



S.I. Osipova



E.A. Rudnizkiy

UDC 378.1

Team-building for Implementing Innovative Basic Education Program within CDIO Ideology

Siberian Federal University
S.I. Osipova, E.A. Rudnizkiy

It has been revealed that to improve the quality of engineering education it is required to build a creative team of teachers for developing innovative framework which guarantees adaptation and implementation of CDIO ideas. The article presents the experience in team-building including selection criteria. The task to create the unified team of teachers, students, employers and University authorities is set.

Key words: innovative process, CDIO ideas, criteria for selecting team members, team-building.

CDIO ideology implementation in engineering training is an innovative complex process which implies adaption, development, assimilation, application of CDIO concept, as well as dissemination of the innovations aiming at improving the quality of engineering education [1, 2, 3].

Conceptual principals of the engineering education in CDIO ideology are the following:

1. Basic Education Program (BEP) addresses learning outcomes (LOs) that are developed in collaboration with employers to meet the needs of particular industry, and defined as graduate's competences with taking into account international and domestic educational experience, as well as CDIO concept, and manifested through problem solving activities.

2. Phased implementation of skill development as a technological and methodological process of engineering skills enhancement, as well as personal, communicative and professional skills development based on active learning, integrated educational content, and project activity.

3. Practice-oriented educational process that is ensured by increasing number of internships and training in real industrial environment.

4. Evaluation and monitoring of

learning outcomes achievement by measuring competence constituents.

5. LOs in the form of competences are specific and measurable.

This process implies principle changes in BEP content and educational technologies. It is focused on graduate's competences as the form of LOs, and implemented according to the following steps:

- adapting CDIO concepts;
- developing innovative BEP;
- implementing BEP in educational process;
- spreading the proposed concept and implementing it in social and educational environment.

The innovative process described above is logical and relevant to CDIO ideology: Conceive – Design – Implement – Operate.

While implementing CDIO ideology at School of Non-Ferrous Metals and Material Science, Siberian Federal University, it was found out that this process, like all educational innovations, caused some resistance of teachers, since they have to adjust themselves to new educational environment. This pushback was manifested through various forms: persistent disregard of innovation; demonstrative adherence to the traditional and established ways; criticism of innovation without understanding its essence; obvious

unwillingness to change their activity. The intensity of such resistance depends on a number of factors with the main one being teacher's matching the impending changes with his/her personal benefits and self-determination in a new educational environment. It was necessary to take away the teachers' fear and anxiety of unknown, which set a number of objectives for the initiators of CDIO innovation. Firstly, the teaching staff were to be widely informed about the key provisions of worldwide CDIO initiative, goals, objectives, and learning outcomes of the innovative educational process, which could be achieved by ensuring access to information about CDIO, as well as launching a website to convey information about a project "Local system of continuous multi-level engineering education, specialty "Metallurgy", in CDIO ideology. Secondly, it was necessary to develop a training and consulting system in the frame of staff professional development for those who might be willing to be involved in innovative activity.

Professional development of teachers for innovative BEP is not to teach something new, but to change the traditional knowledge approach to training process to the activity approach which is less acquired. In fact, it is required to train teachers to teach other things (priority to activity) in a completely different manner.

However, BEP implementation in CDIO ideology made it necessary to build a team of creative like-minded persons united by the aim to develop and implement an innovative educational process. Engineering education quality improvement can be achieved through the development of effective teamwork. It is a new complicated task that needs much time to be solved. Team building for innovative BEP implementation in CDIO ideology is a big challenge for engineering education due to the following factors. Firstly, teacher team building has not been well studied yet both in theoretical and practical aspects. Secondly, while implementing a

competence approach with competences being viewed as learning outcomes, it is necessary to develop BEP with regards to professional competences being developed during a whole course, thus ensuring their interconnection and interdependence, as well as their evaluation. Being a forecasted aim of engineering training, the learning outcomes determine the content of engineering education and the number of credits for each discipline. All the mentioned above allows us to say that the learning outcomes are the base of the learning content for a whole education period, which differs from the traditional approach with the curriculum cut into separate disciplines and teaching staff of non-graduating department being unaware of final results.

The integration process is implemented through a teaching staff that ensures the learning content to be connected with learning outcomes, which makes stronger interdisciplinary connections.

Such team of teachers is a collective unit with different forms of group behavior, interconnection in activity and intensive relations between group members [4]. Regarding team building as a targeted process, one should answer the following questions:

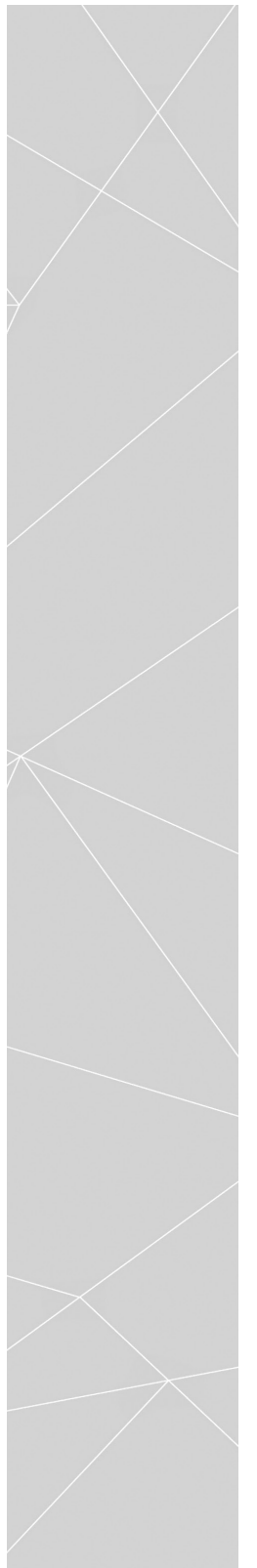
- How can the teaching staff be involved in innovative activity?
- How can teachers be supported in difficult situations forcing them to change themselves?
- What requirements should the group members meet?
- How many members should be the group comprise of?

The answers to the questions are given further.

The team building process identifies the following stages:

- focus on CDIO ideology values;
- adherence to CDIO ideology values through collaborative design if BEP;
- consolidation as a team while implementing BEP.

The key factor of the first stage is to



promote faculty awareness on advantages of innovative concepts. This stage resulted in teachers' making decision on whether to participate in the innovation or not. The decision was motivated by numerous factors including those that are significant for being involved in innovation, such as psychological disturbance, interest in positive experience of other universities.

The second stage involved building a team of teaching members who were willing to implement CDIO ideology in the educational process. During 2013-2014 academic year, the team with participation of the administration office developed an innovative BEP in accordance with the concepts mentioned above. On the one hand, it was a cooperative activity contributing to team building, on the other hand, different members of the team worked individually or in small groups fulfilling different functions (distribution of roles):

- teaching staff of graduating departments, administration office of the School, and industry stakeholders/employers were jointly working to agree the significance of each BEP competence as a key learning outcome;
- faculty members who were in charge of theoretical analysis examined the data submitted by industry stakeholders/employers to define whether they were in compliance with FSES and CDIO standards. Based on the analysis results, the graduate's competence model was developed;
- being the result of a joint effort (stakeholders/employers and university), the competence model was justified, discussed and revised at various problem-based learning seminars, which made it possible not only to analyze the work done, but also to comprehend the common goal of the team and the ways to achieve it;
- competence model design in accordance with BEP sections, the need to agree them with the subject

areas stipulated building the team comprised of teaching staff from different departments;

- the new-build team was consolidated alongside BEP implementation, and in order to ensure the final goal achievement, it involved teaching process monitoring, joint action in identification and analysis of possible challenges with a view to making recommendations.

The main criteria which we used in team member selecting are as follows [5]:

1. ability to adapt to change;
2. high degree of professionalism;
3. adaption of and adherence to CDIO values, clear identification and division of objectives and responsibilities for innovative BEP implementation;
4. communicative skills.

The number of team members was defined on the basis of reasonable sufficiency enabling, when necessary, the substitution or replacement of a team member.

The ability to adapt to change allows a faculty member to implement innovative approaches into teaching process, i.e. one of the components of CDIO ideology team work. It manifests through continuous development and renovation of professional activity in compliance with the project specifications agreed by all team members. Team building is facilitated by specially developed information support to handle and promote engagement, collaboration and dialogue among the team members.

High degree of teaching staff professionalism enables to implement more innovations in the teaching process due to more creative responses to emerging challenges.

The communicative skills that govern the interaction between teaching staff provide them with every opportunity to discover their creative and professional potential which, in its turn, contributes to achieving the common goal of the team.

Understanding the importance of adapting the goal of innovative changes by

all teaching staff, we decided to organize the weekly problem-based learning seminar series. The experience showed that such form of problem discussion stimulates self-reflection of team members, contributes to finding a common ground for their views, beliefs, and values forming a specific subculture of the team. Today, School of Non-Ferrous Metals and Material Science (SibFU) has initiated the implementation of innovative education program "Metallurgy". The experimental student group comprises 25 persons. In 2014-2015 academic year, the program involves 27 faculty members who have adapted CDIO standards. The number of faculty members having candidate (PhD) and doctor degrees is 75 %. The team consists of rather young specialists (average age is 44) who were engaged in developing new education program within one year. The team is still being developed. At this stage, one of the tasks to be addressed is to instill in each team member the responsibility not only for the results of their activity, but also for implementation of the entire project. This can be achieved by introducing monitoring activities developed and agreed by all project participants.

As students are the main constituents of the teaching process, it is reasonable to provide them with the conditions which will help them adhere to team work ideas and consolidate the image "We". When

students perceive themselves as parts of this image, they can work as one team regarding CDIO values; demonstrate a genuine will to implement CDIO standards collaborating with each other or faculty members. Student team is consolidated through joint activities in preparation for meetings with teaching staff and industry stakeholders/employers, development of "visit cards", participation in collaborative work-shops and training seminars.

We strongly believe that the creation of an integrated team involving teaching staff, students, University administration, and industry stakeholders/employers is a logical result of team building as a part of CDIO ideology implementation in the innovative BEP. Practical activities aimed at finding a common ground for innovative teaching and its implementation by the stakeholders continues: the role of employers both in traditional classroom learning and internships including advanced training has been specified; the schedule and content of intermutual professional development programs for teaching staff (in enterprises) and employers (at university) have been adjusted and improved; the issues that are faced by real industry have been identified, and the ways to address them in bachelor training have been proposed; a number of meetings involving students and the leaders of industry have been held.

Human Resource Management for Developing Basic Education Program in CDIO Ideology

Siberian Federal University
N.V. Gafurova, O.A. Osipenko

The article highlights the issue of human resource training for CDIO ideology implementation. The issue is addressed by reviewing human resource management that involves all the stakeholders of the program: teaching staff, university managers, university applicants, students and business and industry representatives.

Key words: human resource of Basic Educational Program (BEP), University applicants, students, teachers, project managers.

Defining human resources (HR) groups is an essential element of preparatory stage of any new project implementation. Therefore, at Siberian Federal University (SFU), while developing education programs that meet CDIO initiatives, the following HR groups have been involved: teaching staff, university managers of different levels, university applicants, students and business and industry representatives that are responsible for further staff training and improvement.

At the beginning of the work we studied basic challenges each of the group is faced with. For example, employers traditionally spend some resources on retraining or further training of young specialists. Therefore, those teachers who keep in touch with the graduates, professional community and employers are often dissatisfied with their professional results. University applicants when choosing an engineering course are typically unaware of their future professional activities and areas. University managers try to find points of growth and positive changes in educational system, on the one hand, and to optimize its resources, on the other hand. Thus, we did a good work by uniting representatives of all the groups into one project team to achieve new results in engineering education. This work is still being carried out to guarantee educational process to

be within CDIO ideology [1, pp. 2-10]. The characteristic features of the proposed approach is highly used and developed pattern that allows us to implement separate elements of the educational process in a technological way, and being flexible and having a wide scope, the CDIO ideology can be effectively adopted to particular educational conditions.

Four specialties of SFU became an experimental base. They are: Thermotechnics and Heat Power Engineering, Metallurgy, Software Engineering and Informatics and Computing Technology.

The first stage was to determine (identify) the University staff that would be interested in further professional development and be ready to significant changes in their professional activity. This means that teachers and managers should be motivated by two factors: personal investments of time and efforts and dissatisfaction with their work results and student learning outcomes in general. It is impossible to solve this problem at a big University (there is a wide scope of engineering specialties in SFU) just by "giving an announcement" or holding a competition. The staff's motivation should be supported by real demand for particular engineers and by productive interaction between a University and employers who tend to be involved in such educational

REFERENCES

1. Worldwide CDIO Initiatives: international seminar on innovation and reform of engineering education: materials for participants / translated by S.V. Shikalova; ed. By N.M. Zolotaryova and A.Y. Umarov. – M., 2011. – 60 p.
2. CDIO Initiatives. Standards: guidance / translated from English into Russian by Chuchalin A.I., Petrovskaya T.S., Kulyukina E.S. – Tomsk, 2011. – 17 p.
3. Worldwide CDIO Initiative. Planned learning outcomes (CDIO Syllabus) / translated from English and edited by Chuchalin A.I., Petrovskaya T.S., Kulyukina E.S. Tomsk: TPU. – 22 p.
4. Brushlinskiy A.V. The Problem of Subject in Psychology [The Problem of Subject in Psychology] [Electronic resource] // *Psikhologicheskiy zhurnal* [Psychology journal]–1991. – № 6. – P. 6-10. – Electronic version – URL: <http://test-metod.ru/index.php/stati/136-problema-subekta-v-psikhologicheskoy-nauke-a-v-brushlinskij>, free. – Title from the screen (reference date: 12.12.2014).
5. Osipova S.I. Synergetic Effect of the Command of Activity / S. I. Osipova, V.S. Okuneva // *Modern problems of science and education*. – 2012. – № 3. – P. 195-199.



N.V. Gafurova



O.A. Osipenko