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ARCTISER Research Report 2026-01

The Bachelor Burden

Structural Organization of Science Degrees in Norway and EU Universities: A Pilot Comparative study

Research focus

This pilot study examines how science degree programs structure academic workload within the European Credit Transfer and Accumulation System (ECTS).

Programs analyzed

- Biology
- Chemistry
- Pharmacy

Institutions examined

- University of Oslo (Norway)
- University of Zagreb (EU reference case)

Key structural comparison

Indicator	Norway (UiO)	EU Reference
Average ECTS per course	~10 ECTS	~5–7 ECTS
Course count (first 180 ECTS)	Lower	Higher
Curriculum structure	Larger integrated modules	Higher course segmentation

Executive Summary

This report presents a pilot comparison of undergraduate science degree structures between Norway and the European Union. Curricula from the University of Oslo (Norway) and the University of Zagreb (Croatia) were analyzed in order to examine how the European Credit Transfer and Accumulation System (ECTS) is structurally implemented across institutions. The analysis focuses on three scientific disciplines: Biology, Chemistry, and Pharmacy. For integrated pharmacy programs, only the first 180 ECTS were examined to maintain comparability with bachelor-level programs. Results show that the EU reference programs exhibit substantially higher curriculum segmentation than the Norwegian equivalents. The Croatian programs contain approximately twice as many course units within the first 180 ECTS, with significantly smaller ECTS allocations per module. These differences may influence perceived workload, examination frequency, and scheduling density.

Research Objective

To explore how curriculum architecture differs across European science programs and how module size influences the organization of scientific training.

Background

European higher education operates under the Bologna framework, which introduced the ECTS credit system as a standardized mechanism for measuring academic workload. Under this system, 60 ECTS credits correspond to one academic year of full-time study. While ECTS provides a unified credit metric, the structural implementation of modules varies significantly across institutions. Some universities organize curricula into larger modules, typically around 10 ECTS per course, while others divide subjects into a larger number of smaller modules. Understanding how these structural choices influence degree design is important for evaluating academic workload, curricular flexibility, and institutional approaches to knowledge segmentation.

Methodology

The study compares curriculum structures from two institutions: the University of Oslo (Norway) and the University of Zagreb (Croatia). Zagreb was selected as a representative EU case due to its adherence to Bologna ECTS standards and its status as a major public research university. Program structures were extracted from official university curriculum documentation and course catalogs publicly available on institutional websites. The analysis focuses on structural indicators rather than course content. Key indicators include:

- Number of required courses within the first 180 ECTS
- Average ECTS allocation per course
- Distribution of laboratory and practice modules
- Segmentation of scientific disciplines across course units.

Curriculum Dataset

Program	Country	Courses	Average ECTS
UiO Biology	Norway	19	10
Zagreb Biology	EU (Croatia)	25	6.5
UiO Chemistry	Norway	18	10
Zagreb Chemistry	EU (Croatia)	32	5.5
UiO Pharmacy (180 ECTS)	Norway	16	11.25
Zagreb Pharmacy (180 ECTS)	EU (Croatia)	31	5.8

Figure 1: Course segmentation

Figure 2: Average ECTS per Course

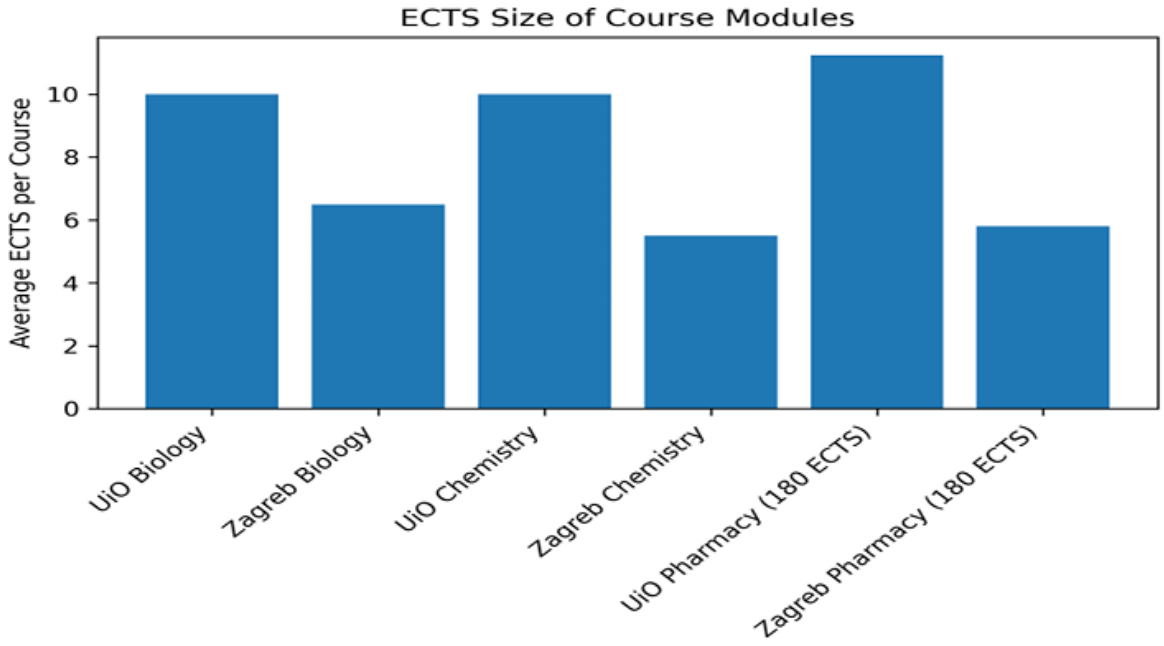
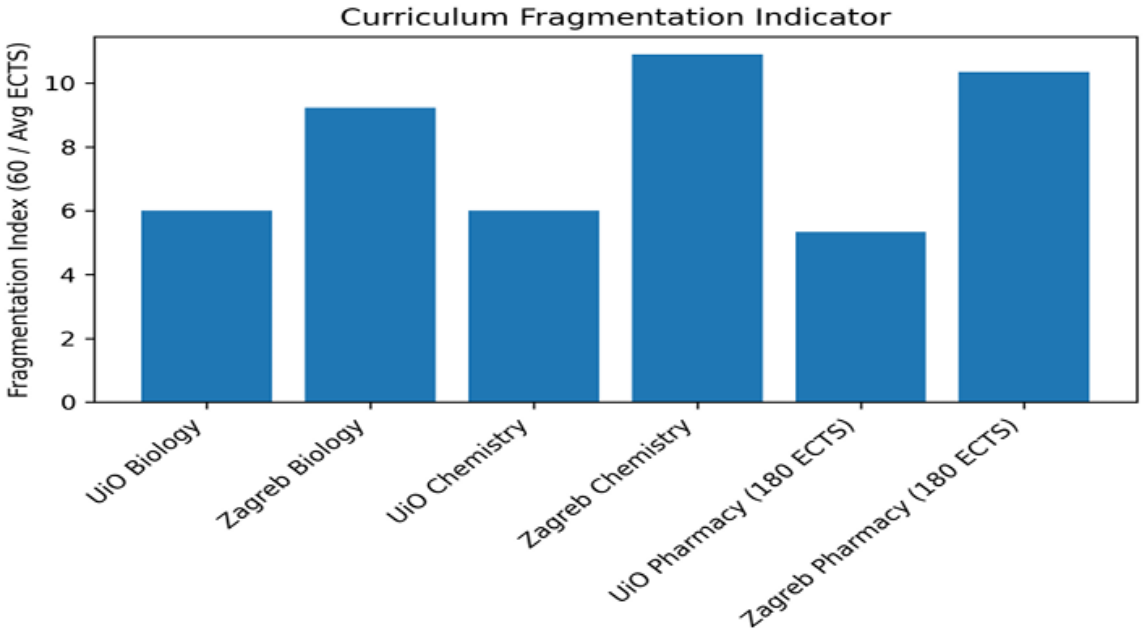


Figure 3: Curriculum Fragmentation Index

The Curriculum Fragmentation Index (CFI) is calculated as the ratio between the standard academic year workload (60 ECTS) and the average ECTS value of course modules.



Methodological note on pharmacy programs

For the purposes of cross-disciplinary comparability of this research series, the pharmacy programs included in the study were analyzed only within the first 180 ECTS of study. Both the Norwegian and Croatian pharmacy degrees examined are structured as integrated five-year master programs rather than separate bachelor and master cycles. However, restricting the analysis to the initial 180 ECTS allows the structural organization of the early stages of pharmacy education to be compared with bachelor-level programs in Biology and Chemistry. This approach ensures methodological consistency across disciplines while still capturing the structural characteristics of the curriculum during the equivalent period of undergraduate training. The analysis therefore focuses on the structural organization of the early academic phase of the degree rather than the full professional training cycle.

Discussion

The comparison reveals consistent structural differences between Norwegian curricula and the examined EU reference programs. Across all three disciplines analyzed - Biology, Chemistry, and Pharmacy - the Norwegian programs tend to organize academic content into relatively large course units, typically around 10 ECTS each. This structure results in a smaller total number of course modules across the first 180 ECTS of study. In practice, scientific content is therefore grouped into broader thematic blocks that integrate multiple subtopics within a single course unit.

By contrast, the examined EU reference programs display a noticeably higher degree of curricular segmentation. Courses are distributed across a larger number of individual modules, with many carrying ECTS values in the range of approximately 5 - 7 credits. In several cases, the curriculum also includes very

small modules below 2 ECTS, representing narrowly defined instructional components such as short methodological training blocks, orientation courses, or specialized laboratory activities.

This structural pattern is particularly evident in the pharmacy programs examined in this pilot study. Within the first 180 ECTS of study, the Croatian curriculum contains nearly twice as many separate course units as the Norwegian equivalent. While both programs ultimately deliver the same total credit volume under the European Credit Transfer and Accumulation System (ECTS), the internal organization of those credits differs substantially.

These differences illustrate that, although ECTS establishes a common credit framework across the European Higher Education Area, the practical implementation of that framework varies considerably between institutions. The Norwegian model tends to favor larger, integrated modules that combine several disciplinary components within a single course structure. In contrast, the examined EU reference model more frequently separates academic content into a larger number of smaller instructional units.

One immediate implication of this difference concerns the distribution of assessment throughout the academic year. Curricula composed of many smaller modules may generate a greater number of examinations, assignments, and grading events. Students therefore encounter more frequent evaluation points and must repeatedly demonstrate competence across multiple separate subjects. In contrast, programs organized around fewer but larger modules may concentrate evaluation into a smaller number of examinations associated with each integrated course unit.

The degree of curricular segmentation may also influence scheduling complexity and academic workload management. Highly segmented curricula require students to manage a larger number of concurrent course obligations within a single semester, including lectures, laboratory sessions, assignments, and examinations across multiple parallel modules. Larger integrated modules may reduce the number of parallel course structures, but they may also require

longer sustained engagement with individual subject areas before evaluation occurs.

Another important dimension concerns the way scientific knowledge is structured and encountered during the early stages of university education. Larger modules can allow instructors to integrate multiple scientific perspectives within a single course framework, potentially encouraging conceptual synthesis across related disciplines. At the same time, smaller modules may permit more precise disciplinary specialization and allow programs to introduce a wider range of narrowly defined scientific topics throughout the curriculum.

This distinction may also have implications for the type of practical experience students accumulate before entering professional environments. Programs with a larger number of smaller modules may expose students to a broader set of discrete scientific methods, laboratory techniques, and specialized subfields during the early phases of study. Because many of these modules focus on specific procedural or methodological topics, students may repeatedly encounter distinct technical components throughout their degree.

In contrast, programs organized around larger modules may emphasize conceptual integration and theoretical synthesis across broader subject areas. While this approach can provide strong foundational understanding of scientific principles, it may involve fewer separate technical course units during the early stages of study. As a result, the balance between theoretical integration and exposure to specialized technical tasks may differ between the two curricular models.

The pharmacy programs examined in this study illustrate this structural contrast particularly clearly. The Norwegian curriculum integrates several scientific components within broader modules and includes a substantial practice period of 30 ECTS in the sixth semester. By contrast, the examined EU reference program distributes pharmacy across a larger number of distinct modules, each focusing on more specific disciplinary or methodological elements. This results in a curriculum structure that is more fragmented but

also potentially exposes students to a wider range of discrete technical topics earlier in the program.

It is important to emphasize that this pilot comparison does not attempt to determine whether one structural model is inherently superior to the other. Instead, the analysis highlights differences in how academic workload and subject matter are organized within the shared ECTS framework. Both systems ultimately allocate the same total number of credits across the degree, but they distribute those credits across modules in substantially different ways.

Several limitations must also be acknowledged. The present analysis examines only one EU reference institution and therefore cannot be interpreted as representative of all European universities. The study also focuses exclusively on structural characteristics of curricula rather than pedagogical approaches, teaching quality, or measured student outcomes. Nonetheless, the consistent patterns observed across three separate scientific disciplines suggest that the structural differences identified here may reflect broader variations in curriculum design strategies within the European Higher Education Area.

Future ARCTISER research will expand the dataset to include additional universities across multiple EU member states as well as further Nordic institutions. A broader dataset would allow more systematic analysis of how module size, course segmentation, and curriculum architecture vary across European science programs and how these structural differences may influence the balance between theoretical integration and early exposure to specialized scientific training.

Structural Implications for the Bologna Framework

The findings of this pilot comparison also highlight an important structural feature of the European Credit Transfer and Accumulation System (ECTS). While the Bologna framework standardizes the total academic workload required for degree completion - typically 180 ECTS for bachelor-level programs - the internal architecture through which those credits are delivered is not standardized.

The programs examined in this study demonstrate that identical credit totals may be distributed across very different numbers of course modules. In the cases analyzed here, the Norwegian programs organize approximately 180 ECTS across fewer, larger modules, while the examined EU reference programs distribute the same credit volume across a substantially higher number of smaller instructional units.

This suggests that the Bologna system harmonizes credit measurement but leaves substantial institutional flexibility in the structural organization of degree programs. As a result, two programs formally operating under the same credit framework may provide students with notably different patterns of course segmentation, assessment frequency, and exposure to specialized instructional components.

Understanding these structural variations may therefore represent an important dimension of future comparative research on European higher education systems.

Conclusion

This pilot comparison highlights clear structural differences in the organization of science degree programs between the Norwegian case examined and the selected EU reference institution. Although both systems formally operate within the common framework of the European Credit Transfer and Accumulation System (ECTS), the way in which academic workload is distributed across course units differs substantially.

Norwegian programs tend to organize scientific instruction into larger integrated modules, typically around 10 ECTS per course, resulting in a relatively small number of course units within the first 180 ECTS of study. In contrast, the examined EU reference programs distribute academic content across a significantly larger number of smaller modules, many of which carry credit values in the range of 5 - 7 ECTS, with occasional micro-modules dedicated to specific practical or methodological topics. As a result, the EU reference curricula examined in this study display noticeably higher levels of course segmentation.

These structural differences do not necessarily imply differences in total academic workload, as both systems ultimately deliver equivalent credit volumes under the ECTS framework. However, the way that workload is organized may influence several aspects of the educational experience, including the frequency of examinations, the distribution of coursework across semesters, and the extent to which students encounter discrete technical or disciplinary components during their studies.

The findings of this pilot analysis therefore suggest that curriculum architecture - specifically the degree of course segmentation - represents an important dimension of higher education design that may vary considerably between institutions operating under the same credit system. Differences in module size and course distribution may shape how students interact with subject matter, how often they are assessed, and how exposure to specialized scientific topics develops over the course of a degree.

At the same time, this study should be interpreted as an exploratory comparison rather than a definitive evaluation of national education systems. The analysis is based on a limited dataset consisting of one Norwegian institution and one EU reference university. While consistent patterns were observed across Biology, Chemistry, and Pharmacy programs, broader conclusions require a larger and more diverse institutional sample.

Future ARCTISER research will expand the dataset to include additional universities across multiple EU member states and Nordic countries. A larger comparative framework will allow for more systematic investigation of how course segmentation, module size, and curriculum architecture vary across European science programs, and whether the patterns observed in this pilot comparison represent broader structural tendencies within the European Higher Education Area.

By focusing on the structural design of degree programs rather than solely on institutional rankings or output metrics, this line of research aims to contribute to a more detailed understanding of how educational systems organize scientific training and how those organizational choices may influence the learning environment experienced by students across Europe.

Key Findings

1. Substantial differences in curriculum segmentation were observed.

Across Biology, Chemistry, and Pharmacy programs, the EU reference curricula examined in this pilot study contain significantly more individual course units within the first 180 ECTS of study than the Norwegian equivalents.

2. Norwegian programs tend to use larger integrated course modules.

At the University of Oslo, scientific subjects are typically organized into modules of approximately 10 ECTS, resulting in fewer overall courses during the first three years of study.

3. EU reference programs distribute content across smaller modules.

The examined EU programs more frequently use modules in the range of 5–7 ECTS, and in some cases include very small instructional units dedicated to specific practical or methodological components.

4. Structural differences influence how academic workload is experienced.

Programs with higher segmentation may involve more frequent examinations and parallel course obligations, while larger modules may concentrate assessment into fewer but more comprehensive evaluation points.

5. Segmented curricula may expose students to a wider range of discrete technical topics earlier in their studies.

Because subject areas are divided into a larger number of smaller modules, students in more segmented programs may encounter a broader set of specialized scientific topics and laboratory methods during the early stages of their degree.

6. The findings reflect differences in curriculum architecture rather than total workload.

Both systems ultimately deliver the same overall credit volume under the ECTS framework; the difference lies in how those credits are distributed across course units.

7. Further comparative research is required.

This pilot study examines a limited institutional sample. Expanding the dataset to additional Nordic and EU universities will allow future ARCTISER research to determine whether the patterns observed here represent broader structural tendencies within European higher education.

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**All data used in this report was obtained from publicly available university curriculum documentation and official course catalogs.*