

# Teachers' Experiences from In-service Education about Inquiry Based Science Education

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## **Abstract**

Science teachers have often regarded in-service education as an ineffective way to improve their professional competence. At the same time a lot of resources are spent on in-service education, for instance in different projects financed by the EU. This paper reports from a project with the aim to develop science teachers' skills in inquiry based science education ("IBSE") and assessment. In-service teacher education is provided by a series of workshops (24 hours in total). In order to investigate how the teachers perceived their development as professionals during the workshops, the teachers answered a questionnaire individually in the end of each series of workshops. The majority of teachers reported that they consider themselves as more experienced in teaching IBSE after the workshops; something they state will make them use IBSE and assessment more in the future. The results also indicate that teachers' expectations of in-service education have been met by the workshops.

## **Key words**

Inquiry based science education, assessment, in-service education, professional competence.

## **Introduction**

Luft et al. (2011) claim that not enough research has focused on in-service teacher development. The limited research that has indeed been performed, indicates that science teachers have often regard in-service education as an ineffective way to improve their professional competence (Supovitz & Turner, 2000). According to Supovitz and Turner, this is due to in-service education being based on a poor understanding of teachers' motivations, as well as a lack of insight into both the individual and environmental factors in the process of change. These researchers summarize critical components that need to be included, in order to provide professional in-service education of high quality. First, the education should immerse participants in inquiry, questioning and experimentation. The teachers need to be engaged in concrete teaching tasks, which are based on teachers' experiences with students. Further, professional education should focus on subject-matter knowledge and deepen teachers' content skills. Finally, the education needs to show how the teachers may connect their work to specific standards of student performance. This paper reports from a project with the aim to

develop science teachers' skills in inquiry based science education ("IBSE") and assessment. The project – "Strategies for Assessment of Inquiry Learning in Science" (or SAILS) – has received funding from the European Union's Seventh Framework Programme for research and development.

The primary aim of SAILS is to support teachers in adapting IBSE at second level (students aged 12 to 18 years) across Europe. This will be achieved by utilising existing models and resources for both pre-service and in-service teacher education in IBSE. SAILS aims to prepare science teachers, not only to be able to teach science through inquiry, but also to be confident and competent in the assessment of their students' learning through inquiry (SAILS, 2013)

## Method

In-service teacher education in SAILS is provided by a series of workshops. In the end of each series of workshops, totally 12 hours of in-service teacher education per series, the teachers answered a questionnaire individually. The questionnaire consisted of 22 different items about the teachers' experiences of teaching, the workshops, IBSE and assessment. The main purpose of distributing the questionnaire was to investigate how the teachers perceived their development as professionals during the workshops. The results consist of data from two cohorts of in-service teachers that have participated in two consecutive series of workshops (12+12 hours) about IBSE and assessment during 2013. In the first series, the content of the workshops was concentrated on IBSE with only a minor focus on assessment methods. In the second series, more course content was concentrated on theories and methods connected to assessment of IBSE. In the first series of workshops, 12 teachers participated in all workshops; in the second series 10 teachers participated. All teachers in the second series (autumn 2013) had already participated in the first series during spring 2013.

## Results

After the first series of workshops

Most of the teachers took part in the workshops because they were interested in assessment, especially in combination with inquiry teaching. Other reasons to participate were the new curriculum, the possibility to meet teachers from other schools and to get input and inspiration. When asked about their expectations, the teachers wanted to learn more about how to work with inquiry and assessment in the classroom. All of the teachers claim that the workshops either met their expectations (75%) or met their expectations to certain degree (25%). However, only 25 percent of the teachers considered themselves as more experienced in teaching IBSE after the workshops. Only the teachers that considered themselves as beginners before the workshops perceived that they had increased their experience.

The teachers were asked to rate the outcome of the workshops, expressed in different given sentences, on a 5-point scale (1 = strongly disagree, 5 = strongly agree).

- The workshops were useful for me as a teacher 4.3
- The workshops helped me to better understand IBSE 4.0

- The workshops will make me use IBSE more in my lessons 4.0
- I now feel more comfortable working with IBSE and assessment 3.5
- I would like to participate in more workshops about IBSE and assessment 4.5

As the strengths of the workshops, the teachers mentioned the workshop leaders from the university, the input from colleagues and the teaching activities they performed. The teachers emphasized the importance of meeting with colleagues from other schools. There were not so many suggestions about improvements. Some teacher mentioned that learning more about assessment would have made the course even better.

About 50 percent of the teachers claimed to have used something they have learned from the workshops in their own teaching. They report that they have changed some of their laboratory lessons and that they have started to think about how to assess laboratory work in a different way. They have also tried to involve the students more in the planning of experiments. However, a majority of the teachers clearly emphasized that these workshops have only initiated another way of thinking and that they need more education in order to really start working with integrating IBSE and assessment. The teachers hope that more knowledge about these topics will increase their possibilities to work with students' critical thinking, formulating hypotheses, planning, drawing conclusions and self-assessment, which are requirements in the Swedish curriculum.

After the second series of workshops

After the second series of workshops, a clear majority of the teachers reported that the workshops met their expectations. As justifications they mention good examples of assessment, excellent lectures and speakers and interesting discussions. As suggestions for improvements they mention more hands-on activities. About half of the participants reported that they consider themselves as more experienced in teaching IBSE after the workshops, while the rest rate themselves at the same level as before (i.e., to have some experience).

- The workshops were useful for me as a teacher 4.5
- The workshops helped me to better understand IBSE 4.4
- The workshops will make me use IBSE more in my lessons 4.4
- I feel more comfortable working with IBSE and assessment 4.2
- I would like to participate in more workshops about IBSE and assessment 4.7

As the strengths of the workshops the teachers mentioned the course leaders from the university, the input from teachers from other schools, discussing research and performing teaching activities. They emphasized the importance of meeting with colleagues from other schools. The teachers have used rubrics, pedagogical plans, IBSE, and experiments that were discussed during the workshops. Student skills that have developed due to the teachers taking part in the workshops were controlling variables, formulating questions, self-assessment, feed-back, and own responsibility. Students' self-assessment skills were particularly emphasized.

## Discussion and conclusion

This study answers to the call from Luft et al (2011) to focus more on in-service teachers' professional development. By comparing the results from the two questionnaires, the importance of the second series of the workshops is highlighted. The teachers have rated all five items higher after the second series of workshops. According to the questionnaire data, the teachers' are significantly more comfortable working with IBSE after the second series. The participating teachers also claim that this will make them use IBSE more in their classes. The results also indicate the possibility to meet teachers' expectations of professional development, which may be difficult according to Sipovitz and Turner (2000).

## References

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