

Final report for NV faculty: Student Active Learning of Mechanical Physics with IoLAB. (**SALMP IoLAB**)

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Scope of the project

The purpose of the project was **to enhance student learning via active exercises and demonstrations in basics courses at the Physics Department**. This project is part of the strategy for active learning implemented in the Physics Department with the aim of better linking the practical skills with the overall competencies and learning objective of the course.

Our approach consists in integrating into the traditional frontal lectures and exercise sessions, the usage of a novel piece of hardware, i.e. IoLab. The usage of this hardware has been shown to help the connection of the theory with a more demanding laboratory included in many courses in STEM education. IoLab ¹ combines all the measurement devices, and components needed for hundreds of physics demonstrations in a single device and links them to a software solution for gathering data and recording results.

We had already developed some examples with test kits that were provided by the company for some topics in FY1001 and FY1003. However, we got the funding from the faculty on November 2022, and for logistics reasons, we got the IoLab devices only in January 2023, once the course FY1001 was already concluded, and, the FY1003 already started. For this reason, with the funding of the NV faculty, we have begun this process and applied our approaches to the pilot case of FY1003 and to the KOMPIS-courses at the Skolelaboratoriet, which provide support and develop new teaching methods for science teachers at all levels.

The Project is in line with the realization of the FTS principles III, IV, and IX ². In particular, the project enables students to apply new knowledge and skills to real-life situations, i.e. contextual learning, as required by principle III.

¹<https://www.macmillanlearning.com/ed/uk/digital/iolab>

²<https://www.ntnu.no/fremtidensteknologistudier/prinsipper>

Results

With the finances of the NV faculty, i.e. 30000 Noks, we have been able to buy 20 pieces of hardware, in line with what was required in the original application. Those pieces of hardware have been shared for testing with the course leaders and authors of the project, and used in practical exercises and lectures of FY1003 and KOMPIS courses.

In FY1003, the IOLAB devices have been used by the teacher during the frontal lectures to explain the Faraday induction phenomena and the basic concept of circuits. Furthermore, the FY1003 students were asked to participate in two extra sessions, outside standard teaching and exercise hours, "IOLAB activity: Testing the Ohm's Law". The sessions were totally voluntary and were not counted in the final assessment of the students. Despite the fact that the activity was fully voluntary, and, that the outcome of it would have not been considered in the final assessment, a total number of 40 students have been actively participated in the activity, and around 10 of them borrowed the device at home to experience further applications and measurement of the devices. The device was used in teams of 2 or 4 people. The students had several tasks to perform, including building a few circuits in parallel and in series, measuring currents, validating Ohm's Law, and activating diodes in different circumstances. The course coordinator, Assoc. Prof. Raffaella Cabriolus has received very good feedback from the students participating in those sessions and the frontal lectures where IOLAB was used. The usage of the IoLab was also very positively mentioned by the students in the last reference group just submitted for the year 2023 (See FY1003-reference-group final report 2023 in KASPER).

Furthermore, Assoc. Prof. Astrid Johansen from the Skolelaboratoriet organized a specific session for the students of the MREAL study program to make them familiar with iOLab and compare this system to the Pasco loggers usually applied in schools, as part of the project "Læreblikk på grunnemner I fysikk". This project aims to link the subject to the MREAL student's future teacher-practice, where the use of digital tools (including the IOlab) will be a central skill to have. Also in those cases, the participation was voluntary and the answer from the students were quite positive.

Continuity of the project

In reality, the project is still ongoing, and, after the positive first pilot application, the devices will be surely used more extensively in the next years. In particular, the course coordinator of FY1003 has decided to introduce the usage of the device in the compulsory extra activity of the course, and, for practical demonstration during the lectures.

The other professors involved in the application have been informed of the results and are considering to use in their courses. Assoc. Prof. Jon Andreas Støvneng, Deputy of teaching at the Department, ensured that the vision of the Department's ideas were followed throughout the project, and, that the approach meet the aims of the FTS guidelines.

Budget

The total funding, i.e. 30000, was used in agreement with the original plan to buy 21 Iolabs and the relative accessory. The details of the project are as follows: Prosjektnr 976804117 with k-sted 66200501.