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Mind The Gap WP3

3.4 Exchange of understanding of IBST for scientific literacy across the three countries with the purpose of facilitating improvements of practice in science

To fulfill this workpackage, the WP3 partners from Denmark, England/Wales and Hungary used the comparisons of their respective national versions of Scientific Literacy (see 3.1) in the form of concept maps, as well as sample IBST videos (see 3.2) to share ideas for how knowledge of stated goals and examples of practice from one-another's countries facilitate Inquiry Based Science Teaching. The exchanges occurred during a two-day conference among lead teachers from Denmark, England/Wales and Hungary in Budapest in October of 2009. These close looks at the three perspectives of IBST for Scientific Literacy were informed by cultural and historical influences (see 3.1).

One overall outcome of this exchange has been a deep understanding of how all three of our statements of scientific literacy not only allow for, but actually require Inquiry Based Science Teaching to fully achieve their goals. This mutual realization of the dependent complementarities of IBST and SL has turned out to be both motivating and useful as we all move forward to disseminate our MTG understandings (see last three paragraphs of 3.4 for examples).

For example, in the Danish literacy map, Scientifically Literate students: '... carry out practical investigations in the laboratory to establish simple hypotheses' and to assess simple hypotheses.' IBST is the actually the only valid pedagogical method to achieve this goal since only through the constructive engagement of the student in an inquiry laboratory, can such higher level goals be achieved. A traditional transmissive mode of teaching where teachers tell students follow standard 'labs' where they are told what to do to 'prove' a given hypothesis can't achieve the goal of allowing the students to 'establish' and 'assess' simple hypotheses. They could only confirm those given to them by their teachers and textbooks. Our colleagues all realized that some of their frustrations at meeting the constructivist goals of statements of SL could be ameliorated with IBST.

Similarly, in the English/Welsh statements, goals such as: 'The student can plan to test a scientific idea', 'The student can plan to answer a scientific question' and 'The student can plan to solve a scientific problem' all are impossible to achieve with transmissive teaching and require inquiry environments where student's are engaged to think creatively and deeply about how to solve science problems. The Hunarian objectives, while on the whole more traditional than those of Denmark and England/Wales, also are more fully met with inquiry teaching. For example, Hungarian students are required to: 'solve basic problems', 'find evidence-based answers to questions' and 'generate conceptual schemes.' In order for pupils to genuinely achieve these goals, they must do more than follow 'recipes' in science labs. Our colleagues for WP3 discusses in Budapest how the facilitation of genuine

discovery amongst students is actually the easiest way to honestly achieve these types of goals.

Nicely, the teacher leaders among us also realized that national science literacy standards are a political tool to use to get governmental and institutional support for the additional time, facilities and personnel which IBST can demand. The fact that the best way to achieve established SL goals is via inquiry methods, provides a strong argument for the resources necessary for IBST teaching. The Budapest exchange of understanding conference where these perspectives, realizations and methods for change occurred was structured as follows.

Structure of the Budapest Exchange of Understanding Workshop

Target Group: Secondary science teachers from Denmark, England/Wales and Hungary who are educational leaders in their respective countries

Duration: two days

Equipment: laptops (teachers are asked to bring their own...they need one for every two teachers)

earphones (one per person so that many can simultaneously watch and listen to different inquiry videos)

camcorders (one with DVDs for every three teachers)

Internet connections (either WiFi for all or Ethernet connection for all)

Beamer (one)

Workshop Objectives

- Be able to identify themes of scientific literacy from several EU countries in writing and from given concept maps with the goal of discovering similar and unique conceptions
- Be able to identify important and relevant characteristics of inquiry based scientific literacy from videos with the goal of discovering useful IBST methods linked to statements
- Analyze videos of teaching for examples of good and/or deficient use of inquiry teaching methods in teaching for scientific literacy
- Create a video which exemplifies teaching at least one goal of scientific literacy from the three country concept maps using inquiry based methods

Lesson Outline:

I. Pre-Assessment Workshop Activity

Written open-ended activities:

'Describe one example of teaching science using inquiry methods.'

'Give one example of a Scientific Literacy goal from your country that could be taught using inquiry methods.'

II. Clarification of concept of Inquiry Based Science Teaching

A. Look at video of Danish science teacher using inquiry to teach for scientific literacy.

- Participants find examples of when the teacher uses inquiry methods and when he uses non-inquiry methods. They note these for group sharing.

B. Group discussion of Inquiry Based Science Teaching

- Use their observations to clarify inquiry teaching, leading to an exchange of bases for IBST use in the three countries
- Short explanation of what we mean by Inquiry Based Science Teaching

III. Exploration of what Scientific Literacy means in three EU countries and PISA

A. Explore the concept of scientific literacy in PISA, DK, UK and HU

- Very briefly show, via ppt, how concept maps of scientific literacy are made so that all can understand how to read the maps
- Use Internet connections to explore the Web site with concept maps of scientific literacy as defined in PISA, DK, UK and HU. Prepare to answer these questions:
 - What similarities and differences can you identify among these definitions?
 - What are the large general issues scientific literacy addressed in these definitions?
 - How do these definitions compare to your own country's definition?

B. Whole group exchange and sharing of the map explorations

IV. Exploring videos of teaching for scientific literacy

A. Use the Internet to explore the teaching videos from DK, HU and UK

- Groups of three teachers (mixed nationalities/same content areas) together explore and discuss videos of inquiry science teaching linked to scientific literacy goals in their content area. Several videos in each content area are analyzed by participants.
- The goal is to observe and note what makes a specific aspect of a teaching video an example of inquiry teaching and what parts are not good examples of inquiry teaching

B. Whole group sharing of which elements of the videos are examples of inquiry teaching and which are contra-examples

V. Creating videos in groups of three to exemplify the teacher's part in initiating an inquiry lesson linked to one scientific literacy goal from another country

A. Each member of each group of three selects one scientific literacy goal from another country's map and decides how a teacher could initiate an inquiry lesson to teach for that goal.

- Each teacher decides on an inquiry teaching approach and what the teacher's role will be in setting up the lesson. The international groups of three (DK, England/Wales, HU) carefully review, discuss and analyze the chosen goals and plan

how they could lead a science class they currently teach to achieve that scientific literacy goal, using some of the ideas from the Internet based videos.

B. Each group makes a video recording of each of their sample lessons

- They decide who will be 'the teacher', 'the student', the video camera operator and what the precise lesson will be about for each of the three
- They each make a three to five minute recording of 'the teacher' actually teaching 'the student' in the way necessary for an inquiry activity to follow. The recording is NOT telling what they would do, but actually doing it as they would to a class (recognizing of course, that such a set-up in their own classes would take longer). They can interact with 'the student' if they wish, in their role as a 'the teacher'
- If they have time, any of the group can make a second video to improve on their first effort

VI. Group sharing of videos

A. The groups will all share their three to five minute videos for whole group appreciation and comment

- The group will not identify the scientific literacy goal addressed by their video, so that afterwards the other students can try to determine from the video itself, which scientific literacy goal was addressed.

- The goal will be to acknowledge good examples of inquiry based science teaching as well as alignment to different national scientific literacy goals

B. Discussion of resulting videos and the challenges of inquiry based science teaching as well as an appreciation of how it is expressed in different cultures

VII. Summative feedback

- Written open-ended question: 'Describe one example of teaching science using inquiry methods.' 'Give one example of a Scientific Literacy goal from your country that could be taught using inquiry methods.'

- Questionnaire about how to improve this module for teacher workshops similar to this one.

VIII. Outcome

- Participants take their ideas back to their own classrooms to incorporate a goal of scientific literacy education, based on ideas, perhaps from another EU country, into their repertoire.

- When running local teacher workshops and in their own country's professional groups, they promote IBST for scientific literacy with the knowledge of how it is done in two other countries than their own

- Follow-up questionnaire to all participants is used to assess longer-term impact and immediately applied to the next iteration of the training package.

- Video products are examined using an analysis tool to gauge training package impact. In combination with the participant perspective questionnaires, continuous improvement to the training package will easily follow.

Further Use and Development of the MTG WP3 IBST for SL Exchange Workshop

This exchange of understanding workshop has subsequently been used in three more environments to test its further usefulness in advocating IBST for scientific literacy, using the concept maps, videos and application through teaching vignettes. The first, after October in Budapest, was held for pre-service teachers in Copenhagen Denmark in December of 2009. It was successful in helping these new teachers understand not only the uniqueness of their own national SL statement and how it can enable their teaching through inquiry, but also in heightening their awareness of Hungarian and English/Welsh statements and how ideas for teaching are available in those statements and videos.

The next replication of the MTG WP3 workshop was given to Danish and Egyptian teacher leaders in February of 2010. By this time our knowledge of the utility of the concept maps for inquiry into IBST for SL was established enough that we made an Egyptian concept map prior to the workshop. The two sets of teachers, Danish and Egyptian, used comparisons of the maps to great advantage in getting ideas about teaching for SL from one another's perspectives. For example, the Danish teachers found the Egyptian SL goals for 'Skills of acceptance of social and human differences' and 'Tolerance of values' particularly interesting and relevant to their Danish teaching environments. This led to discussions about how Egyptian teachers achieve these goals using IBST. Complementarily, Egyptian teachers learned from the Danes about extensive inquiry laboratory goals. Mixed Danish-Egyptian group videos at the conclusion of the workshop were made using a combination of national SL goals with ideas from the MTG videos.

The third use of the MTG WP3 workshop from Budapest was in April of 2010 in Norway for 25 teacher educators. All elements of the workshop given above were used but modified based on feedback from the previous workshops. A further version of the MTG WP3 workshop is now scheduled for 25 Scottish teacher educators in Glasgow as a part of the S-Team project.