Review of Current Master Provision in Serbia

A compilation of questionnaires obtained from the ten participatory Serbian HE institutions.

Compiled by Ivan Juranić, Faculty of Chemistry, University of Belgrade

1. Current provision in Serbia

<table>
<thead>
<tr>
<th>Institutions</th>
<th>Titles of Programmes</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Kragujevac, Faculty of Science</td>
<td>Master of research and development; Master professor of chemistry, Master – environmental protection</td>
<td>25 students currently enrolled</td>
</tr>
<tr>
<td>University of Belgrade, Faculty of Chemistry</td>
<td>Graduate Chemist – Master; Graduate Biochemist – Master</td>
<td>79 students currently enrolled, 19 students currently enrolled</td>
</tr>
<tr>
<td>University of Belgrade, Faculty of Mining and Geology (UB-FMG)</td>
<td>Master in Geophysics, Master in Geology, Master in Geotechnics, Master in Hydrogeology, Master in Mining Engineering, Master in Petroleum Engineering, Master in Environmental and Safety Engineering</td>
<td>Up to 25 places, presently 7 students currently enrolled.</td>
</tr>
<tr>
<td>University of Niš, Faculty of Sciences and Mathematics</td>
<td>Graduate Academic Studies in General Chemistry – Master: module General Chemistry; module Professor of Chemistry</td>
<td>25 students</td>
</tr>
</tbody>
</table>

[MCHEM]
<table>
<thead>
<tr>
<th>University of Novi Sad, Faculty of Science, Department of Chemistry, Biochemistry and Environmental Protection</th>
<th>Applied Chemistry – Master</th>
<th>20 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Academic studies in chemistry-Master, module Environmental Quality Control and Management</td>
<td>Environmental analyst - Master</td>
<td>32 students</td>
</tr>
<tr>
<td>High Business - Technical School Užice</td>
<td>Basic professional studies in Environmental Protection Engineering</td>
<td>50 students</td>
</tr>
<tr>
<td>University of Niš, Faculty of Technology in Leskovac</td>
<td>Study programme – Chemical Technologies Modules: - Pharmaceutical-cosmetic engineering - Chemical engineering in environmental protection - Organic chemical technology and polymer engineering Study programme – Food processing technology and biotechnology Modules: - Food processing technology - Biotechnology Study programme – Textile technologies Modules: - Textile engineering - Industrial design of textile products</td>
<td>16 students</td>
</tr>
<tr>
<td>University of Belgrade, Faculty of Technology and Metallurgy (FTM)</td>
<td>Master in Environmental engineering</td>
<td>Up to 40 places, at present 29 students currently enrolled</td>
</tr>
<tr>
<td>University of Belgrade, Technical Faculty in Bor</td>
<td>Mining Engineering Metallurgical Engineering Technological Engineering Engineering Management</td>
<td>For all four modules there are up to145 places, at present 61 students currently enrolled</td>
</tr>
<tr>
<td>University of Belgrade, Faculty of Physical Chemistry</td>
<td>Master studies in physical chemistry</td>
<td>60 places per year; on average 40 students per year are enrolled</td>
</tr>
</tbody>
</table>
2. The students

2.1. Entry qualifications:

The general entry requirements for the enrolment of students onto a master level programme are a BSc degree (240 ECTS) in an engineering or science discipline. Alternatively, 180 ECTS have to be collected through a first cycle academic education in chemistry or related study programme (technology, physical-chemistry, biochemistry, pharmacy, ecology). Student ranking is achieved on the basis of their average grade and duration of their first cycle education programme. The average grade required for Master programme entry has to be above 8 (7.7 for Bor).

Not all institutions gave the number of places offered to new master-programme students. Generally, it ranges between 20 and 50 students. Approximately half of them are supported by government funding.

Among the ten Serbian consortium members, four have established Master studies in environmental disciplines.

2.2. Destinations:

All consortium members stated that, in general, their students come from the regions administratively and geographically closest to them. A considerable number of students come from neighbouring countries sharing the same language (Bosnia and Herzegovina, Montenegro, and a small number from Croatia). Students also come from other countries including Libya and Turkey.

At bachelor level, all universities enrol students in accordance with Serbian University law. The entrance exam is not mandatory, but at present, all state Universities use it for the selection of new students. It is necessary to use an entrance examination because the Ministry of Education will waive enrolment fees for a limited number of students. The ranking of university applicants is usually accomplished by combining the scores achieved in a candidate’s high school with their grades in the admissions examination. The best ranked students have their enrolment fees waived. The enrolment quota for new first-year students is published in the call for the enrolment applications.

For second cycle qualifications, the selection of students is based upon achievement in the candidate’s first cycle programme. For candidates who have completed a bachelor degree in another HE institution, the comparability of first-cycle study programmes is evaluated. In some cases it may necessary to take additional subjects in order to qualify for enrolment at master level.

2.3. Performance

Robust statistical information on the master programmes currently offered by the majority of consortium members was difficult to obtain since most of these courses had only recently started recruitment. From the available data it can be inferred that average entry grade is close to 9, and the graduation rate is above 80%.

2.4. Recruitment:

2.4.1. How are students recruited?

There were various answers to this question, mostly varying in specific institutional details. The most common features of Master recruitment amongst the university partners are:

- Specific enrolment calls are broadcast and published in the press.
Modernisation of Post-Graduate Studies in Chemistry and Chemistry Related Programmes
511044-Tempus-1-2010-1-UK-Tempus-JPCR

- Applications for student admissions are announced in the media and on the faculty’s website with the specific entry qualifications clearly outlined.
- Occasionally particular faculty appearances in the media make institutions more visible to the general public which in turn may help recruitment.

Promotion of the work of the Faculty is undertaken by faculty members who may, *inter alia*:

- Present specific study programmes to target groups.
- Give public lectures on popular topics and themes.
- Demonstrate stimulating practical experiments.
- Participate in science fairs, employment fairs, *etc*.

Sometimes students may be recruited through the provision of scholarships from industry for excellent students (whenever possible).

3. The programmes

3.1. Programme design

Graduate study programmes have a credit rating of 60 ECTS in accordance with the Bologna Declaration and last 1 year (2 semesters). Two master programmes offered at the Faculty of Science in *Novi Sad* and at Faculty of Sciences and Mathematics in *Niš*, last 2 years and have an ECTS credit rating of 120 ECTS credits. *HBSU* offers bachelor programmes of three years duration and prepares candidates for 2-years master programmes. In *Novi Sad*, a 4 year (first cycle) + 1 year (second cycle) scheme will be introduced in the near future.

The study programmes include professional subjects, which are deemed necessary for the education of chemists, elective courses and graduate level independent work. The content of the degree programmes are delivered through lectures, calculation and computer practice, laboratory (experimental) exercises, seminars, independent work, as well as the production and presentation of a thesis. The student is required to pass all mandatory and elective subjects. The last exam in the course of study is the Graduation exam, the practical part of which students can do during their studies. The topic chosen, by the student, for the practical part of the Graduation examination is chosen in consultation with a designated supervisor. The diploma thesis is approved by a three-member Advisory Committee. The procedures for the examination and assessment of students are determined by the particular faculty.

3.1.1. Aims and Objectives of the Master programme in Environmental Protection

The aim of this master programme is to educate competent and well trained professionals within the framework of a formal qualification in Environmental Protection. The knowledge, skills and competences acquired by graduates of this degree programme, make them particularly attractive in the job market and also enable them to continue their education to doctoral level.

The objectives of the programme include the achievement of competence and academic expertise in the areas of:

- Waste management
- Remediation and reclamation of contaminated sites
- Preparation and recycling of industrial wastes
- Wastewater treatment
- Pollution and protection of air
Modernisation of Post-Graduate Studies in Chemistry and Chemistry Related Programmes
511044-Tempus-1-2010-1-UK-Tempus-JPCR

• Noise and vibration
• Environmental monitoring
• Planning and design of environmental protection systems

The goal of the study programme is to provide the students with a modern, in-depth training for work in chemical laboratories encountered in all branches of industry, as well as in Research and Development (R&D), Control and Service laboratories. The knowledge acquired in this aspect of the study programme continues and develops the training acquired in the first cycle academic studies in Chemistry or similar study programmes. The level of the knowledge acquired will enable the graduates to further advance their chemical education through a practically based research project.

Depending on the selected study modules and elective courses chosen, the students are:

• Able to collect, evaluate and interpret quality control information of relevance to environmental management. They are further able: to plan environmental monitoring programmes; to form scientifically-based judgments using these data derived from measurements of chemical and physico-chemical processes in the environment; to interpret the data; and on the basis of their data interpretation formulate management proposals for the improvement of environmental quality.
• Able to teach chemistry courses in schools at both primary and secondary levels; and are prepared for work in educational and scientific institutions, as well as in other professional and government contexts.
• Educated and trained for independent work in the R&D laboratories in the chemical industry; and for work in quality control laboratories in the chemical, pharmaceutical, food, petrochemical, agrochemical, veterinary medicine and other specialized industries.
• Educated to be capable of dealing with environmental protection issues in accordance with the concept of sustainable development and the right of future generations to have a healthy environment.
• Able to establish environmental protection measures in commercial and business contexts; develop monitoring procedures for environmental protection; and implement integrated prevention and pollution control measures.
• Trained for independent scientific research and the application of scientific knowledge into practice in appropriate professional fields. Students who complete their graduate studies are able to lead, create and develop new technological processes and products in relevant fields of technology. Students are trained to be familiar with the latest results of scientific and technological progress, and to use modern practical and instrumental methods. Students also acquire the necessary expertise to undertake further studies at PhD level.

The competences of the master graduates are completely aligned with EU standards and Dublin descriptors defined by the Euro master in chemistry which are *inter alia*:

• have the ability to apply their knowledge and understanding, and problem solving abilities, in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the chemical sciences;
• have the ability to integrate knowledge; handle complexity; formulate judgements with incomplete or limited information and should be able to reflect on their ethical responsibilities that are linked to the application of their knowledge and judgements;
• have the ability to communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously;
have developed those learning skills that will allow them to continue to study in a manner that may be largely self-directed or autonomous, and take responsibility for their own professional development.

3.1.2. Benchmarking

There are at present no benchmarking statements used for the design of master qualifications.

3.1.2.1. What is the role – if any – for benchmarking in programme design and content?

Generally, no answers were offered. Some members mention the procedures for the design and accreditation of programmes in the EU.

3.1.2.2. Are there national benchmarks for Master programmes?

All responses were negative. One answer connected this with the practice of programme accreditation.

3.1.3. Is there a role for potential employers in programme design?

Only three institutions gave a positive answer to this question; and of these only one gave details of any formalized connections with industry. These connections include:

- Broad informal contacts and communication with a number of industrial organizations, as well as with the Ministries of Education, Science, and Environmental Protection and with other bodies concerned with environmental protection and sustainability.
- Establishing a business club that brings together industrial partners with the aim of strengthening and formalizing connections with industry and employers of graduates, as well as to provide formal opportunities for direct industrial and business inputs into the design and development of educational programmes.
- Taking into account comments and advice given in the questionnaires that have been circulated to the key potential employers of graduates. These questionnaires are circulated every second year by the Faculty Quality Assurance Commission.

3.1.4. What is the role of government in programme design?

All gave different answers. Some didn’t recognize any role for government in programme design. Others see the role of government as setting a general framework for HE and the imposition of accreditation procedures.

Higher education law provides a general framework for accreditation procedures and the number of ECTS credits to be awarded. Programmes are designed in compliance with the Bologna Process and they should be comparable with similar study programmes offered by eminent universities in at least three selected EU member countries. The National Council is the governmental body which defines standards and monitor outcomes. For a programme going through the process of accreditation, the number of students who can be catered for is agreed, which thus establishes the financial requirements for the programme. Each year the Ministry of Education decides how many students can be funded from the central budget.

The government provides inputs into programmes through directives and communications from the Ministries of Education, Science and Environmental Protection, as well as through the process of accreditation.

3.1.5. Is there a role for NGOs?

There were no positive answers. One institution referred to NGO involvement through informal contact.
3.1.6. Is there a role for Chemical Societies?
There is no formal role for the Serbian Chemical Society (SCS) in programme design; but the SCS does provide inputs into programme design through alerts to current trends in education and research.

3.1.7. Credit rating of courses
The number of ECTS awarded to each course is determined on the basis of making estimates of the student workload – which includes independent student work, with account taken of the formal number of teaching hours; the number and type of practical classes and the number of hours of other forms of active teaching.

The credit status of each course is available in the Course Curriculum on the Faculty website.
In some questionnaires this topic is described at length, but generally, there is no properly developed methodology for the assessing the ECTS rating of courses.

3.2. Programme delivery

3.2.1. Assessment procedures:
Exams are conducted by the professor on the basis of the educational material covered in classes. Knowledge is evaluated by teaching assistants and professors, who decide a candidate’s final score. The assessment procedures are defined by the Faculty and the Education-Scientific Council. The implementation of procedures is carried out by the teachers themselves. External and internal controls of these procedures are still in the development phase. So far no external evaluation has been applied at the level of one professor or subject, except possibly during the accreditation procedures. Students regularly assess the work of professors and assistants and the contents of courses.

A student’s performance is evaluated by constantly monitoring their attainment in: lectures; laboratory work; writing; defence of their seminar contributions and project reports; and preliminary exams. Grades are expressed in points. By completing all the pre-exam assignments and passing the exam, the student can earn up to 100 points (of which a minimum of 30 and a maximum of 70 should be the number of points earned before sitting the exam). The final grade is formed on the basis of the criteria from the following table:

<table>
<thead>
<tr>
<th>Grades</th>
<th>Classification</th>
<th>Percentage of the overall number of points</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Excellent, with distinction</td>
<td>95-100</td>
</tr>
<tr>
<td>9</td>
<td>Excellent</td>
<td>85-94</td>
</tr>
<tr>
<td>8</td>
<td>Very good</td>
<td>75-84</td>
</tr>
<tr>
<td>7</td>
<td>Good</td>
<td>65-74</td>
</tr>
<tr>
<td>6</td>
<td>Sufficient</td>
<td>55-64</td>
</tr>
<tr>
<td>5</td>
<td>Insufficient</td>
<td>up to 54</td>
</tr>
</tbody>
</table>

* Intervals listed in this column may vary a little.
3.2.2. Programme content

The content of a programme is determined by a mixture of: a) institutional experience informed by tradition and years of good practice; b) the “best practice” of prominent world leading academic institutions and their experience; and partially, c) the demands and positive comments of potential employers.

3.2.2.1. How is the programme content decided?

Normally a proposal is made by a professor, who is in charge of, or has specific expertise in, the field in which the subject belongs. The proposal is assessed by the Departmental Council, the Faculty Council and the University Council. It is usual for professors to link the programme/course proposal with their research work.

Course content is approved by experts who sit on the Faculty and University Boards in related scientific areas.

3.3. Programme documentation

Each course within a particular study programme is defined in the course descriptions outlined in the programme documentation. Each course description will contain descriptions of course content, aims, learning outcomes, the assessment schedule and a bibliography. The documentation is available on the Faculty/School web-site.

3.3.1. How are aims and objectives linked with programme outcomes?

The goal of each programme is for all the students to undertake a series of courses in order to fully master the knowledge base of the programmes. The structure of the curriculum, as well as syllabus for each course, is designed as integrated structures which include the aims and the objectives of the study programme together with a description of learning outcomes in terms of the competences to be developed by the graduates. The learning outcomes of the courses are strongly linked to the aims and objectives designated for the study programmes.

The links between the aims and objectives of the programme and programme outcomes are provided in the accreditation material at both programme level and course level.

For each programme, supplementary Diploma documentation exists which can be obtained on request. However, it normally only contains a list of courses which have been taken, general marks and qualifications. No detailed skills and outcomes are identified, but these can be found in the subjects listed as part of the courses.

3.3.2. How is this monitored?

Here we have a number of different answers:

- Student knowledge is monitored and evaluated through exams, oral and written work, seminar papers and through variations of these assessments as approved by the Education-Scientific Council of the faculty.
- At present, there is no monitoring of programme outcomes.
- By external audit through the accreditation process.
- Programme documentation is monitored at Department, Faculty and University Council levels.
- Through the council of study programmes and teaching council and through the achieved ECTS credits.
The development of students’ practical knowledge and skills are evaluated by pre-exam assessments and activities. Learning outcomes, arising from the development of theoretical knowledge, are evaluated by both pre-exam assessments and examinations.

The outcomes of each part of the programme are monitored by student questionnaires, as well as by monitoring and analysis of the success rate at each exam.

It is monitored by the National Accreditation Commission; the University Expert Council of Technical and Technological Sciences; and the Scientific and Education Council of the Faculty.

Grades obtained in each exam are monitored. Unofficial contacts with employers of our students are also used to help provide information about the outputs of programmes. However, communication with employers needs to be improved.

3.3. Professional recognition

3.3.1. Recognition of programmes by professional bodies:

The programmes are subject to national accreditation procedures. As such the National Council for Higher Education recognizes the programmes as well as provides a list of approved and accredited professional, academic and scientific titles and programmes (Sl. List 81/2010). This list is the official list of the Ministry of Education in international relations (ENIC-NARIC).

3.3.2. Recognition by Chemical Societies

Formally, there is no such recognition. The programmes can be informally recognized by Serbian Chemical Society and the Society of Chemical Engineers of Serbia. There are no formal requirements for such recognition.

3.3.3. Alignment with European norms

Formally, any accredited programme has to be harmonized with at least 3 accredited foreign (EU) study programmes.

3.4. Advertising

3.4.1. How are programmes advertised?

Programme promotion is achieved via:

- Faculty websites;
- visits to schools;
- educational seminars;
- workshops;
- science popularization programmes supported by the Ministry of Science and Technological Development and the Ministry of Education.

Programmes may also be advertised in daily newspapers, in special newspaper editions featuring articles on the environment and through articles and interviews with faculty members that deal with scientific issues such as environment and technology.

Programmes may also be promoted through books, leaflets, radio, TV, talks with students, the web and participation in regularly organized education fairs.
3.4.2. What recruitment strategies are used?

There are no specific and predetermined recruitment strategies, but faculties try, as much as possible, to maintain a high public profile. Some activities presented in the completed questionnaires were:

- On-going monitoring of current situations and events in order to exploit recruitment opportunities.
- Monitoring courses offered by competitor institutions.
- Try to provide better academic opportunities and conditions to students.
- Free pre-admission training.
- Raise the profile of successful former students who have graduated from the Faculty.
- Raise the faculty’s profile through attainment of scientific and professional excellence.
- There are a relatively small number of potential students and strong competition is provided by non-state funded universities, so the main basis of our Faculty recruitment strategy is to emphasise:
  - the advanced level of the knowledge delivered to the students,
  - its academic and commercial applicability,
  - and the continuous efforts made to increase the standard of future potential employee’s workplace competence.

These activities are complemented by constant market research and the use of supporting promotional activities. Institutions also actively participate in schemes and events that seek to popularize science. For example: participation in the Festival of Science; and the contribution of motivating lectures at various seminars where available study programmes are also advertised. Attention is paid to what competitor institutions are doing, as well as on what are the contemporary demands from employers.

4. Pedagogic design

4.1. Innovation in teaching and learning

4.1.1. What use is made of e-learning:

Only one institution uses it.

4.1.2. What use is made of on-line learning:

Many don’t use it or have it. A number of teachers have their lectures loaded onto the Faculty web page. However all teachers encourage on-line learning. Faculties have computer labs, and every student has unlimited Internet access. Several software packages have been used by students during classes.

4.1.3. What use is made of Distance learning?

No institution uses it.

4.1.4. Practical experience

Several respondents didn’t acknowledge the use of practical activities, but in general all institutions tend to make use of it. For some programmes field study is included in the curriculum as a separate item. For others, experimental activities and field-work are included in particular courses. Some courses comprise practical industrial training. In addition all students work, individually, on their master theses, which may include laboratory experimental work, field-work, or process design and assessment.
5. Institutional procedures

5.1. How are new programmes approved?

Each programme must be approved by the Accreditation and Quality Assurance Commission of the Republic of Serbia. The initiative for a new programme will come from a group of professors who prepare the proposal for the new/modified study programme. This is initially approved by the Education and Science Teaching Staff Committee (ESTSC) at Faculty/Department level. This approval is then followed by approval from the Faculty Scientific Council, the University Expert Board and finally the Accreditation Commission.

5.2. How are new programmes agreed on?

A variety of answers were provided. In general the following describes the events that lead to development of a new programme.

A working group comprising staff from several faculties, or perhaps just one faculty, make the proposal to the University management. The proposal is based upon market research, the availability of teaching staff and their contemporary expertise. The new programme proposal is published on the faculty website, and faculty members have the opportunity to discuss the proposal at departmental meetings. Departments provide suggestions for changes and additions. The amended proposal is then discussed at faculty meetings. The initiative is thus proposed by a department it is then reviewed in succession by a Faculty Expert Board, a University Expert Board and finally the Accreditation Commission.

The proposal is sent to the Quality Control Assessment Body whose task it is to examine the availability of staff, equipment and accommodation for the implementation of the new programme and to prepare a feasibility study. Faculty Management and the Faculty Education-Scientific Council make the final decision about implementation of the programme based upon the feasibility study of Quality Control Assessment Body. The complementarity of the proposed programme with similar programmes, available at other home and international faculties, are important in the evaluation process. After this review process, the University Science Branch Representative Body and then University Senate complete the approval of the new programme.

5.2.1. Mechanisms for agreeing content and delivery

Usually it is done through meetings and discussion in the departmental council.

5.2.2. What quality assurance quality control procedures are in place?

As a result of the accreditation process, quality assurance is established through outlining the standards necessary for: accommodation, laboratory equipment, well equipped libraries and the quality of teaching staff. A number of different internal regulations are in place that are concerned with:

- The self-evaluation of personal study, pedagogic work and working conditions;
- Evaluation of research work,
- Regulations for students,
- Regulations relating to books and libraries,
- Regulations relating to doctoral studies, etc.

Every three years the accreditation body undertakes an external evaluation. The heads of departments, together with the Departmental Council examine the delivery of the curriculum for each course and propose a series of corrective measures in cases where problems have been identified. Student
questionnaires provide the opportunity for checking whether faculty and teaching associates have proper professional relations with students. The faculties implement a policy of quality assurance and self-evaluation procedures and statutes regulate the work of the internal Quality Control Commission.

5.3. What mechanisms are used for establishing comparability of qualifications between institutions

5.3.1. In Serbia

Various answers were given, but no definite policies are in place with regards the issue of establishing comparability of qualifications. Normally, a university body representing the faculties in several related scientific fields analyse programmes and assess their quality, consistency, and comparability with other similar programmes. Sometimes this is done through projects in which different faculties participates (such as TEMPUS projects). To date there is no national qualification framework.

5.3.2. Internationally

Harmonization of the programme curriculum with similar programmes offered internationally is a necessary component of the accreditation process. Higher Education Law provides a mechanism for the quality control and evaluation of a programme after five years of programme implementation (by accreditation).

Foreign higher education documents can be accepted in the Republic of Serbia for the purposes of recognition procedures. Two recognition procedures have been established and defined by University regulations: 1) for the purposes of undertaking further education; and 2) for employment purposes.

5.4. Staff training for programme delivery

No particular procedures are established. Some universities organize teacher seminars and workshops with international experts relating to developing pedagogic guidelines in the education process and about developing educational policies for teaching. The participation of teaching staff in Tempus projects also contributes to staff training.

5.4.1. How are staff training needs identified?

There is a general awareness about need for long life learning in staff training. However no particular procedures are in place. There is a universal demand for university staff to be involved in the research and in the publication of original scientific papers. They are also expected to attend seminars dealing with teaching.