Open Science for Physicists

Course Development

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Theory

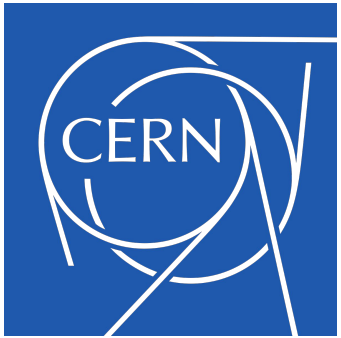
Findable Accessible Interoperable Reusable

Overview

1. Course Description
2. General Assignment & Lecture Ideas
3. Week 1

Aanvullen

Open Science is cool!



Crayon: “ 3 Physicists with heads like fruits working together on an open science project in lilac t-shirts ”

Course Description

Course Goal & Topics (from https://github.com/SanliFaez/OS4Physicists)

Course goal

In Open Science for Physicists (OS4Physicists), students evaluate the best practices, concepts and conditions used by physicists working in- or outside academia in their professional activities and workflow.

Covered Topics (one topic per week)

1. Why open science, how did we get here?
2. Setting up a collaborative environment (readme, templates, community rules, version control, licensing and credit)
3. Big science (CERN, VIRGO, NASA), scale vs precision (for citizen science)
4. Reproducibility: documentation for reproducibility (and data storage)
5. public engagement: story-telling and presentation; activism and trust in scientists
6. open design and open hardware; prototyping
7. from science to business: tech transfer (including open strategies), intelectual property and the academic social contract, scipreneurship
8. the scientific process (grantwriting, scientific careers, searching for a PhD position, professional and entrepreunial careers)

(from https://github.com/SanliFaez/OS4Physicists)

Learning goals:

By following this course students make an attempt to

- understand the advantages and pitfalls of open science
- learn to set up and contribute to digital collaborative environments like GitHub repositories
- understand the structure of big collaborations like CERN, and how to optimally function in such an organizational system
- learn to set up a reproducible research environment for their projects
- understand the role, responsibilities and interaction of scientists with scientific communities and the general public
- learn to develop a prototype for a measuring device
- appreciate the business opportunities for scientists outside academia
- understand the current scientific process and career paths.

Assessment

The exercises for this course are team-based. Teams will be reshuffled for each exercise so that pass/fail is individually determined by collecting a basket of satisfactory project results. Exercises are partially assessed by peers and partially by course coordinators and lecturers.

For testing achivement of the learning goals.

At the beginning of the course all students will fill in a questionnaire on what they understand about the academic workflow in physics.

At various occasions during the course, students are assessed for the ability to

- reimagine their own research in an open science workflow
- be able to set up a github project for the course, with an individual portfolio of forks of team projects
- produce an application for joining an international collaboration
- create a workflow for an analytical or experimental exercise that others can reproduce
- give a presentation about their other assignments using skills learned in the course.
- design and/or develop a prototype
- write a business case for a science-based innovation
- reflect on changes in their understanding of the scientific process in comparison with the pre-course questionnaire

Syllabus (from https://github.com/SanliFaez/OS4Physicists)

Week 1: why open science, how did we get here?

keywords: Five schools of Open Science, Current state of the conversation (NL, UU, Physics), Amateurism, Laboratory life, The reproducibility crisis, Fraud, Access and Emancipation, Community-Discipline-Employer, International context, Transdsiciplinary and interdisciplinary science, Risks and rewards of Open Science, Oposition and counter arguments

Week 2: setting up a collaborative environment

keywords: Version control, Licensing and recieving credit, Readme files and templates, Best practices for community management, Active and passive versioning, Project management and Getting Things Done (GTD), Unit testing (defensive programming), Merging forked repositories

Week 3: big science, scale vs precision vs control

keywords: Big-science collaborations, Citizen science, Credit and recognition, Policy and politics of science, Governance structures, Independence and thriving, Relativism of big, Climate impacts and transformation

Week 4: documentation for reproducibility

keywords: Best practices for documentation, Data structures and data plans, GDPR and privacy rules, templates and bug reports, Persisten identifiers, Machine-readable docs, Systematic review, Scripting, Compatibility, Dockers-Virtual Environments-Pinning, Best practices in data visualization,

Syllabus (from https://github.com/SanliFaez/OS4Physicists)

Week 5: public engagement: story-telling and presentation; activism and trust in scientists

keywords: How storytelling works, Science communication and journalism, Activism and trust in Science, Bounds of expertise, Academic social contract, Metaphores, Communicating uncertainty, Narratives and framing, Difficult to reach audience, Process and outcome

Week 6: open design and open hardware; prototyping

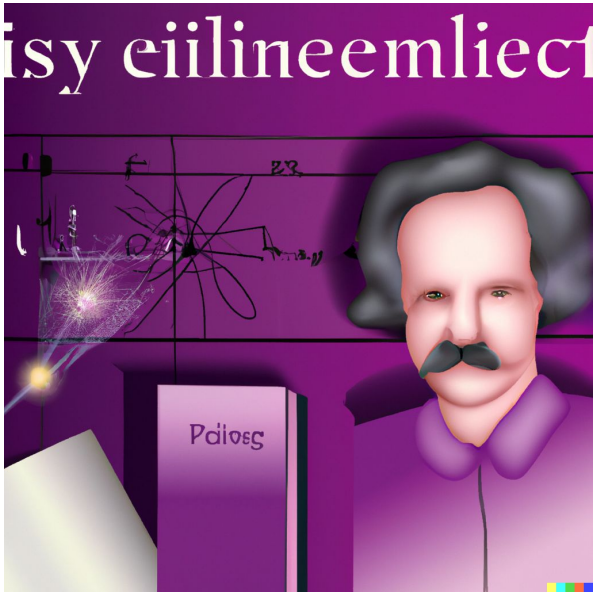
keywords: Scientific design environments, Open protocols, Microcontrollers, Human-computer interface, Automation and bots, Remote labs, Materials-resources-constraints, Defense and national security, Maintenance, Prototyping

Week 7: from science to business: tech transfer (including open strategies), intelectual property and the academic social contract, scipreneurship

keywords: Technology transfer, Open strategies and open science business models, Scipreneurship; starting a business, Creating impact, Forking vs contributing, Moral ambition, IP-Licensing-Conflict of interest

Week 8: The scientific process, beyond the PhD

keywords: Careers in science and beyond, Applying for scientif positions, Data stewardship, Grant writing, the PhD advantage, Mental health in academia, Preprinting and peer-review, CV and applications, Altmetrics and visibiity, Recognition and rewards, Literature and referencing, Science in transition



Dalle2: “Photorealistic physicist designing lectures and assignment in lilac colours”

Dalle2: ”A physicist designing lectures and assignments”

Lecture & Assignment Design

Assignment types

Writing

- Essay (personal or group)
- Report (personal or groups)
- Review (personal or group)
- Write a proposal for an open science PhD (personal)

New media (group)

- Podcast
- Video
- radio show
- …

Explanation of assigments

- In a 30 sec. youtube tutorials (?)
- In a big open science game?
- a mix of letter/tuturial videos/ voice clips?

Ideas:

- Assignment: Find open source software for something cool such as Dalle2 (Something students thing is cool) and do something with it
-
- Road top open science podcast
-
- Assignment: Work with Github by using issues etc. to get feedback. Let them program something easy, such as a data visualization from an open source project. Let the students fork, merge etc. Maybe, we can create a page on the repository of Open Science
-
- Assignment: Meme competition!
-
- Technical assignments: How to use github data structuring etc. and alternate between this and more meta assignments!

On “stage”

- Present a OS topic (groups)
- Scientific Pitch (Personal)
- Organizing a panel or plenary discussion (group)
- Scientific communication outside UU (groups)

Digital

- Start a new project on Github (?)
- Contribute to an existing open source project (?)
- Work with issues etc. On github to get feedback on an assignment etc and to learn on working on an open science project

other

- Choose a physics article, study it and make a popular science story with it
- Meme contest

Hello Hendrik,

I was planning to send you this email the previous week but I completely forgot it. I wanted to explain you how my lectures and assignments were in my home university with a teacher (the only one who tried to make an alternative course). The results really good and almost everyone was happy with that teacher, even if some were exceptical about his methodology.

bronnen

- https://the-turing-way.netlify.app/reproducible-research/reproducible-research.html
- Assignment types:
- https://www.uts.edu.au/sites/default/files/article/downloads/UTS%20Library%20Guide%20to%20Assignment%20Types.pdf
-

Lectures types

- Lectures in video format
  - Pro: watchable multiple times
  - Cons: No possibility to ask questions and create an academic atmosphere in the lecture
- Live lectures which will be recorded to watch again later
- The 18 minute Lecture, TEDtalk like
- Podcast by the lecturers with an expert
- Live lecture in front of a black board
- General: Every lecture week a different format: Podcast, Video, live, etc.

Idea:

- Every week a different lecture format to introduce students to different forms of science communication
- Last lecture in a symposium form?

Forr

-

Idea:

- Lecture in video format(Pro: wa
  multiple times, con: No possibili
  questions and create an acade
  atmosphere)
- Live lectures witch will be recor
- The 20 minute Lecture, TEDtalk
- General: Every lecture week a
  format: Podcast, Video, live, etc

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Source

Aantekeningen

- wetenschaps communicatie
- podcast
- presenteren
-
-

Mail Sanli:

Hi Hendrik,

- I think epic group is not the right target group for consulting. The open science community in Utrecht is perhaps a better place. https://openscience-utrecht.com/. There is also a student chapter if you want to talk to specific people.
- The best resource to start is the **Turing Way** and the links you can find in it. there is also a Slack group for it where you can connect with more people.
- You will perhaps also get to know some of the active people in the TOPS event this Thursday (the NASA course).
- I think the best place to start is to identify 1 main activity (lecture, book chapter, article resource) for each of the 8 sessions and 1 main exercise.
- If you found more, we can make priority list. If you could not find any, then we can talk case by case.
- I have collected some of the resource I have found on the Teams. Do you have access to those?
- We also received some tips from organizers of the similar course in UMC. I will share it with you.

Dalle2: “A colorful painting of students attending the first week of the open science course and working together”

Dale2: “Physics on the moon students listening to a lecture and work on an assignment”

Week 1

Why open science, how did we get here?

Idea: Green in lecture and Orange in tutorial

Keywords student familiarity check week 1

New Concepts

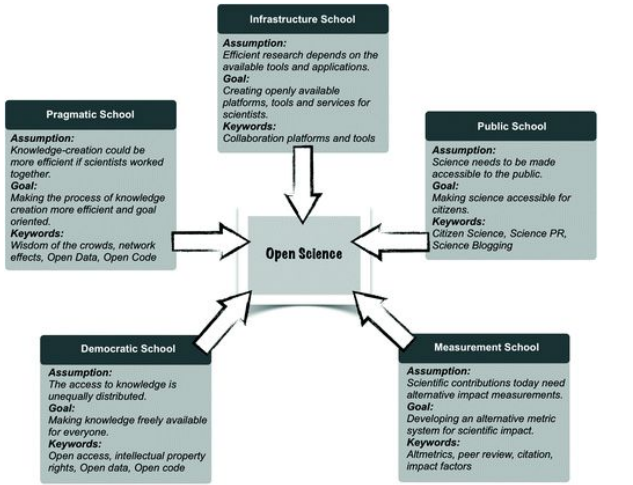
- Five schools of Open Science
- Current state of the conversation (NL, UU, Physics)
- Amateurism
- The reproducibility crisis
- Access and Emancipation
- Community-Discipline-Employer
- Risks and rewards of Open Science
- Opposition and counter arguments

Familiar Concepts

- Laboratory life
- Fraud (No joke intended)
- International context
- Trans Disciplinary and interdisciplinary science

Information sources Lecture week 1: New topics

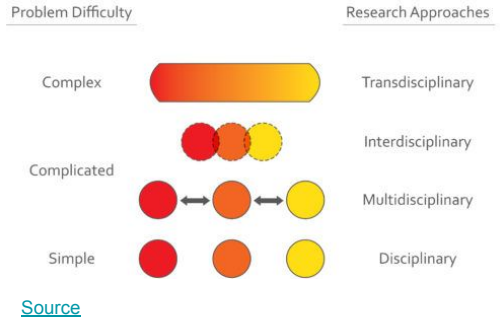
- Five schools of Open Science
  - https://doi.org/10.1007/978-3-319-00026-8_2
- Current state of the conversation (NL, UU, Physics)
  - https://www.uu.nl/onderzoek/open-science
- Access and Emancipation
  - https://www.rug.nl/library/open-access/blog/open-science-practices-in-different-disciplines-an-interview-with-prof-jan-willem-romeijn-and?lang=en
  -
- Community-Discipline-Employer
  - https://www.osc-nl.com/
  - https://www.fosteropenscience.eu/learning/best-practice-in-open-research/#/id/5abe17ffdd1827131b90e618



Source

Information sources Lecture week 1: Familiar topics

- Laboratory life
  - https://www.apa.org/monitor/2021/11/career-open-science
  - https://doi.org/10.2307/j.ctt32bbxc (buy book here)
- International context
  - https://www.youtube.com/watch?v=I3Wkvx_ZaFo&t=102s
  - https://unesdoc.unesco.org/ark:/48223/pf0000379949
- Trans Disciplinary and interdisciplinary science
  - https://www.nature.com/articles/s41599-020-00598-5#:~:text=Transdisciplinarity%20is%20generally%20defined%20by,pressing%20issues%20still%20requires%20improvement.
  - https://www.uu.nl/en/research/transdisciplinary-field-guide/get-started/why-transdisciplinary-research



Source

Other

- https://www.unesco.org/en/natural-sciences/open-science
- https://www.youtube.com/watch?v=BIHuPGg0YT0
- https://digital-strategy.ec.europa.eu/en/library/open-innovation-open-science-open-world
- https://www.openscience.nl/
- https://elifesciences.org/articles/16800

Lecture week 1: Format

Idea

The first lecture will be in person (real life), in the form of 2 TED-talks of 18 minutes. These will be recorded, in order that it can be part of a future fully remote version of the course and/or students can watch it again later.

TED talk 1: Open science - theory and the OS manifest/political point of view.

- Explanation of the five schools of Open Science
- Discussion at the UU and in NL
- Acces and Emancipation
- International Context

TED talk 2: Practical point of view

- Trans disciplinary and interdisciplinary science
- Laboratory life
- Community discipline employer

New

- Five schools of Open Science
- Current state of the conversation (NL, UU, Physics)
- Access and Emancipation
- Community-Discipline-Employer

Familiar

- Laboratory life
- International context
- Trans Disciplinary and interdisciplinary science

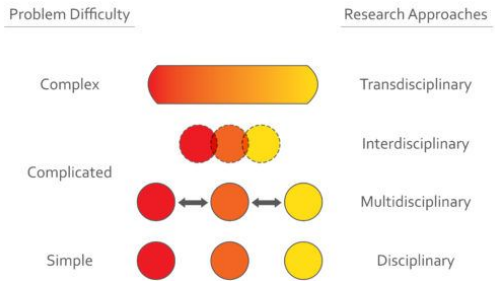
Information sources week 1 Tutorial topics

New Concepts

- Amateurism
- The reproducibility crisis
- Risks and rewards of Open Science,
- Opposition and counter arguments

Familiar Concepts

- Fraud



Source

Idea: Green in lecture and Orange in tutorial

Tutorial week 1: Assignment Ideas

Assignment objective

During the first tutorial session there are some OS experts in the room. Let's say a number of N experts, then, the students are also divided in N groups. Together with their group, they will make their first steps in learning about open science. Each group will talk with all of the experts in such a way that the students can ask questions about the topics below. To process the information, every group can choose between one of the deliverables below.

In a later stage in the course, students need to reflect on this day?

Topics

- Risk and rewards of OS
- Oposition and counter arguments of OS
- The reproducibility crisis
- Amateurism
- Fraud

Possible deliverables

- Write a group argument/ essay
- Use the question hour as input for an plenary discussion your group will organise (Takes place In a later week!)
- Tape the interviews at glue them together as a podcast/radio show.

Assignment preparation

- What questions to ask?
- What way of processing?
- Who does what?
- .

Course Development Week 1

Course Development Week 1 for the Open Science Course for physics students at graduate level. This document is based on the Syllabus.MD.

Date: Nov/02/2022

Name: Hendrik Snijder

Goal: Why open science, how did we get here?

After this week, one is able to describe what open science is and how people are getting there from the current state of science.

In a discussion a student can destiginuge between different open science schools and can take a point of view to name consequences of open science.

Besides that, the international context and access to scientific knowledge is something a student can form an opinion about.

Keywords student familiarity check week 1

Some of the keywords in syllabs.MD are supposed to be new, while some are most probably familiar for students.

Familiar Concepts

+ Laboratory life

+ Fraud (No joke intended)

Dalle2: A female physics student working on her assigment in the second week of the course painted by Robert Dijkgraaf

Week 2

Setting up a collaborative environment

Idea: Green in lecture and Orange in tutorial

Keywords student familiarity check week 2

New Concepts

- Licensing and receiving credit
- Best Practices for Community management
- Project management and Getting Things Done (GTD)
- Unit testing (defensive programming),

Familiar Concepts

- Version control
- Active and passive versioning
- Readme files and templates
- Merging forked repositorie

Ideas:

- Assignment: Find open source software for something cool such as Dalle2 (Something students thing is cool) and do something with it
- Road top open science podcast
- Assignment: Work with Github by using issues etc. to get feedback. Let them program something easy, such as a data visualization from an open source project. Let the students fork, merge etc. Maybe, we can create a page on the repository of Open Science
- Assignment: Meme competition!
- Technical assignments: How to use github data structuring etc. and alternate between this and more meta assignments!

Information sources Lecture week 2: New topics

- Licensing and receiving credit
  - https://www.youtube.com/watch?v=vAQghXQApPU
- Best Practices for Community management
  - Expert on Community managemen?
- Project management and Getting Things Done (GTD)
  - https://gettingthingsdone.com/resources/

Lecture week 2: Format

Idea

The second lecture will be a combination of short videos alternated with some reading. The Lecture consists out of 3 parts. The parts are distributed to a general Github. In the tutorial students are going to fork it!

Video

- 60 sec explanation about **Licensing and receiving credit.** Presented in “bullet points”. These bullet points are not necessary bullet points like in a slideshow, but are different scenes in the video where somebody explains it. This can be a real person or a cartoon. Also an animation is possible. The video ends with a clickable link, where people can find more information.

- A 5 min interview on video with a experienced open science community manager. In the interview best Practices for Community management are shared, together with some examples in real life.

- Project management and Getting Things Done (GTD). A free, individual exploration on https://gettingthingsdone.com/resources/ for aprox. 30 min.

New

-

Familiar

-

Information sources week 2 Tutorial topics

New Concepts

- Unit testing (defensive programming),

Familiar Concepts

- Version control
- Active and passive versioning
- Readme files and templates
- Merging forked repositorie
-

Idea: Green in lecture and Orange in tutorial

Tutorial week 2: Assignment Ideas

Ideas:

- Assignment: Find open source software for something cool such as Dalle2 (Cool = Something students thing is cool) and do something with it
-
- Road top open science podcast
-
- Assignment: Work with Github by using issues etc. to get feedback. Let them program something easy, such as a data visualization from an open source project. Let the students fork, merge etc. Maybe, we can create a page on the repository of Open Science
-
- Assignment: Meme competition!
-
- Technical assignments: How to use github data structuring etc. and alternate between this and more meta assignments!

Topics in tutorial:

Unit testing (defensive programming) | Version control | Active and passive versioning | Readme files and templates | Merging forked repositorie

Tutorial format

Assignment objective To practise with the topics above, the students are invited to fork the repository of the lecture. This repository contains the videos and links discribed and 1 python program with 4 parts. The groups are the same as in the first tutorial. Every group gets a specific task, see possible deliverables.

By pulling their work, each group can interact with the student-assistant in order to practise with the workflow. It is NOT allowed to meet in person during this tutorial, in this way people can practise with digital collaboration.

At the end of the tutorial, the repository contains:

- The videos and links of the lecture
- A tested an updated python file (See 1. below)
- The group specific projects in separated folders (See 2. below)

This repository can be created every year again or it can be a growing repository, with lots of different projects on the topics of week 2.

Possible deliverables

1. All groups have to test a part of the python software. Some specific changes in the software has to be made.
2. Each group can choose between:
    1. Some groups can search for an open source initatives. They try to track down the workflows and they try to add something. The workflow are combined in a .MD file and added to the forked repository. In this way the students can practise with version control and with crediting another project.
    2. Some groups can search for open source data sets and try to visualize them in a fancy way. The group have to calculate something new with the existing data. The new data set can be stored on the repository, which then can be pulled. In this way students can practis with version control
    3. Some groups can search for an open source AI, such as DALLE-2 or craiyon. With this software, students are going to study a topic they like in a systematic way by changing the input a bit. After every iteration, they ask for a pull request on pulling the results on the repopsitory. In this way the students can practise with version control and with crediting another project.As an example, they can ask dalle-2 the following:
        - first iteration: "An apple with a blue hat and two legs cycling on a bike in front of the empire state building, painted by dali."
        - second iteration: "An pine-apple with a blue hat and two legs cycling on a bike in front of the empire state building, painted by dali."
        - ...

Assignment preparation

- Students have to discuss in a teams/zoom environment how they are working together
- ..

Dalle2: “A colorful painting of students attending the first week of the open science course and working together”

Dale2: “Physics on the moon students listening to a lecture and work on an assignment”

Week 3

big science, scale vs precision vs control

Idea: Green in lecture and Orange in tutorial

Keywords student familiarity check week 3

New Concepts

- Big-science collaborations
- Citizen science
- Credit and recognition
- Policy and politics of science
- Governance structures
- Relativism of big, Climate impacts and transformation
- Independence and thriving

Familiar Concepts

- ..

Dalle2: “A colorful painting of students attending the first week of the open science course and working together”

Dale2: “Physics on the moon students listening to a lecture and work on an assignment”

Week 4

Documentation for reproducibility

Idea: Green in lecture and Orange in tutorial

Keywords student familiarity check week 4

New Concepts

- **Data structures and data plans**
- **GDPR and privacy rules**
- **templates and bug reports**
- **Persistent identifiers (e.g. DOI)**
- **Machine-readable docs**
- **Systematic review**
- **Scripting**
- **Compatibility**
- **Dockers-Virtual Environments-Pinning**

Familiar Concepts

- **Best practices in data visualization**

Idea: very practical assignment to practise with all the keywords

Dalle2: “A colorful painting of students attending the first week of the open science course and working together”

Dale2: “Physics on the moon students listening to a lecture and work on an assignment”

NASA

TOPS Funding Possibilities

How we define *Open Science*?

A **collaborative culture enabled by technology** that empowers the **open sharing of data**, **information**, **and knowledge** within the **scientific community and the wider public** to accelerate scientific research and understanding.

Open-Source Science Initiative (OSSI)

Core Values:

- As open as possible, always secure
- Increase the accessibility, inclusion, and reproducibility of Science Mission Directorate scientific activities
- When possible, minimize the burden

What is ROSES?

Research Opportunities in Space and Earth Sciences (ROSES)

- It is the name for an omnibus **NASA Research Announcement (NRA)**
- Always released on **Valentine's Day, Feb 14**
- Wide range of **basic and applied supporting research and technology** in space and Earth sciences supported by the **Science Mission Directorate (SMD)**:

Earth Science

Heliophysics

Planetary Science

Astrophysics

Biological and Physical Science

OSSI ROSES 22: Funding Opportunities

	Title	Description
F.7	Support for Open Source Tools, Frameworks, and Libraries	Support and maintain open sources tools, frameworks, and libraries that are significantly used by the SMD community
F.8	Supplemental Open Source Software Awards	Supplemental award to encourage the conversion of legacy software to open source
F.14	Transform to Open Science Training	TOPS training element primarily solicits proposals for the development training material and the execution of summer schools and virtual cohorts to advance open science literacy
F.15	High Priority Open-Source Science	SMD seeks proposals to support OSSI and that will advance the goals of TOPS. This includes supporting innovative open source tools, software, frameworks, data formats, and libraries that will have a significant impact to the SMD science community
	Supplement for Software Platforms	Supplemental support to existing awards for usage of

Notes

WHo can submit proposals?

- All US institutions
- Non US institutions only on no-exchangeof funds basis

Topics

- Science Core curriculum
- Summer Schools
- Virual Cohorts

Requirements

- Roses Requirements
- DUal-anonymous peer review (DAPR)
- TOPST topics must be in the proposal (only 1 topic per proposal!)
- Open-Source Science development Plan
- Equal Acces Plan (For Summer Schools and Virutal Cohorts proposals only)

Funding

- 1.3 million dollar per year (Divided over the projects)
- 1.2 million dollar per year (“ “ “ “)
- 400.000 dollar (“ “ “ “)

Timeline

- ?

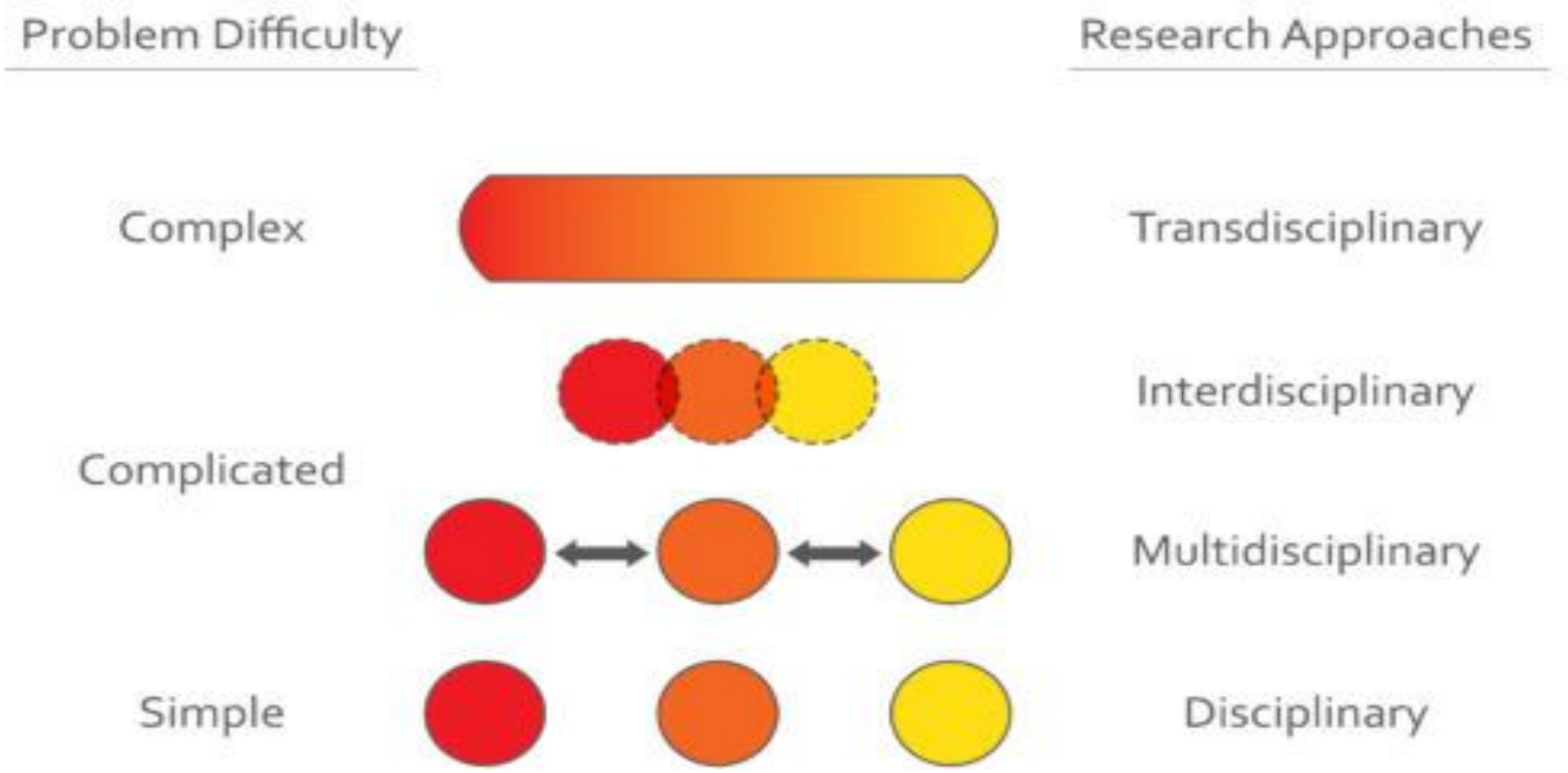
Resources

- Where I should start?
- Additional resources?

!!International Funding is hard!! → Ask local funding office?

Target group = undergrad and above

If we use there work (video’s etc.) Ue CC0! / Or if we create video’s etc use CC0?



Source: https://ian.umces.edu/blog/transdisciplinary-literacy-seven-principles-that-help-define-transdisciplinary-research/

Dalle2: “An apple with a blue hat and two legs cycling on a bike in front of the empire state building, painted by dali.”