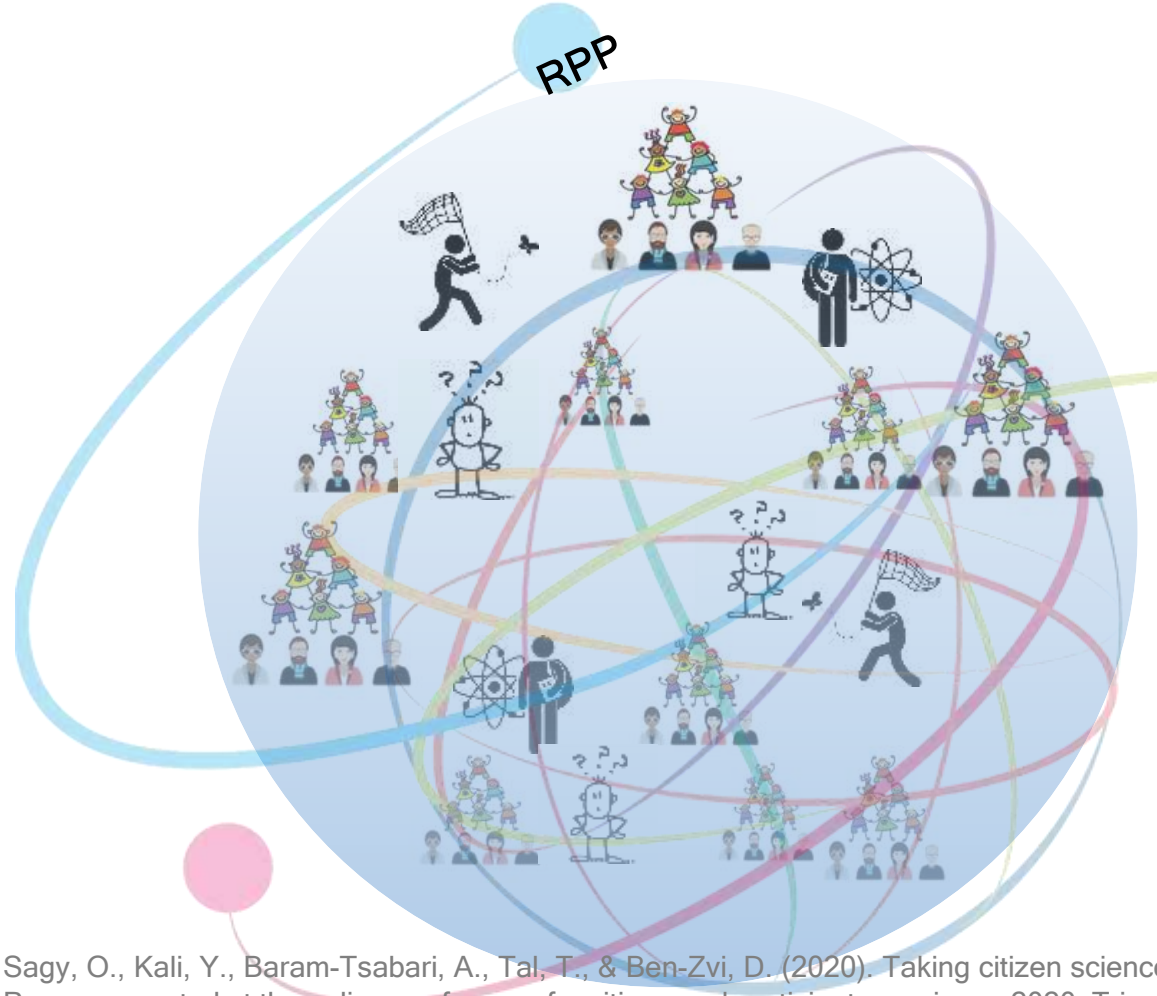
Modular support system for teachers

Citizen science projects: Co-designed



Insights: Co-creating design knowledge

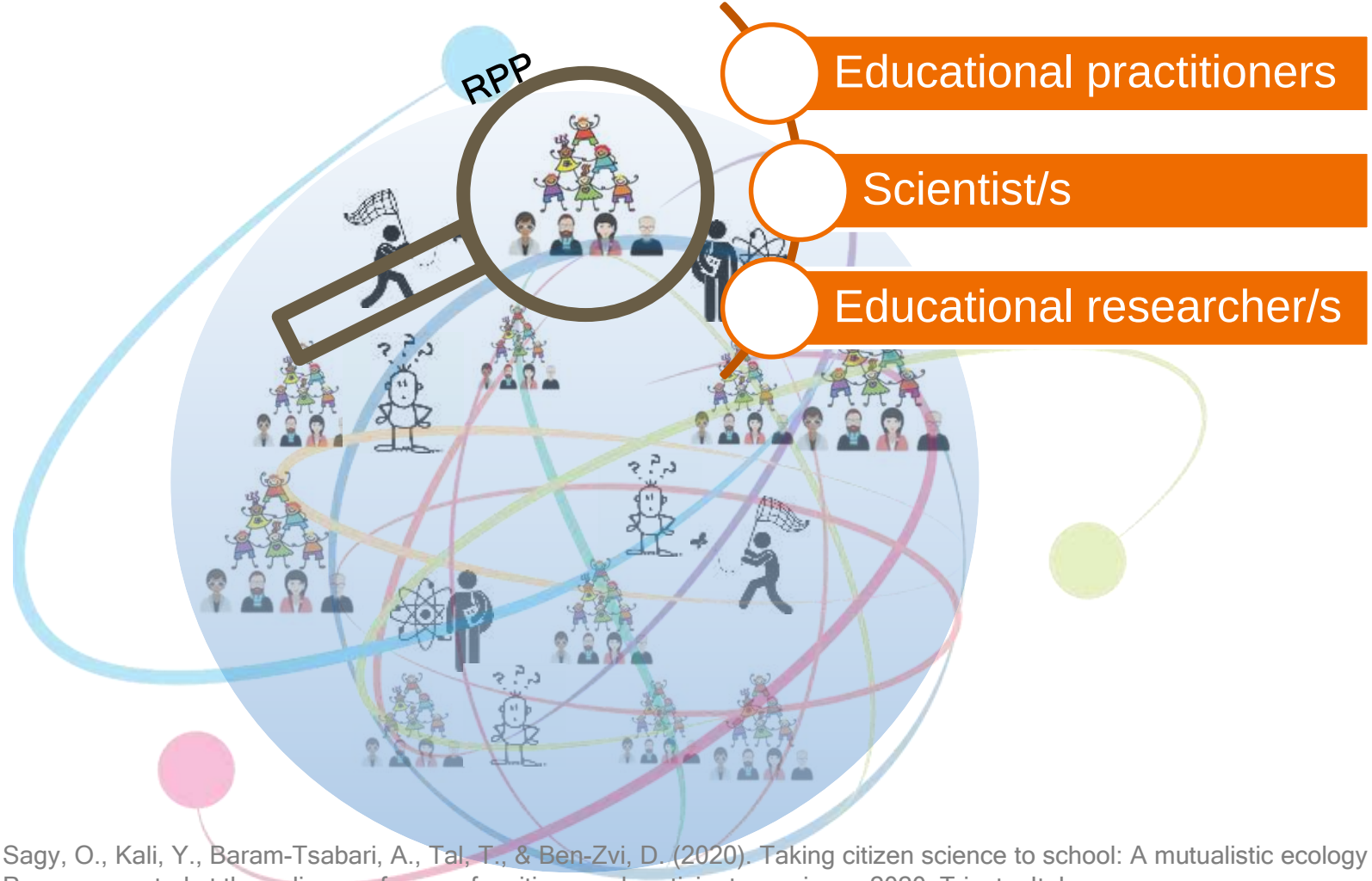




Network of Research-Practice Partnerships (RPPs)

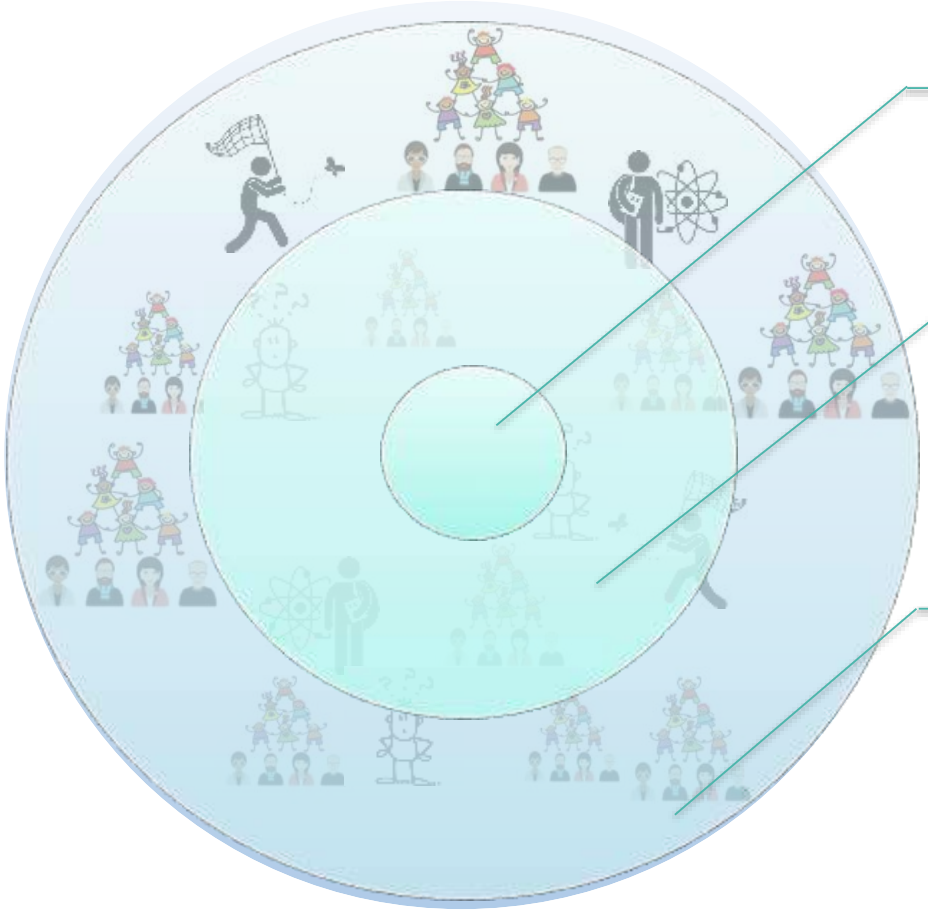
~ 100 schools
~ 180 teachers
> 5000 students
~ 10 scientist teams

Sagy, O., Kali, Y., Baram-Tsabari, A., Tal, T., & Ben-Zvi, D. (2020). Taking citizen science to school: A mutualistic ecology of science learning. Paper presented at the online conference for citizen and participatory science 2020. Trieste, Italy.



Sagy, O., Kali, Y., Baram-Tsabari, A., Tal, T., & Ben-Zvi, D. (2020). Taking citizen science to school: A mutualistic ecology of science learning. Paper presented at the online conference for citizen and participatory science 2020. Trieste, Italy.

Multiple level of engagement model



Long term partnerships:
- co-design of curriculum materials
- negotiating goals for mutual benefits
- co-planning implementation
- teacher involvement in educational research, multiple CS projects

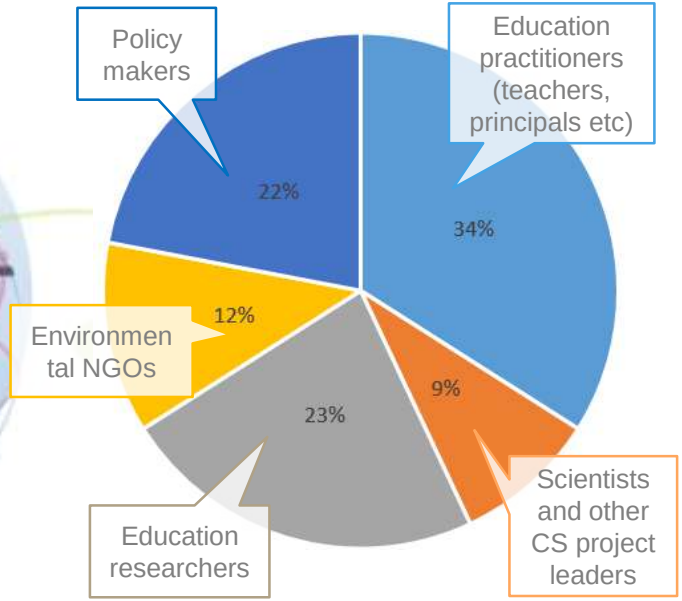
Short term partnerships:
Individual/teams of teachers participate in a community of practice from multiple schools to experience implementation of core activities in a particular CS project

Legitimate peripheral participation:
Individual teachers experience network meetings, may implement sporadic activities from CS projects

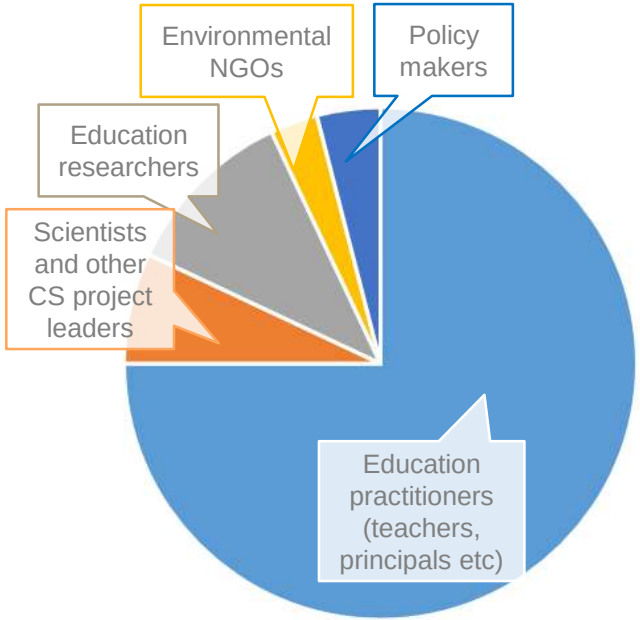
TCSS Network workshops

- Showcasing best practices
- Sharing research findings
- Discussing implementation challenges
- Getting acquainted with relevant educational policies
- Learning about state-of-the-art research in the CS projects

TCSS Network workshops

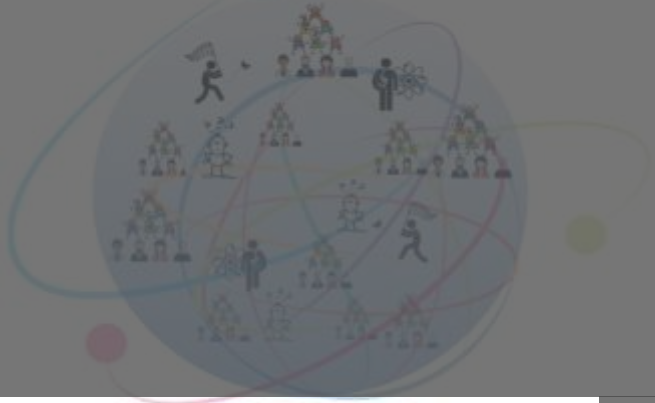


~70 participants
Experiencing CS projects,
Co-design hackathon

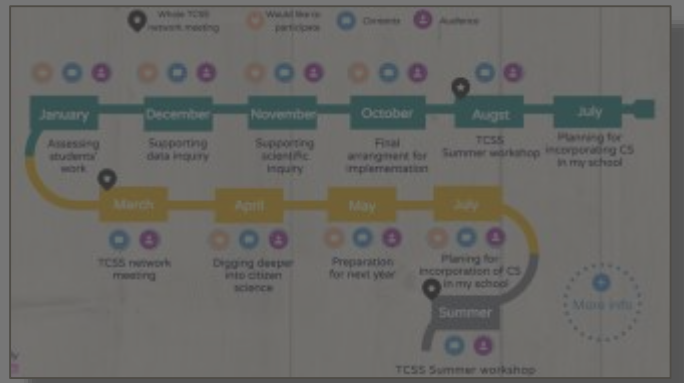


~180 participants
Acquaintance with CS projects
Preparation for implementation

Network of research-practice partnerships (RPPs)

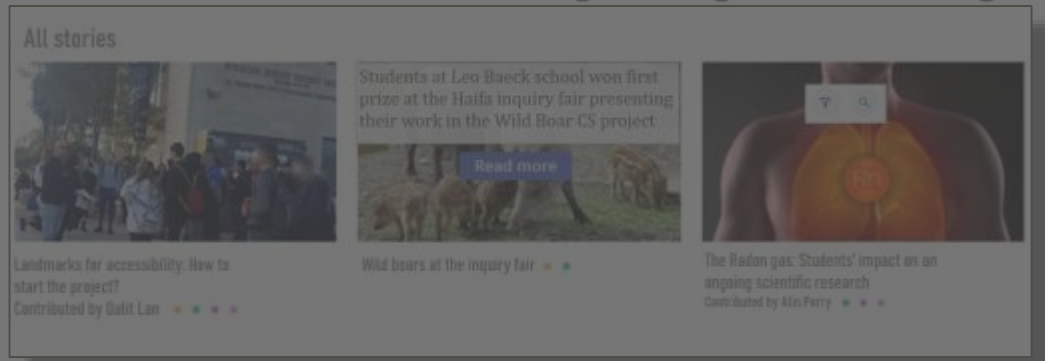


Modular support system for teachers



Citizen science projects: Co-designed

Insights: Co-creating design knowledge

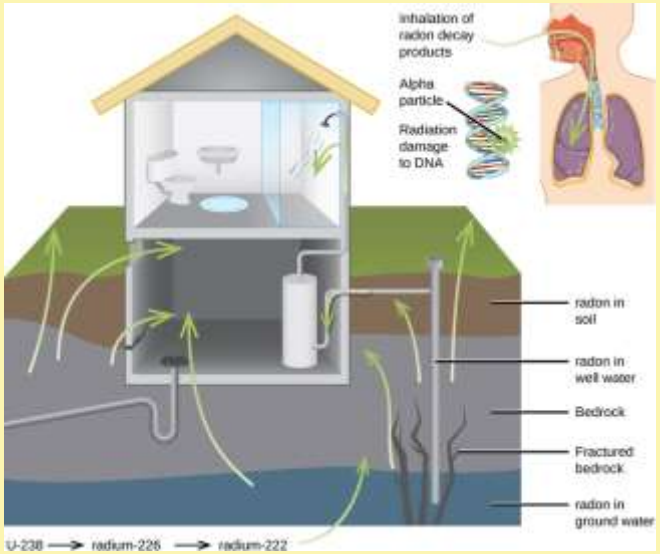


tcss.center/learning-environments (Hebrew only)

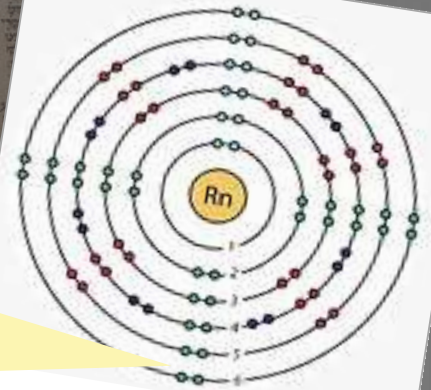
86

Rn

radon


Inhalation of radon decay products
Alpha particle
Radiation damage to DNA
radon in soil
radon in well water
Bedrock
Fractured bedrock
radon in ground water
U-238 → radium-226 → radium-222


Rn
Radon at home?
Sleep: One third of life
The Bermuda Buttercup Mystery



Radon at home?

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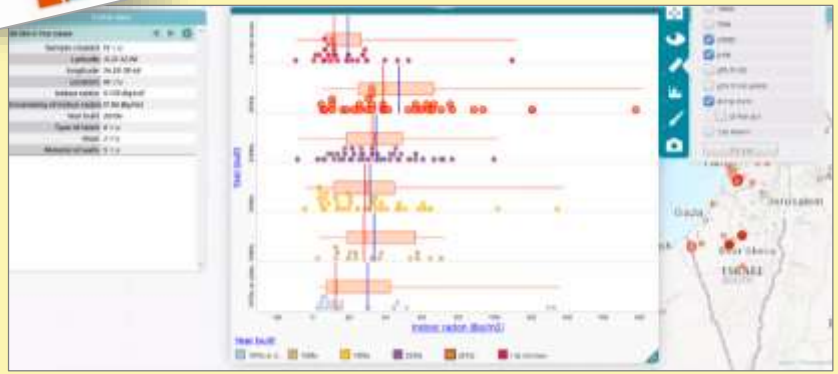
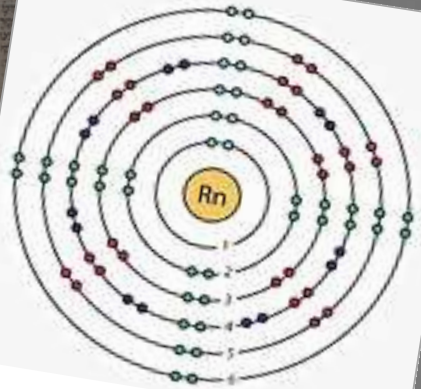
codap.concord.org

CODAP





Radon at home?

Sleep: One third of life

The Bermuda Buttercup Mystery

tcss.center/learning-en (Hebrew only)

tcss.center/learning-en (Hebrew only)

tcss.center/learning-environments (Hebrew only)

SLEEP - A THIRD OF OUR LIFE

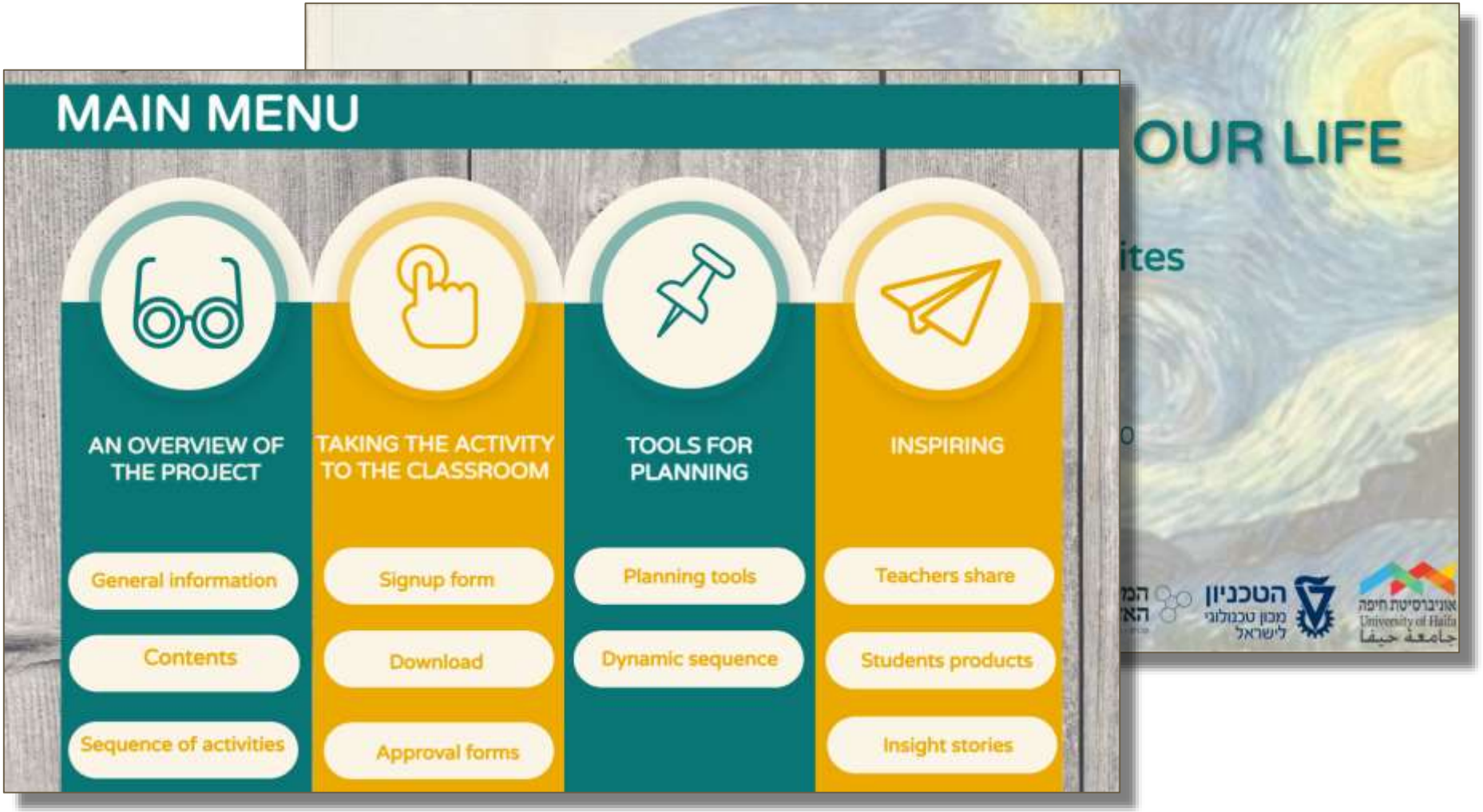
A citizen science project invites you to explore your sleep

Suitable for grades 7-10

← START

Taking Citizen Science to School
המרכז לקידום מדע אזרחי בבית הספר

המעבדה האזרחית
הטכניון מכון טכנולוגי לישראל
אוניברסיטת חיפה University of Haifa جامعة حيفا


MAIN MENU
AN OVERVIEW OF THE PROJECT
General information
Contents
Sequence of activities
TAKING THE ACTIVITY TO THE CLASSROOM
Signup form
Download
Approval forms
TOOLS FOR PLANNING
Planning tools
Dynamic sequence
INSPIRING
Teachers share
Students products
Insight stories
OUR LIFE
ites
הטכניון
מכון טכנולוגי לישראל
אוניברסיטת חיפה
University of Haifa
جامعة حيفا

ACTIVITY SEQUENCE

WHAT IS MY CHRONOTYPE?

3

Understanding the term "chronotype" and its implications on daily life

introduction **STAGE**

minutes 45 **SCOPE**

Design Principles

Support multiple social activity structures
Reuse students' artifacts
Present new concepts in student relevant contexts
Cultivate norms of productive talk in classroom

SHORT DESCRIPTION

In this activity, the students examine their chronotype and discuss with their peers how individuals with different chronotypes can socialize while taking into account their biological clock.

+ MORE

1 מהו מדע אזרחי?
מהו מדע אזרחי?

מדוע לחקור את השינה?

2 מהו פרויקט השינה?

3 מהו הכרונוטייפ שלי?

מהו הכרונוטייפ שלי?

4 מילוי יומני שינה

5 מפגש עם מסד נתונים

6 מה נרצה לשאול ?
מה מעניין אותנו?

משוב עמיתים א'

אוספים נתונים

מה ניתן להסיק מהנתונים?

7 מה גילינו?

CODUP

משוב עמיתים ב'

8 מצגים

יריד תוצרים

משוב עמיתים ג'

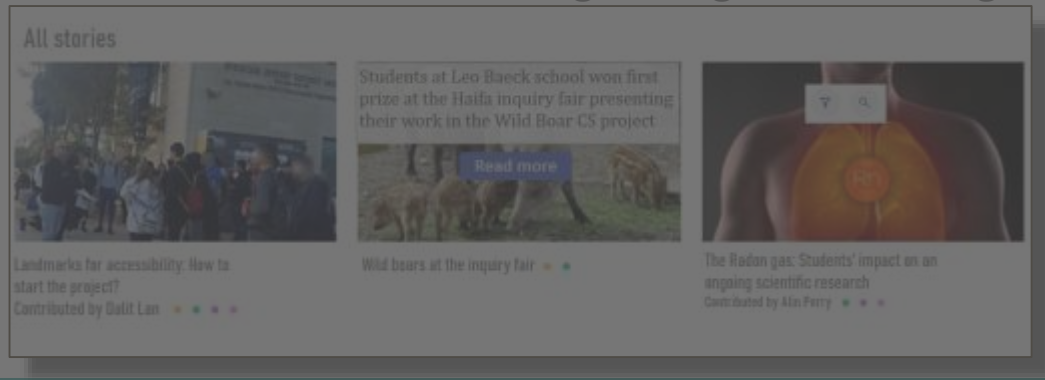
9 דיון ורפלקציה

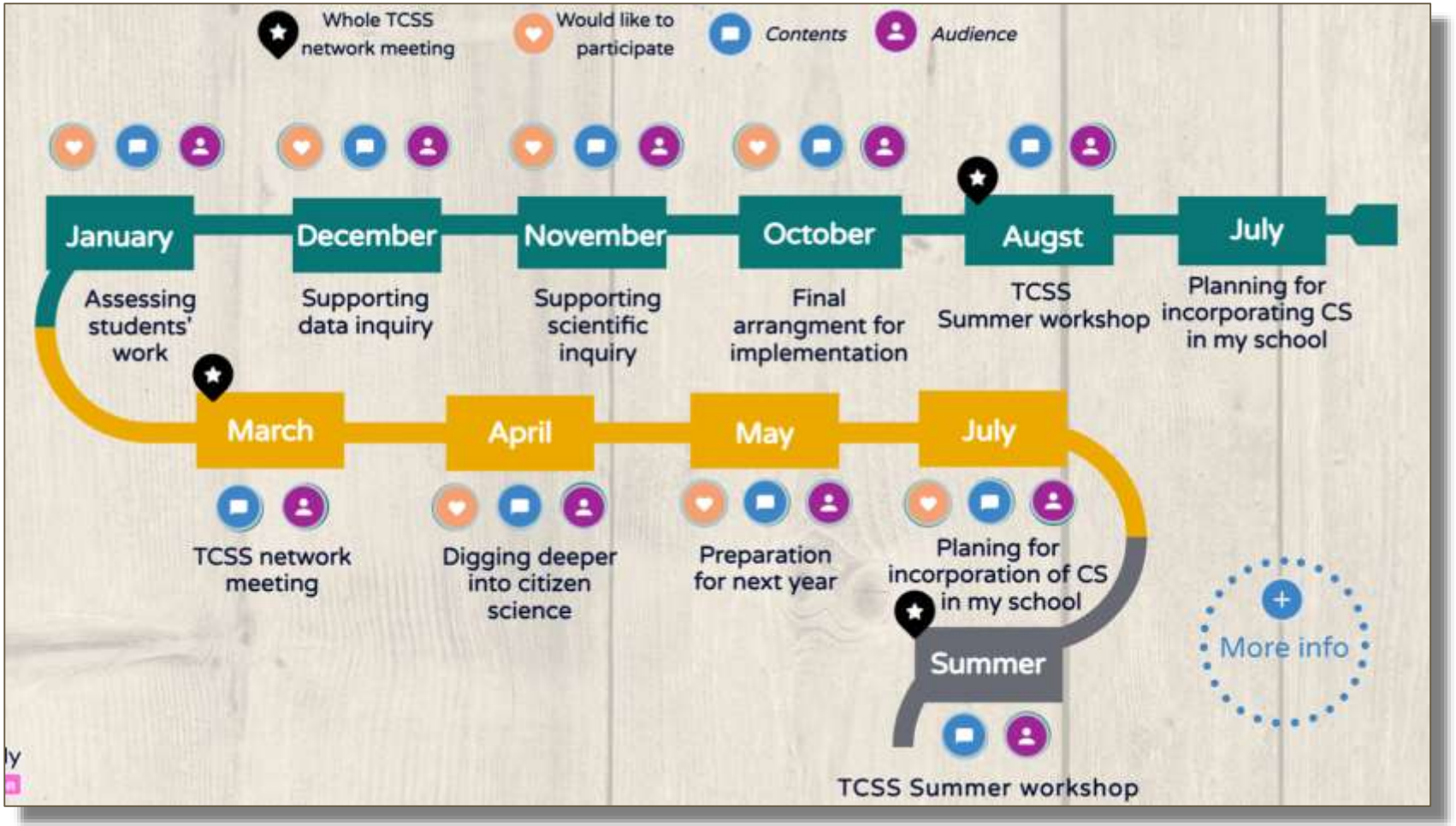
Network of research-practice partnerships (RPPs)

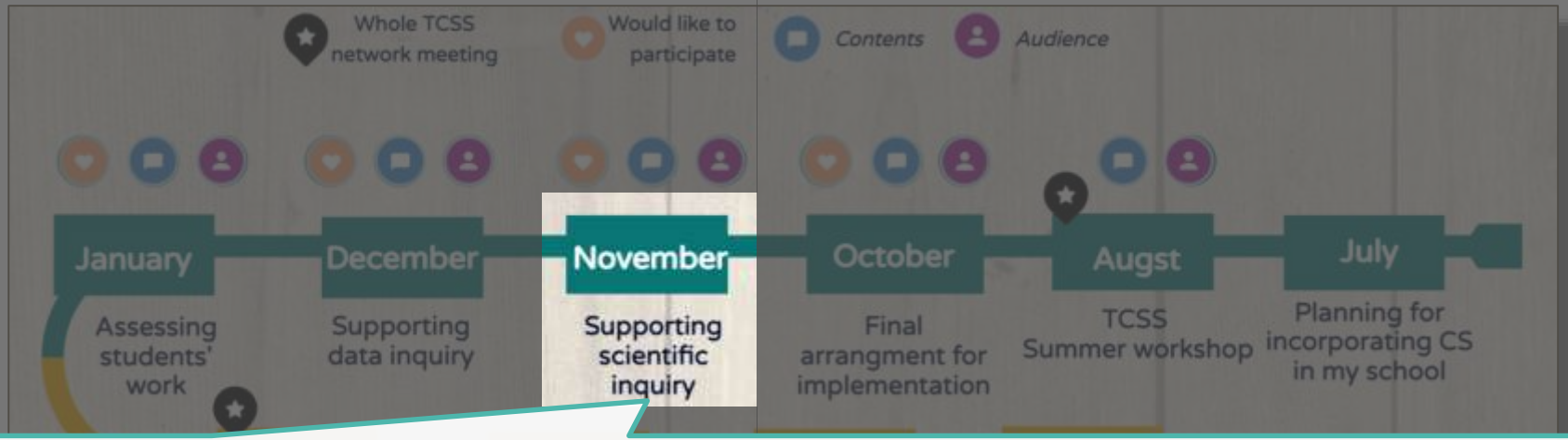
Modular support system for teachers

Citizen science projects: Co-designed

Insights: Co-creating design knowledge

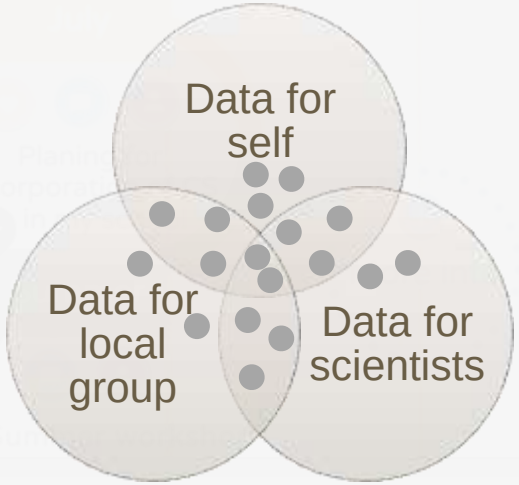



Whole TCSS network meeting
Would like to participate
Contents
Audience
January
Assessing students' work
December
Supporting data inquiry
November
Supporting scientific inquiry
October
Final arrangment for implementation
Augst
TCSS Summer workshop
July
Planning for incorporating CS in my school
March
TCSS network meeting
April
Digging deeper into citizen science
May
Preparation for next year
July
Planing for incorporation of CS in my school
Summer
TCSS Summer workshop
More info



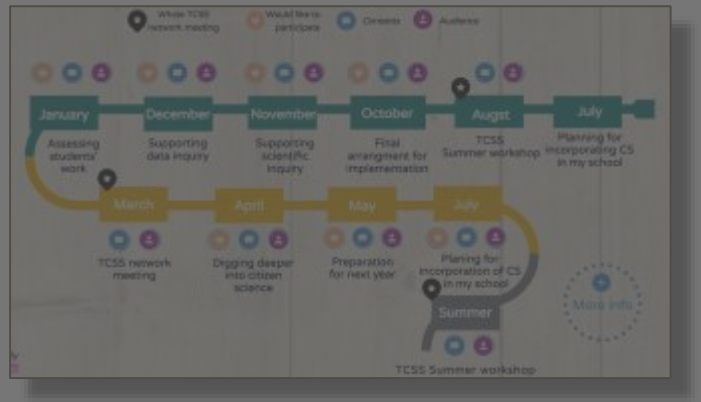
How to address both the scientist research, while also encouraging students to explore their own research questions on the topic?

Nested data in citizen science (Harris et al., 2020)



Network of research-practice partnerships (RPPs)

Modular support system for teachers



Citizen science projects: Co-designed

Insights: Co-creating design knowledge

http://insights.edu.haifa.ac.il

All stories

Landmarks for accessibility: How to start the project?
Contributed by Dalit Lan

Wild boars at the inquiry fair

The Radon gas: Students' impact on an ongoing scientific research
Contributed by Alin Perry

Aridor, K., Dulev-Shaham, R., Lavie-Alon, G., Sagy, O, & Kali, Y. (2022). Coalescing knowledge within networks of research practice partnerships: The case of a school-based citizen science network. In C. Chinn, E. Tan, C. Chan, & Y. Kali (Eds.). Proceedings of the 16th International Conference of the Learning Sciences - ICLS 2022 (2014-2015). Hiroshima, Japan: International Society of the Learning Sciences.

http://insights.edu.haifa.ac.il

Wild boars at the inquiry fair

Connected Design Principles

- Support knowledge representation and organization
- Bridge in-class and out-of-class learning
- Bridge scientific inquiry and data science inquiry

http://insights.edu.haifa.ac.il

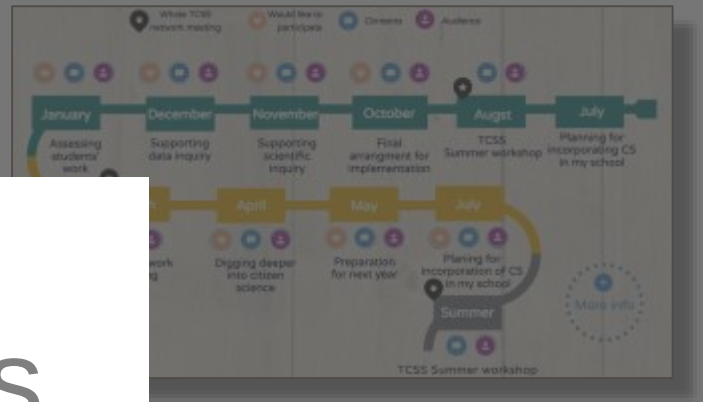
Support knowledge representation and organization


Practical insights
Learning theory
*Nurture students' **accountability** for their inquiry process and*

Outcomes

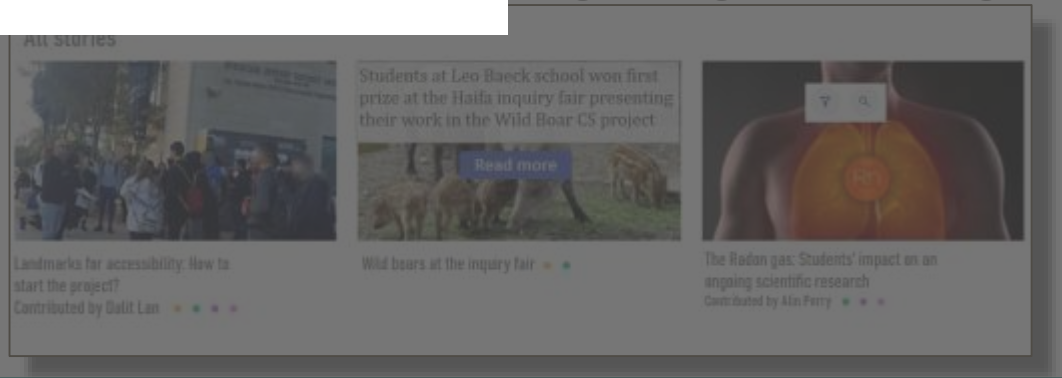
Network of research-practice partnerships (RPPs)

Modular support system for teachers



Citizen science projects Co-designed

Insights: ting design knowledge



Publications (https://www.tcss.center/publications-en)

School participation in citizen science often fosters a sense of meaning and responsibility among the various stakeholders, which is beyond the context they typically act in

We refer to this as **expansive framing**

Benichou, M., Kali, Y., & Hod, Y. (2022). Teachers' expansive framing in school-based citizen science partnerships. In A. Castro Superfine, S. R. Goldman, M-L Ko (Eds.). Teacher learning in changing contexts: Perspectives from the learning sciences (pp. 256-276). Routledge.

Atias, O., Baram-Tsabari, A., Kali, Y., & Shavit, A. (2023). In pursuit of mutual benefits in school-based citizen science: Who wins what in a win-win situation? Instructional Science.

Expansive framing of the various stakeholders

Began to view learning as important ***beyond the classroom*** contributing to the advancement of science, community, and society

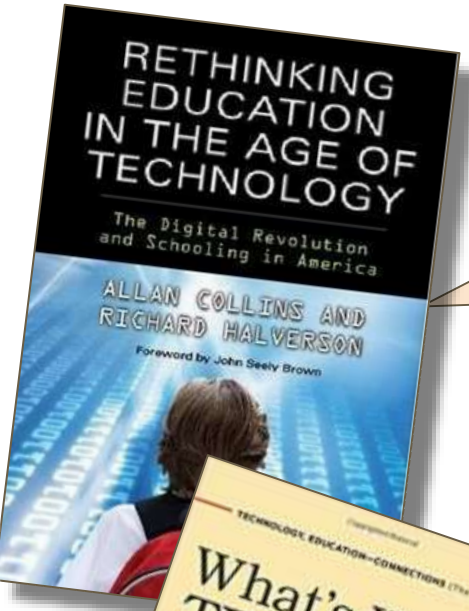
I felt it was important to invest in the project because scientists will use the data we contributed to help people with disabilities

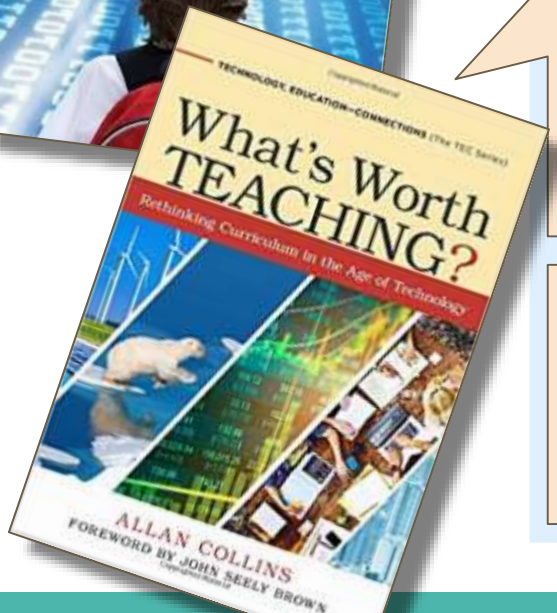
Began to view own expertise as important ***beyond school,*** as part of partnerships with scientists and educational researchers

Providing students an opportunity to do something that really contributes to science - that was fantastic in my opinion... much beyond the didactic goals.

Began to view own expertise as important ***beyond the academic world***, as contributing to education, and societal change

A significant part of my motivation is to drive changes in society in the context of sustainability and nature conservation. Working with children and youth is an important part of that

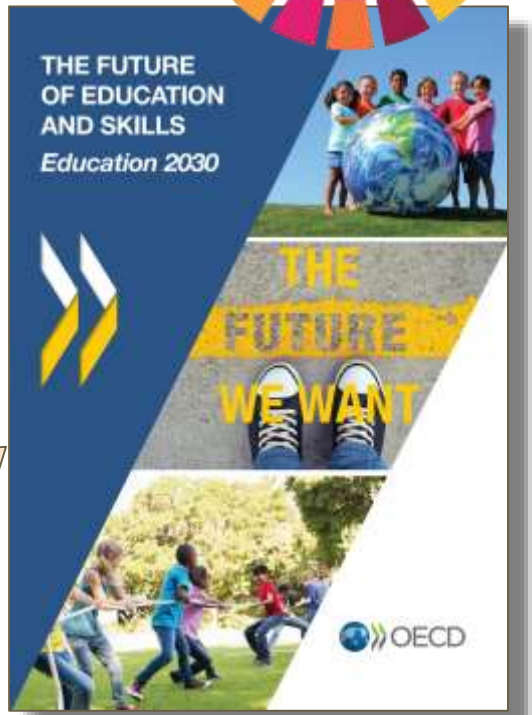




Schools everywhere are anchored in the past…[schools] aren't preparing youth for the complexity of today's world.

What a student should learn is to be a knowledgeable person, a good citizen, a thoughtful worker, a reflective thinker, and a valuable friend in a complex dynamic society.

Education needs to ...equip students with the skills they need to become active, responsible and engaged citizens…



School participation in citizen science as an arena for transformative educational change

Empowering networks of research-practice partnerships through co-creating design knowledge

Keynote presentation at CITERS 2023 by Prof. Yael Kali

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Taking Citizen Science to School
המרכז לקידום מדע אזרחי בבית הספר