



Report on the implementation of Innovation pedagogy and innovation competence assessment

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Implementation of Innovation pedagogy and innovation competence assessment has been lead by TUAS and the work is divided in two work packages:

- introducing innovation pedagogy in teaching and learning
- definition and assessing innovation competences in the four partner countries.

Traditional pedagogical methods are more about facts and reproduction of existing knowledge. To help engineering students in partner countries become more innovative, TUAS has introduced innovation pedagogy which promotes active learning and curricula design focusing on innovation competences and learning outcomes. After that, partner countries have had experiment on innovation pedagogy in Spring semester 2018.

Definition and assessing innovation competences in the four partner countries has included next targets:

- Organized workshop in Finland on innovation pedagogy
- Each partner country university experimented on innovation pedagogy in one of its engineering courses
- Organized workshop on curricular design focusing on competences
- Revised the bachelor or master curriculum for one of the existing engineering programs.

To define and assess innovation competences has included next targets:

- Get partner country staff interested in innovation competences
- EU staff and partner country staff agreement on the contents of innovation competences
- Students to be open to assessment tools.

Subject knowledge which students are learning at universities are not always sufficient to make students creative. TUAS has used outcomes from previous European projects to define the types of innovation competences students should obtain and how these competences can be assessed by teachers and by students themselves. To meet the targets InnoCens TUAS had next responsibilities:

- Organizing a workshop on innovation competences and their assessment
- Developing tools to assess innovation competences
- Implement assessment tools in teaching and learning.

1. Fundamentals of innovation pedagogy and innovation competence assessment

Innovation pedagogy is a practical approach that originated at Turku University of Applied Sciences (TUAS). The ultimate aim of innovation pedagogy when applied in educational institutions is to contribute to success in future working life; that graduates of educational institutions will be successful in their future work and life in general, and that the organizations where they work will also be successful.

The essential aim of innovation pedagogy is to equip students with such competences that they will have access to a good life, and at the same time, will have the opportunity to succeed in working life.

Working life orientation, flexible curricula and multidisciplinary learning environments are essential requirements for innovation pedagogy to succeed.

Innovation pedagogy is a learning approach that aims at supporting learning and encouraging and empowering both learners as well education providers and teaching staff (Kairisto-Mertanen & Konst, 2018.)

To achieve the aims of innovation pedagogy, students have to acquire the core competences of their own study field or discipline and, in addition, set of so-called innovation competences during the study process.

Traditional assessment often focuses especially on assessing the individual competences of students. Individual competences do not ensure that the expectations of working life are met (Kairisto-Mertanen & Konst, 2018.)

At the core of InnoCens project is to get familiar with innovation competences and the Innovation Barometer Assessment Tool by utilizing it in their environment. It is a psychometric tool that measures individuals' capacity for innovation.

The assessment tool is tested in various settings in innovative and unprejudiced way. The aim is to provide solutions for creating a solid path for forthcoming innovators from university to companies.

The Innovation competence barometer can be implemented for self-assessment by students, in two ways: paper-based or web-based. Within InnCENS project, both ways have been practiced. To facilitate the implementation of Innovation competence barometer, a simple guide has been developed by TUAS staff and distributed to partner country staff.

Innovation Barometer Assessment Tool includes five- dimensional innovation competences including totally 34 indicators/items that describes the dimensions as next:

1 Creativity (9 items)

ability to transcend (think beyond) traditional ideas, rules, patterns or relationships, and to generate or adapt meaningful alternatives, ideas, products, methods or services independently of their possible practicality and future added value

2 Critical thinking (6 items)

ability to analyze and deconstruct issues with a purpose (evaluate advantages and disadvantages, foresee how events will develop, estimate the risks involved)

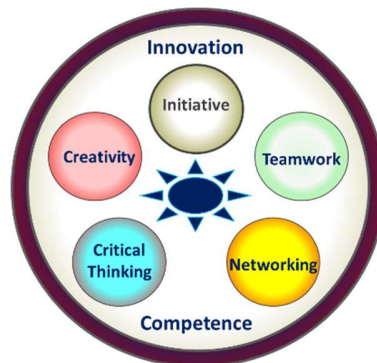
3 Initiative (6 items)

ability to take decisions or carry out actions to operationalize ideas that foster positive changes, as well as to mobilize and manage creative people and those who have to implement ideas

4 Teamwork (7 items)

ability to work efficiently with others in a group

5 Networking (6 items) ability to involve external/outside stakeholders (outside the work group)



© FINCODA UPV-SEE-CSP team (2017). Innovation Competence Model

The innovation assessment measures an individual's capacity on **five dimensions**

The 34 behavioral indicators:

- 1 Think differently and adopt different perspectives
- 2 Be attentive when others are speaking, and respond effectively to others' comments during the conversation
- 3 Use intuition and own knowledge to start actions
- 4 Invite feedback and comments
- 5 Foster improvements in work organization
- 6 Obtain constructive comments from colleagues
- 7 Find new ways to implement ideas
- 8 Identify sources of conflict between oneself and others, or among other people, and to take steps to overcome disharmony
- 9 Take an acceptable level of risk to support new ideas
- 10 Go beyond expectations in the assignment, task, or job description without being asked
- 11 Meet people with different kinds of ideas and perspectives to extend your own knowledge domain
- 12 Convince people to support an innovative idea
- 13 Systematically introduce new ideas into work practices
- 14 Act quickly and energetically
- 15 Generate original solutions for problems or to opportunities
- 16 Use trial and error for problem solving
- 17 Develop and experiment with new ways of problem solving
- 18 Acquire, assimilate, transform and exploit external knowledge to establish, manage and learn from informal organisational ties
- 19 Challenge the status quo
- 20 Face the task from different points of view
- 21 Make suggestions to improve current process products or services
- 22 Present novel ideas
- 23 Forecast impact on users
- 24 Show inventiveness in using resources
- 25 Search out new working methods, techniques or instruments
- 26 Provide constructive feedback, cooperation, coaching or help to team colleagues
- 27 Work well with others, understanding their needs and being sympathetic with them
- 28 Share timely information with the appropriate stakeholders
- 29 Consult about essential changes
- 30 Build relationships outside the team/organization
- 31 Refine ideas into a useful form
- 32 Engage outsiders of the core work group from the beginning
- 33 Ask "Why?" and "Why not?" and "What if?" with a purpose
- 34 Work in multidisciplinary environments

2. Implementation at partner universities

In InnoCens partner universities worked hard in implementing the targeted activities. In generally every university:

- implemented some of the innovation pedagogy methods in two courses
- piloted or introduced Fincoda barometer or the SW tool in some way
- collect feedback of the experiences & reported of it
- analyzed the feedback and defined the lessons to learn topics
- had a positive trust to the future and willingness to continue
- gave honesty feedback of the totality.

In generally there are recognized things as lessons to learn:

- need for more introduction of innovation pedagogy to the univeristy staff
- to define more clear expectations for the courses & outcomes to students
- better preparation and feedback in the end of courses
- better involvement and practicing of students in courses
- continue the innovation pedagogy competence assessment implementation in new courses.

Each partner university describes their implementation journey in next chapters.

2.1 National Polytechnic University of Armenia (NPUA)

NPUA completed piloting for one course for engineers called "Branch economics and management". This course was for year 2018 distance learning students with different engineering backgrounds. The course content and all the materials were put on our Moodle platform, and the format of education changed into blended type. We use interdisciplinary teamwork as an innovation pedagogy method, so that all the students with different specializations worked in team of 3-4 members and prepared their joint paper, which became the economical part of their diploma work in the end. All the students worked in teams by using forum and chat tools of Moodle platform, and the end results were also uploaded there.

Multi-discipline course "Branch economics and management"

(Number of the students: 102)- 2017-2018 academic year

Interdisciplinary teamwork, project base learning, think creatively, differently and outside of the box, the modern IT tools for problem solving, active participation in learning process, pilot projects methods have been used.

Course Feedback:

Positive:

- new interdisciplinary method,
- new format of teaching the mentioned course,
- the course was interesting and innovative,
- the study format emphasized their leadership,
- team working and creative competencies.

Negative:

- difficult to convince the students with different backgrounds and groups.
- It would be more effective to use new technologies and methodology to organize their group work.

The final reaction was positive, and the majority of students confirmed that it was interesting and innovative, and the study format emphasized their leadership, team working and creative competencies.

"Innovation Pedagogy and New Technologies" training for professors

(Number of the students: 46) - 2018-2019 academic year

Interdisciplinary teamwork, project base learning, think creatively, the modern IT tools for problem solving, active participation in learning process methods have been used.

Course Feedback

Positive:

- new interdisciplinary method,
- new format of teaching the mentioned course,
- The course was interesting and innovative.

Negative:

- Too much information for professors.
- Not all methods acceptable for staff

The final reaction was positive, the study format emphasized their leadership, team working and creative competencies.

"Innovative Pedagogy and new technologies" course for lecturer/ Center of Continuous education,

"Product engineering" course work (Number St: 18)- 2018-2019 academic year

Interdisciplinary teamwork, project base learning, think creatively, differently and outside of the box, the modern IT tools for problem solving, active participation in learning process, pilot projects. How to use all methods within teaching process methods have been used.

Course Feedback

Positive:

- new interdisciplinary method,
- new format of teaching the mentioned course,
- the course was interesting and innovative,
- the study format emphasized their leadership,
- team working and creative competencies.

Negative:

- These all not new for professors
- All these tools are usable for teaching process but should be updated for internal use.

For the innovation competences assessment tools implementation at NPUA, the Networking and social factors, as well as teamwork abilities and initiatives were being assessed, and as a result almost all the groupworks were completed and got ready for the diploma work. For the Autumn

semester the adaptation and assessment of innovation competencies by using adapted version of the Barometer.

The main principles and models for Innovation pedagogy, including the Fincoda Barometer and HEINNOVATE were presented with examples have been used.

The main result for the lecturers was the review of their syllabuses by using the innovation competency chart. Each teacher is preparing the pilot project /e-course/ and use the prepared chart of innovation competencies and course objectives.

The Fincoda Toolkit was presented with its examples, and it was suggested to prepare the Armenian version /not only the translation of terms, but also the entire toolkit/, so it will be easy to use in practice int the future.

The HEINNOVATE was presented with its example, and it was suggested to prepare the Armenian version /not only the translation of terms, but also the entire toolkit/, so it will be easy to use in practice in the future, and for the concrete results, it will be more realistic to involve responsible departments and stakeholders.

Additional outcomes, publication of the scientific articles:

1. The role of Innovation and entrepreneurial components in engineering education
2. Modern approaches and features of Innovative Pedagogy

2.2 National University of Architecture and Construction of Armenia (NUACA)

In the scope of the InnoCENS program the following initiatives have been implemented at NUACA. The first step in preparing to teach a particular course is to decide on a particular style of teaching that is compatible with and appropriate for our students and the goals of our course.

In order to reach that aim we organized and realized different workshops and seminars.

The scientific objectives of these events are:

- to investigate the development of teachers' ability in transformational in innovative pedagogical methods,
- to supply the teachers with activities and information about interactive dynamic educational resources for teaching engineering subjects,
- to provide to the teachers and researchers instruments for measuring students' abilities in engineering subjects.

In that scope we have organized several workshops in NUACA, the purpose of this workshop was to hold an interactive discussion where administrative and scientific staff could discuss the incorporation of innovation pedagogy in NUACA, particularly in engineering disciplines. The workshop timetable you can see here.

Faculty of design	06.11.2017
Faculty of construction	09.11.2017
Faculty of urban economy and ecology	10.11.2017
Faculty of management and technology	16.11.2017

Dissemination Workshop agenda include several key points: the education system of Finland Orientation to innovation pedagogy, innovative teaching methodologies for higher education Institutions such as Project Hatchery Method, Business Academy, InnoCamp, Factory learning environment also two online tools FINCODA and HEInnovate.



At the moment we have reached some results by organizing workshops of innovative pedagogy for our staff members and now we have new teaching model by using innovation component which will be applied in our educational system.

Two courses which are experimenting with innovative pedagogical methods

Course Name 1: Management (Coursework), number of students 25.

Implementation time period of course: autumn 2018.

Innovation methods: teamwork and critical thinking.

Course Feedback from student and teachers:

Positive:

- The course is fairly easy to understand, probably due to the lecturer's method of presentation.
- I like the topic and how it is taught. The lecturer used a variety of instructional methods to reach the course objectives, in particular: group discussions, student presentations.

Negative:

- We have a great deal of work to do with ourselves before classes.
- Sometimes the process of working collaboratively with a group of students has been really hard, everyone wants to be head of team.

Analysis of experiences we get feedback for teachers:

- Before the lesson, I had to prepare a lot of materials concerning classroom management processes, developed communication process classroom activities, etc.

Course Name 2: Real estate valuation, number of students 25

Implementation time period of course: autumn 2018.

Innovation methods: project- based learning and project teamwork.

Course Feedback from student and teachers:

Positive:

- The way in which the lecturer describes the topics which are connected with real life, practical context.

Negative:

- From the students` point of view, it is hard to find materials which depend on real life, but at the same time, it's quite interesting and gives them a huge advantage in the future labor market.

Analysis of experiences we get feedback for teachers:

- Requires extra time to prepare course materials, and also soft skills for working with students` groups, sometimes it takes time and too much effort.

The first point we translate FINCODE Barometer in Armenian (Appendix 1). We organized workshops for academic, teaching staff and students, which included key points of innovative pedagogy, Innopeda methods and Innovation Competencies Development and Assessment (FINCODA). In those workshops, we introduced how effective can we use the self-assessment process in the educational system. It is a very user friendly interface but at the same time, they want to have it in Armenian for more applicable. Here you can see FINCODA results report.

Survey ID	Dimension ID	Dimension Name	Dimension Average	Minimum User Dimension Average	Maximum User Dimension Average
229	1	CREATIVITY	4.01853333	3.5556	5
229	2	CRITICAL THINKING	3.75	3	4.6667
229	3	INITIATIVE	4.02778333	3.5	4.8333
229	4	TEAMWORK	3.97916667	3.625	4.75
229	5	NETWORKING	3.93333333	3.2	4.6



Analysis of experiences we get feedback from participants:

- FINCODA is a really amazing tool. It's a unique way to make a boring process of assessment fun.
- Sometimes it's hard to understand because the context is only in English.

During the workshop we also have presented HEINNOVATE self-assessment tool. We have introduced basic tools of program and gave an overview of the project.

Key Outcomes:

Teachers were review of their syllabuses by using the innovation pedagogy methods and innovation competency chart. For these two courses we have designed new curricula which are becoming more centralized and less departmentally based, and with curricula including both core and optional elements. Based on the advances of the past few decades, the future of curriculum design in engineering education is hard to build and create but is sure to hold even more innovation.

2.3 Georgian Technical University (GTU)

Within project InnoCENS activities, based on the project experience, GTU 2 Faculties: Faculty of Power Engineering and Telecommunication (course - "Entrepreneurship and Problem Solving") and Faculty of Power Engineering and Telecommunication (course - "Principles of Entrepreneurship") provided the following innovation pedagogy methods (as pilot project) during the fall semester of 2018-2019 academic year:

- Guest Lecturer (the representatives from business sector were invited to GTU to deliver the lectures presenting their experiences and best practices and talk about their real stories);

- Co-Teaching (Business representatives conducted the lectures together with GTU teacher on appropriate topic which is included in the Syllabus “Entrepreneurship for Engineers”);
- Group work (Group work project is included in the course. Thus, students presented the final projects at the end of the semester. Projects were related to real business cases and had been idea generations as well).

Feedback from student and teachers experiences.

Positive:

- In general students feedback was positive. It was interesting for them to meet with the business representatives and consider the real stories;
- According to the students` feedback, the group work projects were very useful for their communication and group work skills development;
- Final Project that is included in the course, was implemented within working groups and presented by them at the end of the semester;
- Taking into account positive feedback, above mentioned innovative methods will be implemented again in the class during upcoming semesters.

Negative:

- Teachers have mentioned that it was not always easy to attract Businessmen for delivering lectures and be a co-teacher as well as to deliver lectures and share their experiences from both theoretical and practical viewpoints;
- According to teachers` feedback, GTU still needs to promote greater awareness on the types and methods of innovative and technology-enhanced T&L methodology and share best practices;
- Syllabus “Entrepreneurship for Engineers” is a Bachelor Compulsory Elective course (Optional), thereof students are willing to know more about the courses before the start of the semester.

Analysis of experiences:

Teachers feedback pointed out that GTU needs to carry out extensive activities to introduce innovative pedagogy methods to its academic staff.

Other actions:

To support the provision of innovation pedagogy activities at GTU, "Teaching Staff Development Center" (TSDC) was established within the structure of GTU “Innovations Center”.

Consequently, with the help of 11 internal Trainers (ToT), above mentioned TSDC offers the following Innovation Pedagogy programmes/courses to Academic Staff:

- Active Learning, with special focus on Technology Enhanced Collaborative Learning;
- Active learning & ICT-enhanced teaching: m-learning & gamification;
- Video as a Learning tool for teachers & students: Video Lecturing & promoting Interaction in the Classroom;
- Active Learning in the Flipped Classroom;
- Hybrid/Blended Teaching & Learning.

In February- March 2019, certified Teacher Training (TT) courses on innovative methods of teaching and learning were conducted by Teaching Staff Development Center of GTU Innovations Center. All participants successfully completed the course, have been certified – 1 ECTS;

Statistics related to TT participants: Total Number of Participants: 336. Female: 229 (68%); Male: 107 (32%); Average age: 45 years; Professors: 102 (30%); Associated Professors: 144 (44 %); Assistant Professors: 56 (16%); Invited Teachers: 14 (4%); others: 20 (6%).

Some examples (comments) from TT Course Evaluation Questionnaire:

- I will use gained knowledge for effective teaching process;
- We will try, if we will have relevant technical support;
- Interesting, important and timely;
- I liked everything, it was new for me and I'll use it in my practice;
- I will add innovative approaches to the learning process;
- I will combine it with traditional methods;
- I will try to use them step-by-step;
- Thank you for interesting training;
- I am highly satisfied by the training;

Experiences & Challenges:

- The number of teaching staff with new pedagogical approaches should be increased;
- Old courses should be redesigned accordingly;
- There is a need of promoting and farther dissemination of the types and methods of innovative pedagogy and sharing of the best practice.
- We can determine the participants' level of interest and involvement in the training process as equal. Herewith women were more dynamic in certain activities, especially in group work;
- The participants made a very clear statement that they would use the new skills and experience to plan and organize lecture/seminars accordingly;
- At the same time, the participants expressed a desire for the future training courses that would be focused on innovation pedagogy, wishing such trainings to be held more frequently and that more their colleagues to be involved in these useful activities.

How have we developed innovation competences assessment in GTU?

- With the support of GTU administration and coordinating by GTU Innovations Center, "Innovation Competence Assessment Tool" has being prepared and included as an important part of the GTU academic staff's performance assessment system;
- Before the preparation of our local "Innovation Competence Assessment Tool", we had conducted various presentations about FINCODA for the representatives of GTU Administration and Faculties. These presentations were based on project InnoCENS experience.
- For "Innovation Competence Assessment Tool" we had prepared a set of tasks that could be used in this Tool to assess an individual's capacity to innovate. Using this platform, it is possible for individuals to assess themselves and other persons by answering a series of questions.
- As a result, we will start piloting "Innovation Competence Assessment Tool" at the Faculty of Power Engineering and Telecommunication from fall semester of 2019-2020 academic year, before the end of project InnoCENS;
- Based on InnoCENS project experience, we plan to use FINCODA Barometer Questionnaire for locally developed assessment tool;
- FINCODA Questionnaire has been already translated into the Georgian language and is ready to be integrated in the Tool;
- Final version of this tool will be run in 2019-2020 academic year (spring semester);
- We are also working on creation of behavioral assessment training for business and university leaders to provide accurate assessments of colleagues, team members and students as well.

2.4 Batumi Shota Rustaveli State University (BSU_GE)

Within project InnoCENS activities, based on the project experience, Faculty of Technology of BSU, Civil Engineering Program (course - "Entrepreneurship for Engineers") provided the following innovation pedagogy methods (as pilot project) during the fall semester of 2018-2019 academic year:

- Guest Lecturer (the representatives from business sector were invited to BSU to deliver the lectures presenting their experiences and best practices and talk about their real stories);
- Co-Teaching (Business representatives conducted the lectures together with BSU teacher on appropriate topic which is included in the Syllabus "Entrepreneurship for Engineers");
- Group work (Group work project is included in the course. Thus, students presented the final projects at the end of the semester. Projects were related to real business cases and had been idea generations as well).

Feedback from student and teachers experiences.

Positive:

- Taking into account positive feedback, above mentioned innovative methods will be implemented again in the class during upcoming semesters.
- Students/listeners were eager to meet business representatives and hear real success stories.
- As the students/listeners feedback states group work was rather useful for them to obtain good skills of teamwork and communication;
- The new methods gave the students/listeners possibility of interaction;
- Final Project envisaged in the course, was implemented within working groups and presented by them at the end of the semester.

Negative:

- Difficulties to attract co-teachers from business sector due to their busy schedule;
- Lack of awareness and skill development among BSU teachers/lecturers in regard to innovative pedagogy and technology-enhanced T&L methodology. They still need to share best practice of the partner institutions colleagues and build relevant capacity in this regard;

Analysis of experiences:

Teachers feedback pointed out that BSU needs to carry out extensive activities to introduce innovative pedagogy methods to its academic staff.

Other actions:

Consequently, with the help of 6 internal Trainers (ToT), the following Innovation Pedagogy programs/courses to Academic Staff:

- Teachers feedback shows that BSU still needs improve innovative pedagogy methods awareness among its academic staff
- Active Learning, with special focus on technology enhanced collaborative Learning;

- Active learning & ICT-enhanced teaching: I-learning & gamification;
- Video as a learning tool for teachers & students: Video lecturing & promoting Interaction in the classroom;
- Active learning in the Flipped Classroom;
- Hybrid/blended teaching & learning.

Some statistics related to TT participants:

Entrepreneurship for Engineering – Course
 Students – 2
 Staff - 4
 External participants - 25

Some examples (comments) from TT Course Evaluation Questionnaire:

The impact of the course on training the trainees was evaluated according to the scales: Very Good, Good, Fair, Weak, Yet N/A, N/A.

In this InnoCens project Guest Lecturer method are used. As it is known Guest Lecturer (business representatives) are very busy. For this reason sometimes it is difficult to for them normal preparing and conducting studding process in the classroom.

It would be good idea if project develop the thematic – Access to Funding aseptically Crowd funding system. Because of Individuals out of Schengen zone are not able to get funding from this portal.

Experience & Challenges:

- Awareness of the new pedagogical approaches among teaching staff should be increased;
- The course should be modernized in order to meet new European standards;
- The dissemination types of the innovative pedagogy should be rather various in order to give maximum accessibility to the information for capacity building.
- The participants the eagerness to use the new skills and experience in their teaching activity;
- The participants also stated that it is desirable to attend further courses/trainings focused on innovation pedagogy.

How have we developed innovation competences assessment in BSU:

- With the support of BSU administration and coordinating by BSU Innovations Center, “Innovation Competence Assessment Tool” is being prepared and included as an important part of the BSU academic staff performance assessment system;
- As the preparatory work, we are introducing FINCODA for the representatives of BSU Administration and Faculties for raising awareness in this regard.
- For “Innovation Competence Assessment Tool” we had prepared a set of tasks that could be used in this Tool to assess an individual's capacity to innovate. Using this platform, it is possible for individuals to make self-assessment.

- As a result, we will start piloting “Innovation Competence Assessment Tool” at the Faculty of Technologies of BSU in the academic year 2019-2020, before the end of project InnoCENS;
- Based on InnoCENS project experience, we plan to use FINCODA Barometer Questionnaire for locally developed assessment tool;
- FINCODA Questionnaire has been already translated into the Georgian language and is ready to be integrated in the Tool; final version of this tool will run in 2019-2020 academic year (spring semester).

2.5 Belarusian State University (BSU_BY)

During implementation of innovation pedagogy in Belarusian State University Innopeda has been practiced in the list of next courses and programmes:

Modern numerical methods in continuum mechanics
Programming methods
Theoretical mechanics

During practicing the number of students participated in Innopeda pilots was 10, 22 and 41 respectively. The implementation was at autumn semester, 2017, in spring and autumn semester 2018 and spring semester 2019. Also, the Innopeda methods were practiced in courses «Commercialization of research and management of engineering projects» and «Entrepreneurship in engineering based on fablab platforms».

Mostly used Innopeda methods are practical training, co-teaching, team learning, project learning, information retrieval, recognition of prior studies and competence, studying in English. The most prevailing feedback from students was positive. Comments from the participating lecturers were in difficulties in building a team and sharing competences for each participant and necessity to improve collaboration with organizations of real sector of economics.

During winter school for students from China, Dalian, Laoning province in the framework of Joint Institute of Belarusian State University and Dalian University of Technology also were implemented methods of Innovation pedagogy for foreign students. Four groups were selected per 3 students (2 students and 1 team leader). Was used the project- oriented approach with project competition in the end. The feedback from students was positive. Some photos are below.



The Innovation competence assessment was carried out with the help of Fincoda elements. The translation of the questionnaire survey was translated to Russian for better student understanding from the first item “Think differently and adopt different perspectives” until last «Work in multidisciplinary environments».

Students highly appreciated both the way of providing the classes and the format of assessment.

2.6 Brest State Technical University (BrSTU)

Innovation pedagogy methods were implemented in next disciplines: “Innovation methods of intelligent systems design” (Kasyanik V), «Enterprenerships for engineers» (Chetyrbok N.). The number of students participated in Innopeda-based courses was 7 and 51 respectively. The implementation was at spring semester, 2017, spring 2018 and spring semester 2019. In additions Innopeda methods were practiced in course“fundamentals of pedagogy and psychology” (Tarasiuk O.)

In course “Innovation methods of intelligent systems design” was used project teamwork and co-teaching. Students was divided on 3 teams with projects: Autonomous Car, Robot Guide, Robot Bartender.

The Innovation competence assessment was carried out with the help of Fincoda elements. The Fincoda questionnaire survey and self-assessment was proposed for students at the end of course. Students presents results and make assessment with teacher by voting. Feedback from students was positive and they were surprised to discuss a new approach to teaching. Few words from students: “In our project we did all what we want☺, each have chance to say own opinion and crazy ideas. Valery support our meeting without additional regulations.”, “It’s hard to make assessment of your friends, but it’s good experience”

In course «Enterprenerships for engineers» was used working life orientation. Topics was oriented on Belarus reality and future jobs of students. Second method was multidisciplinary. Course contains materials from IT – disciplines and economics. Also feedback from students was very positive. Feedback from students: “Like this new method of assessment. Classical exam is more nervous.”, “I should think more on exam, not just remember.”, “I didn’t like when somebody experiment with me.”

It is obvious that the adaptation of new methods of training in the Republic of Belarus is not so simple. A large number of changes are required not only at the university level, but also in the entire education system. Training courses are allowed to be changed, but within strict limits. Teaching methods remain classic, but the main result of this project is the beginning of changes. Demonstrating to students and university management that the new methods also work and bring results.

2.7 Almaty University of Power Engineering and Telecommunications (AUPET)

Almaty University of Power Engineering and Telecommunications (AUPET) is a partner of CBHE ERASMUS+ project InnoCENS.

The transformation of the post-industrial society into a global information society, based not only on knowledge, but also on the competence of specialists. This trend has significantly increased relevance of the problem of innovative approaches to the organization of educational processes. Advantages of innovative approach are reasonable as compared to the traditional forms of teaching.

AUPET has started execution of transformation process and usage of key tools of Innovation pedagogy (InnoPeda).

Responsible person of AUPET on implementation of Innovation pedagogy methodology:

Madina Aliyarova (madin_al@mail.ru) – local project coordinator; Aliya Yelemanova (a_liya83@mail.ru); Gani Balbayev (gani_b@mail.ru) – teachers.

”Basics of Electronics” is a course in which InnoPeda has been practiced. There were 15 students in the group, 3 teachers are involved, one of them is external specialist, who is a representative of LLP “Saiman Corporation” Mr.Zikirbay Kuanysh – head of technical department.

Teachers used Project Hatchery Method – where students got assignments from existing company LLP “Saiman Corporation” – which is a leading domestic instrument-making enterprise with a full production cycle of electricity metering devices. Instrument-making plant “Saiman” is geographically located in Almaty. It is well known in the republic and the CIS countries as a leading manufacturer and supplier of its own products – with a wide range of electronic electricity meters, current

transformers, cabinets for electric power metering of indoor and outdoor installations, LED products, an automated system for commercial electricity metering and an automated control system for outdoor lighting. Students worked in two groups and have been using methods of peer review or counselling, and implementing some cross disciplinary peer counselling (some issues on economics aspects and IT elements);

Feedbacks from students and teachers` experiences.

Positive:

We received some positive feedback from students, but in the end of course, when they have started to use the integration of knowledge and skills from various fields of science and technology and resources.

We have made evaluation of students' expressions (feedbacks) on new methods of study: about 30% of students said that new experience they got was excellent and about 10% "were not very much excited", and 45% - gave different feedbacks -they did not see much difference; some asked to change the assignment; asked to let them do their task out of classes; to coordinate the student's external teaching task with his internal needs etc.

Negative:

- In the beginning they were confused by new method of teaching and some of them did not get involved fully into the teamwork.
- The project method was focused on the independent activities of students (by two groups), which students performed during a certain period of time (steps of project development). This approach was supposed to be organically combined with a group approach to learning, but involvement of some students in solving of a certain problem was not equal. Some students took the leading role in the group and others just allowed them to work for the group.

Analysis of experiences:

- The first thing which should be done: to define expectations of students after introduction to the new course and new method of teaching (get oral or written information), development of questions list (not too long, around 10 questions but with proposed answers and more precise); To avoid the confusion of classes where the teacher's role is not usual, not lecturing, but guiding, even moderating/
- To get feedbacks in the end of the course (as their feelings) regarding the educational conditions (or factors) that they had utmost effect on their mind, (or even character why not);

-The most difficult is to make students more active and to make them innovatively thinking, to be really involved into the process of teamwork,

- To teach students to take responsibilities for the group work;

- Second is probably even more difficult, how "to teach" the employers to design the assignment in more simple way and formulate a clear task.

- Plan continuation it needs to be clearly defined the learning outcomes of the project to be gained by the students by the end of project

- And one hard thing is to meet the expectations of employers (life-long learning).

To embed the innovation pedagogy technology into the existing system of quality assurance policy

To develop Innovation competences assessment, we used individual-interpersonal-networking model taking into account feasibility of the courses and study program. FINCODA Barometer has been used during the assessment development.

In the frame of course of "Basics of Electronics" we used Fincoda barometer. Innovation competences assessment tool has been implemented in AUPET including the following parameters such as creativity, critical thinking, teamwork, initiative, and networking. During the study students

understood innovation competences meaning and could show few examples from the course how the innovation competences were demonstrated.

Students showed few cases of how the elements of innovation competencies have been brought in their development assignments. Students understood that the innovation competencies are related to the success of their development project not only in frame of the course but mainly related to their future work.

In AUPET, in the educational program “Hardware Engineering” within the framework of the disciplines of “Basics of electronics”, the use of interactive forms of education in the teaching process is included: solving practical problems and analyzing situations, watching educational videos, solving case studies and conducting business games. Meetings and master classes of specialists, preparation and defense of projects on electronics problems are also provided.

The proportion of classes conducted in interactive forms, is not less than 50% of the classroom. Lecture-type classes for relevant groups of students cannot constitute more than 50% of the classroom. This contributed to the formation of an innovative type of thinking among students and young scientists, mastering the ways of creative self-regulation.

- research activities aimed at obtaining new knowledge about how something can be ("discovery"), and how something can be done ("invention");
- project activities aimed at developing a special, instrumental and technological knowledge of how, based on scientific knowledge, under given conditions, it is necessary to act in order to achieve what can or should be ("innovative project");
- educational activities aimed at the professional development of subjects of a certain practice, at the formation of each personal knowledge (experience) of what and how they should do in order for an innovative project to be embodied in practice ("implementation").
- To assess the innovation competence and ability of students to innovate, the Fincoda barometer method was used. According to the results of training, students filled out a questionnaire.

Comments from students	We received mostly positive feedbacks from students, but in the end of course. In the beginning they were confused of new method of teaching and some of them did not get involved fully into the teamwork. The project method was focused on the independent activities of students - by two groups, which students performed during a certain period of time (steps of project development). This approach was supposed to be organically combined with a group approach to learning, but involvement of some students in solving of a certain problem was not equal. Some students took the leading role in the group and others just allowed them to work for the group. They looked not very much interested in this type of learning at first, on the other hand, the started to use the integration of knowledge and skills from various fields of science and technology and resources/ When we got feedbacks on new methods of study - about 30% of students said that new experience they got was excellent and about 10% "were not very much excited", and 45% - gave different feedbacks -they did not see much difference; some asked to change the assignment; asked to let them do their task out of classes; to coordinate the student's external teaching task with his internal needs etc.
Comments from colleagues	They need more time to update and develop our plans for assessment. General comments from lecturers are related to more time to practice and implement InnoPeda methods step by step in order to

	have well planned courses. Applying to most of the courses depending on study program taking into account the specifics of subjects
Constructive comments have been obtained from colleagues	In accordance with the requirements of the educational program, it is necessary to develop the concept of an interdisciplinary formation of an innovative position
Comments from enterprises	The training of specialists in the direction of Hardware Engineering to innovation in the practice of education should become a requirement of the standard of professional education; The emergence of problems of introducing innovations into the educational process is associated with an ambiguous attitude of the pedagogical community to various pedagogical concepts and approaches, problems of “interaction of innovations with administrative bodies, state systems of monitoring, diagnostics and evaluation of educational results”

2.8 Taraz State University (TarSU)

Methods and technologies of innovative pedagogy at the Taraz State University are realized through the creation of a special “Technological Passage” - the innovative infrastructure of the university to improve the professional level of teachers. TarSU believes that innovative education at the university begins with the presence of innovatively thinking teachers, who are ready to realize pedagogical innovations.

The development of innovative pedagogy is included as a separate item in the Development Program of University between 2019 and 2023. Issues of innovative pedagogy are often considered at the University Scientific Council.

In relation to the pedagogical process, innovative pedagogy at the university involves the introduction of innovative methods in the goals, content, methods, forms of training, organization of joint activities of the teacher and students. This leads to transformations, changes in the way of activity, the style of thinking of all participants in the educational process. The University aims to ensure that students become more active participants in the educational process, based on partnership with the teacher, establishing constant feedback.

Carrying out an assessment of innovative competencies of both teachers and students, as well as a generalized assessment of the impact of pedagogical innovations on improving the level of students' training, launched as part of the InnoCENS project.

Today, TarSU introduces innovative pedagogy as part of a series of training seminars that include best practices and active promotion of Barometer FINCODA. This allows to objectively track the development of each student individually, academic group, stream, etc. The barometer has become an indispensable tool for studying the teaching status of any course, as well as studying the work of a single teacher.

For implementation of the innovation pedagogy at TarSU members of the project passed training in the 2017-2018 as follow:

- Members of the InnoCENS project team Faizova E.R. and Alibekova V.N. participated at the study visit to the Innovation Systems of Sweden from May 31 to June 10, 2017.

- As part of the project, a workshop on innovation pedagogy was held at Turku University of Applied Sciences (Finland) from September 11 to 22, 2017. The seminar was attended by members of the project team Faizova ER, Satkymbaeva AB, Zhakiyaeva A.E.
- From November 27 to December 1, 2017, the next workshop “Assessment of Innovative Competencies” was held to continue the Innovative Pedagogy implementation. The seminar was held at the Belarusian State University in Minsk, where members of the InnoCENS team E. Faizova, N. Chernyavskaya and Abduzhalilova M.E. participated. This workshop made it possible for project participants to apply a modern view of education, where students, teachers, and employees will be evaluated through the development of innovative skills.
- In April 2018, an international workshop on innovative pedagogy and entrepreneurship was held at the TarSU as part of the project. The workshop was attended by 30 representatives of universities from Spain, Sweden, Finland, Armenia, Georgia, Belarus. This was the last of the planned workshops and the first results of the project were summarized at it. The members of the project team first tested European methods in January 2018 at a two-day training for university teachers on the topic “Innovative pedagogy: training entrepreneurs”.
- The implementation of InnoPEDA methods in the student learning process for the development of students' innovative competencies - based on practice-based training (project learning, co-teaching, project learning, practical training).

Report of INNOCENS project activity on implementation of innovation pedagogy

Name of the courses/programmes in which InnoPeda has been practised	Innovation system Entrepreneurship for engineers Number of students in Innopeda pilots – 34 Number of University staff in Innopeda pilots – 6 Number of external stakeholders (private, public, NGO) in Innopeda pilots - 8
Implementation period (semester)	Summer semester 2017/18; Winter and summer semester 2018/19
Which Innopeda methods have been practised?	Team learning, project learning, co-teaching, practical training
Feedbacks from students (positive and negative)	Feedbacks: 1. We became more creative and initiative 2. We have skills and working-life orientation competences 3. We can work in project learning environments in groups 4. We get skills in co-teaching Proposals for future 5. To enhance teaching and learning methods towards critical thinking 6. We study in new learning environments
Comments from the participating lecturers (positive/negative experiences, difficulties, improvement/changes needed or planned, etc)	Common comments: 1. Teachers renewing the roles 2. Teachers deepening multidisciplinary approach 3. Teachers changes from traditional assessment to development-oriented assessment
Do you plan to continue practising Innopeda methods in the future?	We plan involving academic staff in innovation pedagogy

How have you developed innovation competences assessment in your University (e.g. utilized FINCODA Barometer)? What are your key experiences, remarks and further development plans in this theme?	We have tested students by Fincoda barometer, as most of our students don't have known English, special assessing module was developed based on the INDIGO software application. The evaluation program has been used so far at the local level. To do this, the FINCODA Barometer questionnaire was used to evaluate innovative competencies. In this survey were participated students of master students from engineering programs. After innovative pedagogy, our students acquired deeper skills for working in groups and being creative. In January, by the project activities has planned internal workshop "Innovative competences: from individual to program" for students and teachers of TarSU, where all participants will be tested twice at the beginning and end of workshop.
Have you used FINCODA Rater Training Toolkit to train your staff/students? If yes, please give us user experiences	We used FINCODA Barometer to train academic staff at the training. But these were only the first steps. We plan to teach all the university staff.

For curriculum development based on innovation competences we defined Chemical engineering program curriculum.
Innovation Competence Matrix for Chemical Engineering (I-Matrix)

5. (extract)

	History and philosophy of science	Foreign languages	Introduction to polymer sciences	Polymer reaction engineering	Applied mathematics	Industrial statistics	...	Innovation systems	Applied chemistry product	MM aster thesis
Ability to think creatively, differently and outside of the box	x			x				x	x	x
Ability to critically evaluate existing solutions, identify needs for improvement and seek new solutions				x				x	x	x
Ability to integrate knowledge and technologies from multiple technical disciplines or business branches				x		x		x	x	x

Ability to take initiatives on interested tasks with devotion and entrepreneurial mindset								X	X	X
Ability to develop teamwork and build collaboration networks	X	X	X	X	X	X		X	X	X
Basic knowledge on innovation and entrepreneurship, skills to transform new ideas and scientific results into viable business								X	X	X
Environmental responsibility, reduce ecological impact of a decision (damage caused to other species, to nature or future generations).			X	X	X	X			X	
Use learning in a strategic, autonomous and flexible way, throughout life	X	X	X	X	X	X		X	X	
Ability to use the modern techniques, skills and updated tools necessary for the practice of the profession			X	X	X	X		X	X	X
Design and evaluate a			X	X	X	X		X	X	X

process effectively until it is finalized in a project										
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The FINCODA Barometer is used to evaluate innovative competencies. For the convenience of users' questions have been translated into Russian and Kazakh. At the same time, the original structure and sequence are preserved. In order to automate the processing (due to the inability to use the questionnaire in the online mode for the time being) a special evaluation module of the INDIGO software application was used (to be freely available).

In this survey were participated students of master degree students of the course "Innovation system".

Results of a survey of students conducted using the Barometer FinCoda questionnaire (translated into Russian) and using INDIGO software (maximum score of self-esteem is 5, min -0)

Number of students surveyed - 25

Printing from the software module

The overall result for all assessment competencies		Percentage of responses by group				
		Creativity	Critical thinking	Team working	Initiative	Networking
Score	Percentage					
0-2	0	0	0	0	0	0
3	36,84	5,26	0	0	0	0
4	57,89	57,89	89,47	27,78	89,47	73,68
5	5,26	36,84	10,53	72,22	10,53	26,32

33 Master students evaluated the acquired competence as the results of studying "Entrepreneurship for Engineers" course, in the period from January 12 to 15 the 2019. There was Master students from 11 specialties: 6M072800 (2) - Technology of processing industries, 6M072700 (2) - Technology of food products, 6M060600 (2) - Chemistry, 6M070200 (2) - Automation and control, 6M060200 (2) - Computer science, 6M073300 (2) - Technology and design of textile materials, 6M070300 (2) - Information systems, 6M075000 - Metrology, 6M072600 (2) - Technology and design of light industry products, 6M072000 (2) - Chemical technology of inorganic substances, 6M073200 (2) - Standardization and Certification (by industry).

The analysis showed that the students, who studied both of 2 courses "Innovation Systems" and "Entrepreneurship for Engineers", clearly understand the essence of competencies and able to critically evaluate themselves and team members. The overwhelming majority rated their level as "excellent" for such important parameters as "teamwork" and "initiative". At the same time, the students showed that they still have difficulties in the ability to promote their ideas - they rated Networking in the majority as "good" - 60.6%.

The results of the student survey conducted using the Fincoda barometer questionnaire (translated into Russian) and based on the use of INDIGO (maximum self-assessment score - 5, min - 0)

Number of surveyed students – 33

Overall result for all assessed competencies		Percentage of answers by groups				
		Creativity	Critical thinking	Teamwork	Initiative	Networking
Score	Percent					
0-2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	34,5	42,4	33,3	12,1	24,2	60,6
5	65,5	57,6	66,7	87,9	75,8	39,4

The survey for teachers was conducted both before and after the training to compare progress.

The latest survey showed that the involvement of teachers in workshops and training, active participation in the design of educational new generation had a positive impact on the development of innovative competencies. General scores for each criterion are higher than 4 points: the average score for the “creativity” indicator was 4.04 out of 5 maximum, for the “initiative” parameter - 4.17, “teamwork” - 4.61, “critical thinking” - 4.25 and networking - 4.19. The total number of responses to the Barometer questionnaire during self-assessment and evaluation by students - team members showed a greater shift in the rating group "5" and a significant decrease in the rating group "3".

Points / Evaluation group	Distribution of answers, % «previous survey» / «last survey»
0-2	4 / 0,6
3	25 / 12,8
4	46 / 34,5
5	25 / 52

The analysis of answers in the context of questions showed a low level in such skills as ingenuity, searching for new methods, finding new ways to implement ideas, accepting risks, etc.

At the same time, all teachers demonstrate the ability to correctly determine innovative competencies and an understanding of what development depends on.

Feedback:

Positive:

- Fincoda barometer highly appreciate to keep self-assessment

Negative:

- Limited access due to ignorance of the English language
- Low level of self-assessment reliability

Lessons to learn experiences:

- Preliminary preparation for testing
- The survey (testing of teaching staff) should be conducted twice – before and after studying.
- The survey (testing of Master Students) should be conducted once.

Among active methods, the project method has proved particularly effective. After completion, the project is evaluated by a group of teachers according to several criteria:

- Creativity (creating a new project through a non-standard solution, the presence of social innovations in ongoing projects),
- Effectiveness (achieving practical results in accordance with the resources expended for the development of the project),
- Practical application and innovation (the presence in the initiative of new previously unused elements or non-standard solutions).

Despite that the training was focused on teachers of the technical departments, the teachers of the Humanities and Law Faculties, also noted a positive impact. The new content of the classes contributes to the training of specialists who are able to act effectively in rich information environment, to navigate freely in the innovations of normative acts, to establish contacts, to properly build dialogs, and to develop consulting work skills.

The positive results of the application of innovative technologies are already visible, which consists not only in increasing teachers' self-esteem of their innovative competencies but also in expanding the use of interactive methods and approaches to teaching and introducing modern forms of teaching.

Innovation pedagogy and innovation competence assessment for master courses and Entrepreneurship for engineers

Innovation system	
Which methods have been used?	Team learning Project learning
Feedback from student and teacher's experiences?	Positive: 1. We became more creative and initiative 2. We have skills and working-life orientation competences Negative: Not available
Proposals for future	1.To enhance teaching and learning methods towards critical thinking 2.We study in new learning environments
Plan:	We plan involving academic staff in innovation pedagogy
Entrepreneurship for engineers	
Which methods have been used?	Co-teaching Teamwork Project learning
Feedback from student and teachers' experiences?	Positive: 1. We became more innovative 2. We can work in project learning environments in groups 3. We get skills in co-teaching 4.We get skills of team building Negative: Not available

Proposals for future:	1.To enhance teaching and learning methods towards case study 2.To enhance teaching and learning methods towards problem solving
Plan	We plan to introduce mentorship

3. Summary of results and remarks

To make the innovation pedagogy methods and innovation competence assessment implementation possible, it needed a lot of work from partners. Innovation pedagogy is a learning approach, not just a method. First partners had to internalize the nature of the innovation pedagogy and secondly to adapt it concretely to practice and to involve the other university staff for cooperation, it was challenging.

Main statement is that targets of innovation pedagogy and innovation competence assessment implementation in InnoCens are met. It has done in different levels and different ways in every university. There is defined lots of lessons to learn in each university. And there is a will to continue the implementation in each university.