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Structuring Safety Education Content through Interdisciplinary Thematic Analysis

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Abstract

Safety education draws on several disciplinary domains, but their representation in research and educational content remains uneven. This necessitates identifying key directions and components of safety content, as well as developing recommendations for incorporating these elements into educational programs. The methodology includes a comparative bibliometric and qualitative content analysis of scientific publications indexed in eLibrary.ru and OpenAlex, semantic analysis of safety-related search terms, expert assessment and validation involving of 45 university teachers specializing in life safety and related areas. The initial bibliometric search identified 21,052 publication records in eLibrary.ru and 184,930 publication records in OpenAlex. The most highly cited and substantively relevant publications were further examined, including 60 publications selected for detailed semantic and qualitative analysis. As a result of the study, 15 thematic safety categories were identified and used to compare the Russian and international bibliometric segments. The analysis demonstrated substantial structural differences between the two thematic profiles and confirmed the interdisciplinary nature of contemporary safety research. Based on these findings, a structure for life safety education was proposed, founded on interdisciplinary integration and a focus on practice-oriented teaching methods. The research findings have practical significance and can be used to improve the content of educational programs on life safety.

Keywords: life safety, educational content, safety directions, training, interdisciplinary approach, safety culture, curriculum development, disaster risk reduction, practice-oriented learning, educational environment, risk management.

1. Introduction

Safety education encompasses problems that originate in different disciplinary domains,

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including information security, psychological safety, environmental and technological risks, public health, transport safety, and social security. The difficulty is not the absence of safety-related research, but the fragmentation of this research across disciplines and terminological traditions. In Russia, this issue is also relevant to educational standards that include competencies associated with safe behavior and risk awareness.

The literature reviewed for this study uses heterogeneous terms for related safety problems and educational tasks. Some studies address individual domains, whereas others examine interdisciplinary links between safety education and school or university subjects. What remains less clear is how these heterogeneous domains can be organized within a common analytical framework suitable for comparing research profiles and informing educational content.

This study aimed to construct and validate a thematic framework for safety-related research, compare its representation in Russian and international bibliometric segments, and examine how the resulting structure may inform life safety education.

2. Materials and methods

We used comparative bibliometric and qualitative content analysis to identify major safety-related research themes and examine their relevance to the content of safety education. The methodological framework combined bibliometric retrieval, semantic analysis of search terms, expert assessment, qualitative analysis of selected publications, and quantitative comparison of the Russian and international bibliometric segments. Such a combination was used because the concept of safety is represented in the scientific literature by a wide range of partially overlapping terms and disciplinary contexts and therefore cannot be adequately described solely by the frequency of individual keywords.

The empirical information base consisted of scientific publications indexed in the Russian bibliometric database eLibrary.ru and the international bibliographic database OpenAlex. The search was conducted using Russian- and English-language keywords and semantically related expressions describing different aspects of safety. The initial search vocabulary included general terms such as *safety*, *security*, *life safety*, as well as more specific terms and their semantic variants, including *information security*, *cybersecurity*, *data protection*, *psychological safety*, *social security*, *public safety*, *transport safety*, *road safety*, *environmental safety*, *technosphere safety*, *industrial safety*, *emergency*, *civil defense*, *safety culture*, and other conceptually related expressions. Russian equivalents and terminological variants were used in parallel. The primary keyword analysis demonstrated substantial terminological heterogeneity. For example, closely related concepts were represented by separate expressions such as “information security”, “cybersecurity”, and “data protection”, while transport-related safety was represented by “road safety”, “traffic safety”, and related terms. Therefore, raw keyword frequencies were not treated as independent thematic areas without additional semantic interpretation.

The temporal scope of the main literature search was 2010–2025. Earlier publications were considered where they had theoretical or historical significance for the development of a particular safety concept; such publications were used for contextual interpretation but were distinguished from the main contemporary analytical corpus where appropriate. The initial bibliometric search was conducted using the general keyword “safety” and its Russian-language equivalent “безопасность”. This broad search identified 21,052 publication records in eLibrary.ru and 184,930 publication records in OpenAlex. At this stage, the purpose was not to form the final analytical sample, but to examine the semantic contexts in which the concept of safety was used and to identify recurring combinations of terms associated with particular safety-related topics.

The analysis of these keyword combinations made it possible to outline a preliminary set of thematic areas. To refine this structure, publications with a citation count >20 were subsequently selected for more detailed consideration. Records in which the concept of safety was used only incidentally, or whose subject matter had little relevance to the substantive interpretation of safety and therefore could not contribute to the identification of thematic categories, were excluded from further analysis. As a result of this screening procedure, 1,350 publications from eLibrary.ru and 3,600 publications from OpenAlex were retained as the citation-based and thematically relevant corpus.

A purposive sample of 60 highly cited and substantively relevant publications representing the principal preliminary thematic areas was selected for detailed semantic and qualitative content analysis. Their titles, abstracts, keywords, research objectives, and, where necessary, full texts were

examined in order to clarify the substantive boundaries of the preliminary thematic areas, identify semantic overlaps, and consolidate closely related safety concepts into broader categories. The results of this semantic analysis were subsequently compared with the authors' expert assessment and the judgments obtained from the survey of university teachers. This procedure resulted in the final system of 15 thematic safety categories used in the comparative bibliometric analysis. The citation-filtered corpus and the purposive sample of 60 publications were used exclusively for qualitative semantic analysis and the development and validation of the thematic framework, whereas the subsequent quantitative comparison of the Russian and international thematic profiles was based on keyword-based publication frequencies derived from the broader bibliometric datasets.

The criteria for inclusion in the qualitative analysis were: (1) direct relevance to one or more aspects of individual, social, technological, environmental, informational, psychological, or public safety; (2) the presence of an educational, behavioral, competence-based, preventive, preparedness, or safety-culture component, or the possibility of substantiating the educational significance of the identified safety problem; (3) sufficient information in the title, abstract, keywords, or full text to determine the principal thematic orientation of the study; and (4) compliance with the established temporal and publication-type criteria. Publications were excluded when the safety concept was used only indirectly, when the study was highly specialized and did not provide content relevant to the objectives of safety education, when the publication duplicated another record, or when the available bibliographic information was insufficient for reliable thematic classification.

The thematic framework was not established a priori solely on the basis of existing classifications. It was developed in several consecutive stages. First, the frequency distribution and semantic structure of safety-related keywords and search expressions were analyzed. Lexically different but semantically close expressions were grouped according to similarity of their substantive meaning. Thus, terms referring to cybersecurity, information protection, digital risks, and data security were considered within a common semantic field, whereas road safety and transport safety expressions formed another semantic field. Similar semantic consolidation was performed for psychological, social, environmental, technological, emergency-related, medical, legal, and other safety concepts. The frequency of a keyword was used as an indicator of the visibility of a topic in the bibliometric corpus, but frequency alone did not determine whether a thematic category was retained. This was necessary because highly frequent terms may represent specialized disciplinary areas without direct relevance to the educational interpretation of life safety, whereas less frequent terms may represent essential components of safety education.

Second, the preliminary semantic structure was subjected to expert analysis by the authors and was compared with the results of an expert validation involving 45 university teachers specializing in life safety and related areas. The respondents represented the Department of Life Safety of Sakhalin State University (Yuzhno-Sakhalinsk, Russia) and the Faculty of Integrated Safety and Military-Patriotic Education of Herzen State Pedagogical University of Russia (Saint Petersburg, Russia). The respondents were presented with the preliminary thematic areas identified through semantic analysis and were asked to assess their relevance to contemporary safety education and to identify overlapping or excessively narrow categories. Their judgments were used to refine and consolidate the preliminary thematic framework. The expert component was used to assess the substantive relevance of the identified semantic areas to contemporary safety education and to reduce overlapping or excessively narrow keyword groups to broader conceptually interpretable categories. Thus, the final classification was based on triangulation of three sources of evidence: the semantic structure of bibliometric search terms, the authors' expert analysis, and the judgments obtained from the group of 45 university teachers.

As a result of this procedure, 15 thematic categories were retained for comparative bibliometric analysis: Life Safety Culture; Household Safety; Transport Safety; Public Safety; Counteracting Extremism and Terrorism; Health and Basic Medical Knowledge; Information Security; Environmental Security; Safety in the Natural Environment; Technological Emergency Situations; Social Security; Civil Defense and Mobilization Readiness; Psychological Security; Physical Security; and Legal Literacy in Security. These categories should therefore be interpreted as analytically constructed thematic domains rather than as clusters generated automatically by a statistical clustering algorithm. Their function was to provide a common semantic framework for comparing differently structured Russian and international publication corpora and for

subsequently interpreting their relevance to safety education. Conceptually adjacent categories were distinguished according to their dominant substantive focus. Environmental Security primarily covered anthropogenic environmental risks, pollution, environmental protection, and ecosystem sustainability, whereas Safety in the Natural Environment referred to human safety in relation to natural hazards, environmental conditions, and behavior in natural settings. Public Safety primarily concerned collective threats, public order, and population protection, while Social Security addressed social risks, vulnerability, social stability, and the protection of individuals and groups in the social environment. Counteracting Extremism and Terrorism was retained as a separate category because it represented a specific and consistently identifiable thematic field within the broader domain of public safety.

The coding unit for the qualitative content analysis was an individual scientific publication. Classification was based primarily on the title, abstract, author-supplied keywords, research objective, and principal findings; where these elements were insufficient for unambiguous classification, the full text was analyzed. A publication was assigned to a thematic category when its central research problem corresponded to the operational meaning of that category rather than merely containing the respective term. For example, a publication was coded as *Information Security* when its principal subject concerned cybersecurity, information protection, personal or educational data protection, digital security risks, information-security awareness, or safe behavior in the digital environment. The same principle was applied to the remaining categories. Where a publication addressed several dimensions of safety, its dominant research focus was used for the primary classification; interdisciplinary relationships were additionally taken into account during qualitative interpretation. This procedure prevented keyword occurrence alone from being treated as sufficient evidence of thematic belonging.

For the quantitative comparison, the unit of analysis was a thematic category rather than an individual publication. For each of the 15 categories, the number of records retrieved in the Russian and international bibliometric segments was recorded using standardized semantically corresponding search expressions. Because the total numbers of publications identified in eLibrary.ru and OpenAlex differed substantially, absolute keyword-based publication frequencies were converted into relative thematic shares within each bibliometric segment. For each of the 15 thematic categories, the relative thematic share was calculated as the keyword-based publication frequency of that category divided by the cumulative frequency across all 15 categories in the corresponding bibliometric segment.

The bibliometric counts used for the thematic comparison were based on the occurrence of safety-related keywords and semantically corresponding expressions. Since a single publication could contain several relevant keywords, the same publication could contribute to more than one thematic category. Therefore, the category counts should be interpreted as keyword-based publication frequencies rather than as mutually exclusive counts of unique publications.

To quantify the overall structural difference between the Russian and international thematic profiles, the Bray–Curtis dissimilarity index was calculated:

$$BC = \frac{\sum_{i=1}^{15} |p_i - q_i|}{\sum_{i=1}^{15} (p_i + q_i)},$$

where p_i and q_i represent the relative frequencies of the i -th thematic category in the Russian and international bibliometric segments, respectively.

The index ranges from 0, indicating identical thematic distributions, to 1, indicating maximum structural dissimilarity. In this study, the Bray–Curtis index was used as a descriptive measure of structural difference rather than as a statistical significance test.

Data extraction, keyword consolidation, category coding, calculation of relative frequencies, and quantitative analysis were performed using Microsoft Excel and Python 3.12.7 with the pandas and SciPy libraries. The analytical procedure included verification of search results, consolidation of synonymous and semantically overlapping expressions, assignment of publications to thematic categories, calculation of bibliometric frequencies and relative shares, and comparative analysis of the resulting thematic profiles.

Several methodological limitations should be considered when interpreting the results. First, eLibrary.ru and OpenAlex differ in database coverage, indexing policies, language representation, and disciplinary structure; therefore, absolute publication counts cannot be interpreted as directly

equivalent measures of research activity. Second, bibliometric results depend on the wording and semantic equivalence of Russian- and English-language search expressions. Third, the 15 thematic categories represent an expert-analytical classification supported by semantic analysis and an expert validation rather than categories generated through unsupervised statistical clustering. The Bray-Curtis index provides an integrated measure of structural dissimilarity but does not explain the causes of the observed differences. Finally, expert judgment was involved in semantic consolidation and thematic classification, and no formal inter-rater reliability coefficient was calculated, which introduces a degree of interpretative subjectivity. To reduce the influence of any single analytical procedure, bibliometric analysis was combined with semantic analysis, qualitative examination of publication content, and expert assessment.

3. Background: literature review

3.1. Sources in the Russian bibliographic segment

The analysis of scientific and methodological works aimed at identifying the content characteristics of safety in the educational process has demonstrated their comprehensive and interdisciplinary nature.

For example, some studies (Akimova et al., 2019) examine the theoretical, methodological, and practical aspects of ensuring integrated safety in educational organizations. The authors provide a detailed description of the regulatory framework, preventive measures aimed at reducing risks, and methods for fostering a culture of safe behavior among participants in the educational process. The publication is intended for teaching staff and focuses on the development of educational programs, professional development, and the creation of a safe educational environment.

Zuev (2014) analyzes the main problems of teaching the subject “Basics of Life Safety” under the requirements of the Federal State Educational Standards. The author identifies five key problems: the organization of classes on emergency situations, revision of the content related to road safety, implementation of information and communication technologies, practice-oriented teaching methods, and the need to conduct summer training camps at training centers affiliated with military units.

Kulikova and Vlasova (2021) examine the integration of the subjects “Basics of Life Safety” and “History,” with an emphasis on military topics, including the study of nuclear, chemical, and biological weapons within the section on emergency situations. The authors developed and tested a methodology for conducting integrated classes aimed at increasing students’ learning motivation. The proposed approach is recommended for use in higher and secondary vocational education across various fields of study.

Danilova and Ivanova (2023) investigate the problem of information education of schoolchildren and the need to develop their information competence. Based on the survey conducted, the authors found that children experience difficulties in working with information, which highlights the relevance of creating an educational environment that supports the development of safe behavior skills in the information sphere.

Milushkina et al. (2019) analyze health risks for schoolchildren and students associated with the use of information and communication technologies, including electronic devices. The study identified negative changes in students’ visual health associated with increased time spent using electronic devices, particularly in environments with insufficient lighting. The authors emphasize the need to develop preventive measures, including compliance with lighting standards, limiting the duration of electronic device use, and performing eye exercises.

Baeva and Baev (2013) examine the actualization of students’ personal resources as a key indicator of their psychological safety. The authors define psychological security as an individual’s resilience to adverse social and psychotraumatic influences, manifested in the ability to maintain internal stability and resist destructive influences. The study emphasizes the importance of personal resources in ensuring psychological safety and protection under unfavorable social conditions.

Kislyakov, Shmeleva, and Tolstov (2015) investigate aspects of ensuring the socio-psychological safety of teachers and students in the educational environment. The authors analyze social risk factors affecting the safety of the educational environment and identify personal and professionally significant qualities of teachers, including stress resistance, tolerance, and communication skills. The study emphasizes the importance of monitoring socio-psychological safety indicators within the education system and teacher training.

Kashnik and Bryzgalina (2013) examine the theoretical aspects of the phenomena of “safety” and “social safety” from philosophical, sociological, and psychological perspectives. The authors emphasize the need for interdisciplinary integration of scientific knowledge in order to develop practical recommendations for preventing the destabilization of social systems. The study identifies safety-level indicators and methods for their assessment and proposes models for managing systems designed to ensure the safety of individuals and society. The theoretical provisions of the study have practical significance for teachers of Basics of Life Safety and specialists in assessing the safety of the educational environment.

Bakhonina, Vershinina, and Yamaletdinova (2023) analyze the role of safety culture in performing high-risk work. Based on accident statistics for 2017–2021, the authors identified the main types of hazardous work, as well as organizational causes of occupational injuries, including fatal cases. The authors substantiate the importance of introducing and maintaining a safety culture as a key method of human-factor management and improvement of working conditions, emphasizing the importance of senior management involvement in these processes.

At the same time, a considerable number of studies are devoted to the interdisciplinary nature of safety content in school education, emphasizing the integrative nature of this educational field.

Matveev (2020), for example, demonstrated the importance of using interdisciplinary connections in the school course “Basics of Life Safety” to improve learning effectiveness. The author emphasizes the need to integrate subjects such as biology, physics, chemistry, and social studies into curricular and extracurricular activities, which helps eliminate duplication of content, save instructional time, and deepen students’ knowledge.

Kislyakova and Kozhukhova (2020) examine the importance of interdisciplinary connections in teaching “Basics of Life Safety,” emphasizing the need to introduce new forms of organizing the educational process, such as interdisciplinary lessons, seminars, excursions, and elective courses. The authors note that interdisciplinary connections contribute to the integration of knowledge from different sciences, make it possible to solve cognitive tasks comprehensively, and ensure a close relationship between the studied material and other school subjects, thereby improving the quality of education.

Svistunova (2020) analyzes modern approaches to implementing interdisciplinary connections between the educational areas “Technology” and “Basics of Life Safety.” The author emphasizes the importance of interdisciplinary connections for developing students’ cognitive interest and improving the effectiveness of the educational process.

Blinov (2016) examines the possibilities of using interdisciplinary connections in teaching “Basics of Life Safety,” focusing on the need to develop students’ understanding of the principles of interdisciplinarity. The author describes integrated lessons conducted jointly by teachers of different school subjects, using game-based methods, situational tasks, and various information sources, which contributes to a deeper understanding and retention of educational material.

Akhkiyamova (2019) examines the implementation of a model for developing a safety culture among students within the teaching of “Basics of Life Safety” in accordance with the requirements of the Federal State Educational Standards. The author emphasizes the importance of interdisciplinary connections in curricular and extracurricular activities for creating a holistic scientific worldview, as well as the need for highly qualified teachers to achieve the intended learning outcomes.

Chikeneva (2023) emphasizes the importance of interdisciplinary integration as a resource for developing students’ readiness for safe behavior. The author notes that the logical relationship between the sections of “Basics of Life Safety,” other school subjects, and extracurricular activities contributes to the development of cognitive activity, emotional engagement, and interest in the subject, thereby strengthening students’ preparedness for safe behavior in everyday life.

3.2. Sources in the international bibliographic segment

In international scientific publications, the structure and content of safety education are presented as follows.

For instance, in their study, Shah et al. (2020) analyze students’ perception, knowledge level, and preparedness for flood risk management in Pakistan. Based on a survey of 100 students from 20 schools located in flood-prone areas, the authors identified a low level of preparedness for emergencies, including the absence of family action plans and inadequate school evacuation facilities. The study underscores the need to enhance awareness programs and disaster preparedness education.

In another study, Shah et al. (2020) assess school preparedness for emergencies in Khyber Pakhtunkhwa, Pakistan, focusing on disaster risk management. Through interviews with 100 teachers and school administrators, the authors found a low level of risk mitigation measures, including the absence of clear action plans and insufficient staff training. The research highlights the need for school infrastructure modernization, comprehensive emergency response planning, and disaster management training.

Further, in their study (Shah et al., 2024), the authors examined the implementation of Disaster Risk Reduction Education (DRRE) in Pakistan's primary education system, identifying key barriers and opportunities for scaling up programs. Using a mixed-method analysis based on surveys of students, teachers, and NGO representatives, they proposed strategic recommendations to improve disaster preparedness education, emphasizing resource availability, partnerships, and child participation.

Paton et al. (2008) investigate risk perception associated with volcanic hazards and the factors influencing people's readiness to mitigate them. The authors analyze four studies, emphasizing the importance of social interactions and trust between communities and authorities in risk management. Their proposed model presents preparedness as a social process, where the quality of interactions determines safety actions. The study advocates for adapting educational programs to the social context to enhance their effectiveness.

Gokmenoglu et al. (2023) analyze curricula and textbooks in Turkey to assess the integration of Disaster Risk Reduction (DRR) concepts into compulsory education. Their findings indicate inadequate representation of risk management tasks, particularly at early learning stages, as well as a prevalent perception of disasters as inevitable events. The authors emphasize the need to revise educational materials and incorporate practice-oriented teaching methods to improve DRR education.

Wang et al. (2022) examine the impact of different safety education methods on rural residents' risk perception in geologically hazardous regions. Using data from 516 households and the Propensity Score Matching (PSM) method, the authors found that a combination of educational formats—brochures, training sessions, and evacuation drills—substantially improved risk awareness. Classroom-based learning proved to be the most effective approach. The results highlight the importance of a comprehensive educational approach in disaster risk reduction and community resilience.

Garibay Rubio et al. (2024) assess the disaster risk reduction education strategy implemented in elementary schools in Mexico City since 2019. Based on surveys of 1,788 teachers from 714 schools, interviews with government representatives, and regulatory document analysis, the authors identified key success factors, including the development of self-efficacy and student responsibility. The most effective methods involved materials and activities related to psychosocial support and emergency response plans, particularly using interactive technologies. The study underscores the importance of adapting educational strategies to enhance school disaster resilience.

Seddighi et al. (2023) analyze informal educational programs for school disaster preparedness in Iran, including the "Earthquake Safety School Drills" (ESSD) and "Students' Readiness for Disaster Days" (DADRAS) programs. Interviews with 48 participants, including students, teachers, and emergency response personnel, revealed 14 key challenges related to communication, planning, coordination, and logistics. The authors highlight the need to improve infrastructure, increase funding, and expand coverage to include non-school-attending children. The study recommends a multi-faceted approach to disaster preparedness that goes beyond earthquake response alone.

Cels et al. (2023) examine the preparedness of Sri Lanka's coastal schools for tsunamis within the country's educational system. Interviews with school principals and representatives from regional education and disaster management agencies revealed a low level of fundamental hazard preparedness, including the absence of evacuation plans and training drills. Despite reliance on early warning towers, only half of the 430 schools are within hearing range, underscoring the need for alternative warning systems. The study recommends using school safety committees and incorporating evacuation training into teacher preparation programs to improve disaster resilience.

Amri et al. (2022) explore the integration of disaster risk reduction education (DRRE) into Indonesian school curricula, evaluating the "Disaster-Ready Schools" (SPAB) initiative. Based on data from 10 interdisciplinary workshops involving 211 representatives of educational institutions,

government authorities, and NGOs, the authors found that schools depend heavily on local government initiatives, which often lack the commitment to invest in DRRE training. The study emphasizes the need to remove institutional barriers to scaling up DRRE programs and achieving the goals of the Sendai Framework for Disaster Risk Reduction.

Nakano and Yamori (2021) critique traditional approaches to disaster risk reduction education (DRRE) that focus on knowledge transfer without fostering proactive attitudes among students. The authors propose a "proactive engagement paradigm," which includes merging teacher and student roles, participation in practical communities, and long-term engagement assessment. This model was tested in teacher training programs in Nepal, demonstrating potential for bridging the gap between knowledge acquisition and behavior change in DRRE education.

In a subsequent study, Nakano and Yamori (2024) explore the cultural adaptation (CT) process of the "Bosai Duck" safety education tool, originally developed in Japan, for use in El Salvador and Mexico. The authors emphasize the importance of considering cultural differences when implementing educational materials, as this reduces conflicts and enhances the sustainability of educational outcomes. The study demonstrates that effective adaptation involves changes in values, risk perception, and organizational procedures, ensuring the continuous use of materials at the local level without cultural inconsistencies.

Zhao et al. (2024) analyze information security risk factors in smart cities using grounded theory methodology. The authors apply a three-stage coding process (open, axial, and selective) to identify and systematize key risk factors affecting information security. Their developed model includes four main risk categories and describes their interconnections, offering pathways to enhance system resilience against security threats and ensure uninterrupted urban operations.

Abdillah et al. (2024) examine big data security risks in social media and strategies for their mitigation, emphasizing user psychological resilience. The authors review literature on cybersecurity threats in social networks and risk management approaches, identifying the insufficient effectiveness of most national government strategies. The study offers practical recommendations for governments, including Indonesia, on developing and implementing robust policies and strategies for data protection and resilience against digital threats.

Rezgui and Marks (2008) analyze factors influencing information security awareness among higher education staff in the context of a developing country (UAE). Using an interpretive approach and data collection methods, the authors found that integrity, cultural beliefs, and social conditions shape employees' attitudes toward work and information security. The study provides recommendations for raising cybersecurity awareness in educational institutions.

Wright (1998) highlights the critical need for cybersecurity education to protect organizations and individuals from increasing threats, including computer fraud, telecommunication abuse, and unauthorized data access.

Oroni et al. (2025) investigate the impact of e-learning engagement, cybersecurity awareness, and information security policy compliance on cybersecurity measures in virtual learning environments. Based on data from 398 students and using PLS-SEM and fsQCA methods, the authors found that cybersecurity awareness and policy compliance substantially improve cybersecurity levels. The study highlights the need for integrated strategies to enhance online learning security through a combination of educational programs and strict data protection policies.

Cohen (1999) explores network security management challenges in the rapidly evolving digital landscape. The author emphasizes that technological solutions for data protection lag behind the rapid expansion of network systems, making the success of information security programs increasingly dependent on effective management decisions.

Griffith and Redmond (2014) discuss principles and methods of food safety training and hygiene education, highlighting the importance of combining knowledge and motivation to establish safe practices. The authors analyze the role of social cognitive models in understanding the behavior of food industry workers and the need for tailored educational strategies for consumers. The study establishes a connection between training effectiveness and food safety culture, proposing approaches to improve staff preparedness and compliance with safety standards.

Young et al. (2019) review risk communication strategies and educational approaches for teaching children and youth about food hygiene and safety. The authors examine the experiences of the e-Bug program, which focuses on infection prevention and antibiotic resistance awareness, and assess its potential for developing new educational materials within the SafeConsumE project, funded by Horizon2020. The study highlights the importance of adaptive educational strategies for

preventing foodborne infections and raising awareness among youth about food safety risks.

Madaki et al. (2024) investigate the impact of climate risk adaptation strategies on food security among rural households in Nigeria. Based on survey data from 1,080 farming households across six agro-ecological zones and using an endogenous regression model, the authors found that access to agricultural and weather information, credit, and advisory services contributes to the adoption of climate adaptation strategies. Implementing such strategies, including drought-resistant and early-maturing crop varieties, increases dietary diversity and reduces food vulnerability. The study underscores the need to expand access to climate-resilient technologies and financial support to enhance food security.

Dehnavi et al. (2025) evaluate the impact of a home safety training mobile application on accident risk management among elderly caregivers. A randomized clinical trial involving 66 caregivers in Iran revealed that using the application substantially improved risk management indicators compared to traditional brochures. The authors emphasize the potential of mobile technologies to enhance elderly safety and reduce the burden on healthcare systems, recommending further research into innovative educational approaches.

Tran et al. (2024) analyze the impact of air pollution, particularly road dust, on the microbiological safety of street food in educational zones, highlighting health risks for students. Using microbiological tests and a survey of 200 students based on the Theory of Planned Behavior (TPB), the authors identified high contamination levels of coliform bacteria in food samples. The results emphasize the need for stricter food safety regulations and educational programs to raise youth awareness about risks associated with street food consumption.

Mustapha et al. (2025) examine the relationship between risk perception, driving task awareness, and attitudes toward road safety among oil and gas tanker drivers in Nigeria. Based on data from 311 survey responses and structural modeling, the authors identified a positive correlation between risk perception and safe driving behavior ($\beta = 0.611$, $p < 0.05$), as well as the influence of non-driving activities on safety ($\beta = 0.145$, $p < 0.05$). The study highlights the need for targeted training programs, compliance campaigns, and road safety monitoring to improve driver safety.

Fouzi et al. (2024) present a systematic review of risk management methods in chemical safety and security, aimed at minimizing threats to humans and the environment. Analyzing 26 studies using the PRISMA methodology, the authors identified four primary approaches: organizational (63 %), regulatory (16 %), technological (16 %), and individual (5 %). The study emphasizes that structured measures and processes play the most significant role in chemical risk management. The authors highlight the need for further research to address identified limitations and improve existing safety strategies.

George (2024) explores the link between global competence and national security, emphasizing the role of education in international relations. The author identifies three pathways through which global competence enhances security: strengthening economic and military resilience, supporting soft power and global influence through public diplomacy, and increasing institutional resilience by combating misinformation and reducing vulnerability to foreign interference. The study provides recommendations for integrating global educational programs into national security strategies.

Summary of the literature review

The analysis of international research confirms the importance of interdisciplinary approaches to safety education. Studies in the field of disaster risk reduction (DRR), food safety, digital security, psychological resilience, transportation safety, and climate adaptation highlight the need for integrated educational programs that address contemporary security challenges.

Disaster risk reduction – Research emphasizes the role of interactive education, school preparedness measures, and community involvement in reducing the impact of natural disasters (Shah et al., 2024; Amri et al., 2022).

Digital and information security – Studies show that cybersecurity awareness, policy compliance, and personal resilience are critical for protecting sensitive data (Rezgui, Marks, 2008; Abdillah et al., 2024).

Food and environmental safety – Research highlights the need for improved food safety training, better regulatory measures, and climate adaptation strategies to ensure sustainable living conditions (Young et al., 2019; Madaki et al., 2024).

Psychological and social security – The findings suggest that psychological preparedness, community support, and institutional resilience play key roles in social stability and individual

security (Fouzi et al., 2024; George, 2024).

Transportation safety – Studies emphasize the importance of risk awareness and regulatory measures to improve road safety, particularly for high-risk occupations such as oil tanker drivers (Mustapha et al., 2025).

These findings align with Russian research on interdisciplinary safety education, reinforcing the need for integrated educational models that combine theoretical knowledge with practical applications to enhance safety in educational environments.

4. Thematic analysis of publications

The qualitative review initially revealed several broad and partly overlapping thematic areas. These broader areas are discussed below and subsequently refined into the 15-category analytical framework used for the comparative bibliometric analysis.

The analysis of scientific publications has identified key trends and challenges in the field of safety, covering information security, food security, environmental and climate safety, transportation safety, psychological safety, national and social security, and technosphere safety. The classification of these research areas allows for a structured approach to integrating safety education into various disciplines.

4.1. Information security

The increasing digitalization of education and society as a whole has led to a growing number of vulnerabilities related to cybersecurity and the protection of personal data. Research in this area highlights the importance of behavioral factors and awareness in mitigating risks (Rezgui, Marks, 2008; Wright, 1998; Cohen, 1999).

Particular attention is paid to cybersecurity in online education, where awareness and compliance with security policies are determining factors in protecting sensitive data (Oroni et al., 2025). Additionally, studies emphasize the threats posed by big data and social media, requiring comprehensive risk management approaches and protective strategies for smart city infrastructures (Ab-dillah et al., 2024; Zhao et al., 2024).

In the Russian segment, information security challenges are closely linked to digitalization, with a focus on developing students' digital literacy and minimizing the negative health effects of prolonged exposure to digital devices (Danilova, Ivanova, 2023; Milushkina et al., 2019).

4.2. Food security & food safety

Food security & food safety studies focus on risk management and the development of safe behavioral habits. Educational programs on food hygiene and safety have been shown to improve awareness and adherence to sanitation standards (Griffith, Redmond, 2014; Young et al., 2019).

Innovative approaches, such as Produce Prescription (PPR) programs, have proven effective in improving nutrition and public health, particularly among vulnerable populations (Harper et al., 2024). Additionally, research highlights the need for enhanced microbiological risk controls, especially in urban environments with high levels of air pollution (Tran et al., 2024).

4.3. Environmental and climate safety

This area focuses on disaster risk reduction (DRR) education, climate change adaptation strategies, and ecological responsibility. DRR programs have demonstrated effectiveness in enhancing community resilience, particularly in schools (Shah et al., 2024; Amri et al., 2022).

Culturally adapted approaches to disaster education (Nakano, Yamori, 2024) have been found to significantly increase the effectiveness of preparedness programs. Additionally, adaptive agricultural practices and the use of climate-resilient technologies play a crucial role in enhancing food security in regions affected by climate change (Madaki et al., 2024).

4.4. Transportation safety

Research on transportation safety highlights the role of risk perception and behavior in accident prevention. Studies show that individual awareness and compliance with safety regulations are key factors in ensuring road safety, particularly for high-risk professions such as oil and gas tanker drivers (Mustapha et al., 2025).

Other studies examine safety concerns in ride-sharing services, where risk perception varies based on gender and social factors (Wang et al., 2025). These findings emphasize the need for targeted training programs and regulatory measures to minimize risks.

4.5. Psychological safety

Psychological safety research focuses on individual resilience and the ability to withstand social and psychological stressors. Studies highlight the importance of personal and professional

stability for both students and educators (Baeva, Baev, 2013; Kislyakov et al., 2015).

Additional research examines the role of social and psychological risk factors in educational environments, emphasizing the need for stress management and mental health support programs (Yurevich, 2015).

4.6. National and social security

National and social security studies explore resilience against misinformation, digital threats, and the development of global competence. Education in global security is viewed as a means of strengthening national resilience, diplomatic influence, and institutional stability (George, 2024).

Other studies focus on social media risk management, including data protection strategies and digital resilience enhancement (Abdillah et al., 2024).

In Russia, social security research examines childhood risk factors (Dementieva, 2011) and integrated approaches to preventing social instability (Kashnik, Bryzgalina, 2013).

4.7. Technosphere safety

Bakhonina et al. (2023) examine safety culture in hazardous oil and gas operations, focusing on human-factor management and its relation to occupational and operational risk. Fouzi et al. (2024) address chemical safety from an organizational perspective, emphasizing structured control measures and continuous monitoring as elements of technological risk management.

4.8. Interdisciplinary integration of safety education

Interdisciplinary approaches to safety education are represented in studies of cross-subject teaching in Basics of Life Safety. Matveev (2020) and Kislyakova and Kozhukhova (2020) examine links between BLS and other school subjects, while Kulikova and Vlasova (2021) and Svistunova (2020) consider integration with history, technology, and related educational areas. Together, these studies describe interdisciplinary teaching as a way to connect safety content with knowledge acquired in other subjects.

4.9. Thematic classification of safety directions

Table 1 presents a thematic overview of safety research directions based on Russian scientific publications, while Table 2 provides a similar classification using international sources.

Table 1. Thematic classification of safety research directions (based on scientific publications in the russian bibliometric segment according to elibrary.ru)

Safety Area	Authors, Year	Brief Thesis (up to 5 words)
Information Security	Danilova, Ivanova, 2023	Formation of information competence
	Milushkina et al., 2019	Health risks of ICT usage
Psychological Security	Baeva, Baev, 2013	Resilience to social influences
	Kislyakov et al., 2015	Safety factors for teachers and students
Social Security	Yurevich, 2015	Contradictions in Russian mentality
	Dementieva, 2011	Social risks in childhood
	Kashnik, Bryzgalina, 2013	Knowledge integration for risk prevention
Technosphere Safety	Bakhonina et al., 2023	Safety culture in the oil and gas industry
Interdisciplinary and Integrated Safety	Matveev, 2020	Interdisciplinary links improve efficiency
	Kislyakova, Kozhukhova, 2020	New forms of learning organization
	Aksenov, 2020	Integrative learning as subject linkage
	Chikeneva, 2023	Logical connection between BLS and other subjects
	Akhkiyamova, 2019	Formation of safety culture
	Zuev, 2014	Problems and challenges in BLS teaching
	Svistunova, 2020	Connections to enhance cognitive interest
	Kulikova, Vlasova, 2021	Integration of disciplines through military topics
	Blinov, 2016	Knowledge integration through play activities

Table 2. Thematic classification of safety research directions based on scientific publications in the international bibliometric segment (<https://openalex.org>)

Safety Area	Authors, Year	Thesis
Information Security	Rezgui, Marks, 2008	Awareness factors in universities
	Wright, 1998	The need for security education
	Oroni et al., 2025	Cybersecurity in online learning
	Abdillah et al., 2024	Data risks in social media
	Cohen, 1999	Network security management
	Fouzi et al., 2024	Chemical safety and risk management
	Naga, Tinam-isan, 2024	Personality and behavior in security
	Zhao et al., 2024	Risk factors in smart cities
Food Security	Griffith, Redmond, 2014	Food safety training
	Young et al., 2019	Risk communication for youth
	Harper et al., 2024	Food prescription programs
	Tran et al., 2024	Microbial contamination risks in food
Environmental and Climate Security	Madaki et al., 2024	Adaptation to climate risks
	Nakano, Yamori, 2024	Adaptation of educational tools
	Nakano, Yamori, 2021	Developing proactive attitudes
	Amri et al., 2022	Integration of disaster education
	Seddighi et al., 2023	Disaster preparedness programs
	Cels et al., 2023	School tsunami preparedness
	Shah et al., 2024	Disaster risk reduction education
	Shah et al., 2020	Schoolchildren's preparedness for floods
Transport Security	Mustapha et al., 2025	Driver risk and safety
	Wang et al., 2025	Perceived safety in ride-sharing
National and Social Security	George, 2024	Global competence and security
	Abdillah et al., 2024	Data risks in social media
	Fouzi et al., 2024	Organizational approaches to chemical safety

4.10. Publication frequency analysis by safety-related topics

To refine the structure and content of the concept of “safety” and identify relevant scientific trends, the distribution of keyword-based publication frequencies across the identified safety-related thematic categories was analyzed in the Russian and international bibliometric segments (Table 3, Figure 1, Figure 2).

Table 3. Keyword-based publication frequencies across safety-related thematic categories

Safety Area	Number of Publications in the Russian Segment (eLibrary.ru)	Number of Publications in the International Segment (openalex.org)
Life Safety Culture	252	10271
Household Safety	180	4518
Transport Safety	139	15041
Public Safety	150	4626
Counteracting Extremism and Terrorism	1378	14412
Health and Basic Medical Knowledge	453	18759
Information Security	9734	16855
Environmental Security	5484	4116
Safety in the Natural	472	3356

Safety Area	Number of Publications in the Russian Segment (eLibrary.ru)	Number of Publications in the International Segment (openalex.org)
Environment		
Technological Emergency Situations	603	29639
Social Security	423	11106
Civil Defense and Mobilization Readiness	137	11989
Psychological Security	351	22428
Physical Security	780	8841
Legal Literacy in Security	516	8973

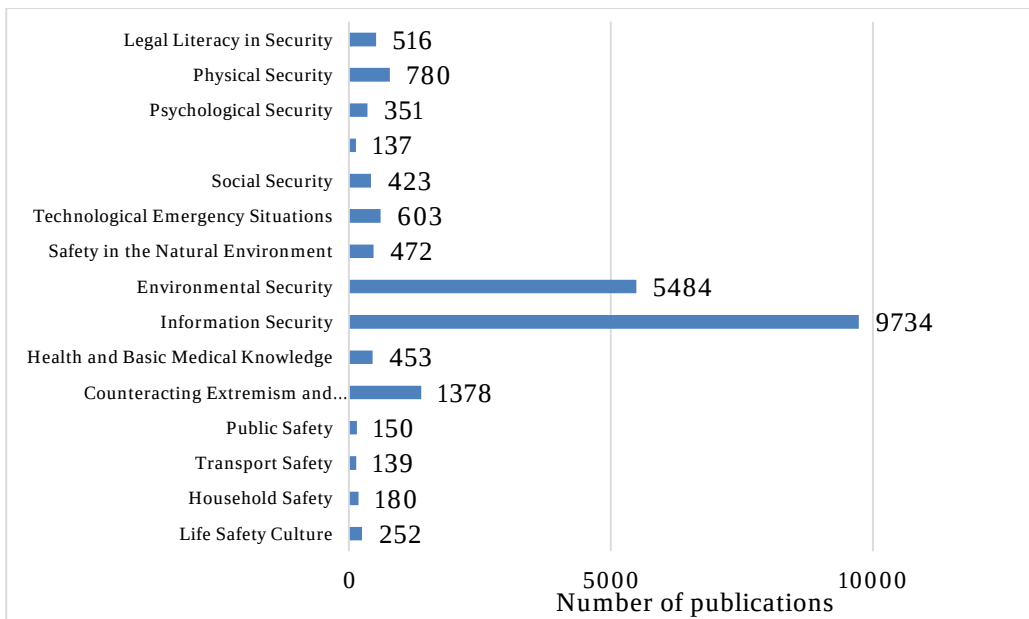


Fig. 1. Number of Publications in the Russian Segment (eLibrary.ru)

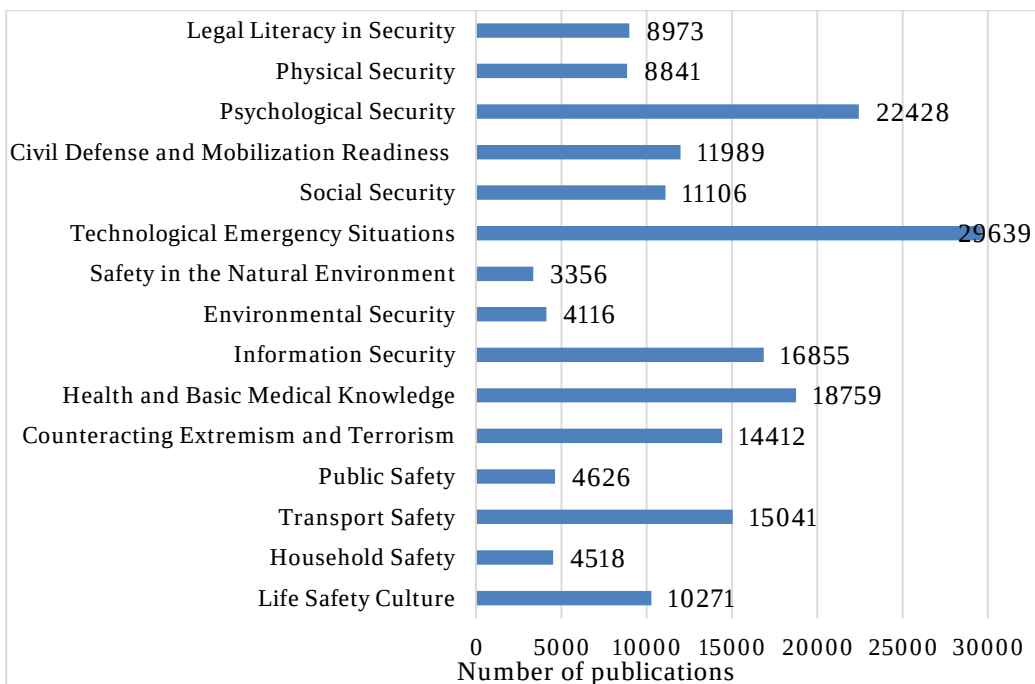


Fig. 2. Number of Publications in the International Segment (open-alex.org)

4.11. Structural dissimilarity analysis

To assess the degree of difference between the thematic profiles of the Russian and international bibliometric segments, the Bray-Curtis dissimilarity index was used. Unlike correlation analysis, which evaluates the degree of association between two variables, the Bray-Curtis index makes it possible to quantify differences in the internal structure of two distributions. In the present study, it was used to compare the relative representation of the 15 safety-related thematic categories identified through semantic analysis and expert assessment.

Since the total number of publications indexed in eLibrary.ru and OpenAlex differs substantially, absolute publication counts were converted into relative frequencies before calculating the index. For each bibliometric segment, the number of publications in each thematic category was divided by the total number of publications across all 15 categories.

The cumulative keyword-based publication frequencies across the 15 thematic categories amounted to 21,052 in the Russian segment and 184,930 in the international segment. Because individual publications could be associated with more than one thematic category, these totals should not be interpreted as counts of unique publications. The calculated Bray-Curtis dissimilarity index was $BC = 0.614$.

The obtained value indicates a structural difference between the keyword-based thematic profiles of the Russian and international bibliometric segments. After conversion to relative thematic shares, the two segments retained different patterns of thematic representation. These differences should be interpreted as differences in keyword-based thematic representation within the analyzed metadata rather than as direct measures of national research activity.

The greatest contribution to the structural dissimilarity was associated with categories characterized by markedly different relative keyword-based representation in the two segments. In the Russian bibliometric segment, Information Security and Environmental Security occupied considerably larger shares of the analyzed thematic profile. In contrast, the international segment demonstrated relatively greater representation of Technological Emergency Situations, Psychological Security, Health and Basic Medical Knowledge, and Transport Safety.

The Bray-Curtis index was used as an integrated measure of structural difference rather than as a statistical significance test. Accordingly, the obtained value does not indicate whether the difference is statistically significant in the inferential sense, but quantitatively characterizes the extent to which the distributions of publications across the selected thematic categories differ. The category-level differences underlying this overall measure are examined in greater detail in the following section.

5. Results

The comparative analysis revealed substantial structural differences between the thematic profiles of the Russian and international bibliometric segments, as demonstrated by the Bray-Curtis dissimilarity analysis.

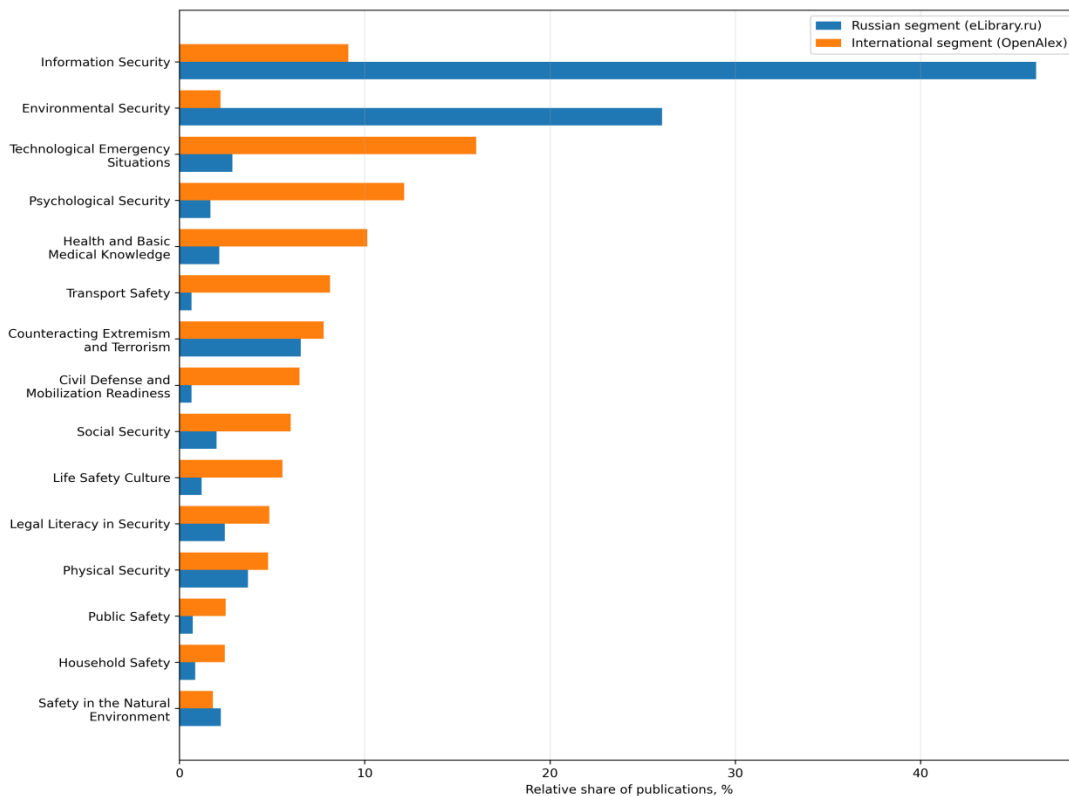
5.1. Content analysis results

We compared the distribution of publications across the 15 thematic safety categories to examine the structural differences between the Russian and international bibliometric segments in greater detail. Since the total number of publications differed considerably between eLibrary.ru and OpenAlex, absolute keyword-based publication frequencies were converted into relative thematic shares within each bibliometric segment. For each of the 15 thematic categories, the relative thematic share was calculated as the keyword-based publication frequency of that category divided by the cumulative frequency across all 15 categories in the corresponding bibliometric segment. This transformation made it possible to compare the internal thematic structure of the two publication sets independently of differences in their overall size.

The resulting values presented in [Table 4](#) characterize the relative keyword-based representation of each safety-related topic within the analyzed Russian and international publication profiles. Their comparative distribution is also illustrated in [Figure 3](#). The comparison makes it possible to identify the thematic categories that contribute most strongly to the overall structural dissimilarity between the two bibliometric segments. The percentages represent the relative thematic share of each category within the cumulative keyword-based publication frequency across the 15 analyzed categories in the corresponding bibliometric segment.

Table 4. Relative distribution of keyword-based publication frequencies across the 15 safety-related thematic categories in the Russian and international bibliometric segments

Safety Area	Russian Segment (eLibrary.ru), %	International Segment (openalex.org), %	Difference, percentage points
Life Safety Culture	1.20	5.55	-4.35
Household Safety	0.86	2.44	-1.58
Transport Safety	0.66	8.13	-7.47
Public Safety	0.71	2.50	-1.79
Counteracting Extremism and Terrorism	6.55	7.79	-1.24
Health and Basic Medical Knowledge	2.15	10.14	-7.99
Information Security	46.24	9.11	+37.13
Environmental Security	26.05	2.23	+23.82
Safety in the Natural Environment	2.24	1.81	+0.43
Technological Emergency Situations	2.86	16.03	-13.17
Social Security	2.01	6.01	-4.00
Civil Defense and Mobilization Readiness	0.65	6.48	-5.83
Psychological Security	1.67	12.13	-10.46
Physical Security	3.71	4.78	-1.07
Legal Literacy in Security	2.45	4.85	-2.40

**Fig. 3.** Relative distribution of publications across the 15 safety-related thematic categories in the Russian and international bibliometric segments

Key findings from the content analysis

A detailed examination of the relative distribution of publications across the 15 thematic categories reveals structural differences in the research profiles of the Russian and international bibliometric segments. The percentages indicate the relative thematic share of each category within the cumulative keyword-based publication frequency across the 15 analyzed categories in the corresponding segment.

The comparison shows that the largest differences between the Russian and international bibliometric profiles are concentrated in a limited number of thematic categories. Information Security (+37.13 percentage points) and Environmental Security (+23.82) have substantially larger relative shares in the Russian segment. By contrast, Technological Emergency Situations (-13.17), Psychological Security (-10.46), Health and Basic Medical Knowledge (-7.99), and Transport Safety (-7.47) are more strongly represented in the international segment.

Several categories show comparatively smaller differences between the two profiles. Safety in the Natural Environment differs by only 0.43 percentage points, Physical Security by 1.07, Counteracting Extremism and Terrorism by 1.24, and Household Safety by 1.58 percentage points. Public Safety, Legal Literacy in Security, Social Security, Life Safety Culture, and Civil Defense and Mobilization Readiness occupy intermediate positions between these two groups.

The overall pattern therefore reflects an uneven thematic distribution rather than a uniform difference across all 15 categories. The Russian profile is characterized mainly by the strong relative representation of Information Security and Environmental Security, whereas the international profile contains larger shares of technological emergency, psychological, medical, transport, and several socially oriented safety topics. These results describe differences in keyword-based thematic representation and do not, by themselves, establish the causes of those differences.

Summary of content analysis results

a) Russian research tends to focus more strongly on information security and environmental safety, which occupy substantially larger shares of the analyzed thematic profile compared with the international segment.

b) International research shows greater relative representation of public health, psychological security, technological emergency situations, transport safety, and disaster risk reduction.

c) The identified disparities reflect structural differences in the thematic distribution of research attention across the Russian and international bibliometric segments; however, the present analysis does not allow the underlying causes of these differences to be determined.

d) There is a need for greater interdisciplinary collaboration to integrate national and international research priorities and enhance the effectiveness of safety education programs.

5.2. Influence on the content of education

The evolving demands of society and the state require new approaches to education that focus on preparing students for effective personal and public safety management while fostering patriotic consciousness and civic responsibility.

To ensure that educational institutions develop structured and well-funded safety training programs, it is necessary to strengthen the resilience of the educational system in Russia. This will allow future educators to gain practical experience and apply their knowledge in real-life scenarios, ultimately improving the quality of professional training.

Contextual and competency-based approaches can connect safety knowledge with practical situations in which students must assess risks, make decisions, and respond to emergencies. In this model, theoretical content is not treated as an end in itself but as a basis for action in situations relevant to everyday and professional safety.

Safety education should also allow the curriculum to incorporate changes in technologies, regulatory requirements, and emerging safety problems without losing coherence. Its content should connect technical, legal, psychological, environmental, and social dimensions of safety with practical training based on real or simulated situations.

5.3. Recommendations for structuring safety education content

The thematic structure identified in the analysis provides a basis for several curriculum-level recommendations for safety education.

Safety education can be organized around thematic modules that reflect the domains identified in the analysis. These modules may combine information, psychological, social, environmental, medical, transport, technological, public, and legal aspects of safety while allowing institutions to adapt their sequence and emphasis to specific educational contexts.

Practice-oriented methods should accompany theoretical content where the learning objective involves action under risk. Case-based tasks, simulations, first-aid exercises, cybersecurity scenarios, and emergency drills can be selected according to the thematic module and expected learning outcomes. Digital tools may support simulation, scenario-based training, and access to updated safety-related materials where their use is consistent with the learning objectives.

Psychological security should be represented as a distinct component of safety education rather than treated only as a general condition of the educational environment. Across the thematic modules, safety culture can serve as an integrating educational objective linking knowledge of risks with responsible behavior and decision-making.

The interdisciplinary structure also places demands on teacher preparation. Professional development should address areas in which safety content, risk assessment, or emergency practices change substantially over time. Curriculum content should likewise be reviewed periodically as the thematic structure of safety research, regulatory requirements, and relevant risks change.

6. Conclusion

Summarizing the results of the analysis, it can be concluded that safety in the modern world requires a comprehensive and interdisciplinary approach, integrating technology, education, and risk management not only in academic settings but also in everyday and professional activities.

The comparative analysis of the Russian and international bibliometric segments revealed structural differences in the thematic distribution of safety-related research. The Russian segment is characterized by a greater relative representation of information security and environmental security, whereas the international segment shows greater representation of psychological security, health and basic medical knowledge, technological emergency situations, transport safety, and several other areas. The Bray-Curtis dissimilarity index ($BC = 0.614$) quantifies the structural difference between the two thematic profiles.

At the same time, the results demonstrate that contemporary safety research cannot be reduced to a limited number of isolated areas. Based on semantic analysis of search terms, expert assessment, and the survey of university teachers specializing in life safety, 15 thematic categories were identified and used as an analytical framework for comparing the Russian and international publication profiles. These categories reflect the multidimensional nature of safety and provide a basis for structuring the content of safety education.

The analysis of contemporary scientific publications revealed the necessity of integrating knowledge from various fields to foster a culture of safe behavior, risk awareness, and preparedness for different types of safety challenges.

Special attention in this study was given to interdisciplinary connections and to the need to combine theoretical knowledge with practice-oriented learning. The identified thematic diversity indicates that safety education should not be limited to individual disciplinary areas but should integrate informational, psychological, social, environmental, technological, medical, legal, and other safety-related components.

The proposed recommendations include:

1. The development of educational programs reflecting the identified safety-related thematic areas and focused on risk reduction.
2. The use of practice-oriented learning methods aimed at developing risk assessment, decision-making, and safe behavior skills.
3. Continuous professional development of educators in the field of safety education and emerging safety challenges.
4. The use of appropriate digital and educational technologies to support interactive and practice-oriented learning.
5. Systematic evaluation and updating of safety education content in response to changes in scientific knowledge, technologies, and emerging risks.

The proposed structure can support the development of safety curricula that combine interdisciplinary content with practice-oriented learning. The thematic framework also provides a basis for comparing safety-related research profiles and structuring the content of life safety education.

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