

GENERAL INFORMATION ABOUT THE PROJECT

File number	405.19865.246
Grant tier, year and theme	Teaching Fellows - vrije categorie
Name projectleader	Miaomiao Zhou
Project title	Big Data in Biology Education
Organisation where the project is executed	Avans University of Applied Sciences

In this form we will ask you some questions about your project, which is financed through the Comenius grant programme. The first part of this form focuses on the execution and results of your project and will be used to share the insights generated through your project with others. The second part is aimed at gaining a more general insight into the workings and processes of the Comenius grant programme. We kindly request that you fill out all questions and motivate your answers. *The answers to the questions below can be used anonymously to aid evaluation(s) of the Comenius grant programme.*

SHARING THE KNOWLEDGE GAINED IN YOUR PROJECT VIA ONDERWIJSKENNIS.NL

In 2021, the NRO launched the website www.onderwijskennis.nl, aimed at sharing scientific knowledge and research informed innovation with education professionals. The website is organized thematically and is dedicated to making its content easily accessible. We will use the answers to the questions below to write a summary about your project. This summary, along with the products and publications produced during your project, will be published on the website. Please try to formulate your answers to the questions in such a way that they resulting paragraphs are easy to read and pique the interest of a large audience.

1. Factsheet: characteristics of your project

Fill in the table below with a concise summary of the characteristics of your project. These will give the reader a sense of the scale and context of your innovation.

Number of course(s) and students that participated in the innovation:	25
Duration of development phase:	09-2019 till 10-2021
Composition projectteam:	Project leader and dry-lab team: Miaomiao Zhou Wet-lab leader: Kees Rodenburg Wet-lab assistant: Kelly Raets Education expert: Janine van der Rijt
Time spent on development:	1180 hours
Total budget: (including any additional funding from your institution or any other financial resources secured alongside the Comenius grant)	Subsidy: 50,000 euros Institution matching: 48,200 euros

2. Introduction (max. 100 words)

As an introduction, write a short summary with a concise overview of what is to follow. Try to describe each of the following elements in a sentence or two: cause, goal, plan, method and results. Type your answer here (Klik of tik om tekst in te voeren):

Big data handling is essential in modern Biology education. Existing curricula suffer from gaps between 1, traditional analysis method and modern computationally-intensive data handling, 2, the young and older generation's learning styles, and 3, school laboratory facility and big data creation requirement. In order to bridge the gaps, we built an education scheme covering from big data creation to analysis. We embedded a novel side-by-side learning strategy during the learning process. The innovations were carried out by an interactive scheme based on "train-the-trainers" model. The project resulted in a practical infrastructure which can effectively implement big data in biology education.

Klik of tik om tekst in te voeren.

3. Cause and goal of the projet (max. 150 words)

Please, use your answers to the following questions as the basis for a paragraph on the reason you started your project and its primary goal(s).

- What was the reason you started your innovation project?
- What was the primary goal or aim of your innovation?

In response to the job market requests, we aim to equip the future Biologists with first-hand experiences in big data skills. However while facing the rapidly upgrading biotechnological world, our current curricula renewal teams are lack of equipment, knowledge, skills and experiences in big data handling.

The primary goal of this project was to use a novel DNA detection as an entry point in building a generic curricula upgrading scheme. A side-by-side learning strategy was designed to guarantee effective knowledge transfer. Students, teachers and teaching assistants would learn to generate and analyze big DNA datasets together. We would also utilize the "train-the-trainers" model to fortify the overall structure of the renewal scheme.

By creating and implementing such a system, we aim to build a sustainable method to effectively merge technological updates into education.

4. Plan and method (max. 250 words)

Please, use your answers to the following questions as a basis for a paragraph on your project plan and methods.

- Which method(s) and/or processes have been used? Were these selected on the basis of and/or adapted from previous research (were they research informed)?
- Did you use any IT tools or other specific means to carry out your innovation?
- How did the development and implementation processes transpire?
- What were the most important challenges and how did you deal with them?

Due to the impact of COVI-19 pandemic, this project lasted 24 month instead of 18 months as planned. Our project ran in three rounds with three interactive work packages: the wet-lab, the dry-lab and the dissemination teams (Figure 1).

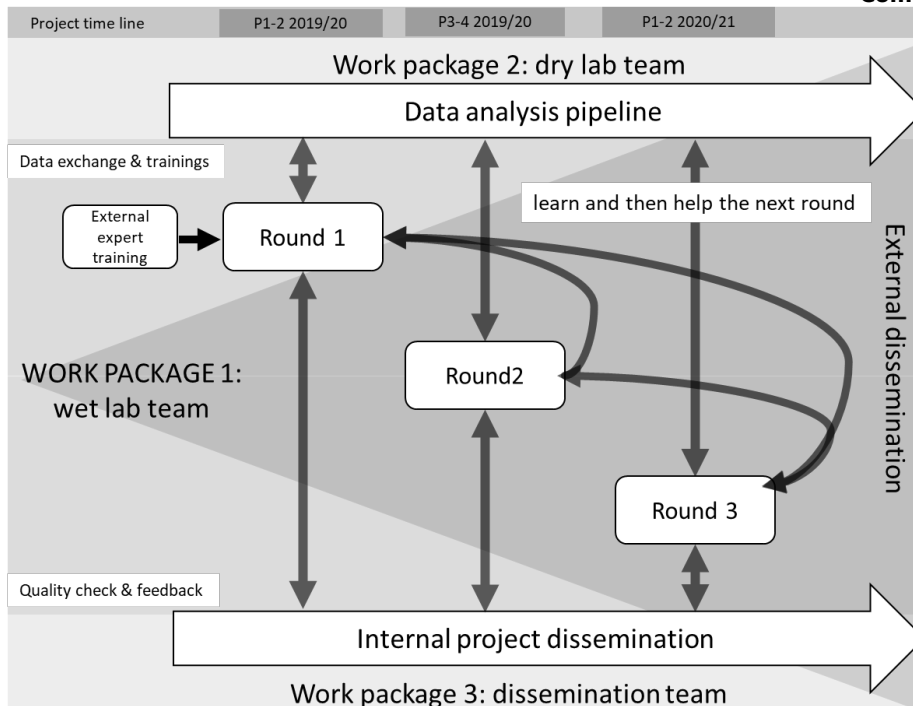


Figure 1, a schematic overview of the project

In each round of implementation, we used a novel “side-by-side” learning model. A teacher, a teaching assistant and 2-4 students teamed up to learn the subject together. We also used the train-the-trainers model to boost teacher’s skills in the subject.

In this project, the novel portable DNA detection device Oxford Nanopore MinION® was used to create big DNA data. The open source data handling platform Galaxy (<https://galaxyproject.org/>) was used to carry out data analysis education. After two years construction, we have become one of the most active Dutch dedicators in the international Galaxy training network consortium.

The development and implementation process was timely reported by the department newsletter. We’ve created several course catalogs in GitHub, BrightSpace, Teams and SharePoint. The training scheme was announced periodically via group meetings, Teams notification and emails. Most of our Galaxy tutorials were made open-source and announced via the international Galaxy training network (<https://training.galaxyproject.org/>).

The biggest challenge during this project was the COVID-19 pandemic impact. We had to switch most of the learning activities online. Due to the 1.5 meter regulation, lab usage was limited, we had to stretch many subjects on both time and space aspects in order to guarantee the effect of learning.

5. Evaluation and results (max. 200 words)

Please, use your answers to the following questions as the basis for a paragraph on the evaluation and results of your project.

- Was the innovation evaluated? If it was evaluated, how did you carry it out?
- What were the project’s most important results?
- Which aspects/factors hampered your project?
- What should those, who want to replicate your innovation keep in mind? What is essential to success, or what are important pitfalls they must avoid?

In this project, one of the three workgroups was the dissemination team composed by the academy educationalists, members of the examination committee and the scientific experts from the Centre of Expertise. The dissemination focused education quality, student competence

building and scientific research qualities, respectively. The dissemination was carried out by (online) meetings and online questionnaires (Microsoft Forms) at each round of the activities.

The project produced important results. 1, most of the participants reflected that their knowledge and skills in big data creation/handling exceeded the novice level; 2, the "side-by-side" learning model was highly appraised; 3, we received an evaluation score of 4.2 out of 5 for the "train-the-trainers" events; 4, we've summarized an effective scheme which can help to embrace other technique upgrades in the future.

The COVID-19 pandemic caused many difficulties. Participants reflected that online learning decreased their concentration and confidence. To monitor the learning process we used the Galaxy Tiaas system (<https://galaxyproject.eu/tiaas.html>), but still direct interaction was missed.

To replicate this project, one must bear in mind that scheduling ahead is essential for "side-by-side" learning scheme in order to guarantee the availability of the multidisciplinary participants in a learning group.

6. If applicable: prospects for future use and/or expansion (max. 150 words)

Describe *if* and *how* the results of your project will be used in future in your institution, or maybe even outside of it. Will your project be scaled up? Please indicate which aspects are important in facilitating its sustained or wider usage.

This project has brought a great impact to both inside and outside of our institution. As a continuation of the project, I adapted the project scheme and created the "ATGM BootCamp of Data skills (ABCDs)". In ABCDs, all teachers in our institute will participate in series of data skill workshops. The infrastructure, network and dissemination experiences resulted from the comenius project will benefit greatly to the ABCDs project.

By integrating the tutorials and protocols created from the comenius project, we formed a big data creation and analysis learning module for second year biology students. The first round of trial gained us a evaluation of 4.3 out of 5 from the students.

We centralized our big data Galaxy protocols and implemented them in a "see it, use it, teach it" train-the-trainers course. Both the ABCDs project and the Galaxy course are open to all teachers from University of applied sciences.

7. Literature

Please provide the references for the five most relevant research publications you have used to draw up your project plan or that were used in the execution of your project.

- Donovan, S., *Big data: teaching must evolve to keep up with advances*. Nature, 2008. **455**(7212): p. 461.
- Afgan, E., et al., *The Galaxy platform for accessible, reproducible and collaborative biomedical analyses: 2018 update*. Nucleic Acids Res, 2018. **46**(W1): p. W537-W544.
- Juul, S., et al., *What's in my pot? Real-time species identification on the MinION*. bioRxiv, 2015.
- National Academies of Sciences, E., and Medicine; Division on Earth and Life Studies; Board on Chemical Sciences and Technology; Board on Agriculture and Natural Resources; Board on Life Sciences; Committee on Future Biotechnology Products and Opportunities to Enhance Capabilities of the Biotechnology Regulatory System., *Preparing for Future Products of Biotechnology.*, in *Emerging Trends and Products of Biotechnology*. 2017, Washington (DC): National Academies Press (US).
- Bulte, C., et al., *Student teaching: views of student near-peer teachers and learners*. Med Teach, 2007. **29**(6): p. 583-90.

8. Products and presentations

We ask you to do the following:

- Go to the ISAAC tab "products". Add all the files and weblinks for any publications and other (educational) products produced during your project.

I have uploaded my presentations to ISAAC. But many of our products were not in a publication form. Hereby I list two of the education products that were not uploaded to ISAAC:

- <https://training.galaxyproject.org/training-material/topics/assembly/tutorials/mrsa-illumina/tutorial.html>
 - <https://training.galaxyproject.org/training-material/topics/assembly/tutorials/mrsa-nanopore/tutorial.html>
 - Klik of tik om tekst in te voeren.
- Please enumerate the instances when you gave (or will give) a presentation on your project in the table below (either within or outside of your institution). Please list the (planned) date and if possible a reference to the webpage with information about the meeting.

Description of the presentation, if available with weblink with further information about the meeting	(planned) date of the presentation
A presentation to demonstrate how we use Galaxy to equip second and third year biology students with big data handling skills (https://galaxyproject.org/events/2021-04-gr4-education/) This presentation was oral without a PowerPoint file.	April 28 2021
A presentation to share the experiences we gained from the comenius project with other biology teachers from Dutch Universities of Applied Sciences.	November 4 2021
A presentation given to the educationalists from the Avans Learning Innovation Centre. The goal was to extend our "side-by-side" learning scheme to other study programs within Avans. This presentation was conducted without a PowerPoint file.	November 17 2021
A presentation to the data skill work force from the Domain of Applied Sciences foundation, the goal is to share the experience we gained from the comenius project.	January 2022
Poster presentation to share the project results with audiences from research, education and business in molecular life sciences.	June 2022

These meetings can be added to the [meetings overview on onderwijskennis.nl](#). You are always welcome to suggest meetings for the overview by sending an email to knooppuntho@NWO.NL.

OTHER & SIGNATURE

1. Have you been able to realise the activities concerning knowledge sharing about your project as presented in the original proposal?

- ☒ YES
☐ NO, because...

Klik of tik om tekst in te voeren.

2. Besides this final report, do you have other information available that shows your project's contribution to an improved education? For example, the results of student evaluations.

- ☒ YES. Please add this information as a separate document in ISAAC. This information will not be made public without your permission.
☐ NO.

I have made a collection of student reports and evaluation forms. But there seems to be no place to upload in ISAAC. Most of the upload areas are meant for published papers. It would be great to receive some help in uploading supporting materials.

3. Has receiving a Comenius fellowship had any further effects on your (educational) career, such as recognition from colleagues, more time for education, next steps in your career, possibilities for other forms of funding, etc.?

Yes. Receiving this comenius fellowship helped me to gain vast recognition from my colleagues. I was able to create more related projects to conduct educational innovation. This fellowship has definitely given a boost in my career.

4. Do you have any further remarks about the Comenius programme in general?

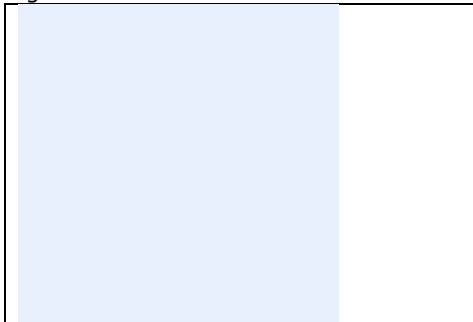
Klik of tik om tekst in te voeren.

5. Can the researchers who are conducting an evaluation of the Comenius programme contact you in due course?

☒ YES

☐ NO

Signature



Name project leader Miaomiao Zhou

Date: 20-12-2021