PROFILES modules for best Practice

Jack Holbrook & Miia Ranikmae

Workshop plan

The workshop has 3 stages:

- Presentation of the underlying theoretical constructs and structures.
- Examining modules and the included components.
- Developing a scenario and the IBSE science question(s) derived from the scenario.
- What about assessment?

Constructs

The theoretical aspect considers the underlying learning approach

The practical considers the teaching in operation

Modules

The looks at the way they are constructed and the rationale behind this.

It tries to recognise the commonality of PROFILES in terms of design, structure and learning targets.

Scenario

Tyis examples the idea of the scenario, the manner in which it s created and its major function.

Also considered is the interlinking of the scenario and the IBSE via the scientific question.

Formative assessment

- This builds around the idea of the need to assess student progress (as well as student attainment)

- It reflects on the multitude of ways to undertake this and the ways to overcome time wasting and heavy teacher involvement in marking

Theoretical Ideas

- A social constructivist approach to inquiry-based science education.
- Interdisciplinary learning related to cognitive, person and social development and an appreciation of the nature of science.
- The promotion of the 'Education through Science' concept.
- Recognising the need for including Education for Sustainable Development.
- Striving for competencies related to acting autonomously, using tools interactively and functioning in socially heterogeneous groups (OECD, 2005) and the promotion of 21st century skills.

Modules in Practice

- The teacher acting as a professional, willing to reflect on his/her practice.
- Stimulating and sustaining student intrinsic motivation and student centred learning environments.
- Developing scientific problem solving and socio-scientific decision making skills.
- Encouraging the self determination and self efficacy of students.
- Ensuring safe practices and developing the capability for risk assessment.

The Three stage model

- Student Motivation
- IBSE Problem Solving
- Socio-scientific Decision Making

PROFILES design structure

In the model, stage 1 seeks to:

Evoke the intrinsic motivation of students

by

Putting forward a relevant, meaningful and well understood title.
Initiating a scenario that has a local social context which has relevance for the students.
Evoking an emotional response from students by addressing a concern, issue or interesting situation

Identifying issues

- Lack of an awareness of situations which are relevant to students.
- Difficulty in putting forward a scenario which is socio-scientific (this differs from science being applications within society e.g. using paint on rusted iron railings; sound reflection via echo location by bats; rate of change of distance with time shown by the velocity of a car).
- Ensuring that the science learning, stemming from the scenario, is within the students' learning needs for the particular students involved (it is within the intended curriculum or within the students' academic capabilities).

Reminder

- The scenario is not, in itself, about the learning of conceptual science, but an attempt to lead towards student appreciation of the value in learning the scientific ideas that will follow.

- An important constructivist component related to the scenario is determining the related students' prior science knowledge

From motivation to science learning

From the student motivational scenario, and from which the teacher establishes the prior science knowledge on which the learning will build, the task confronting the teacher is to maintain student motivation and the learning moves from the contextual socio-scientific scenario to the decontextualised science learning

Identifying the science question

- The science learning is inquiry-based, which is initiated via a scientific question. In IBSE it is the scientific question that is investigated and evidence to solve the problem determined.

- The science question to be investigated is the introductory stage for undertaking IBSE, which also includes 'education through science' learning, especially risk factors. The question thus drives the problem solving, student-centred approach.

Developing the science question to investigate

- The IBSE can be designed in different formats.
- Structured inquiry – the students follow instructions and put forward explanations (interpretations) of their findings
- Guided inquiry – the teacher guides the students who may develop their own investigatory plan
- IN BOTH OF THESE THE TEACHER IS LIKELY TO SUPPLY THE SCIENCE QUESTION
- If the students supply the science question and the investigatory plan, this is Open Inquiry – a PROFILES target.

Undertaking IBSE problem solving learning

- *Theoretical construct*
- The problem solving is promoted through minds-on, hands-on, student-centred learning to enable problem solving to reflect on the validation of the data collection, the accuracy by which it is expressed and the interpretations that can be made leading to the solution of the problem.
- The learning involves conceptual science, practice of science and the Nature of Science, personal development and social development

Stage 2

- This is the major component of a PROFILES module and stresses student centred development. It is important that the students understand the purpose of the investigation and the ideas being developed.

- The teacher's role is one of facilitator and for this will be visiting the groups probing the conceptual and well as practical understanding of the students.

Consolidating the science learning

Theoretical construct

- Stage 3, is an important step in the consolidation of the conceptual science learning and transfers the science learning back into a socio-scientific frame (the original scenario).
- The purpose of learning the science was to be able to better appreciate the socio-scientific situation and to be able to put forward a meaningful decision, which, in stage 1, was not possible because of the missing science knowledge.

Socio scientific decision making

- Stage 3 is further consolidation of the science learning by transferring the ideas to a social situation (the original scenario) and thereby initiate a socio-scientific decision making activity.

Examining a module

Each module has at least 3 parts

- a front-page, elaborating general information;
- student part;
- teacher's guide, and,
- an assessment guide and
- possibly teacher notes.

Module components

In designing a module, the following components are important:

- *Module Title* which has a society orientation using words/situations familiar to students.
- *Learning Outcomes* are included: as cognitive, process, personal and social.
- *The Scenario* is motivational for students and will stimulate discussion.
- *IBSE:* Students are involved in seeking evidence for the Science Question.
- Modules include a *Socio-Scientific Decision- making* component.

Constructing modules

In constructing modules, it is expected that:

- Student ownership through participation is anticipated to be high.
- Intended scientific learning by student emphases higher order cognitive learning.
- Nature of Science is stressed as tentative (not the absolute truth); empirical (evidence-based); culturally embedded (society and personally biased); theories seen as independent of laws.
- Experimentation/modelling included, ensuring high gains in cognitive and process skills.
- Promoting learning for responsible citizenry (STL/Education through Science), as indicated by the stated specific learning outcomes/ competencies.
- Suggested formative assessment approaches can be given.

Feedback or assessment

Assessment is expected to cover all aspects of learning.

In PROFILES modules this relates to:

- **Cognitive or intellectual development,** especially with
- **Appreciation of the Nature of Science;**
- **Development of personal skills**;
- **Development of social skills**;

Approaches to formative assessment

- 1 The assessment is based on the competencies developed during the teaching of the module
- 2 The assessment is lesson based
- 3 The assessment is geared to teacher organised activities – student written assessment, assessment from oral interaction (individual or group; teacher observation (individual or group)