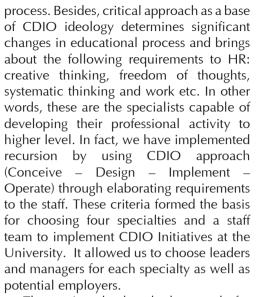**REFERENCES**

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Human Resource Management for Developing Basic Education Program in CDIO Ideology

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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

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process. Besides, critical approach as a base of CDIO ideology determines significant changes in educational process and brings about the following requirements to HR: creative thinking, freedom of thoughts, systematic thinking and work etc. In other words, these are the specialists capable of developing their professional activity to higher level. In fact, we have implemented recursion by using CDIO approach (Conceive – Design – Implement – Operate) through elaborating requirements to the staff. These criteria formed the basis for choosing four specialties and a staff team to implement CDIO Initiatives at the University. It allowed us to choose leaders and managers for each specialty as well as potential employers.

The project leaders had to seek for motivated teachers who could be interested in project design and development. Thus, each project organized a team that was familiar with CDIO Initiatives. The University administration did not control the selection of candidate for the project team. Though being selected in accordance with CDIO ideology, not all the leaders managed to apply this approach at the starting point of their activity. Nevertheless, they had to study CDIO ideology in detail in the course of project development to explain the main objectives to the teams. As a result, the process of project design concentrated necessary staff for further project implementation.

In accordance with CDIO, there are two staff training areas: pedagogical and engineering. In addition to that the staff took English courses to be more integrated in the international CDIO community and to apply the English language in the teaching process. Staff development is a continuous process that should be carried out throughout project duration, i.e. for not less than 5 years. Pedagogical was the first area to be suggested for the staff. The main objective was to implement the first standard that is to take CDIO ideology as a base of professional activity. The staff development was founded on the

following principles: various forms of training, practice oriented tasks, public report on learning outcomes and expert assessment of learning outcomes. Our teachers took part in different courses and seminars in Russian and foreign universities (Tomsk, Moscow, Ekaterinburg, Chalmers, Barcelona etc.), taught their courses and public expert events (seminars, CDIO days) for better understanding of CDIO ideology and its implementation in teachers' professional activities. The University administration insisted that all the staff members of the project should study in detail the CDIO Initiatives and report on their professional achievements in terms of CDIO ideology, otherwise, the teachers have no rights to deliver courses in the frame of the project, which is recorded in the University regulations.

A number of public CDIO events were regarded as further professional development since they gave the opportunities for the teachers to report on their results, evaluate others, to identify new challenges and clear up some notions and ideas. It was a productive way to communicate with the University administration, to make a collective reflection that results in personal one. Such seminars and "CDIO days" always included reports on each education program, on particular CDIO issues, as well as "problem team" work focused on particular challenges to find different ways of solution. Experts' work was the other essential element of the seminars. They were to assess the reported results and to make the "problem team" achieve their goals. In addition, every seminar participant filled in questionnaires that reflected their readiness to work in CDIO ideology, which allowed the managers to capture a complete picture of the project development stage. Thus, these events fulfilled a monitoring function, as well.

The teachers should develop a curriculum in a discipline, implementation methods and teaching materials as a result of their annual work. While evaluating the teachers' work, we discovered the

following: different levels of the ideology acceptance among the teachers, poor success in applying examples presented in the courses for their practical course development, low (elementary) reference level of pedagogic competences that are mostly based on practical work rather than theoretical knowledge of the teachers. It is explained by the fact that engineering disciplines are taught mostly by engineers and technical university graduates who are unaware of fundamentals of pedagogy and psychology of higher school, didactics, etc. Thus, the first year of staff training resulted in dividing the trained staff into two groups. The first group included those (mostly young ones) who are interested in the CDIO ideology, value and quite understand it, though having problems and making mistakes in its practical application. The second group of teachers did a lot formally but was not really interested in any changes having no inner motivation for that and being quite satisfied with the results of their professional activity. Furthermore, the administrative staff experiences deficiency of specialists qualified enough to do such kind of staff development, the situation being the same of other Russian universities.
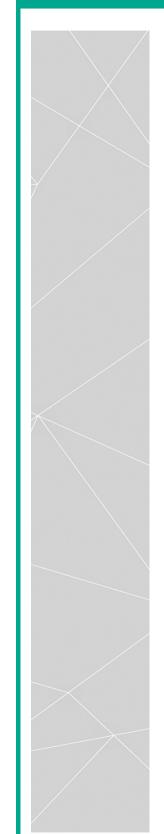
Collaboration with employers gave us the ideas of the courses that have never been offered for traditional staff development but are necessary to prepare teachers for innovative education. They are the following:
- "Engineering project" as a discipline.
- Kaizen (continuous improvement).
- Advanced education (to teach in advance).
- Network education.
- Backbone and value-setting disciplines of engineering areas.
- Team competency.
- Productive management stimulation of individual work.
- Education fundamentalizing.
- Competence measurement.
- Assessment of teachers.
- Teaching process evaluation by students.

- Curriculum assessment by professional communities.
- Employers, their role in network teaching process.
- Methodology of modern engineering science.
- Development of new engineering idea and technological breakthrough.
- Effective business unit.

A special challenge we dealt with while implementing the first CDIO standard was to elaborate and approve a common concept on new learning outcomes. Most part of young participants and only few representatives of managers and teachers (those who concern with innovative activities) are ready to abandon traditional learning outcomes and professional activity. Most teachers feel stress and resist to development of new learning outcomes for particular discipline though formally accepting the idea. Some teachers substitute projects with lab tasks developed long ago and are strongly against employers delivering special courses. In these cases, it is reasonable to give the choice for the staff to "leave" the project and return to traditional teaching approach. Those who keep to CDIO ideology should be motivated both by material stimuli and higher status that allows them to participate in education development problem solving including implementation of CDIO education practice with its essential reflexion.

Other difficulty was collaboration with employers. University and employer's representative speak "different languages", which is explained by different production cultures. Thus, before negotiating new cooperative learning outcomes, it is necessary to construct a "field of mutual understanding". Consequently, it is impossible to start working in CDIO ideology with any employer. The results can be achieved only with the employers having close informal educational and scientific relations with the University. Besides, an enterprise should perceive the new collaborative project as a strategic line

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of staff development.

All the mentioned resulted in the following requirements to the employers to participate in CDIO ideology implementation. They are: regional employer; the product is demanded in the market; HR policy have been developed in collaboration with the University for many years and is expressed through informal contracts performance, active employment of the graduates, effective collaboration in internship, scientific activity and public relations. Not being sure of a long-term CDIO contract and not being able to ensure official contract relation at the starting stage of the project, we asked the employers for a written agreement on their participation in CDIO education project development with an indication of people responsible for implementation.

The next stage of collaboration with the employers was an iterative process to elaborate and range the learning outcomes. Different employers were ready to different levels of the work. The task was understandable and easily achieved for those who have their own professional standards or were working on them. But they were few. As for the others, we summarized the learning outcomes according to FSES and CDIO for them and asked them to add, exclude or specify the points to their mind. At the same time we compared the FSES and CDIO requirements with regard to four specialties and made sure that they do not contradict each other, though having different values for different points. As a result of iterations and mutual coordination, which was time consuming, the employers managed to write a list of requirements to the learning outcomes. Then, the employers were offered to range the elaborated requirements or to divide them into 3 groups according to their value. The results were added by interviews with graduates, staff of special departments and other stakeholders.

While elaborating CDIO syllabus and basic education program most teachers have had to review for the first time didactic units of the disciplines in terms of their importance and continuity. They had to overcome traditional approach to the scope of disciplines, their place in a curriculum and, what was the most difficult, to decide whether some parts of course or the whole course are necessary at all [2, pp. 1-3]. Thus, as we recognize that the first stage of the project was carried out by teachers, the objective of revolutionary changes in curriculum was not achieved. However, we put an objective for a teacher not to transfer knowledge but to make conditions for student's professional growth and to monitor it.

On elaborating the new curriculum and the education program we had to break down stereotypes that had been created for decades, to change the members of teams that are responsible for developing such documents, to make them coherent, logically and didactically justified for CDIO ideology. Curriculum should be constantly developed in the frame of the ideology as the staff develops their competences in this field.

For the most part of the teaching staff it was very difficult to elaborate methodical support of a discipline, having no experience in methodology. Being unaware of active training techniques, they didn't take into account some important points. So, in spite of the learning delivery, the key quality indicator will be implementation of study process in the frame of a discipline. Besides, to address managerial issues, we organized methodical support for a project work including interdisciplinary [3, pp. 155-156]. With the help of employers the topics, types and leaders of the projects were chosen. Thus, preparing methodical support, we also gave the possibilities of personal realization for every teacher in the frame of CDIO ideology. But the main scope of such work will be implemented at the next stage of the project.

A special task was to define approaches and requirements to University applicants and to find the ways to make the new education programs attractive for the students. [4, pp.48-50]. This aspect was not paid attention to until the Enrollment began. Consequently, this process was organized spontaneously: questionnaires, school diploma assessment etc. It is useless to resolve this task without taking into consideration the potential of the stakeholders. But this potential can be expressed only through the study process itself. The administration suggested the ways and had to motivate the staff to use them.

It took us one year to prepare the HR for CDIO ideology introduction into study process. As a result, the study process has been launched and the next stage of CDIO introduction has been started.

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