

Scientific paper

Environmental Education Programmes: A Case Study of Slovenia

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Abstract

Environmental chemistry plays a vital role in the assessment of chemical pollution of the environment and thus contributes to the protection of ecosystems and human health. For this reason, it is important to provide future generations with the necessary knowledge and skills in environmental chemistry. The overall aim of this study was to assess the state of environmental chemistry education in Slovenia in 2023 by providing an overview of Slovenian study programmes in environmental science and identifying the significance of chemistry for secondary, short-cycle higher vocational, and higher education (including bachelor's, master's, and PhD studies). A total of 46 study programmes offering environmental science were identified, with wide variability in their chemistry content at different levels of education. This study provides valuable information on environmental chemistry education programmes in Slovenia to students and scientists interested or engaged in environmental science.

Keywords: environmental programmes, environmental chemistry programmes, Slovenia, secondary education, short-cycle higher vocational education, higher education

1. Introduction

Given the increasing global awareness of environmental issues, environmental sciences are crucial in understanding and addressing pressing and complex environmental issues. Protecting the environment requires an explicitly multidisciplinary approach, encompassing environmental research, natural sciences, ecology, technology, conservation, management and policy development. Therefore, adequate and trained experts with multidisciplinary knowledge in environmental sciences are needed to solve environmental problems at both national and European levels. Among the disciplines of environmental science, environmental chemistry is of particular importance. According to the definition of S. Manahan,¹ “*environmental chemistry is the discipline that describes the origin, transport, reactions, effects and fates of chemical species in the hydro-*

sphere, atmosphere, geosphere, biosphere, and anthroposphere”. Environmental chemistry, therefore, plays an important role in protecting ecosystems, the climate, human health, and the assessment of chemical pollution.

The emergence of environmental chemistry as a discipline in European education was revealed by a 2014 survey on higher education in environmental sciences with an emphasis on chemistry.² It demonstrated that nearly all European countries (28 in total) offer programmes in environmental chemistry, comprising 152 bachelor's and 181 master's programmes and two diploma and six advanced study programmes. Since some programmes recognized in the 2014 survey may have become outdated, and new ones have likely emerged in the past decade, there is a need for a new evaluation of environmental science education. To estimate the state of environmental education in Europe in

2023, two online databases, Study.eu (<https://www.study.eu/>)³ and Educations.com (<https://www.educations.com/>)⁴, which provide information on universities and their bachelor's, master's and doctoral programmes in Europe and worldwide, were used. According to these databases, the number of environmentally related programmes has doubled over the last ten years. Namely, depending on the specific online database used, a total of 183 or 354 bachelor's degree programmes and 555 or 704 master's degree programmes were identified in 2023 (Table S1). It should be emphasized that the data retrieved from the online databases cannot be directly compared to that of the 2014 survey owing to the varying environmental disciplines included, which is a result of the different methodologies employed for data collection (questionnaires in the 2014 survey *versus* programmes searched by disciplines accessible through the online databases). Nevertheless, the findings undoubtedly demonstrate a significant increase in the number of bachelor's and master's programmes linked to environmental sciences across Europe in the past decade.

Slovenia, a small European country with a population of approximately 2.1 million and situated between the Alps, the Adriatic Sea and the Pannonia Plain, presents a unique context combining rich biodiversity, historical landscapes, and contemporary environmental concerns. In 2004, Slovenia joined the European Union (EU), which triggered, among others, an increased need for the implementation of sustainable development principles into Slovenia's research and education strategy. As a result, environmental science topics and subjects have been incorporated into its education system since then. A 2014 study identified two bachelor's and two master's programmes in environmental chemistry,² while one bachelor's, two master's and one doctoral programme in environmental studies were retrieved from the two online databases in 2023 (Table S1). Nevertheless, the data on environmental education programmes in Slovenia provided in these overviews has either been underestimated, incomplete, or outdated. Given the significance of this information for advancing strategic planning and progress in sustainable development, there is a need for a comprehensive and systematic evaluation of the present state of education programmes in environmental chemistry within the Slovenian context.

In this work, we aimed to provide an overview of the study programmes in the field of environmental sciences in Slovenia in 2023 and to determine the importance of chemistry in these study programmes. Unlike 2014 study and 2023 database that included higher education programmes (bachelor's, master's, and doctoral studies), this overview included also secondary education and short-cycle higher vocational education, which we believe are equally important. The study was conducted by members of the Section for the Environment, founded in 2022 within the Slovenian Chemical Society⁵ with the vision of becoming one of the leading associations of experts in Slove-

nia dealing with environmental chemistry topics. The mission of this Section is to bring together members of the Slovenian Chemical Society who are interested in or involved with environmental chemistry topics. The goal is to promote cooperation, networking and knowledge sharing to improve the understanding and perception of environmental chemistry among various stakeholders. The Section also aims to encourage the proper use of chemistry in evaluating and resolving environmental issues and addresses those aspects of environmental chemistry requiring regulation. In addition, the Section's work programme also includes promoting the integration of new environmental chemistry content into Slovenian education and cooperation with international environmental organizations, particularly with the Division of Chemistry and the Environment (DCE) of the European Chemical Society. In line with the latter two objectives, the Section aimed to identify the current situation and potential gaps in environmental chemistry study programmes in Slovenia by following the example of the 2014 survey on higher education programmes in environmental chemistry in Europe conducted by the DCE.²

2. Methodology

2.1. Slovenian education System

The Slovenian education system has three levels: primary, secondary, and tertiary (Figure 1).

Briefly, secondary education is provided by (upper) secondary schools offering general or technical upper secondary education (4-year programme), short upper secondary vocational education (2-year programme), and upper secondary vocational (3-year programme) or technical education (2-year programme). Tertiary education consists of short-cycle higher vocational education (2-year programmes) and higher education, which is part of the Bologna Process and includes undergraduate programmes (3–4 years of bachelor's – first cycle), postgraduate programmes (2 years of master's – second cycle) and doctoral programmes (3–4 years of PhD – third cycle). The education system in Slovenia is organized mainly as a public service rendered by public and private institutions providing officially recognized or accredited programmes. Primary education is mandatory and funded by the government in accordance with the Constitution of the Republic of Slovenia, which guarantees the right to free education. However, both public and private institutions offer further levels of education such as upper secondary schools and higher education studies.⁶

2.2. Data Collection

An overview of the study programmes in environmental science available in Slovenia was obtained for upper secondary technical education, short-cycle higher vo-

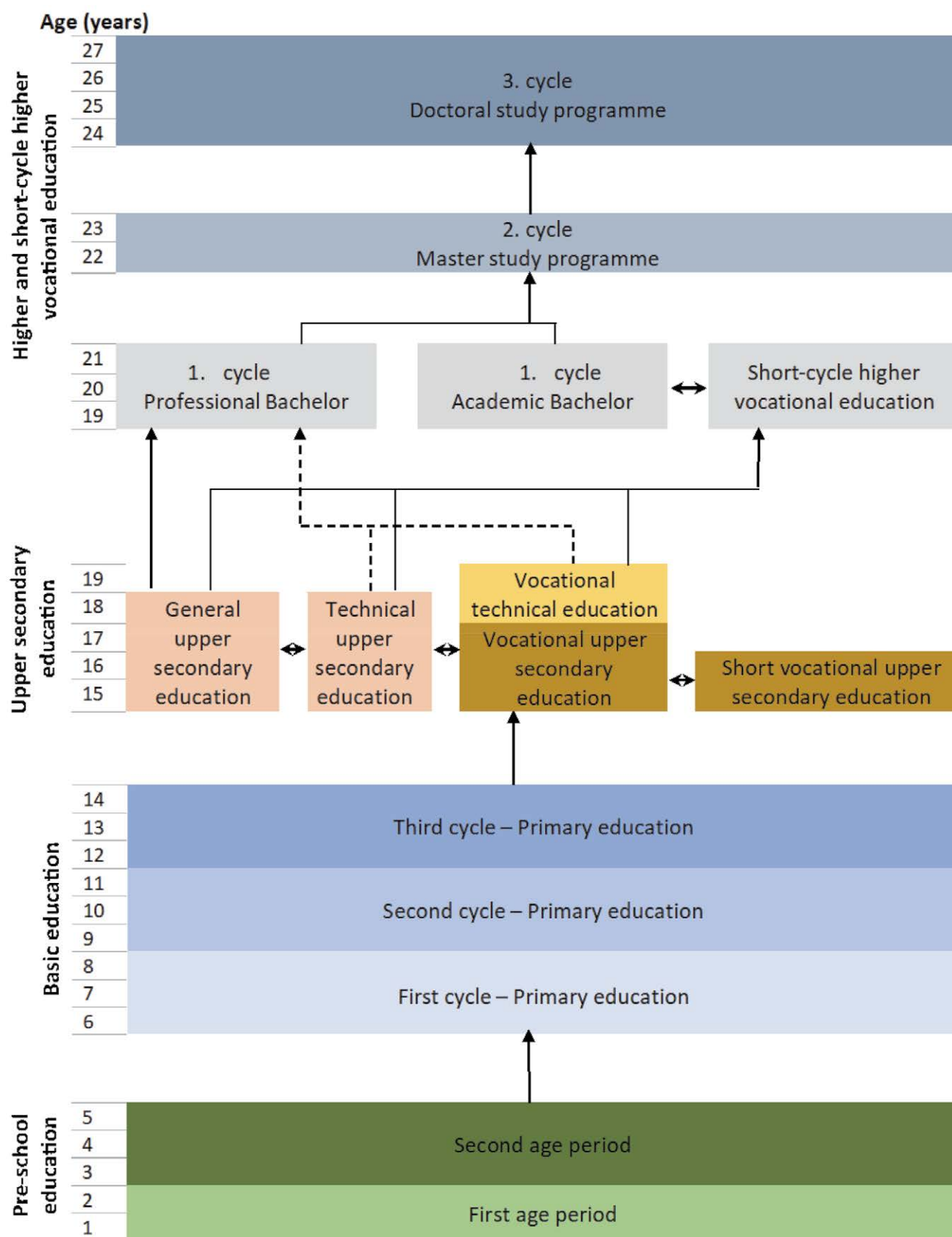


Figure 1: Schematic representation of the Slovenian education system, including primary, secondary, and tertiary education.⁶

cational education, and higher education that includes bachelor's, master's, and doctoral studies. First, existing educational institutions offering environmental studies were overviewed with the help of online databases. Relevant study programmes in upper secondary technical and short-cycle higher vocational education were obtained from the Institute of the Republic of Slovenia for Vocational Education and Training (CPI) website.⁷ The CPI is a central national research and development institution in vocational education and training, which hosts several national coordination points and education and counselling centers in this domain. The list of higher education study programmes was compiled with the help of the GOV.SI Portal of the Slovenian government administration.⁸ The GOV.SI Portal is a central website which provides comprehensive information on the organization and operation of the state administration, including education. Next, programmes with significant coverage of environmentally related subjects were deemed relevant. Identification of “environment/environmental”, “ecotechnology”, “water management”, and “nature conservation/preservation” in the title of the study programme was considered necessary for the programme to be reported as relevant. In some cases, programmes focused on related fields, such as, for example, ecology, biology, geotechnology, and agriculture, were also included in the overview. We acknowledge that the data collected herein may be incomplete, as our selection criterion may result in overlooking programmes that cover environmental chemistry in their curricula but do not explicitly feature environmentally related topics in their titles. However, this methodology had to be selected to narrow down the search within the extensive database of the Slovenian education system, which would otherwise require reviewing the curricula of approximately 560 study programmes across different levels of education.

2. 3. Data Analysis

From the collected data, a list of study programmes was constructed containing various information, including the name of the educational institution, the title of the programme, a summary of the programme's content, the resulting professional or scientific title obtained, the location of the programme, the language of instruction, the institution type (public or private), the tuition fees (if applicable), the year the programme was established, and the study programme website (Table S3–S5). The overview also includes the professional or scientific titles obtained for each study programme, which were translated into English using the Slovenian Qualifications Framework (SQF)⁹ for the benefit of non-Slovenian readers. However, it should be emphasized that these translations have no legal status under Slovenian legislation, which prohibits translating professional and academic titles into a foreign language. The study programmes' start year was determined with the help of a Register of educational institutions and educa-

tional programmes¹⁰ and based on their first accreditation, provided by the Slovenian Quality Assurance Agency for Higher Education.¹¹ The Agency is responsible for quality assurance in Slovenian higher education. General information applicable to all study programmes at each level of education is summarized in Table S2, which comprises details on the type of education, programme duration, ECTS credits obtained and entry-level requirements.

Detailed information on the curriculum offered by each study programme, including course descriptions, was gathered from the websites of the respective educational institutions. To assess the significance of chemistry and the environment in selected programmes, we first identified all courses, including both compulsory and elective ones, that focus on either chemistry or the environment. The share of the identified courses in relation to the total number of courses offered by a given study programmes, hereafter referred to as the percentage of courses with chemistry or environment content, was determined by considering the number of hours (for secondary education) or credit points (for tertiary education) assigned to each respective course. The courses assigned to chemistry and environment are shown in Table S6.

It is important to stress that this overview presents the status of the existing programmes as of 2023, which are likely to change in the future, especially in light of the forthcoming reform of primary schools, general upper secondary education and higher vocational study programmes initiated by the Ministry of Education Science and Sport in 2021. The modernization of the programmes by updating the curriculum prioritizing the inclusion of competencies and qualifications for the digital and green transition also became an integral part of the National Recovery and Resilience plan, as confirmed by both the Government and the EU Council in 2021.¹²

3. Results and Discussion

3.1. Distribution and Diversity of Programmes

Forty-six relevant environmental science programmes were identified at all levels of education: ten in secondary education, ten in short-cycle higher vocational education, nine in bachelor's programmes, 11 in master's programmes, and six in doctoral programmes (Table 1).

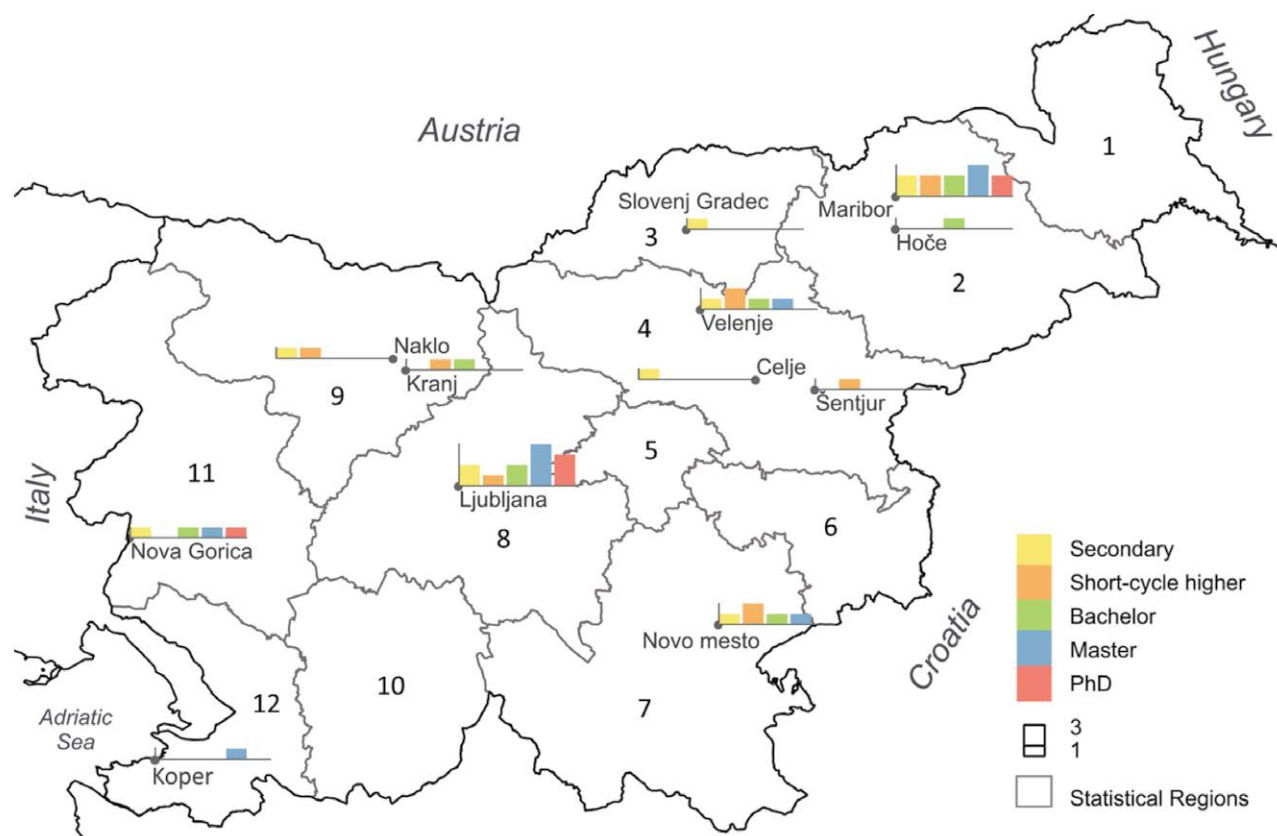
A detailed list of identified programmes is presented in the Supplementary Material (Table S2–S5). The identified study programmes are offered by 26 different educational institutions (ten offer upper secondary technical education, nine short-cycle higher vocational education, and ten higher education). This finding means that environmental study programmes are offered in about 19% of the existing institutions of short-cycle higher vocational education in Slovenia (considering 29 public and 18 pri-

Table 1: Number of relevant environmental science programmes per Slovenian statistical region.

Slovenian statistical region	Secondary	Short-cycle higher vocational	Bachelor	Higher Master	PhD	Total
1. Pomurska						
2. Podravska	2	2	3	3	2	12
3. Koroška	1					1
4. Savinjska	2	3	1	1		7
5. Zasavska						
6. Posavska						
7. Jugovzhodna Slovenija	1	2	1	1		5
8. Osrednjeslovenska	2	1	2	4	3	12
9. Gorenjska	1	2	1			4
10. Primorsko-Notranjska						
11. Goriška	1		1	1	1	4
12. Obalno-Kraška				1		1
Total	10	10	9	11	6	46

vate higher vocational schools in Slovenia)¹³ and in about 22% of the existing higher education institutions in Slovenia (considering three public and three private universities, one independent public higher education institution and 39 private higher education institutions in Slovenia).¹³ Five out of six universities in Slovenia (University of Ljubljana, University of Maribor, University of Nova Gorica,

University of Primorska and University of Novo mesto) offer at least one higher education programme related to environmental sciences. The institutions hosting these programmes are correspondingly diverse and include disciplines from the natural sciences (chemistry, biology), environmental sciences (earth sciences, biotechnology, agriculture, geology, sustainable development), civil or me-

**Figure 2:** A map showing the geographical distribution of relevant environmental science programmes offered by educational institutions in different Slovenian statistical regions. The numbers correspond to statistical regions that are in alignment with Table 1.

chanical engineering and even business sciences (Tables S3–S5).

Twenty of the identified educational institutions are public institutions, and six private institutions, including two private institutions of short-cycle higher vocational education (Institute for Education Erudio and DOBA Vocational School) and four private higher education institutions (Jožef Stefan International Postgraduate School, B&B College of Sustainable Development, Alma Mater Europaea and Postgraduate School ZRC SAZU). Private higher vocational colleges and higher education institutions charge tuition fees for all enrolled students or they can be publicly funded, provided that they hold a concession for their full-time study programmes. Meanwhile, public educational institutions in Slovenia charge tuition fees for part-time enrolled students, all international students (except for those coming from EU member states, Bosnia and Herzegovina, Montenegro, Kosovo, Serbia and North Macedonia), doctoral students, full-time students who already hold an equivalent degree or international students applying for certain English-taught degrees at the University of Maribor. The tuition fees for the environmental science programmes in those cases range between 1,045 and 2,000 €/year for short-cycle higher vocational education, 2,000 and 11,000 €/year for bachelor's degrees, 2,600 and 11,000 €/year for master's degrees and 3,000 and 4,500 €/year for doctoral degrees (Table S3–S5).

As expected, the highest number of environmental science programmes was identified in Slovenia's two largest cities, Ljubljana and Maribor (Figure 2). These two cities are Slovenia's largest university cities, reflected in the highest number of study programmes allocated to higher education, i.e., nine in Ljubljana and seven in Maribor. A relatively high number of environmental programmes in secondary and short-cycle higher education were also identified in Novo mesto (three in total) and Velenje (three in total).

The number of bachelor's (9) and master's (11) environmental science programmes per number of inhabitants is in this study significantly higher (i.e., 9.5 programmes per million inhabitants) than the highest number of relevant higher education programmes found in the 2014 survey (i.e., 1.2–1.3 programmes per million inhabitants identified for Finland, Norway, Sweden and Serbia).² This can be partly explained by the outdated information from 2014 since it can be expected that new programmes have been created in the last ten years, both in Slovenia and in other European countries. Nevertheless, the outstanding number of environmental study programmes per number of inhabitants found in Slovenia in 2023 indicates a robust educational base in environmental sciences in a country as small as Slovenia.

Most of the programmes in secondary education and short-cycle higher vocational education were established between 2008 and 2014, with the most recent programme in Nature Conservation being established in 2018/2019 at

the School of Machinery, Geotechnics and Environment, School Centre Velenje (secondary education) (Table S3 and S4). Higher education programmes in environmental sciences have similarly long tradition, with most programmes established between 2005 and 2012. Some of the most recently established programmes include Environmental Management at the University of Novo mesto, Faculty of Business and Management Sciences, with bachelor's and master's degrees initiated in 2020 and 2021, respectively. The Postgraduate school ZRC SAZU also introduced a master's programme in Earth and Environmental Sciences and a doctoral programme in Environmental and Regional Studies, both launched in 2021. Over the past decade, several programmes have undergone renewal due to the launch or renaming of new programmes or the transformation of a higher education institution (Table S5).

Next, subjects that were identified from the titles of environmental science programmes were listed and grouped into various categories (Table 2). In this context, subjects represent the disciplines, sub-disciplines, and fields of study that can be identified within the environmental sciences. Fifty-seven subjects were recognized in 46 programmes, as specific programme titles were classified under two distinct subjects. The identified subjects are very diverse. "Environmental Protection" is the subject most frequently identified (15 times, corresponding to 33% of all programmes), followed by "Nature Conservation/Preservation" (11 times, corresponding to 24% of all programmes), "Environmental Engineering/Ecotechnology" (nine times, corresponding to 20% of all programmes) and "Environment/Environmental Studies/Environmental Science" (eight times, corresponding to 17% of all the programmes). None of the study programmes are explicitly entitled "Environmental Chemistry". As can be further seen from Table 2, only two distinct programme subjects, Environmental Protection and Nature Conservation/Preservation, were identified for secondary and short-cycle higher vocational education. In contrast, higher education study programmes include a much more comprehensive range of subjects, such as Environmental Engineering/Ecotechnology, Environment (including similar terms in programme titles) and Ecology/Biology (and similar terms), which reflects the interdisciplinary nature of environmental study programmes in the higher education system in Slovenia.

The subjects identified in the programmes titles evidently do not cover all aspects of environmental sciences, notably lacking subjects such as air quality, meteorology, and soil science. Since the programme titles may not fully reflect the diversity of their content, examining the courses offered within these programs can provide a more comprehensive overview of the programme's content. For instance, courses such as "Air protection", "Air pollution and meteorology", "The Atmosphere: Gases, Aerosols and Climate Change", "Soil and Environment", "Soil Conserva-

Table 2: Identification of subjects (disciplines, sub-disciplines and fields of study) in programme titles that offer environmental science and the corresponding number of study programmes.

Subject	Secondary	Short-cycle higher vocational	Bachelor	Higher Master	PhD
Env Engineering, Ecotechnology			3	4	2
Env Management			1	1	
Env Protection	5	6	2	1	1
Water Science/Water Management			1	1	
Environment, Env Studies, Env Science			3	3	2
Geotechnology		1	1		
Agriculture			1		
Ecology, Eco Sciences, Biology, Evolution, Biodiversity			1	3	2
Nature Conservation, Preservation	5	3	1	2	
Earth				1	

tion”, “Soil Ecology”, “Soil pollution”, etc. were frequently identified in the course titles (Table S6), demonstrating their inclusion in the curricula of the programmes examined in this study.

3. 2. Significance of Chemistry in Programmes

The significance of chemistry in environmental science programmes presented as the percentage of courses assigned to chemistry topics was calculated as described in section 2.3. (Data analysis). From a list of compulsory and elective chemistry courses presented for all levels of education (Table S6), it can be seen that the most common subjects identified in the course titles at all levels of education were “environment” or “environmental” (74 times), followed by “chemistry” or “chemical” (30 times), “technologies” (23 times), “water” (21 times), “waste” (17 times), “management” (14 times), “materials” (12 times), and protection and pollution (each 11 times). The most common chemistry-related courses covered different areas of chemistry (including analytical, inorganic, organic, colloidal,

bio-, geo- and radiochemistry) or were related to the environmental chemistry (Environmental Chemistry and Technology, (Principles of) Environmental Chemistry, Chemistry and Environmental Technology, Chemistry in Environmental Protection, Chemistry of Environmental Systems, Chemistry of Pollutants, Chemistry of the Agricultural Environment, Colloid Chemistry in the Environment, Environmental Analytical Chemistry, Organic Chemistry for Sustainable Development, and Green Chemistry (Table S6). Only three courses within the bachelor’s programmes are explicitly entitled “Environmental Chemistry”. A similarly low percentage of environmental chemistry was found in 2014, in which only six universities included in the survey offered environmental chemistry as a specific programme subject.² Other chemistry-related courses that were associated with the application of chemistry to solve environmental problems were entitled Ecoremediation, Environmental Science/Technologies/Management/Monitoring/Engineering, Air Protection, Air/Water/Soil/Environmental Pollution (including similar terms), Environmental/Research/Experimental/Instrumental Methods(ology) (including similar terms),

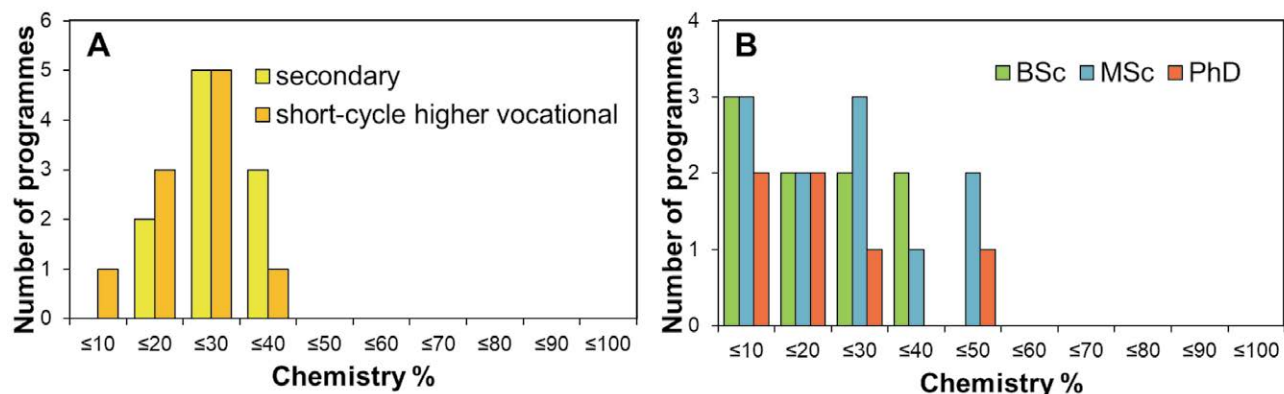
**Figure 3:** Histogram showing the number distribution of A) secondary programmes (n = 10) and short-cycle higher vocational programmes (n = 10) and B) higher education programmes (bachelor’s (n = 9), master’s (n = 11) and doctoral (n = 6)) that include a certain percentage of compulsory and elective courses given for chemistry.

Table 3: Percentage of courses (compulsory and elective) with at least 5% allocated to chemistry (% , mean) for the study programmes grouped into different subjects. The number of programmes is given in brackets.

Subject	Secondary	Short-cycle higher vocational	Bachelor	Higher Master	PhD
Env Engineering, Ecotechnology			<30% (3)	<30% (4)	<40% (2)
Env Management			<10% (1)	<10% (1)	
Env Protection	<40% (5)	<30% (6)	<30% (2)	<30% (1)	<10% (1)
Water Science/Water Management			<20% (1)	<10% (1)	
Environment, Env Studies, Env Science			<20% (3)	<40% (3)	<20% (2)
Geotechnology		<10% (1)	<10% (1)		
Agriculture			<10% (1)		
Ecology, Eco Sciences, Biology, Evolution, Biodiversity			<20% (1)	<20% (3)	<10% (2)
Nature conservation, Preservation	<20% (5)	<50% (3)	<20% (1)	<30% (2)	
Earth				<20% (1)	

Waste(water) Management/Treatment, Basic/Applied/Fundamentals of Ecology or Marine/Freshwater Ecology, and Ecotoxicology. It is evident that the diversity of courses in higher education programmes was greater than in secondary and short-cycle higher vocational education programmes (Table S6).

The distribution (number of courses) with a certain percentage of chemistry for all education levels studied is shown in Figure 3 and allocated to the subjects identified in the programme titles in Table 3. Most programmes have a relatively low percentage of chemistry in their curricula: 31% in secondary education, 26% in short-cycle higher vocational education, 21% in bachelor's programmes, 30% in master's programmes and 23% in doctoral programmes (Figure 3). These values are comparable to the percentage of chemistry content identified in bachelor's ($15 \pm 11\%$) and master's ($28 \pm 21\%$) programmes in Europe in 2014.² The distribution of chemistry content is more diverse in secondary and short-cycle higher vocational programmes than in higher education programmes. When considering the programme subjects, it is evident that, regardless of the

level of education, the highest proportion of courses with chemistry content is to be found in the fields of Environmental Engineering/Ecotechnology, Environmental Protection, Environment (including similar terms) and Nature Conservation/Preservation, with an average of around 30% of courses allocated to chemistry.

3. 3. Significance of Environment in Programmes

Similar to chemistry, the significance of the environment in the identified environmental science programmes was evaluated. The course titles (Table S6) of the programmes across all educational levels most frequently contained the word “environment” or “environmental” (202 times), followed by other commonly found terms, such as “ecology” or “ecological” (74 times), “biology” or “biological” (48 times), “nature” or “natural” (42 times), “management” and “conservation” (each 39 times), “protection” (36 times), “technologies” (32 times), “chemistry” or “chemical” (30 times), and “sustainable” (24 times). Of the envi-

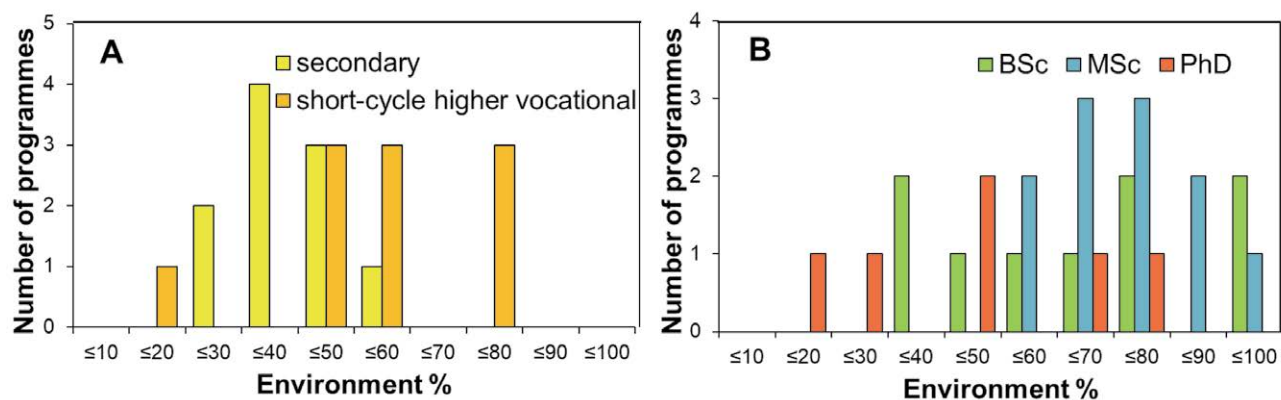
**Figure 4:** Histogram showing the number distribution of A) secondary programmes (n = 10) and short-cycle higher vocational programmes (n = 10) and B) higher education programmes (bachelor's (n = 9), master's (n = 11) and doctoral (n = 6)) that include a certain percentage of compulsory and elective courses given for environment.

Table 4: Percentage of courses (compulsory and elective) with at least 20% allocated to environment (% , mean) for the study programmes grouped into different subjects. The number of programmes is given in brackets.

Subject	Secondary	Short-cycle higher vocational	Bachelor	Higher Master	PhD
Env Engineering, Ecotechnology			<50% (3)	<60% (4)	<40% (2)
Env Management			<80% (1)	<70% (1)	
Env Protection	<50% (5)	<60% (6)	<70% (2)	<80% (1)	<80% (1)
Water Science/Water Management			<40% (1)	<60% (1)	
Environment, Env Studies, Env Science			<70% (3)	<80% (3)	<40% (2)
Geotechnology		<20% (1)	<40% (1)		
Agriculture			<100% (1)		
Ecology, Eco Sciences, Biology, Evolution, Biodiversity			<100% (1)	<80% (3)	<50% (2)
Nature Conservation, Preservation	<40% (5)	<80% (3)	<100% (1)	<80% (2)	
Earth				<70% (1)	

ronmental matrices, water (i.e., waste, drinking, process, ground, surface and freshwater) was the matrix most frequently identified in the course titles (31 times), followed by soil (16 times) and air (10 times). Again, the variety of courses, specifically elective courses, was much greater in tertiary education programmes than in secondary and short-cycle higher vocational education programmes.

The average percentage of courses allocated to the environment was 43% in secondary education, 59% in short-cycle higher vocational education, 62% in bachelor's programmes, 85% in master's programmes and 50% in doctoral programmes (Figure 4 and Table 4). It is evident that the environmental content of programmes is much higher than their chemistry content and varies considerably among different levels of education (Figure 4) and subjects (Table 4). A closer look at the programmes grouped by subject area shows that the significance of the environment is highest in Environmental Management, Environment (including similar terms), and Ecology (and similar terms), with an average of around 70% of courses allocated to the environment. These numbers adequately reflect the interdisciplinary nature of environmental science programmes.

3. 4. Teaching Language

None of the secondary or short-cycle higher vocational programmes offer courses in English. In higher education programmes, all courses in two bachelor's, five master's, and three doctoral programmes are offered in Slovene and English. The language is switched to English when non-native students are enrolled. This finding indicates that a relatively large proportion of the identified environmental programmes are taught in English, more so at the master's and doctoral levels (45–50%) than at the bachelor's level (22%). The percentage of courses taught entirely in English is higher in Slovenia than at the European level in 2014, when 15% of bachelor's and 24% of master's programmes were taught in English.²

4. Conclusions

We showed that many environmental science study programmes are offered in Slovenian educational institutions at all levels of education, including secondary education, short-cycle higher vocational education and higher education. The high number of environmental programmes per capita (9.5 programmes per million inhabitants) indicates a robust educational base in environmental sciences in a country as small as Slovenia. The identified programmes offer a broad and diverse range of subjects, particularly in higher education, reflecting the interdisciplinary nature of environmental science programmes.

The environmental content of the identified programmes is much higher than their chemistry content and varies considerably among different levels of education and subjects. Only three courses within the bachelor's programmes are explicitly entitled "Environmental Chemistry". This fact suggests that despite a strong educational foundation in environmental sciences in Slovenia, environmental chemistry as a programme subject is less represented. The programmes identified in this study are established after 2005. A significant share of courses within higher education programmes (an average of around 40%) are taught in English or offer the possibility to be taught in English. This number reflects the mobility of students within the EU, which has already been implemented in higher education in line with the Bologna objectives.

As programmes have a life cycle between accreditations, it is reasonable to assume that some information (e.g., programme titles and tuition fees) may have become outdated or changed by the time of publication of this work. Nevertheless, the overview of environmental science programmes provided in this study gives valuable information for students, academics and researchers interested in environmental chemistry and environmental sciences. In addition, it is believed that the results of this study will help raise the visibility and importance of this discipline at national and international levels.

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Povzetek

Okoljska kemija ima pomembno vlogo pri ocenjevanju kemijske onesnaženosti okolja, s tem pa prispeva k varovanju ekosistemov in zdravja ljudi. Zato je bistvenega pomena, da prihodnjim generacijam zagotovimo potrebno znanje in veščine s področja okoljske kemije. Splošni cilj te raziskave je bil oceniti stanje izobraževanja na področju okoljske kemije v Sloveniji v letu 2023, s pregledom slovenskih študijskih programov s področja okoljskih ved in opredelitvijo pomena kemije v srednješolskem, višješolskem strokovnem in visokošolskem izobraževanju (vključno z dodiplomskim, magistrskim in doktorskim študijem). Identificirali smo skupno 46 študijskih programov, ki ponujajo okoljske vede, z veliko raznolikostjo v vsebini kemije na različnih stopnjah izobraževanja. Ta raziskava nudi študentom in raziskovalcem, ki jih zanima ali se ukvarjajo z okoljsko kemijo, dragocene informacije o izobraževalnih programih s področja okoljske kemije v Sloveniji.



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