Horyzonty Edukacji Akademickiej

Horyzonty Edukacji Akademickiej 3/2025 (128-141)

DOI: https://doi.org/10.26881/head.2025.3.14

Iwona Maciejowska
Jagiellonian University,
Faculty of Chemistry
ORCID: 0000–0002–3788–4853

Beyond borders – an example of international cooperation in subject teaching

Summary

The article presents an analysis of the development and significance of the *European Variety in University Chemistry Education* (EuroVariety) international conference as an example of effectively overcoming the isolation of academic teachers through international collaboration. A comparison of conference presentation topics from 2005 and 2025 made it possible to identify key shifts in the priorities of chemistry education – from formal and curricular issues toward reflection on universities' social responsibility, sustainable development, inclusivity, and the professionalisation of the academic teacher's role. Digital technologies remain a constant feature of conference debates; however, their scope has evolved from simple e–learning tools to advanced VR/AR and AI solutions.

The evaluation of EuroVariety 2025 shows that the conference not only provides participants with inspiration and professional connections but also fosters a sense of community and strengthens teachers' confidence. The case discussed confirms that bottom–up initiatives can evolve into lasting international forums for the exchange of teaching experiences and reflection on higher education practice. The recommendations emphasise the need to increase the accessibility of the conference by offering financial support to participants from countries with lower levels of educational funding and by considering hybrid formats as a complement to in–person meetings, saving participants time. The authors also suggest that the EuroVariety model can serve as inspiration for other disciplines, fostering the professionalisation of academic staff, building communities of practice, and advancing academic teaching in an international dimension.

Keywords: higher education teaching, international collaboration, EuroVariety, conference, chemistry education, academic teacher

Introduction

Teaching, and especially academic teaching, is often perceived as an isolated activity of a teacher standing alone in front of a group of students or equally alone struggling with the dilemmas of assessing them. M. T. Brookes' (1983) report "Meeting the Challenges: Developing Faculty Careers" states that the academic profession is a "very solitary activity" with limited mentoring and social support. Similarly, S. Moore's textbook Teaching at College and University notes that "*teaching can be quite a solitary* activity," even though lecturers are part of a wider academic community. In his work,

Jandrić distinguishes between *alone time* (time spent alone that is conducive to concentration and creativity) and *loneliness* (unwanted emotional isolation), which is discussed in this paper. He points out that lecturers often need silence for writing and reflection, but a lack of support within the academic team can lead to feelings of loneliness (Jandrić, 2022).

On this basis, it is worth posing a few questions: Do I feel the same way in this role? Does this situation affect/worry me? What does it involve? What are the consequences? When answering these questions, it is worth considering several factors, for example:

a) lack of a teaching partner. Co–teaching is not particularly popular at Polish universities, except perhaps for laboratory classes. Every class taught solo lacks the support of a co–teacher with whom one could jointly solve problems *as they arise*, i.e. at the moment they occur. This can deepen the feeling of isolation, especially in difficult teaching situations.

b) lack of social reinforcement during and outside of classes. Although outside the classroom, the lecturer may (but does not have to) be part of a teaching team teaching a given subject, specialisation or field of study, the frequent lack of regular meetings, constant exchange of ideas, observations, reflections, questions, conclusions, and joint solving of everyday problems encountered in working with students significantly limits their ability to improve their teaching.

c) Lack of constructive feedback on the classes conducted. The lack of a second person (co–teacher) to consult on ongoing decisions, who would be able to respond during the class, as well as the lack of supportive classroom observations or, post– , simply peer observations, makes it difficult, among other things, to flexibly adapt the actions taken to the situations and needs of a given group of students.

Teaching cooperation as a *sine qua non* condition for the quality of education

The phenomenon of isolation in the role of an academic teacher described above can be contrasted with the idea of community, on the basis of which the very concept of the classical university as a community of students and professors was developed, as well as with the ideas of cooperation and collegial teaching. They promote communication and the exchange of experiences in the academic environment. Examples of such activities include: the creation of *Community of Practice* teams (Wenger, 1998), cooperation between teachers of the same subject (common in the natural and medical sciences), institute teaching seminars and the activities of Programme Councils.

Today, teaching cooperation extends beyond the walls of the university

In alliances such as *European Universities* (e.g. Una Europa), joint programmes and procedures for supporting the quality of education are being developed. The improvement of teaching competences of lecturers takes many different forms in the international environment (Fig. 1).

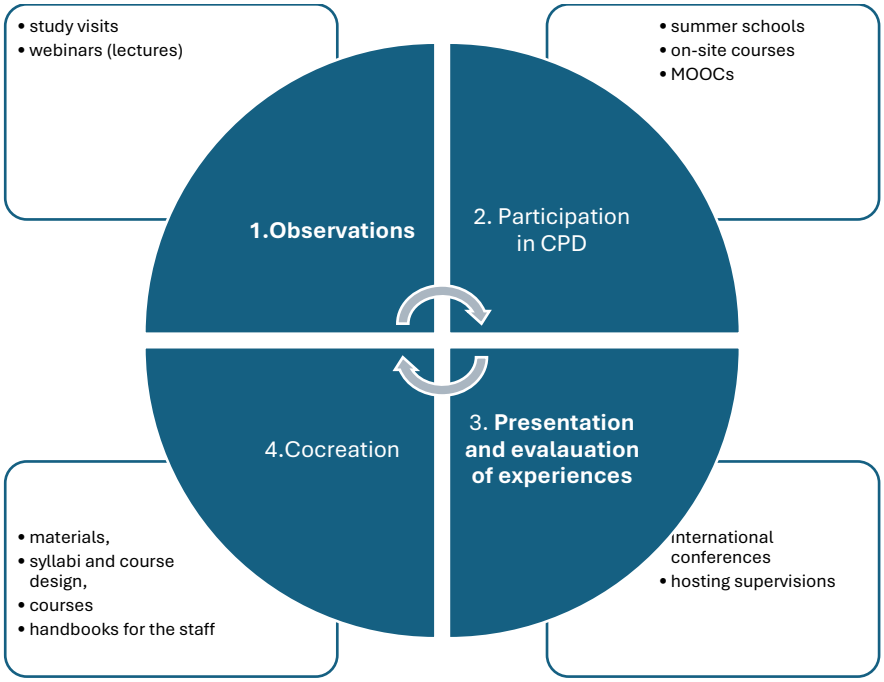

Fig. 1. Examples of forms of international cooperation for the development of teaching competences of academic teachers (Maciejowska, 2022)

One of the forms of developing teaching staff is the participation in international teaching conferences. Participation, even passive, allows one to learn about the latest trends, achievements, research and examples of good practice in academic teaching, as well as to establish interesting contacts (Hauss, 2022). Active participation, on the other hand, allows for the presentation of one's own teaching activities and their evaluation, which leads to reflection on one's own teaching practice (Hutchings & Shulman, 1999; Felten, 2013; Cruz et al., 2023). Participation in teaching conferences is a recognised form of professional development for academic teachers – it provides a forum for sharing results, projects and initiatives aimed at improving teaching (Boyer, 1990; Hutchings & Shulman, 1999).

An example of good practice in international teaching cooperation

One of the two objectives of this paper is to present an example of good practice in building high–quality education through international teaching cooperation. The analysis focuses on cooperation across national borders, with particular emphasis on the experience of the Faculty of Chemistry of the Jagiellonian University in organising an international teaching conference. A case study approach was used, combining descriptive and chronological analysis (Yin, 2015; Strumińska–Kutra, 2018) and elements of an autoethnographic approach containing a reflective analysis of how the author's own professional experiences reflect broader institutional mechanisms.

The Faculty of Chemistry at the Jagiellonian University employs approximately 150 research and teaching staff and approximately 25 teaching staff. With this potential, it independently runs four fields of study and co–runs another four. In order to meet these challenges, the development of

teaching staff competencies is pursued not only within the department and the university as a whole, but also through international teaching cooperation. Previous research conducted in this environment has shown a positive correlation between the international activity of academic teachers in the field of teaching within the international ECTN (European Chemistry Thematic Network) and the quality of education at the faculty (Maciejowska, 2022).

In 2002, staff from the Department attended the British conference *Variety in Chemistry Education* in Plymouth for the first time. This meeting, devoted to good practices in chemistry education at the academic level, inspired the author to organise a European equivalent of that conference. At that time, there was a lack of space in Poland for the systematic exchange of teaching experiences – the only opportunity was the chemistry teaching sessions during the annual meetings of the Polish Chemical Society, where the subject of higher education took up only a small part of the agenda. It seems that the situation was similar at the time in other scientific and natural sciences disciplines, and in some cases it remains so today.

In 2005, in Krakow, the participants of the 2002 conference, supported by their colleagues and the Faculty authorities, organised the first international conference *European Variety in Chemistry Education* (EuroVariety), addressed to lecturers at universities, technical universities and vocational colleges (https://www2.chemia.uj.edu.pl/~eurovariety/html/index.html). Its main objective was to create a platform for the exchange of experiences in chemistry education within the European Higher Education Area (EHEA). The three–day meeting was attended by over 40 guests from 16 countries and almost as many academic teachers from Poland, including fifteen lecturers from five different teaching departments of the Faculty of Chemistry at the Jagiellonian University (*European Variety in Chemistry Education. Scientific Programme, 2005*). Unfortunately, no formal evaluation of the conference was carried out at the time. One indicator of the conference's success may be its inclusion in the DivCEd EuChemS calendar and its organisation for the next 20 years, alternating with the ECRICE conference dedicated to research in chemistry education.

Based on the author's own experience, it can be said that this was a unique opportunity for Polish lecturers to see how their colleagues from other European countries work and what challenges they face. The differences were very clear. One of them was the diversity of students undertaking studies. The teaching challenges discussed in the presentations related to, among other things, diverse prior knowledge (e.g. no chemistry lessons at secondary school level in some countries), diverse professional and family responsibilities (student–employees and student–parents), teaching chemistry to "non–chemists", and the associated need to reduce the number of students dropping out after the first year or semester, seemed to us at the time to be taken from a completely different fairy tale. At that time, chemistry studies in Poland were mostly undertaken by people immediately after secondary school and the chemistry matriculation examination, and future doctors, pharmacists and biochemists were taught by chemistry lecturers employed specifically for this purpose in those departments. Topics such as activating students during lectures, introducing problem–based tasks that did not have one correct solution, inquiry–based science education (IBSE), and starting classes by presenting the practical context of the concepts discussed were also almost completely new to us. On the other hand, topics related to teaching and learning specific chemical concepts and relationships, introducing activating methods in practical classes, and using newly developed information and communication

technology tools appeared among both Polish and foreign authors. The conference allowed the author and her colleagues not only to prepare for the new teaching challenges that will inevitably arise in academic education in the coming years, but also to build a sense of community with colleagues teaching chemistry students in other parts of Europe.

In 2025, the conference returned to Krakow under the slightly more precise name *of European Variety in University Chemistry Education* (https://eurovariety2025.confer.uj.edu.pl/). According to the author, after 20 years, the differences in the topics of presentations between participants from Poland and other EU countries have been virtually eliminated.

A comparison the structure of the organising committees of both editions shows that the effective organisation of a conference on academic teaching is based on cooperation between representatives of various teaching institutions, which allows for better use of their diverse competences, experience and networks, increasing the impact of the event and promoting its interdisciplinary nature. This cooperation has continued since 2002 and will continue until 2025, also outside the conference context, which demonstrates not only the enormous need for a community of practice (CoP), but also its effectiveness in ensuring high–quality education.

On the other hand, basing the composition of scientific committees on members of the teaching section of the European Chemical Society (Division of Chemical Education EuChemS) created “an international umbrella” facilitating access to a wide range of potential participants and ensuring a high level of programme content. In the author's opinion, without this support, breaking through the "iron curtain" in academic teaching would be very difficult. This is particularly important in an era of so–called "fake" conferences, which are springing up like mushrooms after rain, masquerading with their names and acronyms as events with tradition and reputation, but do not review submissions, do not invite experts in the field, and focus on generating profits.

The statements of the participants of the EuroVariety 2025 conference, captured in the evaluation survey, showed, among other things, that:

- As described in the literature, participants had three main goals for attending the conference: to be inspired (38% of responses), to share their own experiences, and to network (29% each; more than one response could be selected).
- The two main obstacles that may hinder the decision to register for participation are lack of funds (81%) and lack of time (51%).
- Unlike scientific conferences, where this format is extremely rare, practical workshops were well received at EuroVariety. When asked about the future, participants were strongly in favour of workshops in a wide variety of fields. The most votes were cast for experiments in student education (60%), followed by artificial intelligence (58%) and teaching software (42%). The topic of soft skills development was also important (46%).

In response to the question "What will you say to your colleagues when you return to work?", the following comments were made[1] , among others: "It was nice to learn what is easy and what is

[1] Automatic translation

difficult to teach about sustainable development at universities – it gave me an indication of where I and my teaching are at." "Although teaching is a solitary activity, meeting people who do the same thing is very helpful." "Some of our activities have official names – we are doing the right thing!" "The presentations and other formats were inspiring. I liked the diversity represented and experienced (different nationalities, education, etc.)." It fulfilled my goals of networking and making new friends. I still remember some of what I learned. The sense of belonging to an international community that shares common interests and can convey inspiring and insightful thoughts is of great value.

Analysis of thematic trends at the European Variety in University Chemistry Education conferences between 2005 and 2025

The unique situation in which an international conference was organised in Poland after a long interval provided an opportunity to identify topics and trends from the last 20 years. The analysis includes a comparison of the topics "theoretically" proposed by the scientific committees of both conferences and those implemented in practice, based on the abstracts of all presentations (oral and poster) from 2005 and 2025. A thematic approach was used **–** a simplified content analysis (*Content Analysis*). The stages of the analysis are as follows (Braun & Clarke, 2006):

1. Familiarisation with the data – preliminary reading of the abstracts.
2. Coding – identification of meaningful units (keywords, issues) and assigning them preliminary codes.
3. Searching for themes – grouping codes into thematic categories (e.g. 'ICT in teaching', 'Professional competences', 'ZR and SDG') and defining themes.
4. Reporting – summarising changes over time.

Research on the topics of conferences and publications on STEM (*Science, Technology, Engineering, Mathematics*) education has been conducted for many years. The most recent include the works of Odden, Marin and Caballero (2020), Caramaschi and Odden (2025), Draman and Mohamad (2021).

Odden, Marin and Caballero (2020) noted that there have been clear changes in educational research: from simple conceptual studies (2000–2005), through complex analyses based on quantitative data and mixed methods (after 2010), to a shift towards diversity and inclusiveness (since the mid–2010s). There have also been waves of increased interest in specific topics, including a shift from qualitative research on student understanding to analyses of problem solving. Since 2010, there has been a noticeable increase in the importance of sociocultural approaches, including research on communities of practice, student identity and institutional change.

Draman and Mohamad (2021) in their work *A Bibliometric Review on Chemistry Education: Bodies of Research 1980–2020* pointed out that after 2000, there were many publications devoted to, among other things, green chemistry, *problem–based learning (PBL*) and evaluation. The most

frequently cited works concerned research on students' conceptual competences, motivation, and activating methods. The authors identified several main thematic clusters:

- Inquiry–Based *Learning*,
- evaluation and assessment of learning outcomes,
- integration of digital technologies in teaching and chemistry laboratories,
- sustainable development and green chemistry as a growing trend after 2010.

The source of data in this work were descriptions of both conferences published on their websites (list of topics proposed in the conference invitation) and the EuroVariety 2005 and 2025 abstract books.

A comparison of the topics proposed by the EuroVariety scientific committees in 2005 and 2025 shows a clear evolution. In 2005, issues related to the implementation of the Bologna process, international teaching projects and the relationship between teaching and research dominated. This reflected the realities of the first decade of the 21st century and the need to place chemistry studies in a new institutional context. After twenty years, there has been a shift towards global issues that are important for the future: sustainable development, social responsibility, lifelong learning, as well as new digital technologies (AR, VR, AI) and experiences related to remote learning. Transversal competences that increase employability and the professionalisation of academic staff have also gained in importance.

Based on the literature (Odden, 2020; Draman, 2021; Bretz, 2008) and preliminary content analysis, 10 thematic categories of abstracts (T1-T10, Appendix 1) were defined using keyword heuristics. In cases of doubt, manual verification was used. Ultimately, all abstracts were coded and assigned to one of these thematic categories. For example, abstracts concerning the education of future teachers were assigned to category T7, regardless of which aspect of a teacher's work they concerned. The trend analysis consisted of: calculating the number of occurrences in each category in both conferences, determining the percentage shares (to account for the different sizes of the conferences), and identifying topics with increasing and decreasing frequency of occurrence. Finally, the results were compared with trends described in the global literature. Table 1 lists examples of occurrences in the categories identified above.

Table 1 Examples of presentations and posters in the previously identified categories[2]

Category	2005	2025
T1 – Teaching innovations	Yuri Orlik – *Active teaching methodology: the basis for innovation in improving students' knowledge and skills*	Małgorzata Krzeczkowska – *Feedback as a tool for success – how to effectively support student development?*
T2 – Digital technologies	Barbara Dębska–*www.e–chemistry.pl, E–learning portal for chemistry education*	Siegfried Schindler – *Don't panic! A hitchhiker's guide to augmented reality with AI*
T3 – Education for ZR + RRI	Inci Morgil et al. – *Analysis of the scale of awareness in the field of renewable energy*	Vesna Ferk Savec – *Accelerating the transition to sustainable development through green chemistry education*
T4 – Academic and professional competences	Piotr Tomasik – *Training students in scientific report writing*	Jasmijn Ruijgrok – *Training future laboratory specialists – combining research and education for energy and material transition*
T5 – Students	Geoffrey W.H. Potter – *Towards student–centred laboratory exercises*	Julio Garay – *Learning styles theory – can student preferences facilitate learning in STEM subjects?*
T6 – International context	Piotr Stepnowski – *GRATE: an international initiative for transdisciplinary education in environmental sciences*	Iwona Maciejowska, Denis Zhilin – *The dictionary as a catalyst for understanding in chemistry education – the CCE IUPAC project*
T7 – Training school teachers	Krystyna Skrok – *Teaching competences of future chemistry teachers*	Carla Morais – *STEM–based laboratory in chemistry education: conclusions of teachers during professional training*
T8 – Lecturers' competences	–	Jurica Bauer – *A new perspective on professional development to support a diverse teaching staff*
T9 Chemistry teaching	Małgorzata Brindell, Antonina Chmura, Wojciech Macyk, Konrad Szaciłowski – *Application of problem–solving methods in teaching bioinorganic chemistry*	Antonella Rossi – *Introduction to electrochemistry for first–cycle students – an inquiry–based approach*
T10 Formal issues	*Małgorzata Majka – European health and safety regulations in education and research*	Marek Frankowicz – *RPL as a "master key" to opening doors in the house of chemistry education*

[2] Automatic translation

The analysis shows (Annex 2) that in 2005, the dominant categories were T1 (Teaching innovations), T2 (Digital technologies), T7 (School teacher training) and T9 (Chemistry teaching) and, to a lesser extent, T6 (International context) and T10 (Formal issues) were dominant, while in 2025 – again T2, T7 and T9 and, to a slightly lesser extent, T3 (Education for ZR + RRI) and T5 (Students). A comparative analysis of abstracts from 2005 and 2025 revealed significant thematic shifts:

- T3 – Education for sustainable development and responsible research and innovation (RRI): more than a threefold increase (from 2.6% to 8.11%),
- T5 – Students (diversity, UDL, SCL, inclusiveness): a slightly smaller increase than in the case of T3, but still more than 2.5 times (from 2.6% to 7.21%).
- T8 – Development of teaching competences of academic teachers – this is a completely new category, not present in 2005,
- T2 – Digital technologies: stable share (approx. 25%),

At the same time, some areas have lost importance:

- T1 and T10 – Teaching innovations in teaching and assessment: a decrease of almost 70% compared to the baseline (from 16.88% to 5.41% and from 11.68% to 3.60%, respectively),
- T6 – International context: the largest decline, almost 5–fold (from 9.09% to 1.80%).

Conclusions

The first EuroVariety 2005 conference allowed Polish participants not only to prepare for the new challenges that were inevitably going to appear in academic education in the coming years, but also to build a sense of community with colleagues teaching chemistry students in other parts of the European Union, which our country had just joined at that time.

From the statements of conference participants in 2025, four main advantages of participating in this meeting emerge:

- a sense of community in a profession that is often perceived as lonely,
- appreciation of inspiring diversity (nationalities, educational paths, experiences),
- strengthened self–confidence,
- a sense of belonging to an international community that shares common goals and reflections.

Based on the evaluation of the EuroVariety 2025 conference, it can be concluded that it provided participants with a common language, a network of contacts and support in their teaching activities, which is consistent with the statements in the literature cited at the beginning of this paper (Hauss, 2022, Hutchings & Shulman, 1999; Felten, 2013; Cruz et al., 2023). For the organisers, it confirmed that the adopted formula effectively breaks the isolation of teachers and translates into plans for specific changes in the practice of teaching chemistry. Its unique value compared to other events is the combination of an international perspective with a practical nature and a friendly atmosphere for the exchange of experiences.

Significant thematic shifts in the content discussed by conference participants in 2005 and 2025 can be explained by changes in the external environment and adaptations undertaken by higher education institutions, including the levelling of differences between higher education in Poland and Western European countries. Thus, the growing importance of education for sustainable development and responsible research and innovation (RRI) reflects the increasing responsibility of universities towards society and the implementation of the UN 2030 Agenda. The greater number of abstracts addressing the topic of the student indicates a paradigm shift from a teacher–centred model to a student–centred model. As the professionalisation of the role of academic teachers has become a leading topic of discussion and action for international bodies (e.g. EUA) in the 21st century, the conference featured presentations discussing the development of academic teachers' teaching competences. Digital technologies retained their stable share in the number of presentations, but with the development of technology accelerated by the COVID–19 pandemic, their content changed – from simple e–learning platforms and digital tools to VR/AR, simulations and AI tools. The decrease in the share of topics related to teaching innovations in teaching and assessment may indicate a shift from general innovations (such as "activating methods") to the analysis of specific cases of application in the teaching of specific areas of chemistry. The reduction in formal and curricular issues may be related to the stabilisation of changes following the introduction of the Bologna process. On the other hand, the smaller number of presentations on the international context of chemistry education can be explained by the spread of international cooperation across Europe, which is no longer a novelty or a special achievement worth presenting to a wide audience.

Trend analysis points to the professionalisation and institutionalisation of chemistry education: the emergence of new thematic categories, the decline in the importance of certain areas, and the growing role of social and global issues. Digital technologies and chemistry teaching remain the foundation of conference discussions, but they are increasingly complemented by reflections on social responsibility and inclusiveness in academic education. These conclusions are consistent with international trends described in the literature – as in the case of the PERC conference (Odden, Marin & Caballero, 2020), digital technologies and diversity play an important role, and bibliometric analyses of chemistry teaching (Draman & Mohamad, 2021) point to the importance of PBL, information and communication technologies, and education for sustainable development.

Recommendations

The case described above, involving the launch of the EuroVariety conference series, which arose from the need to exchange teaching experiences across national borders, proves that grassroots initiatives can develop into a permanent international academic forum. Especially in the third decade of the 21st century, with advanced communication tools, similar projects can also be developed in other disciplines, supporting the development of teaching and educators in various areas of higher education. Such an initiative can serve three functions simultaneously: a forum for inspiration, an exchange of teaching practices enabling the comparison of solutions used in different countries and contexts, and a networking space for participants, including for initiating new cooperation projects. The same can be said about the cooperation of representatives of various faculty units in organising this event.

A lack of funds and time may result in lower representation of universities from countries with lower levels of teaching funding and of individuals with particularly heavy teaching and research responsibilities. The former should prompt organisers to make greater efforts to find financial support (lowering conference fees, introducing a one–day fee) for doctoral students, retirees, those on an exclusively teaching career path, and those from countries in a worse economic situation (according to the OECD list). A "live" conference is crucial for building a community of practitioners, although a hybrid format may increase accessibility for people with limited budgets and time.

Changes in the theme of EuroVariety reflect both pan–European and pan–university trends (e.g. inclusiveness, sustainable development) and the specific nature of subject–specific education (the continuing importance of digital tools and chemistry teaching). This type of conference can also respond to these challenges in other disciplines and strengthen the professional and community identity of academic teachers.

Acknowledgements

I would like to express my sincere thanks to Dr Maria Babinčáková from the Department of Chemistry Didactics – the conference secretary, without whom this event would not have been such a success – as well as to all the staff of the Faculty of Chemistry at the Jagiellonian University – members of the Organising Committee, who made this project possible.

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Appendix 1

Table 1. Categorisation of topics (own work)

Code	Term	Example keywords, details
T1	Teaching innovations in teaching and assessment	teaching methods, PBL, flipped classroom, interactive lectures, projects, columns, feedback
T2	Digital technologies in teaching	ICT, e–learning, hybrid teaching, VR/AR, simulations, gamification, AI
T3	Education for sustainable development (ESD), RRI, external cooperation	sustainable development, responsible research and innovation, green chemistry, cooperation with industry and local governments (without cooperation with schools)
T4	Academic and professional competences (including transversal competences)	critical thinking, scientific communication, teamwork, leadership, soft skills, future skills
T5	Students	student diversity, UDL, SCL, learning styles, learning difficulties, communication, inclusiveness
T6	International context	Erasmus projects, international cooperation, European universities
T7	Relations with lower levels of education	training of chemistry teachers, professional development of school teachers, cooperation with schools, classes for pupils, educational outreach
T8	Development of academic teachers' competences	training, workshops, mentoring, classroom observation, teaching development for staff
T9	Chemistry teaching	proposals for courses and fields of study, understanding chemical concepts, the order in which they are introduced, cognitive difficulties
T10	Formal and other issues	legal regulations, structure of study programmes

Appendix 2

The figures below show the percentage share of categories T1–T10 in 2005 (Fig. 2) and 2025 (Fig. 3).

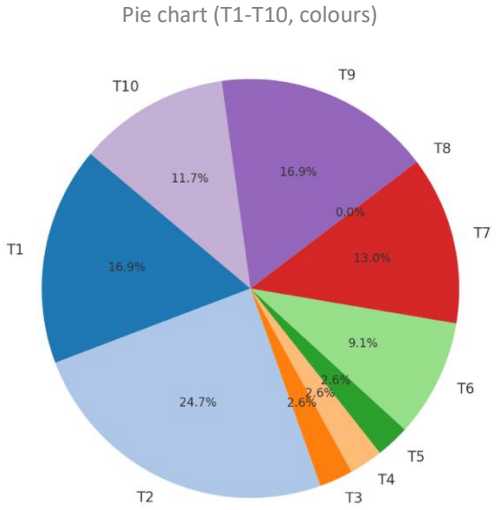

Fig. 2. Percentage share of thematic categories T1–10 among presentations at the EuroVariety 2005 conference

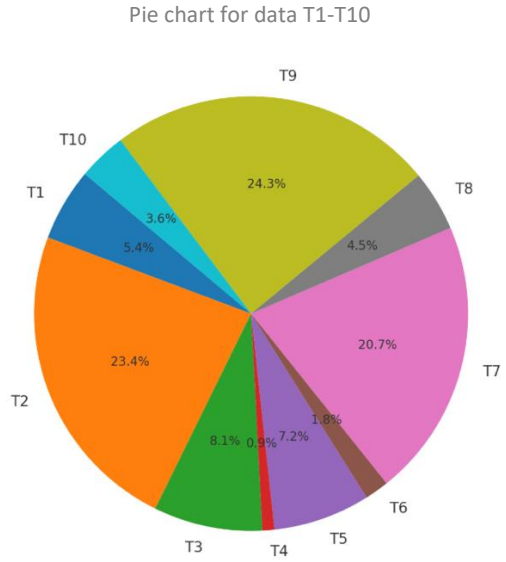

Fig. 3. Percentage share of thematic categories T1–10 among presentations at the EuroVariety 2025 conference