Teachers as Researchers in IBSE

PATHWAY

Summary:

Undertaking educational research as part of a Masters programme to develop understanding of inquiry-based science education.

Aims:

To learn about inquiry-based science education through formal educational research approaches.

Main activities:

Construction of a research project (generally based around action research), which focuses on inquiry-based science education.

Narrative:

Teachers undertake a Masters programme of one year, which completes their Masters education begun in initial teacher education and training. Many opt to study inquiry-based science education. Teachers study part-time, using a mixture of online discussion workshops with a small chat-room group, to face-to-face teaching sessions on Saturdays. They continue to work full time in school, undertaking (generally) research on aspects of their own practice, to follow their interests. They gain an understanding of educational research methodology, and use such understanding to plan a small scale research project, in which they inquire into aspects of their practice. Those students undertaking inquiry about inquiry based science education form the subject of this best-practice. In many cases, teachers follow an action research model, where they realize and appreciate the limitations in their use of e.g. practical work in the classroom, and they realize that they need to make such work more inquiry-based. We undertake training with them to help them become appreciative of the research and professional literature, and they develop a focus for their study, including definition of appropriate research questions, which they then undertake in school They have about one term to undertake data collection, and one term to write up the final thesis, with many going on to publish their findings in the peer-reviewed literature. They also present their work to their subject departments, spreading the impact of their training more widely, and involving a larger number of teachers.

Methods of learning/training:
Participants draw on evidence from the research literature to support development of their thesis, using in-school data collection, under guidance from University tutors working in a blended approach, via a VLE and face-to-face.

End user:
Teachers from 11-18 comprehensive schools.

Involved actors:
Teacher trainers and University researchers (who are generally the same people)

Location:
At schools and possibly in informal educational settings.

Languages available:
English

Where to find the application:
University of Cambridge, mediated through the VLE

Evaluation parameters:
Teachers complete formal evaluation questionnaires, and the Masters programme as a whole is regulated and evaluated by internal Faculty of Education procedures.

Duration:
This can be relatively open-ended, but it would generally last 12 months, working part-time.

Optimum number of participants: 15

Additional information or resources:
The site which outlines the Masters programme within which this falls is included here: www.educ.cam.ac.uk/courses/graduate/masters/strp.html

Teachers' Competencies

1	subject matter/content knowledge	
2	nature of science	x
3	Multidisciplinary	x
4	knowledge of contemporary science	
5	variety of (especially student-centred) instructional strategies	x
6	lifelong learning	x
7	self-reflection	x
8	teaching/ learning processes within the domain	x
9	using laboratories, experiments, projects	x
10	common sense knowledge and learning difficulties	x
11	use of ICTs	x
12	knowledge, planning and use of curricular materials	x
13	Information and Communication Technologies with Technological Pedagogical Content Knowledge	

Mapping best practices with main principles

1. Building interest in natural science phenomena and explanations:

Undertaking inquiry into their own practice enhances their curiosity about science education, and planning an intervention to support inquiry in the classroom enhances pupils' curiosity and ability to question the world around them. By planning research interventions which enable pupils to find out and make connections between observations and theory, these research projects provide a useful architecture to support IBSE.

2. Building up informed citizens: Students understanding the nature of Science & Science in society:

By undertaking interventions designed to support inquiry, teachers are supported in helping students to collect, interpret and make conclusions from evidence. Within the wider context of the UK curricula, this work happens in the context of the How Science Works initiative, which itself provides a formal structure to educate students in examining claims on the basis of the evidence presented.

3. Develop multiple goals:

- **understanding big ideas in science including ideas of science, and ideas about science**
- **scientific capabilities concerned with gathering and using evidence**
- **scientific attitudes**

Teachers' interventions invariably involve practical work, and focus on students' understanding of the nature of science, and of developing students' capabilities in data collection. Depending on the teacher's interest, their projects also examine students' understanding of the process of science, and ideas about science in more detail, frequently in response to students being demotivated by classical science practical work.

4. Understanding students' concepts and learning style about of science phenomena:

The basis of many (/all) action research enquiries is to examine the learners' conceptions in your class, and to plan an intervention to initiate a change in those conceptions. This is the case in this best practice.

5. Relevance of the content to daily life of students:

Because teachers' research is planned in response to a perceived deficit in the teaching and learning that takes place in their lessons, teachers invariably plan an intervention part of whose purpose is to contextualize science against students' daily life, developing relevance for them in learning about science.

6. Understanding science as a process not as stable facts. Using up to date information of science and education:

As part of their own education in the Masters programme, teachers learn about different perspectives on knowledge building, constructing their own realization of the positivist approach to knowledge construction. Their interventions in the classroom structure activities so students can experience such knowledge construction, and we try to support teachers in making such a process explicit to their students.

7. Activities for gaining knowledge, not for entertainment, nor for simple imitating of results:

All of our teachers are used to undertaking practical work, and generally their inquiries involve practical work for students. Their impetus to undertake research is seeing a deficit (e.g. simple imitating of results) in their prior use of such work, and as such they are supported in developing activities which enable pupils to gain knowledge in the ways described above.

8. Doing science: experimenting, analyzing, interpreting, redefining explanations:

Principal 8 forms the basis for the changes which teachers make in their classrooms.

9. Assessment: formative ~ of students' learning and the summative ~ of their progress:

Because any classroom intervention needs to be evaluated within the action research paradigm, any intervention needs to be accompanied both by activities which can assess students' learning in a summative and in a formative way.

10. Cooperation among teachers and with experts:

Teachers work together within online discussion groups, and face-to-face to design their research studies, building their appreciation of inquiry-based learning together, and commenting on each others' plans in a mutually supportive way, under the guidance of expert tutors.