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COMPARISON OF COMPATIBILITY OF STUDY PROGRAMS WASTE MANAGEMENT (J.E. PUKYNĚ UNIVERSITY IN ÚSTÍ NAD LABEM, CZECH REPUBLIC) AND ECOBIOTECHNOLOGY (KNRTU, KAZAN, RUSSIA)

Ключевые слова: экологическая биотехнология, магистерская программа обучения, студенческая мобильность, международное сотрудничество.

В статье рассмотрена совместимость учебных программ «Управление отходами» (университет Я.Е. Пуркине, г. Усти-над-Лабем, Чешская Республика) и «Экобиотехнология» (КНИТУ, г.Казань, Россия). Проведенное исследование показало высокую степень совместимости, которая позволила спроектировать совместную магистерскую программу "Экологическая биотехнология" на основании получения двойного диплома. Программа должна быть аккредитована в конце 2013 года, а обучение по ней должно начаться в 2014 году.

Keywords: *environmental biotechnology, double-degree programs, student mobility, international collaboration.*

The aim of this contribution was the comparison of compatibility of study programs "Waste management" (J.E. Purkyně University, Ústí nad Labem, Czech Republic) and "Ecobiotechnology" (KNRTU, Kazan, Russia). Subject-by-subject comparison revealed high (~70%) compatibility which enabled launching of the preparation of double-diploma common master program "Environmental biotechnology" based on these programs. The new program should have been ready for accreditation by the end of 2013 so as, in case of successful accreditation, the first students could be introduced in 2014.

Introduction

As a consequence of the ongoing integration processes in Europe the importance of academic mobility and sharing is increasing. Among other collaborative activities the number of joint-degree and double-degree study programs offered by universities worldwide is increasing.

Jan Evangelista Purkyně University (further UJEP, www.ujep.cz) is a multidisciplinary university located in the city of Ústí nad Labem in the north-west of the Czech Republic (further CR). Faculty of Environment (further FŽP, fzp.ujep.cz) has been one of its founding faculties and since 1991 it served as the first faculty in the CR solely oriented on the environment and its protection. While the first research topics were focused on the local problems of severely polluted region (land reclamation after surface mining, pollution control etc.), during twenty-year history the research activities spread to wider environmental topics (environmental analytical chemistry, applied ecology, "green" technologies etc.). Consequently, new fields of studies were established and offered to students. Currently there are two study programs accredited in six fields of studies (3 BSc., 2 MSc., and 1 Ph.D. degree).

One of recently introduced emerging fields was biotechnology. Since 2004 six biotechnological research projects (both fundamental and applied) have been resolved on FŽP UJEP (focused on industrial wastewater treatment, bioremediation of polluted soil, biosensing) and the research team has been established. As a logical next step research experiences should be transformed into education. In 2009 FZP UJEP jointed the consortium of universities from several Europian countries (Germany, Lithuania, Belarus, Russian federation) to resolve the TEMPUS REHAUT project (511426-TEMPUS-1-2010-1-RU-TEMPUS-JPCR: Reform der Hochschulausbildung in der Biotechnologie: Entwicklung und Modernisierung der BSc/MSc-Lehrangebote, i.e. Reform of the higher education of biotechnology: Development of new bachelor- and master-degree study programs) funded by EU. The aim of the project is the development of the universal biotechnology study programs in BSc. and MSc. degrees and all fields of biotechnology including environmental biotechnology.

Here we introduce the idea of preparation on new MSc. program "Environmental biotechnology" which is intended as double-degree on UJEP and KNRTU. The new program should be based predominantly on already accredited programs "Waste management" (UJEP) and "Ekobiotechnology" (KNRTU); comparison of compatibility of these two programs is the main aim of this contribution.

Significance of new double-degree study program

Desired accreditation of new double-degree program "Environmental biotechnology" will have several positive consequences for both UJEP and KNRTU. In CR such study program is missing. Czech study programs oriented on biotechnological are currently taught on six universities in 17 study programs and 32 field of studies (11 BSc., 17 MSc., 4 Ph.D.). Majority of the programs are oriented on general biotechnology or agricultural biotechnology. Only two fields are oriented on Environmental biotechnology: the study program "Environmental biotechnology" (Technical university of Ostrava) is accredited in bachelor degree only and master degree "Biotechnology and waste management" (Mendel University of Brno) has too narrow orientation. Since proposed program "Environmental biotechnology" is intended in master degree and with wider orientation on all aspects of environmental biotechnologies, it should fill this substantive educational gap.

With its area of high-quality agricultural soil, enormous natural resources, number of well-trained experts, and government-level priority, Russian federation is very perspective country for further development of all branches of biotechnology. KNRTU with its ~30 000 students is the biggest technological school in Russian federation and also one of the best rated. Thus its participation in the education is a guarantee of the program quality. KNRTU students will gain the opportunity of obtaining double-degree from two respected Russian/EU universities.

Basic characteristics of compared study programs

Both compared programs are designed for 4 semesters and are taught in accordance with Bolonga declaration. Study program "Waste management" is focused on all aspects of waste production, liquidation, handling from technological point of view as well as from legislative and economic points of view. The students have to gain 120 credits (60 per year) out of them 108 credits from obligatory subjects and the rest from elective subjects. The students find the jobs in wide industrial companies as well as in civil services. Study program "Ekobiotechnology" (see http://www.kstu.ru/updetail.jsp?idplan=4617 for details) is focused wider on all aspects of environmental biotechnologies. Students also have to gain 120 credits, out of them 100 from obligatory subjects.

Comparison of study programs

Subjects of "Waste management", their compatibility with "Ekobiotechnology" and remarks of proposed harmonization steps are listed in Table 1. Elective subjects are by analogy listed in Table 2. Subjects of "Ekobiotechnology" that do not have its counterpart in "Waste management" are listed in Table 3.

Overall the analyses revealed high compatibility of the two study programs:

Within obligatory subjects there is a 57% credit harmony.

Other 12% of credits belong to subjects that are included in "Waste management", however they require enhancing. These are especially general subjects related to biotechnology (biochemistry, microbiology etc.) which stand somewhat in the background in "Waste management" but require priority in "Environmental biotechnology".

Approx. 17% of the credits might be easily harmonized. These are especially subjects related to analytical chemistry including laboratory training. They might be simply changed so as to become more "bio-". Also legislative subjects fall into this category.

Only 15% of credits are completely incompatible. These subjects should be eliminated so as to make space for enhancing of more important biotechnology-related subjects.

Students, that gained one of FŽP UJEP BSc. degree, carry some of the knowledge already from their BSc. degree. This is especially case of environmentally oriented subjects.

Significant portion of incompatibilities are based on the simple fact that FZP UJEP is an environmentally oriented faculty and study programs are thus more oriented on the environment while biotechnology related subjects are sidelined. FZP UJEP student also carry some of the environmental knowledge already from BSc. degree, while KNRTU students have to fill this knowledge gap in specialized subjects. Opposite is true for KNRTU students of biotechnological BSc. programs, which carry some of the "biotechnology" knowledge from BSc. degree, while FŽP UJEP students have to chase this knowledge gap. This contradiction also lines the way of further harmonization. While KNRTU can offer more "biotechnology" skills and experts, FŽP UJEP will contribute to new common program on the "environmental" side.

Matters of discussion are the elective subjects, which enable students to individualize their studies. Contemporary list of elective subjects of "Waste management" is currently quite long, especially when regarding recent decreasing number of program students due to demographic wave. Thus possible reductions of less popular subjects is currently under review.

Future perspectives

This preliminary comparison revealed a good compatibility of both analyzed programs. And since both UJEP and KNRTU are interested in preparation of the double-degree common program, its preparation has started. Here is a draft of how the new program "Environmetal biotechnology" could look:

It should be based more on "Ekobiotechnology" since the topic is closer and also already accredited on KNRTU.

Students should spend two whole semesters in Kazan and two in Ústí nad Labem. It was not yet decided whether the places of study will alternate after each semester or after year. Student mobility might be co-funded from running EU mobility projects as well as other sources.

Split of the subjects between FŽP UJEP and KNRTU will be based on the detailed analysis of compatibility. In order to optimize the whole educational process, the subject split will take into account simultaneous co-teaching of the same subjects for students of different study programs.

Diploma work should be prepared and final exams should be taken on the home institution (this does not eliminate the opposite opportunity).

Study languages should be Russian and Czech. According to current Czech legislative, the use of Czech language is necessary in order to have the program funded by Ministry of education of the Czech Republic. If the studies were carried out in English (which would be clearly an interesting option worth discussing), the student would have to pay the full costs of the education.

The working teams from FŽP started preparation of the details of the new study program. We hope to finish all the necessary work by the end of 2013. In 2014 a re-accreditation of all study programs will proceed on UJEP so the new study program should be accredited within this process. This would enable introduction of new students already from winter semester 2014.

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Table 1 - List of obligatory subjects of the study program "Waste management" and their comparison with "Ecobiotechnology"

Abbr	Subject	C	Y/Sem	Compatibility, proposed harmonization
1GIS2	Geographical information systems	5	1/W	Compatible
1MAN1	Environmental management I.	2	1/W	Compatible
1NAPO	Company teachning	3	1/W	Absent - lower credits / exclude
1SOC	Sociology	2	1/W	Compatible
1BICH	Biochemistry	2	1/W	Already in BSc - enhance
1INAN	Instrument analytics	2	1/W	Different - adapt (more biotechniques)
1PT3	Cleaner and waste-limited technologies	6	1/W	Compatible
1TOXI	Toxicology	3	1/W	Compatible
1ENIN	Environmental informatics and reporting	3	1/S	Compatible
1TEZA	Technology of landfill safeguard	4	1/S	Compatible
1MAN2	Environmental management II.	4	1/S	Compatible - merge I. and II. ???
1ACHZ	Analytic chemistry of environment	5	1/S	BSc - merge "Env. analytical chem." and "Bioanalytics"
1BIOT	Biotechnology	5	1/S	BSc. - Enhance / Split to more subjects
1HNO	Assessment of waste hazardous properties	2	1/S	Compatible
1ODP1	Wastes and secondary raw materials	4	1/S	Compatible
1ENPO	Environmental politics	3	2/W	Lower credits / harmonize
1IPPC	Integrated Pollution Prevention and Control	3	2/W	Different - Harmonize
1LCA	Life-cycle assessment	4	2/W	Different - Harmonize
1CHD	Chemodynamics	5	2/W	Absent - Eliminate / Change / Integrate into Biochemistry
1EKZA	Environmental burdains and decontamination technologies	3	2/W	Accent bioremediation
1ODP2	Wastes and secondary raw materials II.	6	2/W	Compatible
1BEPR	Labour protection	3	2/S	Compatible
1PSYR	Psychology of management	3	2/S	Compatible

Abbreviations: Y/Sem – year/semester (W = winter, S = summer), C – credits,

Table 2 - List of elective subjects of the study program "Waste management" and their comparison with "Ecobiotechnology". Abbreviations are

Abbr.	Subject	C	Y/Sem	Compatibility, proposed harmonization
1DTM	Digital terrain models	2	1/W	Absent - Substitute by modeling of biotechnological processes?
1TWS	Creation of www pages	1	1/W	Compatible
1GEO2	Environmental geology	4	1/W	Absent – harmonize
1AOT1	Specialized text in English	1	1/W	Compatible
1HOPZ	Assessment and valuation of natural resources	5	1/W	Absent – harmonize
1MAJ1	Specialized environmental English	4	1/W	Compatible
1MANG	Introduction into management	2	1/W	Absent – harmonize
1ONI	Specialized German	2	1/W	Compatible
1RABE	Radiation safety	2	1/W	Absent – harmonize
1STAP	Construction law	2	1/W	Absent – harmonize
1DPZ	Remote exploration of land	2	1/S	Compatible
1INTE	Dynamic internet technologies	1	1/S	Compatible
1MOFY	Introduction to modern physics	2	1/S	Absent – harmonize
1ZMEI	Display methods I.	2	1/S	Compatible
1VREZ	Water regimes of landscape	2	1/S	Absent – harmonize
1AOT2	Specialized text in English II.	3	1/S	Compatible
1MAJ2	Specialized environmental English II.	4	1/S	Compatible
1ON2	Spcialized German	4	1/S	Compatible
1PRVP	Project management CR and EU	3	1/S	Compatible
1RIAN	Risk analysis	2	1/S	Compatible
1UCET	Introduction to accountancy and calculation	2	1/S	Compatible
1PRZN	Industrial regions and zones	2	1/S	Absent - eliminate
1GIS3	GIS applications	2	2/W	Compatible
1ZME2	Display methods II.	3	2/W	Compatible
1PSY4	Environmental psychology	2	2/W	Compatible as an obligatory subject
1STRO	Introduction to mechanical and electrical engineering	2	2/W	Absent - adapt to bioengineering???
1PPOK	Antiflooding precautions in landscape	2	2/S	Absent – eliminate
1ETIK	Ethics and aestethics	2	2/S	Compatible

Table 3 - List of subjects of the study program "Ekobiotechnology" that do not have its counterpart in "Waste management"

Subject	Remark
Applied biochemistry	Harmonize according to KNRTU
Applied microbiology	Harmonize according to KNRTU
Introduction to biotechnology	In BSc.
Bioremediation techniques	Partly in BSc.
Bioremediation - field practices	Harmonize according to KNRTU
Fytoremediation	Harmonize according to KNRTU
Bioanalytical methods	Adaptation of contemporary analytical subjects
Laboratories in bioanalytical methods	Adaptation of contemporary analytical subjects
Separation techniques	Adaptation of contemporary analytical subjects
Genetical engineering	Partly within contemporary Biotechnology
Bioengineering	Partly within contemporary Biotechnology
Mechanisms of pollutants biodegradation	Harmonize according to KNRTU
Hygienic aspects of biotechnologies	Partly within contemporary Biotechnology and Microbiology
Environmental information and reporting	Partly in other GIS subjects in BSc.
Biostatistics and chemometrics	Partly in other BSc. subjects
Xenobiochemistry	Partly in Toxikology
Applied enzymology	Partly in Biotechnology
Biochemistry of secondary metabolites	Partly in Biotechnology
Cultivation techniques	Partly in BSc. microbiology
Soil microbiology	Parlty in BSc. microbiology
Laboratories in Applied microbiology	Harmonize according to KNRTU
Biotechnological applications of microorganisms	Harmonize according to KNRTU
Waste-water treatment	In BSc.
Introduction to sampling of wastes.	Included in waste-management subjects
Project in Environmental biotechnolgoy	Harmonize according to KNRTU
Bioindication	Harmonize according to KNRTU
Modeling of biotechnological processes	Harmonize according to KNRTU

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