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Curriculum Matters
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CONTENT ANALYSIS OF UPPER-SECONDARY PHYSICS AND ASTRONOMY CURRICULA (GRADES 9TH – 12TH): A COMPARATIVE STUDY OF THE 2000 AND 2018 PROGRAMMES IN BULGARIA

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Abstract. This study presents a systematic content analysis of Bulgaria's upper-secondary Physics and Astronomy curricula (Grades 9th – 12th) across two policy periods: the pre-reform framework implemented between 2000 and 2018 and the curriculum introduced in 2018 and currently in force. Using quantitative and qualitative content-analysis procedures and a coding scheme based on the revised Bloom's taxonomy, we examine changes in cognitive demand, thematic emphasis, and competence orientation. The results indicate a shift toward competency-based curriculum discourse, a reallocation of attention across major physics domains, and the incorporation and/or greater visibility of modern physics topics (e.g., quantum and nuclear physics, elementary particles). The analysis also highlights structural changes that postpone specialised study, with implications for depth of learning and equity of access to advanced physics. Overall, the study provides an empirical basis for understanding the evolution of Bulgarian physics education in the context of contemporary curriculum.

Keywords: physics education; curriculum; content analysis; Bloom's taxonomy; competencies; curriculum reform

Introduction

Early twenty-first-century education reforms reshaped European curricula by placing greater emphasis on twenty-first-century competencies and scientific literacy (Bao & Koenig, 2019). As a member of the European Union since 2007, Bulgaria has implemented a sequence of reforms, the most consequential being the adoption of the Pre-school and School Education Act in 2015 (effective August 2016) and the subsequent curriculum updates introduced in 2018 (Bankov et al., 2019).

Physics and astronomy occupy a central position within science education. In Bulgaria, Physics and Astronomy is taught as a separate subject starting in Grade 7th. Comparative analyses of curricula from different historical periods provide insight into the evolution of education policy, content priorities, and pedagogical approaches (Nordin & Sundberg, 2018).

The aim of this study is to conduct a systematic comparative analysis of the Physics and Astronomy curricula for Grades 9th – 12th in Bulgaria across two key periods (the 2000 curriculum framework and the post-2018 curriculum). We focus on changes in content, cognitive complexity, and competence orientation. The guiding research questions address (i) differences in the distribution of cognitive levels as operationalised through the revised Bloom's taxonomy and (ii) shifts in thematic coverage across major physics domains.

Literature review

Content analysis is a systematic approach to examining curricular documentation (Krippendorff, 2004). It enables both quantitative and qualitative assessment of themes, concepts, and learning objectives. Typical procedures include categorising curricular content, classifying objectives, and structuring learning topics in relation to competencies (Stemler, 2001; Neuendorf, 2017). In the present study we apply a modified coding and thematic-analysis approach aligned with principles used in evidence synthesis (Borenstein et al., 2011).

Contemporary methodologies also include Posner's (2004) framework, which analyses curricula along five dimensions: documentation, aims and content, organisation, implementation, and evaluation. Similarly, the Cambridge Assessment report "Towards a Method for Comparing Curricula" proposes a structured document-analysis approach that includes defining scope and objectives, selecting curricula for comparison, identifying key characteristics, collecting documentation, and extracting and coding data (Greatorex et al., 2019).

Within the Bulgarian tradition of science education research, Gendjova (2012) compared higher- and lower-order thinking skills embedded in Bulgarian and Canadian chemistry curricula using the revised Bloom's taxonomy, reporting an approximate 6:1 ratio in favour of lower-order skills in the Bulgarian curricula. Bankov, Tafrova-Grigorova, and Mavrodieva (2019) provide an overview of Bulgaria's education system in the TIMSS context, documenting major reforms and structural changes. Tafrova-Grigorova (2013, 2014) analyses trends in school science education and approaches to developing scientific literacy, while Bankov, Mikova, and Smith (2006) examine between-school variation in educational resources and achievement in mathematics and science.

Bloom's original taxonomy (Bloom et al., 1956) proposed a hierarchical classification of six cognitive levels. The revised taxonomy (Anderson & Krathwohl, 2001) reformulates the model as a two-dimensional framework that distinguishes cognitive

processes (remember, understand, apply, analyse, evaluate, create) from knowledge types (factual, conceptual, procedural, and metacognitive). Krathwohl (2002) highlights the relevance of the revision for instructional planning and assessment.

Applications of Bloom's taxonomy to curriculum analysis in physics and science education are well documented. Lee, Kim, and Yoon (2015) analysed the intellectual demands of intended primary science curricula in Korea and Singapore and reported high inter-coder reliability. Pugh and Gates (2021) applied Bloom's taxonomy to higher-education physics examinations and found a predominance of lower- and mid-level cognitive processes.

International studies report a sustained trend toward integrating modern physics content into upper-secondary curricula (Krijtenburg-Lewerissa et al., 2017; Stadermann et al., 2019). Bao and Koenig (2019) argue that physics education should move from predominantly content-oriented instruction to a model that emphasises scientific practices and twenty-first-century skills. Strat, Henriksen and Jegstad (2023) synthesised 142 empirical studies (2000–2022) on Inquiry-Based Science Education (IBSE) in teacher education, highlighting the importance of structured pedagogical support, explicit learning goals, and clearly defined roles and activities for sustainable outcomes.

Theoretical framework and methodology

The study uses the revised Bloom's taxonomy (Anderson & Krathwohl, 2001) as its primary analytical framework. This two-dimensional structure allows learning objectives to be classified by cognitive process (remember, understand, apply, analyse, evaluate, create) and by knowledge type (factual, conceptual, procedural, metacognitive). Its use in physics curriculum analysis provides a basis for more transparent appraisal of the intellectual demands placed on students (Lee et al., 2015; Pugh & Gates, 2021).

We apply a systematic comparative content-analysis design that integrates quantitative and qualitative procedures, following the tradition of content analysis as formulated by Elo and Kyngäs (2008) and conceptually grounded in Krippendorff (2004). This approach supports the examination of both manifest and latent curriculum characteristics through frequency measurement, categorical structuring, and interpretive analysis. The study adopts a longitudinal comparative design (Widdersheim & Koizumi, 2017) to investigate diachronic curriculum change across two policy periods: the 2000 framework and the post-2018 curriculum.

The corpus comprises official Physics and Astronomy curricula for Grades 9^{th} – 12^{th} approved by Bulgaria's Ministry of Education and Science, relevant regulatory documents, and the TIMSS 2019 Encyclopedia description used for international contextualisation (Bankov et al., 2019). For both periods, we analysed materials for compulsory preparation (Grades 9^{th} – 10^{th}) and specialised preparation (Grades 11^{th} – 12^{th}), enabling comparisons of structural and didactic parameters.

The analytical framework includes two complementary levels. At the macro level, we systematised thematic areas, formal structure, and relative distribution of curricular content. At the micro level, the analysis focused on formulations of expected learning outcomes. These were operationalised through a four-step adaptation of the revised Bloom's taxonomy (Anderson & Krathwohl, 2001; Armstrong, 2010), allowing us to infer dominant cognitive demands and instructional emphases expressed in outcome statements. In parallel, we also coded pedagogical focus by distinguishing epistemic (disciplinary) goals from practical–civic goals, consistent with contemporary models of scientific literacy.

The coding procedure followed the DCAM model (Defining, Coding, Analysing, Modelling) (Liu, 2022). Coding was conducted by four independent experts with extensive experience in physics education research and teaching. A pilot phase was used to calibrate the categories. Agreement between coders provided additional evidence for the reliability of the categorisation. To strengthen analytical validity, interpretations were triangulated with external sources, including national reports and international comparative analyses.

Results

Structural Transformation of the Upper-Secondary Cycle

Understanding changes in specific curriculum content requires attention to macro-structural changes in upper-secondary education, which redefined the place of physics within the national timetable.

In the curriculum model implemented between 2000 and 2018, upper-secondary education was organised into 'levels', reflecting the legacy of specialised schools. The system comprised (1) a compulsory level for all students, ensuring a minimum baseline of knowledge, and (2) a specialised level accessible from Grade 9th for students enrolled in science–mathematics tracks.

This structure enabled motivated students to engage with more demanding physics early. In specialised tracks, physics was taught for at least three hours per week, creating conditions for developing a discipline-specific way of thinking at approximately 15 years of age.

The current legal framework divides upper-secondary education into two stages: (i) a first upper-secondary stage (Grades 8th – 10th) providing general education for all students and disallowing early specialisation in physics, aiming at broad scientific literacy, and (ii) a second stage (Grades 9th – 12th) offering specialised study organised in modules.

A key finding is that postponing specialisation from Grade 9th to Grade 11th constitutes a form of curricular 'de-acceleration' for high-potential students. Under the pre-2018 framework, the specialised programme explicitly provided at least three hours per week in Grade 9th when physics was a profile subject, supporting intensive problem solving and laboratory work.

Under the post-2018 curriculum, all Grade 9 students follow the same general programme. There is no structural mechanism within compulsory hours to offer advanced physics to ninth-graders; the content is explicitly oriented toward producing scientifically literate citizens rather than future physicists. As a result, students do not encounter specialised physics until Grade 11th, reducing the time available for deep conceptual development from four years (Grades 9th – 12th) to two years (Grades 11th – 12th). While the new modules can be academically demanding, the 'runway' for mastering them is substantially shorter. In practice, this gap is often compensated through private tutoring or extracurricular programmes, raising questions about equity and access to advanced physics learning opportunities.

Thematic Content Analysis

In the 2000 curriculum framework, thematic distribution is dominated by Electricity and Magnetism (27.2%) and Modern Physics and Astronomy (19.3%), which together account for 46.5% of coded formulations. A mid-level thematic band is formed by Optics (16.6%) and Waves and Oscillations (14.5%), totalling 31.1%. Mechanics remains significant (13.9%) but not dominant. The smallest share is assigned to Scientific Method and Experiment (8.5%). Percentages are based on the frequency of coded formulations and reflect discursive emphasis rather than instructional time.

The 2018 curriculum exhibits a more modular structure and a reallocation of thematic emphasis. Mechanics is prominent (18.2%), and together with Mechanical Motion (4.6%) the mechanics-related domain reaches 22.8%. The electromagnetism domain is distributed across several interconnected topics and sums to 23.3%. Applied Physics accounts for 6.2%, while Molecular Structure of Matter and Thermal Phenomena sum to 12.0%. Modern physics and space-related content totals 18.4%, and the wave-optics domain accounts for 12.2%. Experiment- and measurement-related topics remain compact (4.8%).

Comparison across aggregated domains shows a systematic reordering of normative priorities (see Table 1). The largest change is the increased emphasis on Motion and Energy (mechanics), from 13.3% to 22.9% (+9.5 percentage points). Electricity and Magnetism remains relatively stable (25.7% to 23.3%; −2.3 pp). The most pronounced decreases occur in Light and Optics (−9.3 pp) and Oscillations/Waves (−9.2 pp), indicating a compression of the wave–optics 'middle band'. Modern Physics and Space decreases by −6.4 pp, and Measurement and Experiment by −5.4 pp.

In addition to these quantitative shifts, a salient qualitative difference is the absence of an explicit treatment of Kirchhoff's laws in the new curriculum. Their omission likely reduces formal circuit analysis and modelling, constrains opportunities to cultivate procedural and analytical skills, and may weaken preparation for engineering pathways. In the longer term, this may shift foundational

circuit-analysis competencies (e.g., systematic nodal/mesh approaches grounded in Kirchhoff's current and voltage laws) from upper-secondary schooling to higher education, increasing the need for remediation in first-year engineering courses and potentially widening preparedness gaps among entrants. Thus, a similar overall share for the electromagnetism domain can coexist with internal reconfiguration toward more descriptive and contextual formulations.

Table 1. Comparable thematic distribution across aggregated domains (2000 vs. 2018)[1]

Domain	2000, % (n=713)	2018, % (n=433)	Δ (pp)
Electricity and Magnetism	25.7%	23.3%	−2.3
Motion and Energy (mechanics)	13.3%	22.9%	+9.5
Light and Optics	16.7%	7.4%	−9.3
Oscillations/Waves (2018: "Waves and Quanta")	14.0%	4.8%	−9.2
Modern Physics and Space	20.1%	13.6%	−6.4
Measurement and Experiment	10.2%	4.8%	−5.4

Cognitive Profile of the Curricula

Table 2 reports the distribution of operational verbs across the cognitive process categories of the revised Bloom's taxonomy in the 2000 curriculum framework and the 2018 curriculum. The analysis reveals substantial changes in the cognitive profile of expected learning outcomes, with direct implications for the cognitive demands placed on students.

In the 2000 framework, Apply (39.8%) and Understand (31.3%) dominate, together accounting for over 70% of all identified operational verbs. This profile reflects an orientation toward quantitative problem solving and model application.

In the 2018 curriculum, Understand rises to 39.1% and Remember to 22.6%, while Apply decreases to 28.2% and Analyse to 8.1%. Evaluate and Create remain marginal in both curricula (2.0% combined in 2018). Overall, the shift suggests reduced cognitive complexity in the formulation of intended outcomes, potentially improving accessibility but risking weaker transfer and problem-solving skill development.

Table 2. Distribution of cognitive-process levels (revised Bloom's taxonomy) in the Physics and Astronomy curricula (2000 vs. 2018)[2]

Cognitive level (Bloom)	2000 – count	2000 – %	2018 – count	2018 – %
Remember	127	14.6%	117	22.6%
Understand	272	31.3%	202	39.1%

Apply	346	39.8%	146	28.2%
Analyse	91	10.5%	42	8.1%
Evaluate	12	1.4%	5	1.0%
Create	21	2.4%	5	1.0%
Total	869	100.0%	517	100.0%

Science Education and Intensive Foreign-Language Study

A major structural challenge of the post-2018 curriculum arises from variability in Grade 8th provision, particularly the long-standing model of elite 'language schools'. In these schools, Grade 8th is devoted almost entirely to intensive foreign-language instruction (approximately 18 hours per week), and science subjects – including physics – are not taught. By contrast, in schools without intensive language study, Physics and Astronomy is taught in Grade 8th (72 hours per year), covering mechanics and thermal phenomena.

To standardise students' level by the end of Grade 9th, students from language schools study physics in Grade 9th with an increased allocation (around 90 hours), effectively covering two years of content in one. Students who studied science in Grade 8th receive a reduced Grade 9th allocation (around 36 hours) and a lighter content load. Although this policy aims at standardisation, it often results in curricular compression and reduced time for consolidation and practice. The inefficiency of this arrangement is reflected in Bulgarian students' PISA performance, measured precisely in Grade 9th. Figure 1 compares Bulgaria's outcomes with OECD averages in reading, mathematics, and science for 2006 – 2022 (OECD, 2023).

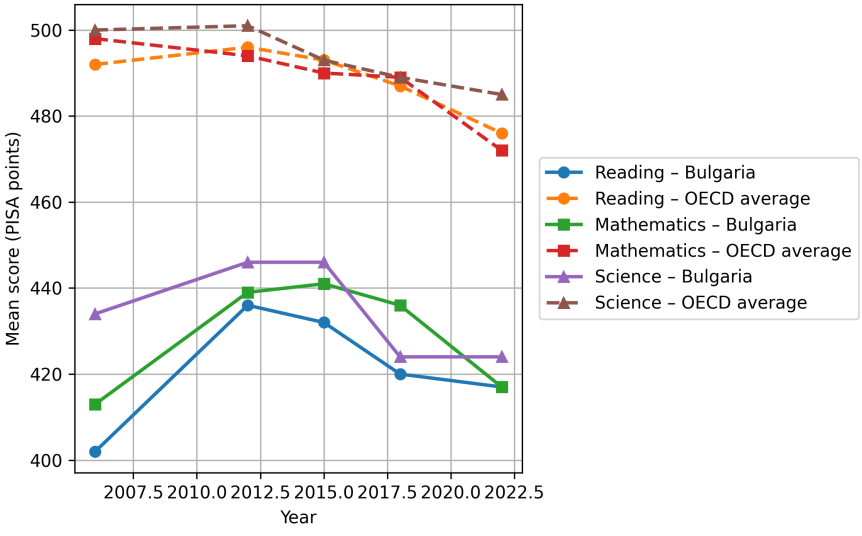


Figure 1. PISA performance trends for Bulgaria compared to the OECD average in reading, mathematics, and science (2006 – 2022). Solid lines represent Bulgaria; dashed lines represent the OECD average

Conceptual Sequencing: Electric Field and Electric Current

A pedagogically important issue is the altered sequencing of 'Electric Current' and 'Electric Field/Electrostatics' in the post-2018 curriculum. In the 2000 framework, electrostatics (charge, field, and potential/voltage) preceded electric current, supporting a causal account of current flow.

In the current curriculum, direct-current circuits and Ohm's law are taught in Grade 9th before a systematic introduction of field and potential in Grade 10th. Students therefore use voltage in quantitative relationships without prior field-theoretic understanding, which is postponed to the following year. This may increase accessibility but risks procedural application of Ohm's law at the expense of deeper conceptual understanding.

Discussion

From Content-Algorithmic to Competency-Oriented Curriculum Discourse

The findings indicate a shift from a content-algorithmic curriculum style toward a more competency-oriented discourse. This is visible in the modular organisation and in the cognitive profile of outcomes, which shifts toward remember/understand at the expense of apply/analyse. While consistent with 'scientific literacy for all', the shift risks promoting descriptive recall unless accompanied by explicit expectations for procedures, modelling, and problem solving. A plausible contributor is how 'competence' is defined and operationalised in the curriculum text: competencies are often formulated as broad integrative descriptors, which can increase the share of general 'understand/describe' outcomes unless they are coupled with explicit procedural expectations (e.g., modelling steps, multi-representation reasoning, and formal problem-solving methods). In this sense, the competency-oriented discourse may become broader but not necessarily deeper when the intended outcomes remain weakly specified in terms of method and analytical procedure.

Integrating Modern Physics: Opportunities and Constraints

Greater visibility of modern physics may support engagement and contemporary relevance, but it raises issues of age-appropriateness, the breadth-depth trade-off under limited time, and implementation capacity (teacher preparation, resources, simulations, and laboratory activities). Without these supports, modern topics may remain at the level of terminology.

Experimental Work: Increased Practice, Limited Normative Anchoring

Although laboratory work is often encouraged, experiment – and method-related competencies appear less explicitly anchored as assessable outcomes. Strengthening outcomes related to planning investigations, controlling variables, estimating uncertainty, interpreting data, and arguing from evidence would better align the curriculum with inquiry-based approaches.

Assessment Alignment

Misalignment between intended objectives and assessment can drive 'teaching to the test', favouring recall and standard explanations over modelling and analysis. The marginality of evaluate/create and the reduced share of apply-oriented formulations therefore has practical consequences for classroom priorities.

International Context and PISA

The coexistence of ambitious curricular scope with below-OECD-average PISA performance suggests that key challenges lie in implementation conditions, pedagogy, resources, and assessment, not only in topic selection. International trends emphasise scientific practices, modelling, argumentation, and data work; without time and support, expanding scope may weaken rather than strengthen scientific literacy.

Depth vs. Breadth and Curricular Compression

Increased emphasis on mechanics coupled with compression of wave–optics and experimental domains, alongside postponed specialisation, can intensify curricular pressure. Reducing scope or increasing time and support may be necessary to cultivate higher-order thinking and scientific practices.

Conclusions and summary

This study applied systematic content analysis and Bloom-based coding to compare Bulgaria's Physics and Astronomy curricula for Grades 9^{th} – 12^{th} between the pre-reform framework (2000 – 2018) and the curriculum introduced in 2018. The reform affects curriculum structure, thematic emphases, and the cognitive profile of intended outcomes.

At the macro level, specialisation is postponed, reducing time for advanced learning among high-potential students and raising equity concerns. The thematic analysis indicates that mechanics and electromagnetism remain central, but the wave-optics component and explicit experimental outcomes are compressed. The cognitive profile shifts toward remember/understand at the expense of apply/analyse. A specific content change – the omission of Kirchhoff's laws – may weaken systematic circuit analysis and reduce opportunities for procedural and analytical skill development, with potential downstream consequences for preparedness in university engineering programmes.

Three recommendations follow: (1) rebalance breadth and depth by reorganising or reducing scope, or by increasing time allocation; (2) strengthen experiment- and inquiry-related competencies as measurable outcomes; and (3) improve alignment between curriculum goals and assessment to support higher-order cognition and transfer.

A limitation is that text-based indicators reflect normative emphasis rather than enacted classroom practice. Future work should triangulate curriculum analysis with textbooks, assessment tasks, and empirical data on classroom implementation, and link curriculum changes to student outcomes such as scientific literacy and problem-solving performance.

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NOTES

1. Percentages are computed from the number of occurrences of coded outcome formulations in the "Learning content" sections (2000: n=713; 2018: n=433). Δ (pp) denotes percentage-point difference (2018–2000).
2. Percentages are computed relative to the total number of identified operational verbs in the respective curriculum.

REFERENCES

Armstrong, P. (2010). *Bloom's Taxonomy*. Vanderbilt University Center for Teaching.

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Longman.

Bao, L., & Koenig, K. (2019). Physics Education Research for 21st Century Learning. *Disciplinary and Interdisciplinary Science Education Research, 1*(1), 2. https://doi.org/10.1186/s43031-019-0007-8.

Bankov, K., Mikova, D., & Smith, T. M. (2006). Assessing Between-school Variation in Educational Resources and Mathematics and Science Achievement in Bulgaria. *Prospects, 36*, 447 – 473. https://doi.org/10.1007/s11125-006-9005-7.

Bankov, K., Tafrova-Grigorova, A., & Mavrodieva, M. (2019). Bulgaria. In I. V. S. Mullis, M. O. Martin, S. Goh, & K. Cotter (Eds.), *TIMSS 2019 Encyclopedia: Education Policy and Curriculum in Mathematics and Science*. TIMSS & PIRLS International Study Center.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I: Cognitive Domain*. David McKay.

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2011). *Introduction to Meta-analysis*. Wiley.

Elo, S., & Kyngäs, H. (2008). The Qualitative Content Analysis Process. *Journal of Advanced Nursing, 62*(1), 107 – 115. https://doi.org/10.1111/j.1365-2648.2007.04569.x.

Gendjova, A. (2012). High and Low Order Thinking Skills in Bulgarian and Canadian Science School Curriculum. *Chemistry: Bulgarian Journal of Science Education, 21*(1), 60 – 70. [In Bulgarian]

Greatorex, J., Rushton, N., Coleman, T., Darlington, E., & Elliott, G. (2019). *Towards a Method for Comparing Curricula*. Cambridge Assessment Research Report.

Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: An Overview. *Theory into Practice, 41*(4), 212 – 218. https://doi.org/10.1207/s15430421tip4104_2.

Krijtenburg-Lewerissa, K., Pol, H. J., Brinkman, A., & van Joolingen, W. R. (2017). Insights into Teaching Quantum Mechanics in Secondary and Lower Undergraduate Education. *Physical Review Physics Education Research, 13*(1), 010109. https://doi.org/10.1103/PhysRevPhysEducRes.13.010109.

Krippendorff, K. (2004). *Content Analysis: An Introduction to Its Methodology* (2nd ed.). Sage.

Lee, M. H., Kim, J., & Yoon, H. G. (2015). The Intellectual Demands of the Intended Primary Science Curriculum in Korea and Singapore: An Analysis Based on Revised Bloom's Taxonomy. *International Journal of Science Education, 37*(13), 2193 – 2213. https://doi.org/10.1080/09500693.2015.1072290.

Liu, L. (2022). Quantitative Content Analysis Methods in Instructional Technology Research: Defining, Coding, Analyzing and Modeling (DCAM). *Journal of Educational Technology Development and Exchange, 15*(1), 19 – 46. https://doi.org/10.18785/jetde.1501.03.

Neuendorf, K. A. (2017). *The Content Analysis Guidebook*. Sage.

Nordin, A., & Sundberg, D. (2018). Exploring Curriculum Change Using Discursive Institutionalism – A Conceptual Framework. *Journal of Curriculum Studies, 50*(6), 820 – 835. https://doi.org/10.1080/00220272.2018.1482961.

Organisation for Economic Co-operation and Development. (2023). *PISA 2022 Database*. OECD. https://www.oecd.org/en/data/datasets/pisa-2022-database.html.

Posner, G. J. (2004). *Analyzing the Curriculum* (3rd ed.). McGraw-Hill.

Pugh, S. L., & Gates, J. (2021). The Application of Bloom's Taxonomy to Higher Education Examination Questions in Physics. *New Directions*

in the Teaching of Natural Sciences, 16, Article 3674. https://doi.org/10.29311/ndtps.v0i16.3674.

Stadermann, H. K. E., van den Berg, E., & Goedhart, M. J. (2019). Analysis of Secondary School Quantum Physics Curricula of 15 Different Countries: Different Perspectives on a Challenging Topic. *Physical Review Physics Education Research, 15*(1), 010130. https://doi.org/10.1103/PhysRevPhysEducRes.15.010130.

Stemler, S. (2001). An overview of content analysis. *Practical Assessment, Research, and Evaluation, 7*(1), 17. https://doi.org/10.7275/z6fm-2e34.

Strat, T. T. S., Henriksen, E. K., & Jegstad, K. M. (2023). Inquiry-based Science Education in Science Teacher Education: A Systematic Review. *Studies in Science Education, 60*(2), 191 – 249. https://doi.org/10.1080/03057267.2023.2207148.

Tafrova-Grigorova, A. (2013). Contemporary Trends in School Science Education. *Bulgarian Journal of Science and Education Policy, 7*(1), 121 – 200.

Tafrova-Grigorova, A. (2014). Education for Enhancing Scientific Literacy. *Chemistry, 23*(1), 27 – 47. [In Bulgarian]

Widdersheim, M. M., & Koizumi, M. (2017). Historical Case Study: A Research Strategy for Diachronic Analysis. *Library & Information Science Research, 40*(2), 144 – 152. https://doi.org/10.1016/j.lisr.2018.06.003.

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