THE PROBLEMATICS OF NATURAL SCIENCE EDUCATION 1995 – 2024: AN OVERVIEW OF THE CONFERENCE PUBLICATIONS

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Science education undoubtedly remains a highly relevant area of education both in a scientific and practical sense. National and international student achievement tests, such as PISA, TIMSS and others, show that the scientific achievements of Lithuanian students are average or lower than the EU average (OECD, 2023). This clearly implies the need to strengthen scientific literacy (Graham, 2024; Kelp et al., 2023). Science education requires qualified teachers who are able to creatively present information and involve students in research and experiments. Therefore, improving teacher qualifications remains a long-term priority.

Science education (SE) in Lithuania is periodically reformed, however, this area remains problematic. As we have already mentioned, Lithuanian students' scientific achievements are average or lower than the average of the EU, and the Organisation for Economic Cooperation and Development (OECD) countries. Students often lack not only theoretical knowledge but also the ability to apply it in real-world situations, solve problems, or conduct experiments. On the other hand, natural sciences are often considered complex and have little relevance to everyday life; therefore, students lack motivation to delve deeper into this field. And the teaching process sometimes does not sufficiently engage students – there is a lack of interesting and relevant examples, practical activities, or the application of innovative methods. It is also important to mention that schools in regions often face greater challenges than in cities: lower funding, poorer infrastructure and laboratory equipment, limited opportunities to participate in science competitions and projects. In recent years, great attention has been paid in Lithuania to the integration of STEM (natural science, technology, engineering, and mathematics) fields. Various initiatives, competitions, and trainings are organised, encouraging students to become interested in these fields. STEM centres have also been established in regions and schools.

Since 1995, annual national scientific-practical conferences, "Natural Science Education in a General Education School", have been held in Lithuania (http://gu.puslapiai.lt/conferences_lt). 30 national scientific-practical conference publications (have been published in the years 1995 to 2024). They reflect the issues of natural science education, its changes, and challenges for the community of natural science teachers. Scientific and methodological reports read at the conferences are published in these publications. It is obvious that the articles in the conference publications were basically selected randomly, the geographical distribution of authors is extremely wide, including the authors from some foreign countries. A total of 677 articles were published during the aforementioned period. Therefore, it is useful to examine the development of natural science education precisely on the basis of published works. When analysing the published articles, the following main areas of natural science education were conditionally distinguished (Lamanauskas & Laurukėnienė, 1999; Lamanauskas, 2009):

1. Natural science education methods (SEM).
2. Natural science education process (SEP).
3. Natural science education comparative analysis (SCA).

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4. Natural science education resources (SER).
5. Integrated natural science education (ISE).
6. Historical aspects of natural science education (HAE).
7. Philosophical and psychological aspects of natural science education (PAE).
8. Ecological, environmental education (EEE).
9. Informal natural science education (ISE).
10. Project-based natural science education (PSE).
11. Non-traditional natural science education (NTE).
12. Health education, teaching healthy living (HET).
13. Natural science pedagogical competence, teacher training (SPC).
14. Other (O).

Despite the fact that such a division is conditional, the areas essentially "overlap", are integral, it is still possible to reveal some tendencies in the change of natural science education in Lithuania.

As we have already mentioned, 677 articles were published over the entire period (30 years) We had provided a similar overview earlier, when 20 years of practice were analysed (Lamanauskas, 2014). It is quite understandable that the majority of publications (24.0%) were devoted to the SE process (Appendix 1). This group included articles that analysed the content of education, the application of ICT, and other articles. Ecological and environmental education problems are in the second position. 88 (12,8%) articles can be attributed to this area. Project-based SE issues (10.9%) remain in the third place. This shows that teachers' attention to project activities remains in the centre of attention. It can be conditionally stated that there is also interest in the issues of integrated SE and, of course, informal SE. These areas account for 7% of all publications. Interest in other areas is significantly lower. The least interest is in historical SE issues. During the entire period, only 15 (2.2%) articles in the field of SE were published.

After analysing the SE publications by level, it is obvious that the majority of publications are dedicated to the primary and secondary education levels. A total of 297 (43.8%) articles were published. There are practically half as many publications whose SE level is not defined, in other words, these are general issues (22.7%). Of course, it should be emphasised that the number of publications that analyse SE issues in primary school has slightly increased. During the period 1995 – 2014, there were 84 such publications (14.8%). Meanwhile, when analysing the entire mentioned period, the number of such publications increased to 123 (18.2%). After analysing the distribution of publications according to this indicator, it is clear that there has also been an increase in publications in the field of pre-primary and preschool education of SE.

When analysing publications by didactic areas (subjects), it is seen that most of them are devoted to general SE questions (40.0%). In the second position are the other various publications, which are not attributed to the main SE areas, such as physics, chemistry, or biology (27.5%); however, in one way or another, related to SE. When analysing by main natural science subjects, most publications are devoted to chemistry teaching issues (13.2%), followed by biology (8.7%), physics (5.8%), and geography (4.8%).

It is known that the largest part of publications (82.4%) was published by Lithuanian authors, and 17.6% by authors from foreign countries. Here can be mentioned the authors from Latvia, Estonia, Czech Republic, Brazil, Taiwan, Ukraine and other countries. Of course, the conference is not international, and such analysis is only informational. On the other hand, this shows both interest in the conference and interest in cooperation.

When evaluating all publications over a 30-year period, one can discern at least in part certain tendencies. The years from 1995 to 2000 (initial period). During this period, ecological and environmental education, students' value attitudes, and nature cognition dominate. Methods of natural science education and the development of primary teachers' competencies are often discussed. Great attention is also paid to the development of ecological awareness, research on environmental pollution, and integration of nature cognition into the teaching/learning process. It can be seen that problems are often related to teaching content modernisation and lack of resources.

2001–2010 (modernization period). During this period, there is a growing interest in integrated education (e.g., biology and chemistry) and its implementation in practice. Various international and national projects are becoming more popular, in which both teachers and students actively participate. In addition, non-formal education activities are being expanded quite actively. Attention is also paid to the use of new teaching/learning technologies in lessons. However, it can be noted that schools are faced with a lack of resources and insufficient teacher training, especially when it comes to preschool and primary school teachers.

2011–2020 (STEAM and the growth of international dimension). This period is really interesting. First of all, STEAM is being expressed more and more clearly, and the international dimension is strengthening. Such topics as STEAM education, relating natural sciences with engineering, arts, and technologies, are more often noticed. Much attention is paid to student research activity, project-based learning, and non-traditional/ innovative methods, such as teaching/learning outside, in other educational environments. The didactics of integrated lessons occupies a significant place.

2021–2024 (the period of sustainability and digitalisation). It would not be fair to say that these aspects were not discussed in previous publications. However, it is quite obvious that in recent years, the ideas of ecological/environmental education and sustainability have become even more prominent. Project activities, digital tools for education and teachers' readiness to use modern educational strategies and techniques, e.g., artificial intelligence tools, prevail. This theme is reflected not only in published works but also in other reports presented at conferences. The main challenge is the application of sustainability and innovation in educational practice. At the same time, attention is drawn to students' lack of motivation (or even a decreasing tendency) to natural sciences.

When analysing the thematic changes from 1995 to 2024, three main directions can be distinguished. First, there is a shift from ecology to STEAM. While ecology and environmental topics predominated in the early years of SE conferences, later, they were integrated with technologies and interdisciplinary activities. The second noticeable shift is from the so-called (conventional) methods to the application of new (innovative) methods in SE practice. In the articles, more attention is paid to non-traditional education, outdoor activities, and digital tools. The third change is also quite obvious. Let us conditionally call this change integration. There is a noticeable growth/strengthening of the integration of natural science disciplines with each other, aiming to provide students with a holistic understanding of the world. It is really important to provide students with a holistic understanding of the world, and a holistic approach to education can help achieve this goal (Mahmoudi et al., 2012).

When analysing the last decade of SE conferences separately (the period from 2015 to 2024), it is seen that ecological awareness is emerging as the main direction. Such topics as "Ecology", "Sustainability", and others remain extremely relevant. They

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are increasingly combined with various practical projects and digital tools. Of course, much attention is paid to the modernisation of teaching processes, the development of STEAM education, and the implementation of digital resources. The articles reflect the increasing attention to experiential and project-based teaching/learning, which is focused on the active involvement and engagement of the students. Ideas prevail on how to combine natural science subjects into a unified educational process that promotes a broader students' understanding of nature and the world. Of course, it must be said that the articles quite often discuss the improvement of teacher qualifications, their readiness to work with new technologies and methodologies. The articles often discuss the problems of students' interest in natural sciences, looking for ways to increase this interest. There is also increasing attention to inclusive teaching/learning, using innovative educational methods/techniques, such as experiential activities or lessons outside the classroom/school (e.g., using various educational spaces and environments).

Natural science education (SE) problematics in Lithuania from 1995 to 2024 was analysed from various aspects, revealing the main challenges and tendencies (based on published conference papers). It is not intended to generalise these insights and generalisations; however, this analysis shows certain changes and tendencies throughout the entire period under review. It is obvious that SE has undergone significant changes in recent decades. The concept of STEAM education is increasingly emphasised, highlighting the importance of the integration of technologies, engineering and arts. It is noted the greater importance of project-based and non-traditional SE, as well as the inclusion of sustainability ideas and digital tools in the SE process. Despite progress, the problem of improving the qualifications of teachers and their readiness to work with modern educational technologies remains relevant. The analysis of conferences and publications reveals that ecological/environmental awareness, innovative educational methods, and integration have become perhaps the most important SE priorities.

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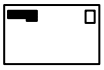

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