

Translated outline & lesson plans

In-service teacher education

These materials are based on the work within the project Promoting Attainment of Responsible Research & Innovation in Science Education (PARRISE).

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Course outline and lesson plan

SSIBL teacher professional development (TPD) sessions

Utrecht University, Freudenthal Institute, The Netherlands

In-service teacher education

Overview course outline

Duration	A 1.5 hour face-to-face meeting, in the context of a conference or other in-service related programme.
Short summary	<p>This teacher professional development (TPD) programme adopts an inductive approach in which teachers get acquainted with the SSIBL pedagogy through several experiential activities.</p> <p>First, teachers explore SSIs, after which they collaborate in designing and reflecting on SSIBL learning and teaching activities.</p> <p>The programme is designed to develop teacher's understanding of, and skills and competence in, teaching and learning through socio-scientific inquiry-based learning (SSIBL). The goal is to support teachers in designing SSIBL lessons and to contribute to their teaching repertoire, by providing them with the means to foster scientific literacy and reflective citizenship in science education.</p>
Intended learning objectives of the TPD	<p>The teacher can:</p> <ul style="list-style-type: none"> • State characteristics and examples of SSIs, in which knowledge of school subjects (biology, chemistry or physics) is involved and develop arguments about why SSIs should be integrated in biology / chemistry / physics education • Map a controversy / SSI (including different stakeholders' viewpoints and values that are at stake) • Identify learning and teaching activities to introduce and discuss SSIs in classroom settings • Link inquiry-based learning to students' questions (SSIs) • Link SSIBL to the science curriculum (e.g. new science modules, Concept-Context approach) • Develop a SSIBL lesson (or school work plan) for science classrooms drawing both on existing and novel SSIs and inquiry contexts • Reflect on peers' SSIBL lesson designs and identify strong and weak elements • Recognise and identify different learning and teaching activities that can be used in classroom practice in the context of SSIBL, as well as their pros and cons • Recognise opportunities for teaching school students about aspects of

	citizenship in SSIBL
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Session no.	Duration	Main Activity /objective	Approach: Inductive
1	1.5 h	<ul style="list-style-type: none"> • Get acquainted with characteristics of SSIs • Learn how to raise meaningful students' questions, a 'need to know' • Scaffold student's inquiry • Get a feel for several teaching activities suitable for SSIBL 	Teachers as learners

Lesson plan

One session of 75-90 minutes

Aim of the session:

Providing tools to foster meaningful science education deriving from societal dilemmas, paying attention to:

- Content-related argumentation (conceptual development)
- Social deliberation/considerations (value clarification & communication)
- Personal opinions (values and beliefs)
- Inquiry-based learning

Learning goals

The teachers are able to:

- Explain the main characteristics of the SSIBL framework and the skills required for the elements to be implemented in science classrooms
- Indicate what socio-scientific issues are and how these can be introduced in the science classroom
- Raise a 'need to know' (authentic students' questions)
- Link together and integrate social and scientific inquiry to explore open-ended questions
- Link SSIBL with the science curriculum
- Analyse teaching scenarios according to elements of the SSIBL framework
- Develop a SSIBL lesson for science classrooms.

Introduction to SSIs, why SSIs? [10']

The in-service session starts with a 10 minute introduction in which the need for SSI-based education (fostering informed-opinion making and critical citizenship) is explained and linked to the Dutch national science education requirements.

Introducing SSIs in the classroom: how? [15']

After this introduction, introduce an example SSI to the in-service teachers and discuss it with them. Different teaching and learning strategies can be used to do this. The PowerPoint (in **Handouts UU** in 'Resources') mentions two options for introducing SSIs (displayed on the blue slide):

1. Using the 'Genetic testing in Elite sports' lesson module (Boerwinkel, Knippels, & Waarlo, 2011; Dutch lesson module available on <https://elbd.sites.uu.nl/2017/07/26/morele-oordeelsvorming-topsport-en-genen/>). Different examples of SSIs can be used, depending on time available and the background of the teachers (e.g. biology, chemistry, mixed group of science teachers). The column of case A in the table is filled in with the teachers (worksheet 'carousel assignment' in **Handouts UU**);
2. The second option is an SSI carousel activity (worksheet 'carousel assignment' in **Handouts UU**, examples of SSIs can be found in the 'SSI cases' document in the Resources, in Dutch), during which teachers discuss several newspaper articles (either you as a teacher educator provide these or the teachers could bring in their own examples). The 'carousel assignment' table can also be used for this.

After this choice, show different examples of learning and teaching activities about how to introduce a dilemma (SSI); e.g. film clips, newspaper articles, (slightly different examples can be used, based on designed lesson modules by UU, see <http://www.fi.uu.nl/synenergene/>) and how these controversies can raise a diverse range of students' questions ('Need to know') that can be divided in 3 categories:

- a. Scientific/content-related questions
- b. Social questions
- c. Personal questions

After this, introduce the six educational phases (Knippels & De Bakker, 2016) and use them explicitly as the backbone of the TPD session.

Optional first activity

*An optional way to start is by using the controversy line activity for enacting an SSI (this activity can be found in the PowerPoints in the lower and upper secondary / pre-service training courses and is also in **Handouts UU** in the 'Resources')*

How to incorporate inquiry in the classroom [25']

Next, discuss possible ways to perform inquiry using SSIs. The focus in the PowerPoint is on social inquiry examples, e.g. mapping controversies, types of argument, source research & reliability and interviews since most science teachers are already well acquainted with scientific inquiry activities.

The 3-parent baby SSI is taken as a case to carry out an inquiry with the teachers.

Newspaper articles:

- <https://www.sciencenews.org/article/three-parent-babies-explained>
- <https://www.newscientist.com/article/2107219-exclusive-worlds-first-baby-born-with-new-3-parent-technique/>

Video:

- <http://www.cbsnews.com/videos/the-ethics-of-having-three-parents/>

The following activity, Mepham's Ethical Matrix, is a possible way to perform inquiry on the social aspects of the case and to be able to complete the green fields of the table (see slide 24 of the PowerPoint in ***Presentations UU*** (and in ***Handouts UU*** worksheet 'carousel assignment'). The assignment 'Mepham's Ethical Matrix' (Mepham, 2000) is done in small groups of in-service teachers (worksheet available in ***Handouts UU*** in 'Resources') as an example of inquiry into different stakeholders' perspectives. This can be done in a plenary discussion, in small groups or individually, or with post-its on the board, to make the process more insightful (for instance, which cells are still empty?) The teachers list stakeholders and fill in the table. The assignment is discussed and reflected upon in a plenary discussion.

Mepham's Ethical Matrix can also serve as a tool for teachers during a classroom discussion, with which they are able to keep track of the different stakeholders' perspectives. It can also show which elements are under-represented in the discussion.

Dialogue in the classroom [10']

Tips for using dialogue in the classroom are given. The example of '*beweegredeneren*' ('Arguments in motion', Van der Zande, 2011) is enacted (see also ***Handouts UU***).

During 'Arguments in motion', participants (teachers, students, etc) think about a statement, their own opinions and whether these opinions were formed based on their feelings (heart) or thoughts (brain). First, introduce a statement (for example: 'Everyone should automatically be registered as organ donor at birth'). Participants place themselves on a line in the room, showing whether they are 'for' or 'against' this statement.

Subsequently, the teacher (educator) introduced the 'heart-brain-axis' by placing the heart and brain pictures with captions 'for' and 'against' in the four corners of the classroom. Participants now have to position themselves according to how they reached their opinion, using mostly feelings/emotions (the 'heart') or rational thinking (the 'brain').

The teacher (educator) is the mediator during the whole activity. They asks participants questions, illustrating as many different sides and opinions as possible. If participants change their opinions regarding the statement, they are able to move to a new location in the classroom. Remind them that there are no 'winners', and answers are not 'right' or 'wrong'.

After this, present the 'teacher tool for classroom dialogue' (and hand out; tool can be found in ***Handouts UU*** in 'Resources'). This tool lists the teacher roles during a dilemma and explains how useful they are in different situations.

Designing activity [20']

Give the in-service teachers the worksheet on SSIBL lesson design (available in ***Handouts UU*** in 'Resources' and depicted in slide 36 in ***Presentations UU***) and brainstorm a SSIBL lesson design they could use in their daily classroom practice. Give the In-service teachers Dutch articles on SSI-based education in the science classroom (for example, Knippels & De Bakker, 2016; Overbeek et al., 2015).



References

- Boerwinkel, D.J., Knippels, M.C., & Waarlo, A.J. (2011). Raising awareness of pre-symptomatic genetic testing. *Journal of Biological Education*, 45(4), 213-221.
- Knippels, M.C. & de Bakker, E.M. (2016). Eerste hulp bij het starten van een dialoog tijdens de bèta-les, *Didactief*, 46(10), 12-13. [First aid in initiating a dialogue in science classes]
- Mepham, M. (2000). A Framework for the Ethical Analysis of Novel Foods: The Ethical Matrix. *Journal of Agricultural and Environmental Ethics*, 12(2), 165–176.
- Zande, P.A.M. van der (2012). Beweegredeneren, een werkvorm bij dilemma's in de klas. See <https://elbd.sites.uu.nl/2017/07/28/beweegredeneren-een-werkvorm-bij-dilemmas-in-de-klas/>
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