Citizen science: producing data with people for innovating research

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Open for you! An introduction series to open science > January 27, 2022

How public engagement in science is born? The most important aspect is need of data processing

Source: **The discovery of a citizen scientist | Hanny van Arkel | TEDxGhent**
https://www.youtube.com/watch?v=p0aTfcXpOEs

Kevin Schawinski By NASA/Carla Cioffi [CC-BY-NC-ND-2.0], via Flickr

„Back in the 2007 there were a couple of astronomers(…) and they had a dataset of about a milion pictures. One of the astronomers Kevin Schawinski had seen 17,000 of them, in one week, before he decided there's just not enough coffee to go on like that."

What is citizen science? There are multiple definitions

Examples from Wikipedia

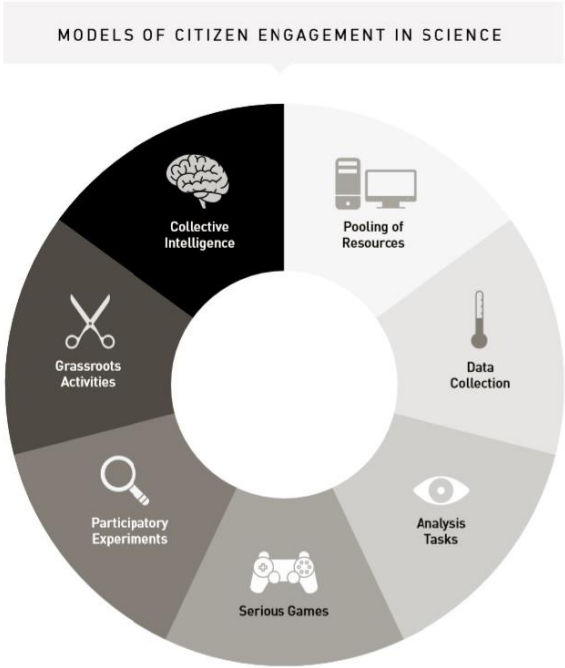
- „The participation of nonscientists in the process of gathering data according to specific scientific protocols and in the process of using and interpreting that data.” – Alan Irwin
- „The engagement of nonscientists in true decision-making about policy issues that have technical or scientific components.” Bruce Lewenstein
- „Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions” – Oxford University Dictionary

Example from Green Paper of Citizen Science

- The general public engagement in scientific research activities when citizens actively contribute to science either with their intellectual effort or surrounding knowledge or with their tools and resources. Participants provide experimental data and facilities for researchers, raise new questions and co-create a new scientific culture.

According to „White paper on Citizen Science for Europe” activities done by Kevin Schavinski and Hanny van Arkel was Data Collection and Analysis Tasks

But there are other citizen science activities



There are also other types of classification for example from a eu-citizen.science Moodle course Citizen Science Typologies

In the Earth there are also sources of unlimited amount of data

- Ocean covers more than 70 percent of our planet surface
- Most of life on Earth is a life in the water
- According to World Maritime Species Registry there are 240470 maritime species but it is probably only small part of general numer of maritime biodiversity
- Ocean has tremendous impact on Earth climate

- **Ocean is in vast majority *terra incognita***

Maritime institutions became pioneers of citizen science in Poland. First example is Institute of Oceanology of Polish Academy of Sciences

Nauka Obywatelska

strona sponsorowana przez Komitet Badań Morza, Wojewódzki Fundusz Ochrony Środowiska oraz Instytut Oceanologii Polskiej Akademii Nauk

Nauka obywatelska (ang. citizen science) to nowy wymiar budowy społeczeństwa obywatelskiego. Polega na zbieraniu obserwacji przez uczestników projektu, którzy za pomocą internetu i pośredniczącej instytucji naukowej tworzą powszechnie dostępną bazę danych. Do najstarszych tego rodzaju inicjatyw należą masowe akcje liczenia ptaków w Wielkiej Brytanii, mapy kwitnienia roślin ogrodowych sporządzane przez tysiące wolontariuszy w Niemczech, czy nowa, włoska akcja na Adriatyku tworzenia map występowania meduz, w której wzięło udział tysiące plażowiczów. W Polsce prekursorska akcja "nauki obywatelskiej" odbyła się w roku 2011, gdy poproszono ludzi, by w czasie dwóch letnich tygodni obserwowali niebo w swojej okolicy i przesłali informację o stopniu widoczności gwiazd. Pozwoliło to na sporządzenie mapy obszarów, gdzie światła miast i zapylenie nie zakłócają obserwacji astronomicznych.

Akcja1 Projekt "Citizen Science" nad morzem	Akcja 2 Projekt „Ukryta Woda" - 04.2014-03.2015
Akcja 3 Dla żeglarzy i podróżników	Akcja 4 "Ocean literacy" czyli przeciwko analfabetyzmowi morskiemu
Akcja 5 Akademia Smętowska – "Woda w naszym otoczeniu"	Akcja 6 "Water Front"
Akcja 7 "Plastik w rzekach"	

Project 1 – Citizen Science near the sea
Research question - Where are habitats of rare maritime species – macrophytes in Baltic Sea?

Source: nauka obywatelska (iopan.gda.pl)

Project 2 – Plastic – unknown threat in Baltic Sea
Research question - How much and what kind of plastic linger on Baltic Sea coastline?

Examples of data protocols

Przykładowe wypełnienie:

data, godzina obserwacji	miejscowość		
17 lipca 2010, 11.30	*Jurata*		
odcinek	butelki	worki	inne
1	*3*	*1*	*0*
2	*1*	*2*	*2*
3	*11*	*0*	*4*
4	*4*	*0*	*4*
5	*0*	*8*	*1*
6	*6*	*3*	*2*
7	*2*	*4*	*1*
8	*6*	*0*	*5*
9	*0*	*1*	*2*
10	*4*	*2*	*0*

Varieties of plastic on coastline

Source: nauka obywatelska (iopan.gda.pl)

Different projects put special emphasis on education. Projects only for children in school and teachers

Project „Hidden water” – are we aware of importance of that we can’t see. Water is everywhere: in soil, in forest, drainage ditches, in puddles

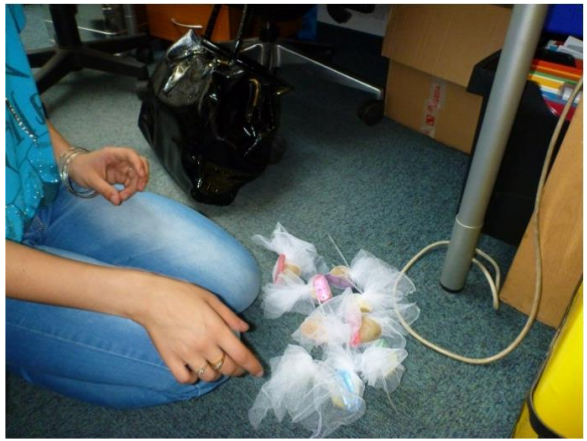


Photo by Marcin Gwiazda IO PAN Polish Academy of Sciences

Litter bag method – used for many years in soil and forest research

Cluodiness of water measurement with a tube

Photo by Marcin Gwiazda IO PAN Polish Academy of Sciences

Describing methodology of collecting samples or other activities needs to be done very carefully and with simple words. But every proceeding is based on scientific literature e.g.

Jędrzejczak M.F., 1999, The degradation of stranded carrion on a Baltic Sea sandy beach, Oceanol. Stud., 28 (3/4), 109–141

Kotwicki L., Węsławski J.M., Anna Szałtynis, Aleksandra Raczyńska, Agnieszka Kupiec. 2005. Deposition of large organic particles (macrodetritus) in a sandy beach system (Puck Bay, Baltic Sea). Oceanologia, no 47(2), pp. 181-199

Also other internet tools can be helpful:
https://www.google.com/maps/d/viewer?mid=1U92TyHnwdxan8Cxlh5nOX-HPSS8&ll=54.45682838418724%2C18.52983489206205&z=11

Institute of Oceanology of Polish Academy of Sciences is still collaborating in making citizen science projects

- They continue collecting information about plastic waste with primary schools and Science Centre Experiment in Gdynia
- They are searching nurdles – microgranulation plastic piece with Greenpeace
- They also cooperates with yachtsmen in researching plankton
- And they educate about ocean

Another maritime institution involved in citizen science projects is National Marine Fisheries Research Institute

On fishery boats like this videomonitoring equipment is being installed for observation purposes

Records at least 50 hours of full HD video and saves boat track through GPS system

What is the scientific aim of such a research?

Pilot study on seabird mortality due to the bycatch in gillnet coastal fisheries in Poland

- Fishery needs to be sustainable to save biodiversity of maritime species e.g. seabirds
- Some bird species are trapped in fishing nets
- Without support of coastal fishermen collecting data would be very hard

Challenges in small coastal boats monitoring

- Attidude to monitoring activities by fishermen that can be challenging
- Lack of space for observer (physical or procedural)
- Not enough space for camera
- Fishermen anxiety about safety of people on board
- Difficult work conditions for observers
- Potential „control” of observations by fishermen

Examples from two previous institutions may raise a question

What makes science project a citizen science project?

Citizen science project need to have attributes:

- a scientific problem to solve
- Include support of people e.g. data collection or data analysis

Maritime research needs uncountable small pieces of research to understand the general concept:

How ocean works?

Citizen science has also significant educational importance

Citizen science projects are based on open research data – datasets on open licenses which can be reused, revised, remixed, redistributed and retain

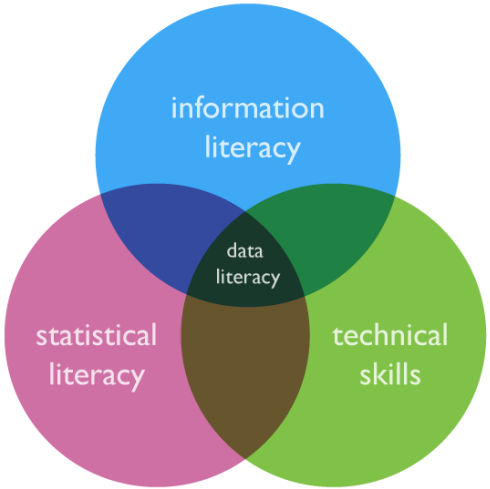
People work on pieces of data analysing photographs (astronomy), signals(biology), assessing places of malfunction (medicine)

They work on data and learn how to understand it.

But data needs to be Open Research Data for Citizen Science

Data Literacy - is the ability to read, understand, create, and communicate data as information

- Nowadays information can be hidden in calculation sheets, digital books in podcasts and recordings, in codelines. It needs special skills and equipment to understand and reuse this data

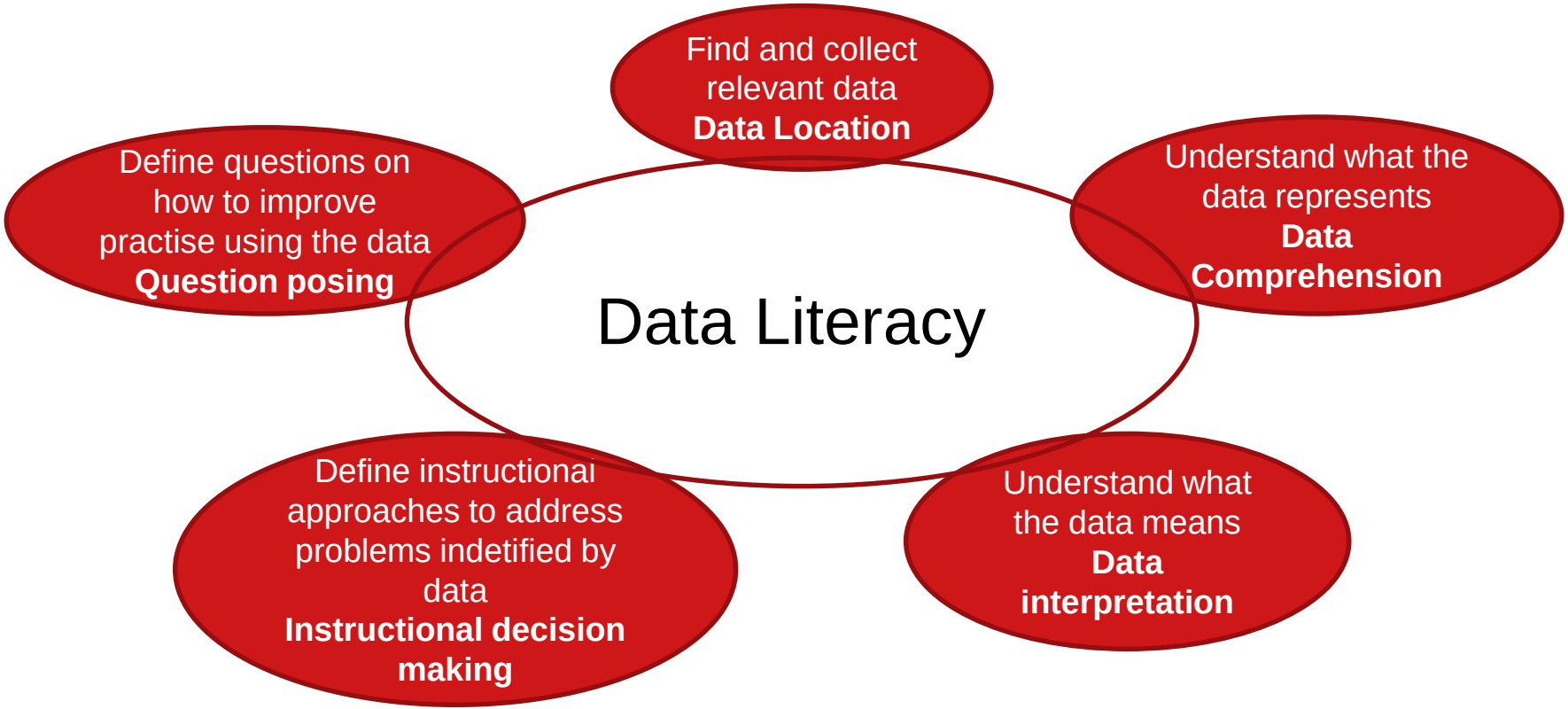


Infographic by Justgrimes CC BY SA 4.0

To improve data literacy new skills are needed like ability to operate on Excel sheets or programming languages like R or Python

You can also develop your data literacy in online citizen science hubs like:
https://www.zooniverse.org/
https://eu-citizen.science/

Aspects of Data Literacy



Source: https://pl.pinterest.com/pin/data-literacy-data-location-find-and-collect-relevant-educational-data-data-comprehension-understand-what-t--578079302139195706/

Citizen Science theorists are making relation between Data Literacy and Citizen Science

It is being analysed in scientific articles:

Learning from the Trees: Using Project Budburst to Enhance Data Literacy and Scientific Writing Skills in an Introductory Biology Laboratory During Remote Learning
https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.432/

Science literacy in action: understanding scientific data presented in a citizen science platform by non-expert adults
https://www.tandfonline.com/doi/abs/10.1080/21548455.2020.1769877

Does Participation in Citizen Science Improve Scientific Literacy? A Study to Compare Assessment Methods
https://www.researchgate.net/publication/232962228_Does_Participation_in_Citizen_Science_Improve_Scientific_Literacy_A_Study_to_Compare_Assessment_Methods

Ocean Literacy – main principles

1. Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of Earth.
3. The ocean is a major influence on weather and climate
4. The ocean makes Earth habitable
5. The ocean supports a great diversity of life and ecosystems
6. The ocean and humans are inextricably interconnected.
7. The ocean is largely unexplored.

Only by citizen scientists we can explore how much we need to learn

Interesting websites about Citizen Science

- If you think about developing your own CS project https://www.zooniverse.org/lab
- If you want to see how CS can be institutionalized at the University https://www.sdu.dk/en/forskning/forskningsformidling/citizenscience/om-videncentret
- If you want to know more about newest academic research about Citizen Science https://theoryandpractice.citizenscienceassociation.org/
- If you want to know more about how Citizen Science is being developed internationally https://ecsa.citizen-science.net/ with their Ten principles of Citizen Science https://ecsa.citizen-science.net/documents/#tenprinciples

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- "**Research Integrity and Open Science: Is sound science open science?**" | 20 June 2022, 10:00 - 11:30
  „**Research Impact & Bibliometrics: open science, society, innovation"**| 4 July 2022, 10:00 - 11:30

- For newest information **check the website**!

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Thank you!

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