Pestalozzi

Training Resources

PESTALOZZI CORE KNOWLEDGE, SKILLS AND ATTITUDES FOR ALL TEACHERS (PCORE)

"Including multicultural education into the curriculum of physics"

by

Author: Afrime Shaqiri – Kosovo*
Editor: Rasa Askinyte-Degesiene

* *« All reference to Kosovo, whether to the territory, institutions or population, in this text shall be understood in full compliance with the United Nations Security Council Resolution 1244 and without prejudice to the status of Kosovo. »*

The Pestalozzi Programme
Council of Europe Training Programme for education professionals

PESTALOZZI CORE KNOWLEDGE, SKILLS AND ATTITUDES FOR ALL TEACHERS (PCORE)

"Including multicultural education into the curriculum of physics"

by

Author: Afrime Shaqiri - Kosovo
Editor: Rasa Askinyte-Degesiene

Last edition: **December 2012**

Theme: Including multicultural education in the physics' curriculum

Expected outcome

- ➔ To reflect on the best ways to live together.
- ➔ To increase communication and understanding between different groups and individuals.
- ➔ To understand the importance of and finding possible ways for including intercultural education into the school curricula, in different subjects (this unit focuses on physics).

Target group

Type of training	School level / age	Subject area
Initial and in-service training	High school	Physics

Brief description of the unit

In a world with an increasing diversity it is important that we foster citizens to be active participants and ready to make changes into practice. These eternal skills are useful in all of the learning fields.
The unit consists in 3 activities. They are examples of how intercultural topics may be included into physics lessons, making analogies between the processes in physics and the processes in social life.

Methods/techniques used

- ➢ Cooperation
- ➢ Group work
- ➢ Individual work
- ➢ Discussions

Time 2 hours 45 minutes

Activity 1	▶ 40 minutes
Activity 2	▶ 80 minutes
Activity 3	▶ 40 minutes

Tips for trainers:

See tips in activities.

Resources

“What is thermodynamics?”	Appendix 1
“An example of Penta-verse”	Appendix 2
“Boyle’s law”	Appendix 3

Activity 1 Knowing each other through symbols

40 minutes

	Notes
▶ **General aim:** ➢ To have an opportunity to know each other. ➢ To understand the positive sides of being different. ▶ **Specific aims:** ➢ To build good and safe relationships in the group.	
▶ **Methods /techniques used:** ➢ Individual work ➢ Group work	
▶ **Resources:** ➢ Flipchart ➢ Markers	
▶ **Practical arrangements:** ➢ Any classroom setting.	
▶ **Instructions/procedure:** ➢ The participants are asked to present themselves by drawing. Each student has a separate piece of paper, and presents data related to him/her in symbols. They may choose any symbols they want. For example, if someone decides to draw a face, the shape of eyes could express his/her mood, the shape of mouth – the things he/she likes, curly hair could represent the number of sisters and/or brothers, the shape of nose could represent whether he/she uses the left or the right hand, etc.	

➢ The participants place the hieroglyphs on the wall. ➢ They present themselves, and shortly explain the meaning of each symbol. The others ask questions which would help us getting what we want to know about each other.	

▶ Tips to trainers/anticipated difficulties: ➢ This activity helps the participants understanding that they are similar in many ways and in many others they are different, and that they should get this as a natural fact. In each surrounding there are many different people. It's impossible to avoid differences. We may succeed only if we learn to see differences as a positive value.	
▶ Debriefing/reflecting: ➢ After the presentations, the trainer leads an overview of all drawings, looking for similarities and differences. • Did the participants use the same symbols to express their data? Why? • What does it say about people?	

Activity 2 Thermodynamics and analogical processes in social life

80 minutes

	Notes
▶ **General aim:** ➢ To encourage the participants to think on how the analysis of processes in physics help us to understand better processes in social life. ▶ **Specific aims:** ➢ To analyse the open and closed systems. ➢ To determine what we call a thermodynamic system. ➢ To make the difference between temperature and heat. ➢ To find analogies between processes in physics and in social life.	
▶ **Methods /techniques used:** ➢ Individual work ➢ Pair work ➢ Group work	
▶ **Resources:** ➢ Book, pen, markers ➢ Appendix 1: "What is thermodynamics?" ➢ Appendix 2: "An example of Penta-verse"	
▶ **Instructions/procedure:** ➢ The lesson is divided into paragraphs (use a topic about thermodynamics from your school textbook, or text from Appendix 1). The participants read the paragraphs one by one; the trainer explains the complicated issues after each paragraph.	

- ➢ After reading, the trainer asks the participants:
- Which are the two procedures in which the study of the systems with a big number of molecules could be done?
- Do those two procedures give the same results?
- As a need of whom, the second procedure, THERMODYNAMICS, was born?
- What do we call a thermodynamic system? (20 minutes).
- ➢ After the participants learn about thermodynamics, the trainer turns the discussion into an intercultural topic by giving an introduction and asking questions:

"Let's make an analogy with human society – if the thermodynamic system consists of a big number of molecules, human society consists of different people, with different cultural, religious, racial values. While the molecules are in constant move and exchange energy during interaction, the people also move and, therefore they should interact and exchange their values and experiences".

- ➢ Questions for discussion:
- When is a system open and when is it closed? Make an analogy with human society. (A system that does not exchange energy with other systems is closed, and *vice-versa*).
- On whom does the internal energy depend, and on whom it does not? Make an analogy with human society. Society values depend on family values, and the family ones depend on the individual ones.
- What does the temperature represent, and what does the heat represent?
- When is the system reversible and *vice-versa*?
- How are the real processes in the nature – reversible or irreversible? (30 minutes)
- ➢ After the discussion, the participants are asked to write penta-verse on the topic of THERMODYNAMICS.
- ➢ Analyse the example of Penta-verse in Appendix 2. A penta-verse is a specific kind of poem with five verses, and which requires summarizing information and different materials into expressions which describe or reflect on the main idea of the topic.
- The first line of the penta-verse is "Thermodynamics".
- In the second line, the participants have to write 2 words, which describe the process of thermodynamics.
- In the third line, the participants have to write 3 verbs.
- On the fourth line – a sentence, which describes the main idea of a thermodynamic process.

➢ After analysing the example, the participants are asked to write a penta-verse, using an expression describing the same process in human society (the way thermodynamics describes it in physics).	

▶ **Tips to trainers/anticipated difficulties:** ➢ The participants have to understand the process of thermodynamic before speaking about intercultural issues.	
▶ **Debriefing/reflecting:** ➢ Was it difficult to find analogies between thermodynamics in physics and similar processes in social life? Why or why not? ➢ Could you give an example of other social processes, which remind you some processes in physics (or an example from physics, which reminds you processes in society)?	

Activity 3 Boyle's law and analogical processes in social life

40 minutes

	Notes
▶ **General aim:** ➢ To encourage the participants to think on how the analysis of processes in physics help us to understand better processes in social life. ▶ **Specific aims:** ➢ To look for ways of implementing the multiple intelligences in the class. ➢ To encourage the participants to analyse formulas connected to the topic. ➢ To find analogies between processes in physics and in social life. ➢ To learn about the different ways people learn (intellectual, social, and emotional).	
▶ **Methods /techniques used:** ➢ Individual work ➢ Work in pairs ➢ Discussions	
▶ **Resources:** ➢ A4 Papers, pens, text, table ➢ Appendix 3: "Boyle's Law"	
▶ **Practical arrangements:** ➢ You will need a quite big empty space (a class or a corridor) for an experiment.	
▶ **Instructions/procedure:** ➢ The trainer gives to the students a worksheet with a wording definition on the Boyle's Law: "For a given mass and temperature of gas, the pressure is in the opposite ratio with the volume" (Appendix	

3). They discuss about the definition (intelligence of speaking/lingual). ➢ The trainer gives a formula describing Boyle's Law: P x V = T. He explains this formula and how it works in physics processes (logical/math intelligence). ➢ The participants are asked to do the following experiment: they fill their mouths with air to the extent their cheeks are swollen. Then they pass the air to one side of their mouths (at less volume) and they show by hand if the pressure increases or drops (it increases); then they are asked to release the air into both sides of their mouths (at high volume) and they are asked to tell (by hands) if the volume increased or decreased (it decreases) (body/kinesthetic intelligence). (15 minutes) ➢ After the participants learn about Boyle's Law, the trainer turns the discussion into an intercultural topic. A group of participants become "air molecules in a pot" (in a given corner of the classroom). They move at a constant rhythm (temperature) and should not move out of the pot (constant mass). Gradually, the mass of the pot reduces. In the meantime, two volunteers hold a string representing one side of the pot and they begin to move it towards the "people molecules". The less space, the more pressure is noticed (collision with each-other); the bigger the space, the smaller the pressure (Interpersonal intelligence body/kinesthetic).	

▶ **Tips to trainers/anticipated difficulties:** ➢ The participants have to understand Boyle's Law before speaking about intercultural issues.	
▶ **Debriefing/reflecting:** Discuss the following issues: ➢ Sometimes people are not very pushed (overcrowded) in space, but they argue anyway. And in opposite – sometimes it is overcrowded, but people are still able to avoid or solve conflicts. How? What attitudes, skills, and knowledge people need to have in those situations? ➢ It is not always possible to avoid being in overcrowded and conflicting situations. What is the difference between people and molecules in these situations? Are molecules able to avoid explosion? What about people? ➢ How the analysis of Boyle's Law helps us to understand better their processes in social life?	

Appendix 1: What is Thermodynamics?

Thermodynamics was developed by the end of the 19th century. It came out as a need for studying the conversion of heat into mechanical work.
Today, this notion is broader and includes macroscopic study of systems with great number of particles. Therefore, it has a broad application in physics, chemistry, biology and other sciences.

Thermodynamic system is called every system composed of a great number of molecules in chaotic movement that interact and exchange energy. This can be a certain amount of gas or liquid, solid, plasma as ionized gas, a living organism, celestial body in general, or any kind of macroscopic object.
The system is isolated or closed if it does not exchange energy with other systems. If there is exchange of energy with other bodies, the system is called an open one.

We call a thermodynamic proces the change, which converts the system from a state into another. The thermodynamic state of the given system is described with the parameters of state, pressure, volume and temperature. We will write (p_1,V_1,T_1) and (p_2,V_2,T_2) or also in the other way 1—2.
The thermodynamic process will be reversible if the opposite process 2—1 brings back all the bodies to participate in exactly the same state (1). Otherwise, the process is irreversible.

Appendix 2: Examples of penta-verses

THERMODYNAMICS

CLOSED OPEN

CONVEYS MOVES WORKS

Studies the transformation of heat into mechanic work

TURBINE

THERMODYNAMICS

REVERSIBLE IRREVERSIBLE

TRANSFORMS WORKS ILLUMINATES

Does the transformation of a system from a state into another?

PISTON

Appendix 3: Boyle's law

- For a given mass and temperature of gas, the pressure is in the opposite ratio with the volume.

A formula describing Boyle's Law: P x V = T.