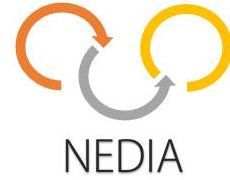# Project NEDIA
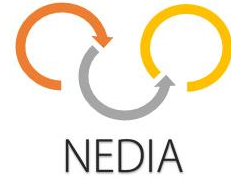
Project number: 2014-1-EE01-KA202-000490

O3 REPORT

LECTURE MATERIALS USING NEW TEACHING METHODOLOGIES AND PILOT LECTURES

Project consortium: IMECC OÜ, Tallinna Tööstushariduskeskus, PIKC Liepajas Valsts Tehnikums, Koneteknologiakeskus Turku Oy, Raision seudon koulutuskuntayhtymä

2016

Table of contents

Introduction

Under the third intellectual output of project NEDIA the attention was turned on the actual topic how to prepare and conduct innovative and effective lectures that would be interesting to the students of vocational education schools. The basis of the work was the research (Intellectual Output 1) and analysis of novel teaching methods (Intellectual Output 2) that gave substance for new challenges. Under intellectual output 3 main tasks were:

- selection of training methodology and composition of pilot lecture material (one by each participating country)

- every participating educational institution will give one pilot lecture that includes the use of new training methods and gathering feedback.

While planning the new lectures it was understandable which are expectations of the youth and how learning could function better, but there were also reasons why all of this is difficult to carry out. Much visual material as videos or some other media is expected to be used in teaching process. The problem turns out to be the embodiment – professional teachers do not have specific skills to prepare themselves technically advances learning materials. For example, video editing, sound etc. could be necessary, but problematic. Also their computer skills are not in high level enough. In addition, they do not have enough time resources or possibilities to order the necessary solutions from somewhere else. Interesting fact turned out that the teachers use a variety of web-based materials that already exist. Unfortunately, there is no such environment where the materials would be rounded up and that could be shared and used commonly between teachers of different countries.

In NEDIA project turned out that methodology of vocational training is different by countries. For example, in Finland more is focussed on guidance of the students and training materials to be used is different from that in Estonia and Latvia. In Latvia, they try to concentrate more on as novel topics as possible. In Estonia there is lack of lessons volume because a lot of topics. Creating novel materials with high quality is time-consuming and creative process. Taking into account the peculiarities of youth (Z-generation), the materials in vocational education could be much more visual and attractive and online so that they could be used regardless of location.

The work process went generally according to plans. Project team analysed and tested several different possibilities, accordingly were made improvements and tested again, so we reached to the understanding what works and what does not. Getting ideas and knowledge about novel teaching methods and the experience of development of lecture materials was important for helping project

partners to make changes in their work. Feedback motivates to be open to innovation and gives ideas for changes. In this report, the process is explained mainly by using Latvian partners' material as an example. As the volume of all materials (videos, CAD drawings and materials in other format) is very big, the example gives an overview of the process done in the project.
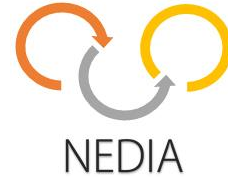
1. Description of the process

In elaboration of lecture materials and preparation of pilot lectures all project partners were engaged:

- IMECC OÜ (Innovative Manufacturing Engineering Systems Competence Centre), EST;
- Tallinna Tööstushariduskeskus (Tallinn Industrial Education Centre, TTHK), EST;
- Liepajas Valsts Tehnikums (Liepaja State Technical School, LVT), LAT;
- Koneteknologiakeskus Turku Oy (Machine Technology Centre Turku, KTK), FIN;
- Raision seudon koulutuskuntayhtymä (Raisio Regional Education and Training Consortium, RASEKO), FIN.

The process was carried out as follows:

1) Development of the structure and methodology of the lecture (responsible partner: TTHK). As a result of this phase, concept was created how to move on.

2) Design of lecture topics according to the lecture structure. All vocational educational schools participating in the project were engaged to this. This phase resulted in a lecture plan containing topics and methods how to teach the topics. All partners contributed to improvement of the activities.

3) Final review and analysis of lecture plans (main responsible partner: TTHK). In this phase final choices were confirmed.

4) Making improvements and changes (all partners);

5) Composing pilot lecture materials (all partners). In this phase a number of different existing materials were collected and analysed as well as elaborated new material and decided how to use and how to integrate the materials;

6) Carrying out pilot lectures and creating visuals (all partners).

7) Feedback collection and its analysis (all partners). The objective of this phase was to find out whether and how the target group was satisfied with the prepared lecture materials and pilot lecture.

8) Improvements according to feedback (in some cases steps 5-8 were repeated several times).

Materials development took more time than it was expected. After conducting pilot lectures we received feedback what should be changed in materials and lectures.

2. Preparation of the lectures

2.1 Lecture structure

For all partners, common structure of lectures was elaborated. The structure of lectures consisted of following parts.

NEDIA: LESSON PLAN

Topic: (title of the lesson)

Instructor …………………………………………………………

Observer …………………………………………………………

Number of the lesson: number of topic and subtopic.

Topic: ………

- ……………………………………………
- ……………………………………………

(topics and subtopics)

Time: number of lesson, time of beginning and date

Purpose: What is the purpose of the lesson, what output or portions of output should the students acquire)

Type of lesson: E.g.: class to perfect one`s knowledge and skills

Kind of lesson: Is this a theoretical or practical lesson?

Didactic methods: …………………………………………………

- …………………………………………………..
- …………………………………………………..
- …………………………………………………..

Timetable:

- …………………………………………………..
- …………………………………………………..
- …………………………………………………..
- …………………………………………………..
- …………………………………………………..

The timing of the lesson in minutes has to be recorded, e.g. how much time was spent on attendance check, on the explanation of a new topic, group work, revision, quiz etc.

Technical equipment used during the lesson:

- …………………………………………………….
- …………………………………………………….
- …………………………………………………….

Technical equipment - actuators, sensors, controllers etc. PC equipment – computer, data, TV etc.

I DIDACTIC PURPOSE

1. The formation of professionally important practical abilities and skills…

II ACTUALIZATION

1. Support definitions and manners of action (skills) …

2. Independent work (problem situations) …

III THE ACQUISITION OF NEW KNOWLEDGE AND WAYS OF OPERATION

1. New knowledge and ways of operation....

2. The expected growth of knowledge…

3. Basic problems and independent work…

IV THE FORMATION OF SKILLS AND PROFICIENCE

1. Independent work (practical tasks)…

2. Links between subjects, the cognition of which the student has to reach…

3. The generalization and systematization of knowledge and skills…

4. The linking of knowledge and skills with real working life…

HOMEWORK:

1. Learning material meant for revision…

Annex 1 Conspectus of the lesson
Annex 2 Assignments (**exercises**) used in the lesson
Annex 3 Feedback (students and observer)

2.2 Latvian (LVT) example

There were several topics to handle. It is very important to find right topic and develop subtopics and to think how to make all this understandable for the students. For example, discussions with project

partners were held over several topics. Are some topics too simple to teach? Are some topics too novel and innovative? How to teach basic knowledge interestingly and should it be interesting? Or how to teach complicated topics interestingly and understandably so that students are able to work with complex equipment in the future? As an example of preparation process of the lectures, lecture plan of Liepajas Valsts Tehnikums (LVT) is presented.

NEDIA: LESSON PLAN

Topic   Introduction programmable logic controller (further in text -PLC) circuit assembling

Instructor   L.Jaunzeme

Observer   K.Gauja

Number of the lesson: 2

Topic: Introduction PLC circuit assembling

- Input/Output schematic symbols and working principle
- PLC control circuit assembly basic principles
- PLC schemes reading, installation and testing

Time: 2 lessons on 12.02.2016.

Purpose:

Students must be able:

- to distinguish between input / output devices
- add devices to the PLC.

Type of lesson: Enhance knowledge and skills

(E.g.: class to perfect one`s knowledge and skills)

Kind of lesson: Theoretical and practical lesson
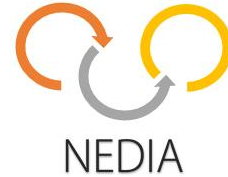
(Is this a theoretical or practical lesson)

Didactic methods:

- lecture
- discussion
- pair work

Timetable:

- 5 min- Introduction

- 20min -Input/Output schematic symbols and working principle
- 15 min- Drawwing PLC shematic circuit
- 10 min- PLC circuit analysis
- 5 min- PLC control circuit assembly basic principles
- 15min - Circuit installation (practical pair work)
- 5 min - Circuit test (practical pair work)
- 5min - Removal of the system and closing lessons

(The timing of the lesson in minutes has to be recorded, e.g. how much time was spent on attendance check, on the explanation of a new topic, group work, revision, quiz etc. ….)

Technical equipment used during the lesson:
- board,
- projector,
- computer
- PLC,
- wires,
- Button panels,
- lamps
- limit switches,
- sensors

(Technical equipment - actuators, sensors, controllers etc. PC equipment – computer, data, TV etc.)

I DIDACTIC PURPOSE

    1. The formation of professionally important practical abilities and skills

To acquire knowledge and skills in the PLC circuit assembling and testing. Understand PLC operating principle.
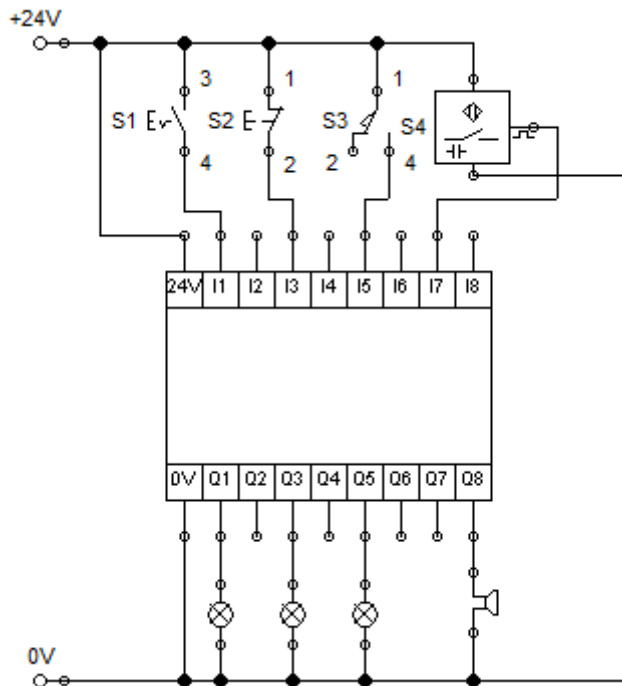
II ACTUALIZATION

    1. Support definitions and manners of action (skills) -

Students are able to choose the necessary device and distinguishes them. Able to assemble circuit subject to safety rules.

    2. Independent work (problem situations) -

Circuit installation

III THE ACQUISITION OF NEW KNOWLEDGE AND WAYS OF OPERATION

1. **New knowledge and ways of operation**

   ………………………………………………………………………………………..

2. **The expected growth of knowledge**

   ………………………………………………………………………………………..

3. **Basic problems and independent work**

   ………………………………………………………………………………………..

IV THE FORMATION OF SKILLS AND PROFICIENCE

1. **Independent work (practical tasks)**

2. **Links between subjects, the cognition of which the student has to reach**

   Electrotechnics- input/output devices working principles

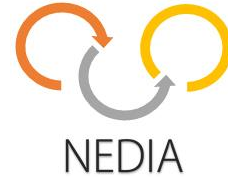3. **The generalization and systematization of knowledge and skills**

   Students learn the system, the complexity of every lecture is increased. In the next

   lesson, students will learn the basics of PLC programming.

4. **The linking of knowledge and skills with real working life**

Learners show how industrial automation is installed. Get acquainted with the various controller types, such as Festo, Siemens.

HOMEWORK:

1. **Learning material meant for revision…**

Annex 1 Conspectus of the lesson
Annex 2 Assignments (exercises) used in the lesson
Annex 3 Feedback (students and observer)

Questions about conducting the lesson

1. How are technical equipment used (overhead projector, board, flipchart etc.)

•   Do they fit in the lesson?

•   Are they spatially in right places?

•   Is the text easily readable?

2. What was signalled by body language?

•   Were the words illustrated, e.g.?

•   How was contact kept with the students?

•   Moving in the room.

•   How could the possible nervousness be seen?

3. How and to what extent have the participants been involved?

•   By means of question?

•   Are the questions serious?

•   Are other participants/students being referred to?

4. How does the instructor impose his/her authority?

•   By using his/her voice?

•   By his/her position in the room?

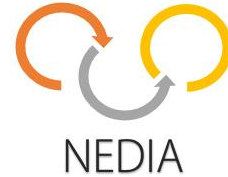•   Referring to the experience related to the topic.

5. How is the topic of the lesson – the so-called "red thread" – being observed?

•   Verbally – in writing

•   What happens if someone intervenes on an irrelevant subject?

•   How will the instructor return to the topic?

6. How is voice been used?

• Does the tone of voice vary?

• Is the pace suitable?

• Are pauses being made?

7. How does the instructor mark the beginning and the end of the lesson?

• Does it function?

8. What, in your opinion, is going on inside the instructor during the lesson?

• Do you see any emotional reaction during the lesson?

• Do you see uncertainty?

• Do you see satisfaction if something works successfully?

• Do you see fatigue, boredom?

9. Structure

• Can the structure of the lesson be seen?

• How does the context fit in with the rest of the study?

10. The opinions of the participants/students (the students will respond):

• How were we engaged in the activities?

• Did we send supporting signals?

• Did our interest last? How did we show it off?

• Did our reactions influence the instructor?

• When did you experience the highest interest?

Evaluation:	………………………………………

3.Lectures and lecture materials

Pilot lectures were conducted by project partners according to planned timetable. For conducting the lectures, videoclips, CAD drawings, picture material, tasks and other lecture material was prepared.

Example 1. Video lecture "Working with PLC" (Programmable Logic Controller)

From the elaborated lecture materials we present Liepajas Valsts Tehnikums video that is freely accessible in Youtube: https://www.youtube.com/watch?v=nmbcVRXiE7o&feature=youtu.be

Novelty of the video and positive aspects in video lecture:

- Use of new technologies;
- Use of novel teaching methods;
- Visually quickly and easily possible to follow;
- It is possible to look the video later (e.g. in case if the student could not participate in the lecture or wishes to review to obtain the topic better);
- In video lecture it is possible to cover theory part as well as tasks;
- Easy to maintain focus, also in details;
- It is possible to put the video on pause in order to think over what was learned;
- It is possible to add to the video separate sound and make video editing according to lesson plan;
- It is possible to go more deep in video lecture as in ordinary lecture (e.g. in case of some unexpectedness, students have different tempo of obtaining the lessons etc.).

Negative aspects in video lecture:

- Teacher does not get direct feedback from the students and can't immediately answer to the questions;
- Preparation is time-consuming and requires special knowledge and equipment (video shooting, editing etc.);
- To make quality video, some services should be purchased in and it is costly (e.g. sound, lighting, editing);
- More difficult to change the content later, this means that preparation should be done very carefully and there is no possibility to make mistakes with facts;
- As the video files have large size, it should be found where it is possible to upload. Also technical preconditions to data transfer have to be clear (otherwise the video may not run or runs with poor quality);

- If the video is in internet, it is possible to monitor who is using the material.

Example 2: Fanuc robot course 1. The movement of the robot. Basic course. (Finnish partners)

There are presented some parts from lecture materials of Koneteknologiakeskus Turku Oy (Machine Technology Centre Turku, KTK). The lecture material consists of presentation covering both theory and visuals, also there are video links and tasks for self-control.

Course content:

- Safety
- The robot
- Robot controller
- The coordinate
- Robot movements and speed change
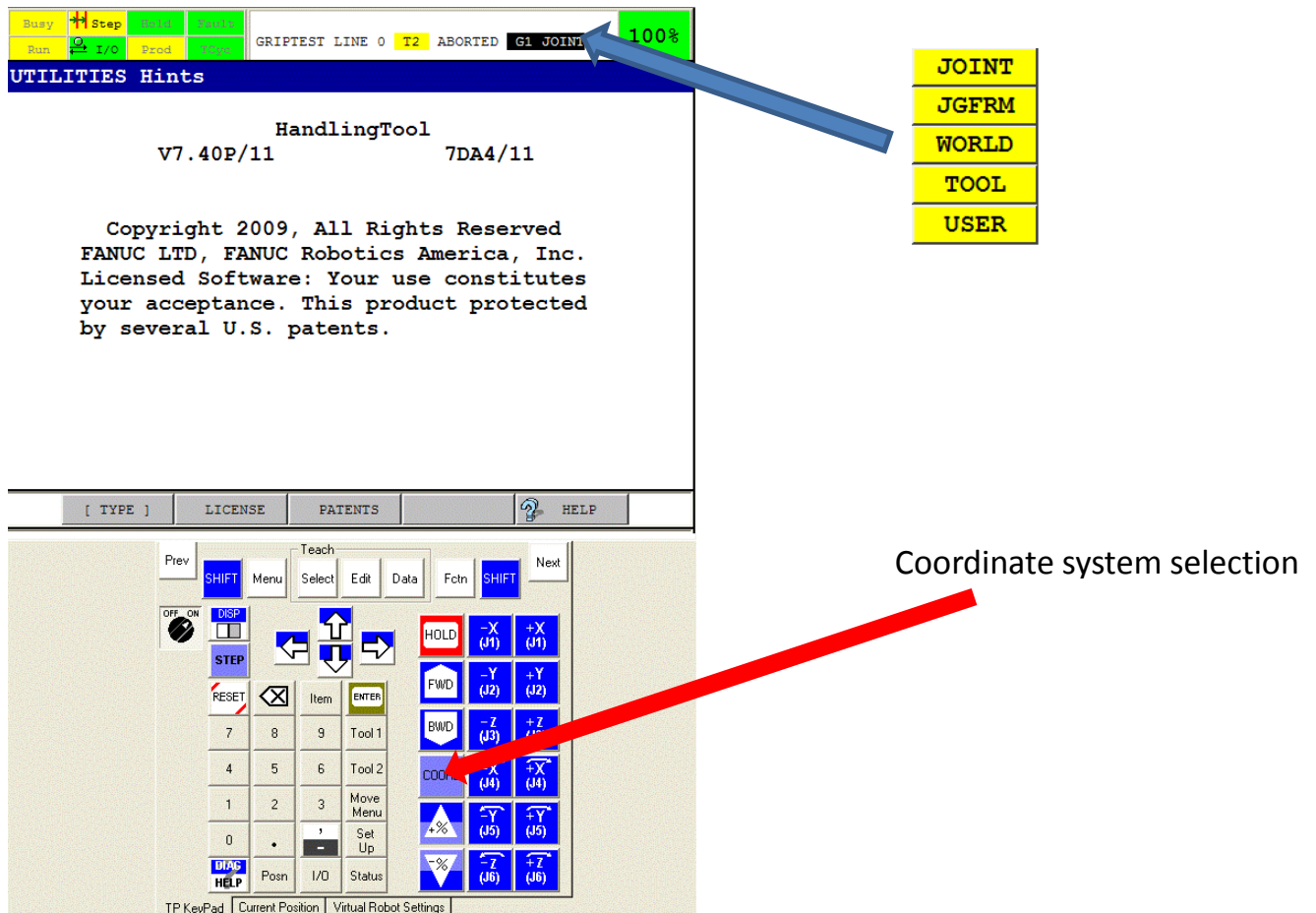- Programming
- Structure of the program
- Automatic operation

Fanuc robot types (Picture 1.)
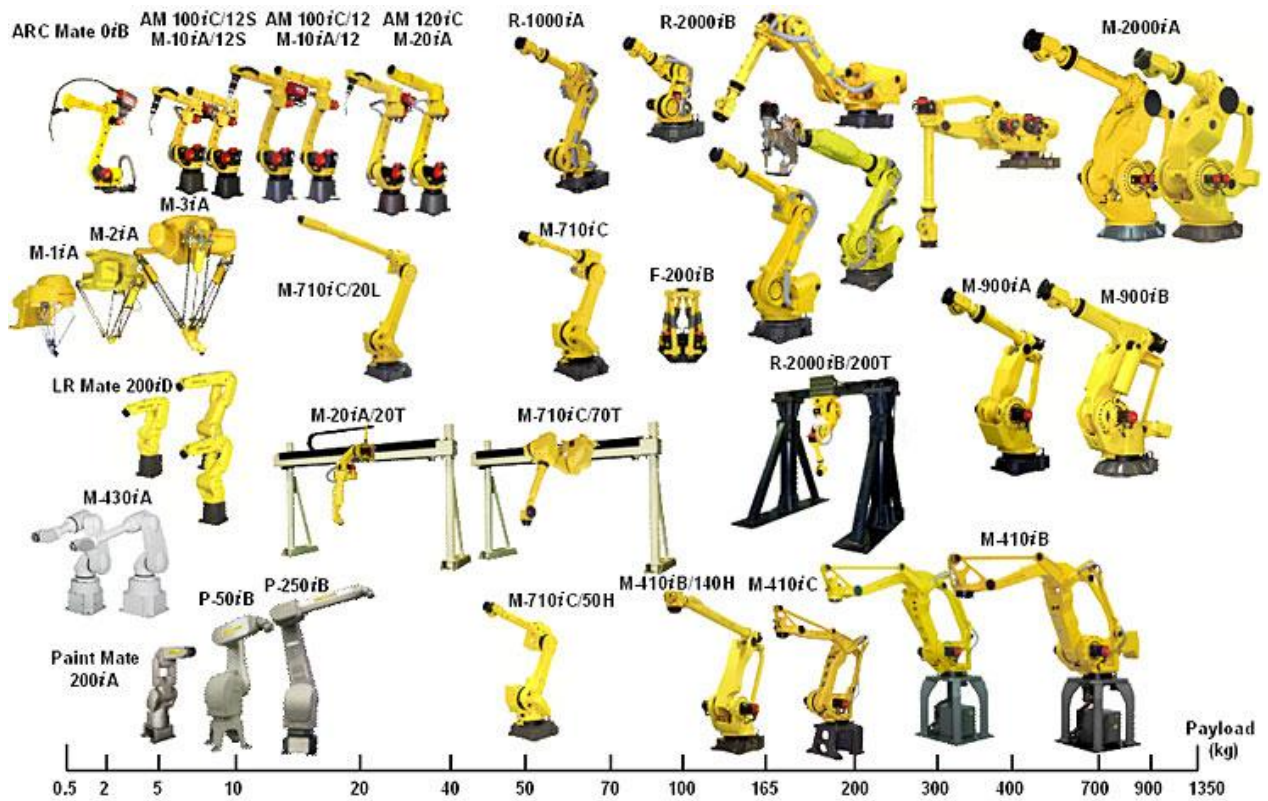
Picture 1. Fanuc robot types.

Coordinate system selection (Picture 2).

Picture 2. View to coordinate system selection.

Movement exercises

Exercise 1.
- Move all axels in Joint, World ja Tool –coordinate systems.
- Try the same movements by changing the rate.

Exercise 2.
- Change the use of the portal
- Try to exercise the robot in Joint, World ja Tool –coordinate systems.
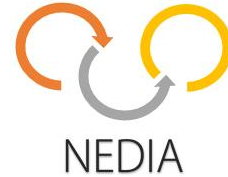- Try the same movements by changing the rate.

Exercise 3
- Move the roll of tape from point A to point B.

Program excercises

Exercise 1.
Making a simple program
- New program
- Greating points
- Creating different paths
- Chenge speed
- T1 spece run Step ON and OFF

Exercise 2.
Create a program in which the robot to move the roll of tape from point A to point B. Use the previously mentioned types of movement and speed.
The program should be:
- The porthal movementPortaalin liike
- Linear and Joint movements
- Different speeds

Run the program:
- T1 space Step ON and OFF
- Auto space (Ask permission before use)

Exercise 3.
- Make your own solution
- Design paths and movements
- Make program
- Run in the test mode
- Auto run (Ask permission before runing)

Novelty of the lecture material and positive aspects:

- Versatile, multifunctional and colourful and in detail description helps to understand and remember more easily (if it would be try theory, it would be more difficult to understand);
- Self-control exercises between topics help to anchor the content of lecture;
- Lecture material in presentation format is more easy to change and continually improve and complement;
- The presentation is possible to look in PC-s, tabs, telephone etc., so the learning could take place wherever and whenever (more easy than in case of book for example);
- The video links used in lecture material enrich the lecture material.

- The lecture material may not be sufficiently in detail;
- Self-control exercises need later over control and attention of teacher.

4.Feedback

After pilot lectures, all partners asked for feedback of the participants to find out how well the objective of the lecture was met and how well they managed in sharing the information to target audience. All countries participating in the project used different feedback methodology and questionnaire. If it cleared out according to the feedback that something could be improved, then the improvements were done in lecture materials according to the feedback.

LVT (Latvia) used questionnaire which is presented in Table 1. Latvian questionnaire. Additionally open comments about video, video topic and content, methods and teacher's work were asked.

Table 1. Latvian questionnaire

REVIEWS FOR THE LECTURE

Contention	Rating			
	Totally agree	**Partially I agree**	**Partially I disagree**	**Strongly I disagree**
Educational videos are used interactive teaching methods.	☐	☐	☐	☐
Training videos are a variety of teaching methods focus binding.	☐	☐	☐	☐
Training videos are widely applied technology capabilities.	☐	☐	☐	☐
Training videos can be used in further study.	☐	☐	☐	☐
Training videos can be used in teaching topics learning remote.	☐	☐	☐	☐
Training videos are good theoretical knowledge acquisition.	☐	☐	☐	☐
Training videos are a good acquisition of	☐	☐	☐	☐

Contention	Rating			
	Totally agree	Partially I agree	Partially I disagree	Strongly I disagree
practical skills.				
Training videos can be used in any country.	☐	☐	☐	☐
Training videos are focused on the acquisition of new knowledge.	☐	☐	☐	☐
Training video leads to an in-depth interest in this topic.	☐	☐	☐	☐
Training videos are linked to the production of everyday life.	☐	☐	☐	☐
The theme has been developed good theoretical study material.	☐	☐	☐	☐
The theme is set out clearly.	☐	☐	☐	☐
A regular communication with students.	☐	☐	☐	☐
It is used in the present day knowledge appropriate methods of control.	☐	☐	☐	☐
Teacher / s explanations are easily accessible.	☐	☐	☐	☐
Teacher / s is sure / her for the rest of the acts subject.	☐	☐	☐	☐
Teacher / her well hold the attention of students study.	☐	☐	☐	☐
I am learning more individual work.	☐	☐	☐	☐
I am learning more teamwork.	☐	☐	☐	☐
I am learning more practical work.	☐	☐	☐	☐
[i]Training videos could be used for the company's employees.	☐	☐	☐	☐

Contention	Rating			
	Totally agree	Partially I agree	Partially I disagree	Strongly I disagree
*Companies are interested in the training environment.	☐	☐	☐	☐
*Companies are willing to work out the tasks related to the actual production.	☐	☐	☐	☐

[1] Completed by representatives of the companies

The feedback was received from 10 participants and results are presented in Table 2.

Table 2. Feedback results

Question	Answer				Sum	Percent			
	Totally agree	Partially agree	Partially disagree	Strongly disagree		Totally agree	Partially agree	Partially disagree	Strongly disagree
1. Interactive teaching methods are used in training video.	9	1	0	0	10	90%	10%	0%	0%
2. Variety of teaching methods are used in training video.	7	3	0	0	10	70%	30%	0%	0%
3. Technology capabilities are widely applied in training video.	10	0	0	0	10	100%	0%	0%	0%
4. Training videos can be used in further studies.	8	2	0	0	10	80%	20%	0%	0%
5. Training videos can be used in teaching topics learning remote.	9	1	0	0	10	90%	10%	0%	0%
6. Training videos are good way of providing theoretical knowledge.	4	6	0	0	10	40%	60%	0%	0%
7. Training videos are a good way of providing practical skills.	6	4	0	0	10	60%	40%	0%	0%
8. Training videos can be used in any country.	8	2	0	0	10	80%	20%	0%	0%

9. Training videos are focused on the acquisition of new knowledge.	9	1	0	0	10	90%	10%	0%	0%
10. Training video leads to an deeper interest in this topic.	9	1	0	0	10	90%	10%	0%	0%
11. Training videos are linked to the production of everyday life.	3	6	1	0	10	30%	60%	10%	0%
12. The theme has been developed good theoretical study material.	5	5	0	0	10	50%	50%	0%	0%
13. The theme is set out clearly.	6	4	0	0	10	60%	40%	0%	0%
14. Regular communication with students.	5	5	0	0	10	50%	50%	0%	0%
15. There are clearly familiar with topic.	8	2	0	0	10	80%	20%	0%	0%
16. Teacher explanations are easily understandable.	5	5	0	0	10	50%	50%	0%	0%
17. Teacher are clearly familiar with topic.	4	6	0	0	10	40%	60%	0%	0%
18. Teacher holds the attention of students.	7	3	0	0	10	70%	30%	0%	0%
19. I prefer individual work.	6	4	0	0	10	60%	40%	0%	0%
20. I prefer teamwork.	4	6	0	0	10	40%	60%	0%	0%
21. I prefer practical work.	9	1	0	0	10	90%	10%	0%	0%
22. * Training videos could be used for the company's employees.	1	1	1	0	3	33%	33%	33%	0%
23. *Companies are interested in the training environment.	2	1	0	0	3	67%	33%	0%	0%
24. *Companies are willing to work out the tasks related to the actual production.	1	2	0	0	3	33%	67%	0%	0%
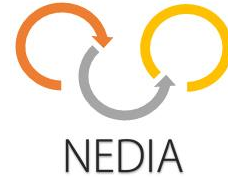
5. Summary

Project NEDIA experience showed that creating of novel teaching materials and implementing them to everyday teaching process is time-consuming and requires more resources and efforts but it will be paying off in the future. With time, the technologies become more complex. To counterbalance it and taking into account peculiarities of youth today (Z-generation), the methods used is vocational education have to become more easily obtainable and understandable. The possibilities to learn online, without depending where you are and what time is, use of different formats and methods are more and more important. Future trends increasingly support more flexible learning environment. As the number of students diminishes, vocational education schools also have to search for possibilities to attract youth to start studies in their schools. Therefore is important to use such novel methodologies and methods that make obtaining the subject more easy and interesting and take into account the youth generation peculiarities. Also cooperation between different education institutions is important. For sure, flexible and efficient vocational education through implementing and using novel methods is a good opportunity for Estonia, Latvia and Finland to raise the level of vocational education.