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## Symposium paper for ESERA 2011, Lyon

Teacher education strand

### **PISCES: Conceptualising Inquiry to improve practice**

(Promoting Inquiry Skills in Curriculum for Excellence in Science)

This paper describes a Scottish initiative (arising out of a EU funded development project) involving university researchers, a local authority curriculum development officer and a group of teachers interested in developing more inquiry based approaches in science education. The project is not one in which the researchers bring prescriptions from research. Rather, it is seen as a joint effort aimed at solving practitioners' conceptual and practice issues. The overall question for the teachers was,

*How do I (we) make our practice more inquiry based?*

The question for the researchers was

*How do we help you (the interested science teachers) to make your practice more inquiry based?*

This has two sub-questions:

*How do we help you to conceptualise the issues?*

*How do we help you to solve the practice problems?*

As it turned out, the particular group of teachers we worked with did not ask for help with practice issues, so we have not made much progress in answering the second question. Therefore, this paper will focus on the first. We seem to have been successful in helping the teachers to acquire some useful conceptual tools for thinking about and changing their practice in ways that they valued for themselves. Perhaps the answer to the second question is that researchers can help teachers to solve their practice problems by helping them to conceptualise the issues.

### ***The problem***

This work was carried out with a group of teachers in Scotland who had asked the academic contingent to bring some structure to the proceedings - they expected some teaching input from the university. This created a dilemma for the academics, as they did not, as indicated above, feel they had prescriptions or answers. As the questions above indicate, they had foreseen a learning community approach in which group members brought their different backgrounds to work together on the problems of using more inquiry-based teaching methods. The result, which seems to have been successful, was the PISCES Module (Promoting Inquiry Skills for a Curriculum for Excellence in Science). On reflection, the resolution produced by this module was quite simple: incorporate tools that:

- Allow the teachers to analyse and reflect on their practice relative to inquiry and supporting scientific thinking;
- Support them in the formulation of inquiry-based teaching goals;
- Aid them in evaluation of progress;
- Allow the teachers to tailor the whole process to their own contexts, degree of comfort, level of experience, and so on.

## ***The pilot PISCES Module***

As the full name suggests, this module was aimed at science teachers wishing to use more inquiry-based methods within the rationale of the Curriculum for Excellence in Scotland. This is a major initiative in Scotland aiming to provide a coherent rationale from nursery education to the end of secondary education. It is openly encouraging of inquiry-based methods in science (Scottish Government n.d.) However, as this is an S-TEAM initiative, in designing the PISCES module, we constantly had in mind the need for a structure that could be adapted by those working in other national contexts.

The pilot PISCES model was scheduled for six sessions of ninety-minutes each. These were planned to occur over the period from the beginning of October to early December. However, unusually severe weather led to the last two sessions being postponed to late January. The module had the following components:

- *A pre-module activity* – written by the researchers, to be completed by the teachers before the start of the module
- *Session 1*: Outline of the Project and how this module fits in. Discussions, based on the pre-module activity, of the nature of inquiry and the issues in making science teaching more inquiry-based. Group work producing concept maps of inquiry and discussion of these.
- *Session 2*: Summary from session 1. Discussion of arguments for & against inquiry (see below). Then a five dimensional model of investigations that includes a model of scientific thinking (Author et al 2010) was offered to the teachers. Teachers were given the opportunity to apply this model to topics they had already taught.
- *Session 3*: Choosing an intervention question and thinking about how to tackle it.
- *Session 4*: Thinking about evaluation and general support in preparation for intervention and presentation of this in next sessions.
- Sessions 5 and 6: Presentations by the teachers of their solutions.

Between sessions 1 and 2, the teachers were asked to read two academic articles, one of which (Kirschner et al (2006) was sceptical about the value of inquiry/problem-based learning methods, whilst the other emphasised proper scaffolding (Hmelo-Silver et al, 2007). These articles, and the teachers' responses, were discussed in session 2.

The paper goes on to discuss models of inquiry emerging from sessions 1 & 2 and the application of these models to practice.

A five dimensional model of investigations, including model of scientific thinking was presented to the teachers in session 2, including an example applied to a topic taught by authors. This model included the argument that a purpose of science teaching is to support pupils in developing scientific thinking.

The teachers then discussed the application of the model to a topic they had previously taught in order to analyse the nature of the activity and how supportive it is, or could be, of scientific thinking.

For session 3, individual teachers prepared possible first drafts of aims and intervention questions – a sheet was provided for this.

A presentation was given, emphasising that teachers were free to choose the form of question but arguing for a form and rationale based upon Whitehead's Living Theory

approach (Whitehead 1989; 2000) - resolving conflicts between what one values and what one is actually doing. Teachers further developed their questions, their aims and how they will proceed and present this on posters. Group members (teachers and researchers) made written comments on the posters to give feedback.

In Session 4, which was about evaluation, the teachers asked themselves various questions, e.g. what was their prediction of what would happen? What actually happened? What surprised them? What were the responses of pupils (better than usual, less than expected, etc)? What 'grabbed' them? Was it successful? How did they (the teachers) define success?

Interestingly, teachers were happy to browse a number of resources provided as they considered their interventions but made no direct requests for advice, other than on evaluation and the presentations.

### **Summary conclusions**

The paper will report on the teachers' questions and their solutions, based on presentations to be given in January 2011 (after ESERA deadline). It will also report on feedback from the course module., which has been that the course is challenging but thought-provoking and worthwhile.

The paper will conclude that the aim of such professional development courses should be to empower rather than to prescribe. The authors describe a follow-up programme (Meta-PISCES) designed to train trainers for the module.

### **References**

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