Course: Foundations of teaching for learning capstone: the reflective practitioner
Assignment 2: Revised lesson plan
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General information

Context

Learners are learners in year 5 of Dutch pre-university education. The age of the learners is 15-18 with the majority being 16-17. This course is taught as part of the Research & Design class[1]. In this class learners develop solutions for real clients and their problems in the technical (for example engineering, biomedical and product development) domain. This course is taught before learners start with their final project for this course (comparable to a Bachelor/Master thesis but on a highschool level). This course is aimed at the need of learners to develop their ability to generate creative solutions. During this series of lessons learners are working on the last project before their final project and lessons run parallel to this. This limits the time that can be spend on teaching activities as learners need to work on their projects as well during the lessons.

Topic: Seeing problems as contradictions (part of a series of lessons on TRIZ; a creativity and problem solving methodology)[2]

Subject: Research & Design

Objective

At the end of the lesson, the learners can formulate a given problem in terms of a contraction (containing a positive and a negative effect).

Link between topic and objective

This lesson is part of a series of lessons on the use of TRIZ as a problem solving tool. The module focuses on the use of the contradiction matrix (one of the tools used in TRIZ). The objectives for this module are the following:

At the end of the module the learners …

1) Can formulate a given problem in terms of one of the principles formulated contradiction matrix[3].
2) Can use the contradiction matrix to select the one or more appropriate (depending on the problem) inventive principles[4].

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[1] For more information on this subject see:
http://www.slo.nl/voortgezet/tweedefase/vakken/onderzoekenontwerpen/ (Dutch)
[2] For more information on TRIZ see: http://en.wikipedia.org/wiki/TRIZ
[3] The contradiction matrix is a tool used in TRIZ.
[4] Inventive principles are a tool used in TRIZ

3) Can generate 3 or more ideas for a problem when using the (appropriate) inventive principles.

This lesson is the first of the module and relates to the first objective of the module.

Activities & materials

Overview of the activities[5]

#	Activity	Duration (min)*	Teacher activity	Learners activity
1	Start	3	Stands at the front of the class. Greets learners.	Enter classroom. Find their place. Get their materials.
2	Teaser	3	Asks learners if they ever encountered a problem and gives some examples.	Think about problems. Write down 2 problems. Share 1 problem if asked by the teacher.
3	Introduction to contradictions	5	Explains the positive and negative effects of each problem.	Listen. Make notes.
4	Practice contradictions	10	Ask learners if to identify the positive and the negative effect in their own problems using think-pair-share methodology.	Identify effects; Think (3 min**), Pair (4 min**), Share (3 min**).
5	Project work	94***	Walks around. Looks if learners have problems.	Work on their project.
6	Wrap up	7	Summarizes the lesson by asking what learners learned through think -pair-share activity. Provides learners with self-assessment problem set.	Identify learning; Think (2 min**), Pair (3 min**), Share (2 min**).
7	End	-	Stands at the front of the class. Greets learners. Prepares the next lesson.	Get materials. Leave classroom.

*Times presented in the 'Duration' colon are the expected durations. Actual duration may differ.

** Expected durations. Actual duration may differ.

*** Teachers can use some of this time on other activities (for example, by providing additional instruction or practice with the new concepts) in case unforeseen activities arise and use it as a buffer by shortening the time students spend on this activity. Teachers are free to shift the schedule as they see fit (as they are independent professionals with only minor supervision from the school board. This is part of a general culture in Dutch education.).

[5] This overview is meant to be used as a quick overview for teachers during the lesson to see if they are on schedule with their lesson and not as a comprehensive explanation of all activities. For a more complete explanation see the section that follows this one.

Description of the activities and required materials

Start
Start of the lesson. Learners enter the classroom (learners switch classrooms between lessons), sit in their places and get their materials. The teacher greets the learners while standing in front of the class.
Required materials: pen/pencil, paper (learners).
Observable behavior: learners enter classroom, learners sit down, learners take out a pen/pencil and paper.

Teaser
In order to engage learners, the teacher asks the learners the question if they ever encountered a problem. By providing some examples (eg flat tire or ball through window) learners are given some ideas about what problems to think of. Learners write two problems down for use later in the lesson. When these have been written down the teacher asks one or two learners to share the problems with the class.
Required material: pen/pencil, paper (learners), example problems (teacher).
Observable behavior: learners look at the teacher, learners write problems down, learners are otherwise engaged (after finishing writing down their problems), learners present their problem, learners look to the other learner (when the problem is presented).

Introduction to contradictions
Using the example problems used in the previous part, the teacher explains the idea of contradictions (every problem is made up from a positive and a negative effect which contradict each other). Learners listen during this explanation.
Required materials: example problems, whiteboard (optional) (teacher).
Observable behavior: learners look at the teacher.

Practice contradictions
Using the think-pair-share methodology learners apply the new knowledge of contradictions to the problems they wrote down earlier. Learners only have to apply this to one of the problems they wrote down (learners can decide themselves which one to use).
Required materials: paper with problems (learners).
Observable behavior: learners look at their paper, learners are silent (think phase), learners discuss with their neighbor, learners listen to their neighbor (share phase), learner share their results, learners look to the learner who is speaking (share phase).

Project work
During this time, learners work on their projects. This is not related to the content of the objectives but an essential part of the approach taken in the subject Research & Design. This cannot be altered by the teacher and learners should spend the majority of the time available in class on this activity.
Required material: not relevant for this assignment.
Observable behavior: not relevant for this assignment.

Wrap up
At the end of the lesson the learners reflect on what they have learned. This is done by using the think-pair-share methodology. After the reflection, learners are provided with a self-assessment problem set. An explanation of this problem set is given in the assessment & follow up section.
Required materials: self-assessment problem set (teacher).
Observable behavior: learners look at their paper, learners are silent (think phase), learners discuss with their neighbor, learners listen to their neighbor (share phase), learner share their results, learners look to the learner who is speaking (share phase).

End
Learners gather their materials and leave the classroom while the teacher greets them and prepares for the next lesson.

Lesson flexibility

In order to create more flexibility to deal with unforeseen events, the teacher can reduce the time spend on project work. Although the project work should be the main activity during this class, the length learners are engaged in this activity is not prescribed to the teachers (as long it is the majority of time spend in this activity during the class). In case unforeseen things happen, teachers can therefore reduce the time leaner spend on this activity and substitute it with other activities (for example, additional instruction or practice with students who seem to struggle with the content).

Assessment & follow up

Assessment of this lesson will be through formative assessment in which learners will be provided with a set of practice problems. In here, learners will be asked to identify the positive and negative effects of given problems. Learners do these problems as an optional homework to self-test their understanding of the lesson. Examples of answers will be provided after the next lesson in the module.

Follow up of the content will be realized by looking back at the content of the lesson by using a think-pair-share activity in the next learners. Here, learners are asked to reflect on what they learned in the previous lesson.

In case learners are struggling with the content of previous lesson, the teacher has either the option to further explain this at the beginning of the new lesson before starting with the new content (in case a majority of the learners is struggling) or during the project work (in case only a few leaners are struggling with the content). Regardless of what the teacher chooses to do if this happens, it will affect the rest of the lesson schedule. This is no problem as it is easily solved by reducing the time spend on project work.