# Vision statement

Freek Pols

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# Contents

## 0.1 Education

Reflecting on educating, I must have more than 25 years of experience with teaching. I think one of my first accounts with teaching is instructing sailing at an age of 14. When I was 16, I became an instructor in the Martial Art (Pencak Silat) that I was practicing. In hindsight, it thus seemed to be a logical step to do the minor education in my third year of the study Applied Physics and to become a secondary school teacher after my masters.

On my own education. not reached the limitst. Set an example to pupils: continue learning.

### 0.1.1 Characteristics

- Innovatie
    1. niet alleen technologie centered
    2. didactiek
- Belangrijkste
    1. niet het trucje leren, maar het principe
- Courses
- Transforming education
    1. Inspiring others

## 0.2 Research

- Eigen onderzoekslijn o Rol van argumentatie in science (education) o Focus veelal op structuur, niet op inhoud o Practicumdidactiek & data-analyse o Rol van technologie, niet an-sich maar in content.
- Begeleiden
- Reviewen o GIREP o SOTL o NRO Klein o ...

## 0.3 Impact, valorization, leadership, organization

Waar het voor sommigen logisch en mogelijk is om onderscheid te maken tussen impact, valorisatie, leiderschap en organisatie, lopen deze thema's door het karakter van mijn werkzaamheden door elkaar. Het is daarmee logischer om elk van deze thema's aan te stippen in de verschillende secties.

### 0.3.1 Teach the teacher

Arduino Inquiry Docenten opleiders doceren Python Jupyter book ->myst Vertalen van onderzoek naar onderwijs Edudag, cursussen, teachbooks..

### 0.3.2 Open pedagogy

- verschil open education en open pegagogy
- SdF
- Python
- teachbooks en OIT

### 0.3.3 Pre-unviersity

## 0.4 Appendices

### 0.4.1 Courses

**2019- TN1405: Inleidend practicum (coordinator)**

The first year physics lab course (6ECTS ~240 students) aims at introducing students to the basics of experimental physics.

**2019- TN2985: Introduction to experiments in physics(coordinator)**

This course (2ECTS ~40 students) introduces students how opted for the minor in physics to the basics of experimental physics.

**2023-2024 WM0318 Wetenschaps- & argumentatieleer (lecturer)**

This course introduces the students to the philosophy of science (Nature of Science). In various sessions they discuss their standpoints regarding statements that are introduced in articles. They thereby explore their own views on the nature of science.

**2022-Now SL4310 Vakdidactiek verdieping (guest lecturer ICT)**

In this lecture I introduce the students to the use of four different ICT tools which can be used in the classroom.

**2022- SL4220 Vakdidactiek basis Natuurkunde/Scheikunde (guest lecturer practicum)**

In this lecture I teach the basics of the pedagogy of practical work.

**2023- SL4301 Implementatie van onderwijs (guest lecturer practicum Online textbooks & escaperooms)**

In this course students are introduced to relevant ideas and materials that they can use in their own teaching practices. I introduce them to the use of escaperooms and the use of open online interactive books.

Master thesis Farah Master thesis Diana

### 0.4.2 Research output

A detailed list of scientific publications with abstracts is available here.

**2024**

- Redesigning a first year physics lab course on the basis of the procedural and conceptual knowledge in science model.
  *Physical Review Physics Education Research*, 20(1), 010117.
  Pols, C.F.J., & Dekkers, P.J.J.M.

**2023**

- Integrating argumentation in physics inquiry: A design and evaluation study.
  *Physical Review Physics Education Research*, 19(2), 020170.
  Pols, C.F.J., Dekkers, P.J.J.M., & de Vries, M.J.

**2022**

- 'Would you dare to jump?' Fostering a scientific approach to secondary physics inquiry.
  *International Journal of Science Education*, 44(9), 1481-1505.
  Pols, C.F.J., Dekkers, P.J.J.M., & De Vries, M.J.
- Defining and assessing understandings of evidence with the assessment rubric for physics inquiry: Towards integration of argumentation and inquiry.
  *Physical Review Physics Education Research*, 18(1), 010111.
  Pols, C.F.J., Dekkers, P.J.J.M., & De Vries, M.J.

**2021**

- What do they know? Investigating students' ability to analyse experimental data in secondary physics education.
  *International Journal of Science Education*, 43(2), 274-297.
  Pols, C.F.J., Dekkers, P.J.J.M., & De Vries, M.J.

### 0.4.3 Educational papers (international)

A detailed list of educational publications with abstracts is available here.

**2024**

- Elements of proper conclusions.
  *Physics Education*, 60(1), 015009.
  Pols, F.
- The Vitruvian Man: An Introduction to Measurement and Data Analysis.
  *The Physics Teacher*, 62(5), 356-359.
  Pols, F.
- The scientific graphic organizer for lab work.
  *The Physics Teacher*, 62(1), 20-21.
  Pols, F.
- A hands-on activity to introduce the structure of NV-center quantum bits in diamond.
  *Physics Education*, 59(4), 045017.
  Ockhorst, R., Koopman, L., & Pols, F.

**2023**

- One setup for many experiments: enabling versatile student-led investigations.
  *Physics Education*, 59(1), 015007.
  Pols, F.
- Collaborative data collection: shifting focus on meaning making during practical work.
  *Physics Education*, 58(2), 023001.
  Pols, F., & Diepenbroek, P.

**2021**

- Students' report on an open inquiry.
  *Physics Education*, 56(6), 063007.
  Pols, F., Duynkerke, L., Van Arragon, J., Van Prooijen, K., Van Der Goot, L., & Bera, B.
- What's inside the pink box? A nature of science activity for teachers and students.
  *Physics Education*, 56(4), 045004.
  Pols, F.
- The sound of music: determining Young's modulus using a guitar string.
  *Physics Education*, 56(3), 035027.
  Pols, F.

**2020**

- Teaching a hands-on course during corona lockdown: from problems to opportunities.
  *Physics Education*, 55(6), 065022.
  Hut, R.W., Pols, C.F.J., & Verschuur, D.J.
- A pandemic-resilient open-inquiry physical science lab course which leverages the Maker movement.
  *Electronic Journal for Research in Science & Mathematics Education*, 24(3).
  Bradbury, F.R., & Pols, C.F.J.
- A Physics Lab Course in Times of COVID-19.
  *Electronic Journal for Research in Science & Mathematics Education*, 24(2), 172-178.
  Pols, F.

**2019**

- Introducing argumentation in inquiry—a combination of five exemplary activities.
  *Physics Education*, 54(5), 055014.
  Pols, F., Dekkers, P., & de Vries, M.

### 0.4.4 Educational papers (national)

A detailed list of Dutch publications with abstracts is available here.

**2024**

- Practicum, wat hebben we (ervan) geleerd?
  *NVOX* 49(10), 22-23
  Pols, C.F.J. & van den Berg, E. & Dekkers, P.J.J.M.
- Eenvoudig online boeken maken met Jupyter Book
  *NVOX* 49(8), 22-23
  Pols, C.F.J. & Idema, T.
- Leren onderzoeken
  *NVOX* 49(6), 50-51
  Pols, C.F.J.

**2023**

- De radioactiviteit van fruit
  *NVOX* 48 (8), 52-53.
  Pols, C.F.J., Zwinkels, N., Bulcke, S.
- Melk in je koffie
  *NVOX* 48 (5), 12-14. Mooldijk, A. & Pols, C.F.J.
- De natuurkunde van Spiderman
  *NVOX* 48 (4), 34-35.
  Pols, C.F.J.

**2022**

- Proeven (v/a)an vroeger.
  *NVOX* 47 (10), 286-286.
  Pols, C.F.J.

**2021**

- Practica bij de valbeweging.
  *NVOX* 46 (10), 34-35.
  Pols, C.F.J.
- Kritisch? Ik?! Ontwikkeling van een kritische houding in een leerlijn onderzoeken
  *NTvN*
  Pols, C.F.J.

**2020**

- Bouw een demoproef.
  *NVOX* 45 (10), 58-59.
  Pols, C.F.J., Hut, R.W., Oosterlaan, L., van Braak, M., Collenteur, F.
- Practicum, net even anders
  *NVOX* 45 (8), 438-439.
  Pols, C.F.J.

**2019**

- De Scientific Graphic Organizer
  *NVOX* 44 (8), 410-411.
  Pols, C.F.J.
- De mens van Vetruvius
  *NVOX* 44 (6), 286-286.
  Pols, C.F.J.
- Leren onderzoeken: een praktische aanpak in klas 4.
  *NVOX* 44 (2), 98-99.
  Pols, C.F.J.

- Leerlingen leren onderzoeken
  Nederlands Tijdschrift voor Natuurkunde, 84 (11), 45-47.
  Pols, C.F.J.
- De hellingproef: Een practicum over het ontbinden van krachten in componenten
  *NVOX*, 47 (8), 442-443.
  Pols, C.F.J. (2019).

**2018**

- Beweging in stop-motion
  *NVOX*, 43 (5), 244-245.
  Pols, C.F.J.

**2017**

- Snaartheorie in de praktijk
  *NVOX*, 42 (2), 72-73.
  Pols, C.F.J. (2017).
- Technisch ontwerpen in 4V.
  *NVOX*, 42 (1), 40-41.
  Pols, C.F.J. (2017).

**2016**

- Een leerlingpracticum quantummechanica voor minder dan 30,-
  *NVOX*, 41 (3), 132-133
  Pols, C.F.J. & Nelk, J.P.
- Een foto of grafiek zegt meer dan 1000 woorden
  *NVOX*, 41 (2), 68-69.
  Pols, C.F.J.

**2014**

- Een versnelling langs een helling
  *NVOX*, 40 (4), 178-179
  Pols, C.F.J.

### 0.4.5 Books & Chapters

- ShowdeFysica 3: Natuurkunde laat je zien (2023)
  NVON
  Frederik, I., van den Berg, E., , Dekkers, P., Pols, F., Sonneveld, W., Spaan, W., van Veen, N., Staderman, K.
- Show de Fysica 2: Natuurkunde laat je zien (2017)
  NVON
  Frederik, I., van den Berg, E., te Brinke, L., Dekkers, P., Pols, F., Sonneveld, W., Spaan, W., van Veen, N., van Woerkom, M.
- Show the physics (2024)
  NVON & TUD
  Pols, F. & Dekkers, P.J.J.M.
- Maker education in the applied physics bachelor programme at Delft University of Technology (2023).
  Chapter in Klapwijk, M., Gu, J., Yang, Q., & de Vries, M. J. Maker Education Meets Technology Education: Reflections on good practices.
  Brill
  Pols, F., & Hut, R.
- Leerstofdomeinen: Technische automatisering (2017)
  Chapter in Kortland, K., Mooldijk, A. Poorthuis, H., Handboek natuurkundedidactiek, 206-211.
  Epsilon
  Mooldijk, A. & Pols, C.F.J.

### 0.4.6 Conferences, workshops & trainings

https://polslab.tnw.tudelft.nl/index.php?page=Conferences

**2025**

- Integration of argumentation as prerequisite for effective practical work
  A presentation on the integration of argumentation and practical work at the ESERA conference, Copenhagen, DK
  Pols, C.F.J. & Dekkers, P.J.J.M.
- We've got 99 demonstrations and so much fun!
  A workshop on physics demonstrations at the GIREP conference, Leiden, NL
  Pols, C.F.J. & van Veen, N.
- Towards Open Physics Education: Teaching with Jupyter (Note)Books
  A presentation on teaching with Jupyter Books at the GIREP conference, Leiden, NL
  Pols, C.F.J.
- Opening up Classroomdemonstrations
  A workshop on physics demonstrations at the AAPT Winter Meeting, Saint Louis, USA
  Pols, C.F.J.
- The Scientific Graphic Organizer for lab work
  A posterpresentation on the SGO at the AAPT Winter Meeting, Saint Louis, USA
  Pols, C.F.J.
- Teaching Scientific Inquiry
  A presentation on my dissertation at the AAPT Winter Meeting, Saint Louis, USA
  Pols, C.F.J.

**2024**

- Jupyter Books
  A teacher professionalization training (betasteunpunt, TU Delft) on the making of Jupyter Books.
  Pols, C.F.J., van Woudenberg, T.
- Python in teaching
  A teacher professionalization training (betasteunpunt, TU Delft) on Python, introducing (physics) teachers to Python programming
  Pols, C.F.J.
- Show de Fysica
  Several physics demonstrations showed at the WND conference, Noordwijkerhout, The Netherlands.
  Pols, C.F.J., Dekkers, P.J.J.M., Frederik, I., Sonneveld, W. et. al.
- Creating magical, meaningful moments with demonstrations
  At the 7th of November, I gave a workshop on the use of physics demonstrations at the education day of TU Delft.
  Pols, C.F.J.
- Python in Teaching event
  At the 14th of March, we have held a Python in Teaching event at Delft University of Technology. Several teachers presented their approach to Python teaching
  Pols, C.F.J.
- Opening up classroom demonstration experiments
  A poster presentation at the 12th International Conference on Physics Teaching in Engineering Education PTEE on our project in which we are opening up our classroom demonstration experiments to students.
  Pols, C.F.J. & Haaksman, R.H.
- Redesign of a first year physics lab course
  A presentation at the 12th International Conference on Physics Teaching in Engineering Education PTEE on the recent redesign of the First Year Physics Lab Course at TU Delft.
  Pols, C.F.J.

- Enhancing a critical attitude in experimental physics
  A workshop at the 12th International Conference on Physics Teaching in Engineering Education PTEE on increasing students' critical attitude towards experimental physics.
  Pols, C.F.J.

**2023**

- The Pedagogy of Lab Work: Unleashing the potential of lab activities
  A workshop on the pedagogy of university lab work at the education day of TU Delft.
  Pols, C.F.J.
- Python4All @ TU Delft
  A presentation and discussion session on how we teach introductory Python at TU Delft.
  Pols, C.F.J.
- Python4All
  A roundtable discussion on the introduction of Python to first year students at the CDIO conference, Trondheim
  Pols, C.F.J., Steele, G.A.
- Development of the mental model of wave – particle as basis for wave-particle duality
  Preliminary results of an investigation on students' understanding of waves/particles presented at the GIREP conference, Kosice
  Ockhorst, R. & Pols, C.F.J.
- Introducing quantum physics concepts through lesson materials on quantum technology
  Teaching materials on QM presented as poster at the GIREP conference, Kosice
  Ockhorst, R., Koopman, L. & Pols, C.F.J.
- Show de Fysica
  Several physics demonstrations showed at the WND conference, Noordwijkerhout, The Netherlands.
  Pols, C.F.J., Dekkers, P.J.J.M., Frederik, I., Sonneveld, W. et. al.

**2022**

- Show de Fysica.
  Several physics demonstrations showed at the WND conference, Noordwijkerhout, The Netherlands.
  Pols, C.F.J., Dekkers, P.J.J.M., Frederik, I., Sonneveld, W. et. al.
- An introduction to the Assessment Rubric for Physics Inquiry.
  Paper on ARPI presented at the GIREP conference, Ljubljana, Slovenia.
  Pols, C.F.J. & Dekkers. P.J.J.M.
- The scientific graphic organizer for practical work.
  Poster on the use of the SGO presented at the GIREP conference, Ljubljana, Slovenia.
  Pols, C.F.J. & Diepenbroek, P.
- Towards inquiry: Redesign of a first year physics lab course.
  Presentation of the transformation of the FYPLC at the GIREP conference, Ljubljana, Slovenia.
  Pols, C.F.J.
- The pedagogy of practical work
  Workshop for teacher educators at the Hogeschool Rotterdam
  Pols, C.F.J.

**2021**

- Differences and similarities in approaches to physics LAB-courses.
  Symposium (chair) at the online GIREP World Conference on Physics Education, Hanoi, Vietnam.
  Pols, C.F.J., Lewandowski, H.J., Logman, P.S.W.M. & F.R.Bradbury.
- Development of a teaching sequence on physics inquiry.
  Paper on the TLS presented at the online GIREP World Conference on Physics Education, Hanoi, Vietnam.
  Pols, C.F.J., Dekkers, P.J.J.M., & de Vries, M.J.

- From producers to consumers: fostering students' scientific approach to practical work.
  Paper on an introductory inquiry activity presented at the Online GIREP conference, Mino, Braga, Portugal.
  Pols, C.F.J., P.J.J.M. Dekkers, M.J. de Vries.
- Using the Assessment Rubric for Physics Inquiry for open inquiries in a multidisciplinary lab course.
  Online Physics Education Research Conference 2021.
  F.R. Bradbury & Pols, C.F.J.
- Assessing a flipped-lab course consisting of open-inquiry projects using Arduinos.
  AAPT Online Summer Meeting 2021.
  F.R. Bradbury & Pols, C.F.J.
- Constraints in Physics Lab Courses: the Good, the Bad, and the Pandemic.
  Invited speaker at APS March Meeting.
  Bradbury, F.R. & Pols, C.F.J.

**2020**

- Open-inquiry experiments using sensors controlled by Arduinos in a pandemic-resilient lab course.
  Poster presentation at Physics Education Research Conference
  Bradbury, F.R., Pols, C.F.J. & Vlaanderen, C.L.
- Teaching Scientific Inquiry
  Workshop for teacher educators at the Hogeschool Utrecht
  Pols, C.F.J.

**2019**

- Using cogency to foster the use of concepts of evidence in physics experiments.
  Paper presented at NARST, Baltimore, USA.
  Pols, C.F.J., P.J.J.M. Dekkers & M.J. de Vries

**2018**

- Data-analysis in practical work, what do students know?.
  Paper presented at the GIREP conference, San Sebastian, Spain.
  Pols, C.F.J. & Dekkers, P.J.J.M.

### 0.4.7 Grants & Applications

| Year | Title | Call | Main applicant | Accepted |
|---|---|---|---|---|
| 2014 | The interactive whiteboard as intervention during practical work in physics class to increase students learning | NRO: Promotiebeurs voor leraren | V | V |
| 2023 | Perspective Agility for Navigating Diversity, Collaboration and Conflict in order to advance Equity and Inclusion | NRO: Comenius Senior fellow | X | V |
| 2023 | A modular programming book for engineering students | TUD Open Education Stimulation Fund | X | X |
| 2023 | Opening Up Classroom Demonstration Experiments | TUD Open Education Stimulation Fund | X | V |
| 2023 | The road to scientific inquiry | TUD Education Fellowship | V | V |
| 2023 | To ChatGPT, or not to ChatGPT: Effectief gebruik van Artificial Intelligence in het onderwijs | NRO: Comenius teaching fellowship | V | X |
| 2024 | NRO: edVenturous Questions | Integration of Argumentation and Engineering Design | V | X |
| 2024 | Student-Centred Learning with AI Tutors in Project Work | TUD: AI-Augmented Engineering Education | V | |
| 2024 | Towards a coherent curriculum: Guiding curriculum transformation through educational design theory | NRO: Hoger onderwijs van de toekomst | X | X |
| 2024 | From Closed to Open: Bottom-up Open Educational Resources with and for pre-service teachers | NRO: Comenius teaching fellowship | V | X |
| 2025 | The Scientific Graphic Organizer as aid for | NRO: Pareltjes uit de praktijk | X | |