

How experienced faculty change their teaching practices to fit into reformed courses

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Abstract. The University of Ljubljana, Faculty of Mathematics and Physics is reforming its Applied Physics study program following the Investigative Science Learning Environment methodology. The reformed courses are conducted by teachers who did not have previous experience in teaching reformed courses. They were prepared for the task by receiving a short training in ISLE methodology and by continuous professional development practices during the semester. We report what aspects of teaching through the ISLE approach turned out to be most challenging to develop, what factors seemed to affect these difficulties, and what training practices were recognized as most helpful.

Introduction

The University of Ljubljana, Faculty of Mathematics and Physics is reforming its Applied Physics study program. The reform involves reforming the major courses of the program, the Introductory physics course with the lectures and recitations and the lab course, and it is based on the Investigative Science Learning Environment (ISLE) methodology [1,2].

ISLE is a holistic student-centred learning approach built around the idea that students should learn physics by practising it. In all reformed courses the students work in groups. In whole-class meetings they develop knowledge following the ISLE cycle [1] and in recitations they solve problems, mostly new types of problems [2], which assist the development of conceptual understanding and problem-solving strategies similar to those used by experts. In the lab course they design and conduct semi-open investigations either to apply the knowledge or to create new knowledge that will be a basis for further inquiry in the whole-class meetings.

The role of the teacher in a reformed course is profoundly different from their role in a traditional lesson. A teacher in a reformed course has to create motivation for student learning, organise group work and whole class discussions effectively, pose productive questions to stimulate higher-level thinking skills, encourage students to generate explanations and productive questions, listen to the students and build on their ideas, etc. Our teachers did not have any prior experience with teaching in reformed courses. The whole-class meetings and recitations were conducted by a professor and a part-time teaching assistant, both with more than 10 years of traditional teaching experience in this course before the reform took place, and the lab course was conducted by a graduate teaching assistant who had the experience with a course in which students solved open-ended problems.

It takes approximately two years to develop habits of mind and practice necessary to implement the ISLE approach [3]. Our teachers did not have that time. Instead, we organised an individualised professional development program for each of them. It consisted of ISLE training before the start of the semester and by continuous professional development activities during the semester. The latter included team-teaching (a practice where an ISLE-novice conducts a lesson together with an ISLE-expert), observations of lessons and reflections, discussions and practice of teaching specific topics using ISLE methodology. By following the professional development of the teachers, we collected valuable data on how teachers change their teaching practices and attitudes.

In our study we aim to answer the research questions: What aspects of teaching an ISLE-based course are most difficult to implement? How does this set of aspects differ depending on the prior teaching experience of the faculty and their beliefs or attitudes related to these aspects? Which training practices have the largest effect on teaching practices?

Methodology

To answer the research questions, we conducted a qualitative case-study [3]. The primary source of data was *classroom observations* of the instructors. The observers were two of the authors. They are professors currently leading the Physics Education Program that has been using the ISLE approach to prepare physics teachers for several years. For the observations we developed and used a custom made protocol: The observer (i) documented the progression of the lesson, (ii) looked for and took notes of the aspects of the instructors' practices that are considered essential for the implementation of the ISLE approach, (iii) observed students' work and recorded whether teacher's practices had intended effects on students.

We triangulate observational data with the interview data. With each instructor we conducted a face-to-face semi structured interview with three foci: the instructor's prior teaching experience and their attitudes towards it, the instructor's prior knowledge about the research-based instructional strategies and the attitude towards it, and on the experience with the reformed program. In addition, we also collect data to quantify the quality of instruction. For this we use a set of selected rubrics developed for self-assessment of teaching one lesson within teacher preparation programs [4] and a Reformed Teaching Observation Protocol (RTOP) [5].

The follow up research will extend to the second semester and the next academic year.

Preliminary findings and conclusions

Preliminary results show that although all instructors are highly motivated to implement reformed instructional strategies, the development of needed skills takes time. For example, we have observed that it was easy for all teachers to arrange students to work in groups, however, to encourage the students to discuss among themselves inside a group was much more difficult. For some of them, taking the role of "a teacher as a listener" turned out to be very challenging.

In terms of research questions, the results show that there are some aspects of teaching an ISLE-based course that are more challenging than others and that not all of these are common to all teachers. We can see some relation between the ease of adopting desired skills and practices and prior experiences and attitudes. As for the most effective training practices it seems that there is a common agreement that the teachers profit the most by having an opportunity to observe direct actions and responses of an expert during team-teaching.

The recommendations for implementation of reformed instructional strategies may soon become obligations. Therefore, the findings of this project will be important for planning professional development of not only future but also present university teachers.

References

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