Latvijas Universitāte

Eksakto zinātņu un tehnoloģiju fakultāte

Starpnozaru izglītības inovāciju centrs

LATVIJAS UNIVERSITĀTE

STARPNOZARU IZGLĪTĪBAS INOVĀCIJU CENTRS

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Latvijas Universitātes 84. starptautiskā zinātniskā konference

Sekcija “STEM izglītība valsts tehnoloģiskajai un digitālajai attīstībai”

Pētījumu kopsavilkumu krājums

2026. gada 16. aprīlī

University of Latvia

Faculty of Science and Technology

The Interdisciplinary Centre for Educational Innovation





The 84th International Scientific Conference of the University of Latvia

The session “STEM Education for Technological and Digital Advancements”

Book of Abstracts

April 16th, 2026

Latvijas Universitātes 84. starptautiskās zinātniskās konferences sekcija “STEM izglītība valsts tehnoloģiskajai un digitālajai attīstībai” notika klātienē 2026. gada 16. aprīlī no plkst. 9:00 līdz 12:15 Zinātnes mājā (Jelgavas ielā 3, Rīgā, 401. telpā).
Sekcijā tika prezentēti jaunākie LU Eksakto zinātņu un tehnoloģiju fakultātes Starpnozaru izglītības inovāciju centra (LU EZTF SIIC) pētnieku un LU EZTF SIIC partneru – Rīgas Stradiņa universitātes, Latvijas Biozinātņu un tehnoloģiju universitātes un Tetovas Universitātes (Ziemeļmaķedonija) – pētījumi. Sekcija norisinājās trīs daļās: referāti, prezentācijas pie apaļajiem galdiem un paneļdiskusija “Kādi ir STEM izglītības potenciālie nākotnes attīstības virzieni mākslīgā intelekta ērā?”. Sekcijā aptvertais tēmu loks bija plašs, akcentējot STEM mācību priekšmetiem raksturīgo:

- mākslīgā intelekta un digitālo tehnoloģiju izmantošanu STEM mācīšanā, mācīšanās personalizācijā un vērtēšanā,
- STEM priekšmetu skolotāju profesionālo pilnveidi,
- skolu vadības un izglītības sistēmas līmeņa pārmaiņas STEM izglītībā,
- STEM priekšmetu (matemātika, fizika, tehnoloģijas, dabaszinātnes) mācīšanas metodiku un mācību programmas,
- tekstpratības, rēķinpratības un problēmrisināšanas prasmju attīstīšanu un diagnosticēšanu.

Ar STEM priekšmetu mācīšanu saistīti jautājumi tika apskatīti visplašākajā tvērumā – sākot no sākumskolas līdz augstskolai.
Sesija notika latviešu un angļu valodās; krājumā iekļautie pētījumu kopsavilkumi ir angļu valodā.
Sesijas vadītājs un pētījumu kopsavilkumu krājuma sagatavotājs: LU EZTF SIIC pētnieks, Ph.D., Mg. chem., Kārlis Greitāns

The session “STEM Education for Technological and Digital Advancements” was held in person on 16 April 2026 from 9:00 to 12:15 at the House of Science (Jelgavas street 3, Riga, room 401) as part of the 84th International Scientific Conference of the University of Latvia.
The session featured the latest research by researchers from the Interdisciplinary Centre for Educational Innovation of the Faculty of Science and Technology of the University of Latvia (UL ICEI) and partners of the UL ICEI – Riga Stradiņš University, Latvia University of Life Sciences and Technologies and the University of Tetova (North Macedonia). The session consisted of three parts: oral presentations, roundtable presentations and a panel discussion “Where is STEM Education Heading in the AI-Era?”. The topics covered in the session were wide-ranging, covering STEM subject specific:

- use of artificial intelligence and digital technologies in STEM teaching, personalisation of learning and assessment,
- professional development of STEM teachers,
- school leadership and system-level change in STEM education,
- teaching methodologies and curricula of STEM subjects (mathematics, physics, technology, science),
- development and diagnostics of literacy, numeracy and problem-solving skills.

The session was open to all those interested in the broadest range of issues related to the teaching of STEM subjects – from primary school to university.
The session was held in Latvian and English. The book of abstracts contains abstracts in English.

The session chair and the editor of the book of abstracts: UL ICEI researcher, Ph.D., Mg. chem., Kārlis Greitāns

Pētījumu kopsavilkumu krājums ir strukturēts divās daļās atbilstoši sesijas programmai: (1) referāti, (2) prezentācijas pie apaļajiem galdiem.

The book of abstracts is structured in two parts following the session programme: (1) oral presentations, (2) roundtable presentations.

Sesijas programma / Session programme

Vadītājs/Chair: Ph.D. Kārlis Greitāns		
1. daļa: Referāti / Part 1: Oral Presentations		
9.00–9.10	***Kārlis Greitāns***	Apakšsesijas atklāšana / Opening remarks
9.10–9.30	***Ģirts Burgmanis***	The Impact of Artificial Intelligence on Educational Assessment: Examples from Literacy and Numeracy
9.30–9.45	***Agon Memeti***	AI-Driven Personalization in STEM Education: Enhancing Learning Management Systems for Digital Transformation in Higher Education
9.45–10.00	***Ilze Saleniece***	Implementing Innovations in STEM Education at the System Level
10.00–10.15	**Kafijas pauze, diskusijas / Coffee break, discussions**	
2. daļa: Prezentācijas pie apaļā galda / Part 2: Roundtables		
Roundtable 1 – Vadītājs/Chair: Ģ. Burgmanis		
10.15–10.30	***Ergi Bufasi***	Practical AI Automation for Teacher Feedback and Learning
10.30–10.45	***Natālija Sergejeva***	Developing an Additional Mathematics Programme for Grade 7 STEM Education
10.45–11.00	***Marta Mikite***	Systemic Diagnostics of Mathematical Literacy within a Multi-Tiered System of Supports: A Two-Level Assessment Model
11.00–11.15	***Inese Dudareva***	AI-Supported Content Learning in Primary STEM Teacher Professional Development
Roundtable 2 – Vadītājs/Chair: K. Greitāns		
10.15–10.30	***Tatjana Rubina, Jekaterina Smirnova***	Methodology for Additional Lessons in “Modern Technology Studio” for Ozolnieki Secondary School
10.30–10.45	***Ildze Čakāne***	Aligning Lesson Study with School Aims: A Case Study of Two Schools
10.45–11.00	***Evija Ozola***	Coaching School Leaders for Sustainable Pedagogical and Digital Change in Education
11.00–11.15	***Kārlis Greitāns***	Advancing Needs-based Teacher Professional Development: Design of an AI-Based Model
Roundtable 3 – Vadītājs/Chair: L. Hačatrjana		
10.15–10.30	***Daiga Kalniņa***	Physics lessons with Khan Academy videos in secondary school
10.30–10.45	***Liena Hačatrjana***	Defining problem-solving and reasoning processes for learning in STEM effectively
10.45–11.00	***Laura Katkeviča***	Literacy as a Universal Skill: A STEM Perspective
11.00–11.15	***Ilze France***	Teaching for Understanding: Changing the Mathematics Classroom Culture in Latvia
11.15–11.30	**Kafijas pauze, diskusijas / Coffee break, discussions**	
3. daļa: Paneļdiskusija / Part 3: Panel discussion		
11.30–12.15	***Agon Memeti, Ergi Bufasi, Liena Hačatrjana, Daiga Kalniņa***	Kādi ir STEM izglītības potenciālie nākotnes attīstības virzieni mākslīgā intelekta ērā? / Where is STEM Education Heading in the AI-Era?

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(1) Referāti

(1) Oral Presentations

The Impact of Artificial Intelligence on Educational Assessment: Examples from Literacy and Numeracy

Ģirts Burgmanis[1]

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The nature of educational assessment today is very different from what it was just a few decades ago. It has evolved from discrete and standardized (focused on declarative memorization) to continuous and adaptive (primed by higher-order cognitive demands). Surges of interest in generative models and technical innovations in natural language processing and predictive analytics have changed the nature of assessment, advanced educational measurement, and redefined literacy and numeracy concepts.
Specifically, these innovations could profoundly change literacy assessment by shifting the focus from static reading comprehension to continuous, automated writing evaluation that provides real-time diagnostic feedback and assesses students' critical interactions with AI-generated texts. Concurrently, numeracy assessment is poised to move away from routine manual calculations, instead utilizing computerized adaptive testing and authentic digital tools to diagnose conceptual misunderstandings and evaluate real-world problem-solving.
Explorations of interactions between these domains have generated a new interest in authentic, process-oriented evaluation. This interest has produced a unique way of examining human-technology collaboration, and has provided the basis for a vastly different underlying knowledge and skills structure in the disciplines, prioritizing critical evaluation, AI literacy, and systems thinking. But the future still challenges and significant problems such as algorithmic bias, data privacy, and threats to academic integrity face educational measurement if it is to remain a viable and equitable practice in the new artificial intelligence society.

The research was conducted within the project “Individualized and personalized support system for students' reading, mathematical and scientific literacy development”. VPP-IZM-Izglītība-2023/1-0001

AI-Driven Personalization in STEM Education: Enhancing Learning Management Systems for Digital Transformation in Higher Education

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The rapid digital transformation of higher education has intensified the need for innovative, student-centered approaches in STEM education. This presentation explores the integration of artificial intelligence (AI) into Learning Management Systems (LMS) to enhance teaching and learning processes in STEM disciplines at university level. Drawing on a case study from the University of Tetova, the research examines how AI-driven personalization mechanisms—such as adaptive content delivery, intelligent quiz recommendations, and real-time learning analytics—can improve student engagement, learning outcomes, and instructional decision-making.

The study is grounded in the practical implementation of an AI-enhanced LMS architecture developed using modern web technologies, including MVC Blazor components and service-oriented design principles. Empirical data collected from student usage patterns and feedback are analyzed to assess the impact of personalized learning paths on students' performance and motivation in computer science and related STEM courses.

Beyond technical implementation, the presentation discusses broader implications for STEM pedagogy, assessment practices, and academic leadership. It highlights how digital and AI-supported tools can support instructors in monitoring learning progress, identifying at-risk students, and continuously refining teaching strategies. The findings contribute to current discussions on sustainable innovation in STEM education and demonstrate how universities can responsibly leverage AI to support inclusive, data-informed, and future-oriented learning environments.

Implementing Innovations in STEM Education at the System Level

Ilze Saleniece[1]

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The implementation of innovations and reforms in STEM education at the system level can be conceptualised as a multi-stage implementation process, in which outcomes are shaped both by the sequencing of implementation and governance mechanisms, and by contextual factors that enable or constrain implementation. Within the study, an integrated implementation perspective was developed that combines several theoretical approaches and viewpoints: a policy-cycle approach to implementing innovations (clarity of goals, coherence of instruments, the specificity of regulation, resources and support mechanisms), a theory of change (how implementation activities are expected to generate intermediate outcomes and impact), an implementation science perspective (interactions among stakeholders and system levels, leadership and management practices, communication, professional development, learning and support), and an outcomes-oriented approach (implementation outcomes and their distinction from policy impacts, including stability over time and the depth of changes in practice). The effectiveness of a system-wide STEM reform increases when policy design, stakeholder participation, institutional conditions and targeted implementation strategies are mutually consistent and cascaded down to the school and classroom levels.

Governance effectiveness in STEM reforms is increasingly explained as a shift from "implementation fidelity" to adaptive governance, since reform success cannot be reduced to simple compliance with the original reform design. The adaptive approach emphasises mutual adaptation between the reform and local - municipal and school - contexts, where implementers' sense-making and shared understanding, capacity strengthening, and sustained support are essential. At the system level, this requires coordinated action across all levels, clear goals, strategic use of data, an appropriate distribution of accountability, and a balance between external oversight and support, while also ensuring political sustainability. Governance outcomes are shaped by context, coherence-building, agency and motivation, as well as co-creation and two-way flows between governance levels - national, municipal and school.

The research was conducted within the project "Operational framework to support capacity building of educational professionals for school improvement solution development in schools and municipalities" VPP-IZM-Izglītība-2024/1-0001

(2) Prezentācijas pie apaļajiem galdiem

(2) Roundtable Presentations

Practical AI Automation for Teacher Feedback and Learning

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Artificial Intelligence is increasingly entering educational environments, yet much of the discussion remains focused on student-facing applications. Less attention has been given to how AI automation can support teachers' professional practice and ongoing development. This presentation explores how AI-driven workflow systems can augment teacher capacity by automating structured feedback processes and facilitating professional learning from academic literature and pedagogical texts.
The first application examines AI-assisted formative feedback generation. By integrating structured rubrics into automated systems, AI can generate consistent, criteria-aligned draft feedback that remains under teacher supervision. The second application focuses on professional learning, demonstrating how AI can process educational literature and transform it into actionable teaching strategies, summaries, and implementation plans. Rather than replacing teacher judgment, AI automation is conceptualized as cognitive augmentation by reducing repetitive workload while preserving pedagogical agency. The session presents conceptual models, implementation examples, and ethical considerations related to transparency, bias, and professional responsibility.

Developing an Additional Mathematics Programme for Grade 7 STEM Education

Natālija Sergejeva[1], Tatjana Rubina[1], Jekaterina Smirnova[1], Natalja Vronska[1], Baiba Briede[1]

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Strengthening pupils' motivation and confidence in mathematics at lower secondary level is important for their continued engagement in STEM education. An additional mathematics programme for Grade 7 pupils has been developed within the Erasmus+ Cooperation Partnerships in School Education project "Diversifying the STEM Ecosystem".

The programme was created through international collaboration between the University of Eastern Finland Teacher Training School and academic staff from the Latvia University of Life Sciences and Technologies. Its aim is to help pupils strengthen their basic mathematical knowledge and skills, while also increasing their interest and motivation to continue learning STEM subjects.

The methodology consists of 64 academic hours organised into 8 flexible modules, combining focused conceptual work with practical, problem-based and interdisciplinary activities. Mathematical topics are linked to real-life situations, project work and exploratory tasks that encourage problem-solving, critical thinking and collaboration. The programme can be adapted to different school contexts and learner needs and can be used with both printed and digital materials.

The presented results focus on the structure and pedagogical principles of the programme and share initial observations from its piloting phase. These observations suggest that the programme has the potential to support pupils' confidence in mathematics and their engagement in STEM learning. The finalised materials will be made freely available for use by schools and teachers.

Systemic Diagnostics of Mathematical Literacy within a Multi-Tiered System of Supports: A Two-Level Assessment Model

Marta Mikite[1], Ģirts Burgmanis[1]

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Educational systems increasingly emphasise data-informed instructional decision-making. However, assessment in practice often functions as episodic measurement rather than as a structured diagnostic mechanism. The Multi-Tiered System of Supports (McIntosh & Goodman, 2016) highlights early identification of learning difficulties and graduated levels of support based on systematic monitoring data. In mathematics education, such systemic diagnostics remain insufficiently structured.

The doctoral research project "Systemic Diagnostics of Mathematical Literacy in Lower Secondary Education" proposes a two-level assessment model that operationalises the principles of the Multi-Tiered System of Supports in mathematics.

Tier 1 consists of comprehensive class-level assessments administered across grade levels. These assessments cover the full range of curriculum content and provide an overview of students' mathematical literacy (OECD, 2023). This level functions as universal screening.

Tier 2 includes thematically focused diagnostic assessments targeting specific content domains. These instruments enable more precise identification of conceptual and procedural difficulties and inform targeted instructional planning (Black & Wiliam, 1998).

The model supports structured data use at student, classroom, and school levels, strengthening data-based decision-making processes (Schildkamp, 2019). Assessment is conceptualised not as isolated testing, but as a systemic mechanism for diagnosing and supporting mathematical literacy development.

The research was conducted within the project "Individualized and personalized support system for students' reading, mathematical and scientific literacy development". VPP-IZM-Izglītība-2023/1-0001

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AI-Supported Content Learning in Primary STEM Teacher Professional Development

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As generative artificial intelligence becomes more common in teacher professional development (PD), an important question is whether it can support deep, topic-specific learning rather than simply providing general assistance. This study explores how a purposefully designed AI chatbot can support primary STEM teachers in strengthening their understanding of student spatial ability, which is an important factor in STEM achievement.
Using a design-based research approach, a custom AI chatbot was developed to guide teachers through structured analysis of spatial reasoning situations. Teachers were asked to justify their answers and reflect on their thinking, while the system provided guided, formative feedback. Twenty experienced educators evaluated the tool through structured tasks and reflective comments.
The findings suggest that structured, domain-specific AI interaction can promote active reasoning and gradual refinement of understanding, functioning as a small professional learning cycle. At the same time, the study highlights the need to balance structured guidance with teacher autonomy and adaptable feedback. The results suggest that generative AI can serve as a scalable support tool within broader, sustainable STEM teacher professional development systems.

The research was supported by Latvian Council of Science, Fundamental and Applied Research Programme project “Functional Model for Personalized and Automated Teacher Professional Development Solutions”. Project number: lzp-2023/1-0122

Keywords: Teacher Professional Development, Generative AI, Spatial Ability

Methodology for Additional Lessons in “Modern Technology Studio” for Ozolnieki Secondary School

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This methodology has been developed within the Erasmus+ Programme Cooperation Partnerships in School Education project “Diversifying the STEM Ecosystem” (No. 2024-1-LV01-KA220-SCH-000250755). The program was created in cooperation between Ozolnieki Secondary School and academic staff from the Latvia University of Life Sciences and Technologies (LBTU).

The methodology “Modern Technology Studio” aims to support students’ digital creativity and technical literacy through modern browser-based tools for image editing, 3D modelling, and multimedia creation. The program combines practical, hands-on activities with digital design thinking to help learners build competence in visual communication, programming logic, and innovation. In addition, the methodology introduces students to the basics of robotics, programming, and control systems.

Aligning Lesson Study with School Aims: A Case Study of Two Schools

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School aims often remain at the level of policy documents and do not translate into classroom practice. At the same time, lesson study is frequently implemented as an activity for individual teachers' professional growth without being explicitly connected to school priorities. This study explores an expert-supported lesson study model aligned with school aims and designed as a whole-school professional development approach. The model combined workshops on pedagogical practice relevant to school aim with expert-supported lesson study cycles, bringing together key features of effective professional development.

The study aimed to examine both how such a model supports the attainment of school aims and how it influences changes in teachers' classroom practice. A case study design was used in two schools involving 52 teachers. In one school, the improvement aim focused on the quality of classroom discourse; in the other, it focused on creating greater opportunities for students' self-regulated learning. Data were collected through post-intervention teacher surveys, teacher focus group discussions, and 27 lesson observations with subsequent analysis.

The findings indicate that the professional development model contributed to observable changes in teachers' practice in both schools. In School A, classroom discourse became more inclusive and less limited to traditional teacher-student interaction patterns. In School B, teachers paid more attention to the teaching and use of metacognitive strategies that support students' self-regulated learning. At the same time, the effects differed across the two schools. Possible explanations include differences in starting positions, particularly teachers' prior experience with lesson study, as well as the degree of focus in the school aim itself. Overall, the study suggests that aligning expert-supported lesson study with school aims is a promising whole-school approach to professional development and may help schools translate strategic goals into classroom-level change.

The research was supported by Latvian Council of Science, Fundamental and Applied Research Programme project "Functional Model for Personalized and Automated Teacher Professional Development Solutions". Project number: lzp-2023/1-0122

Coaching School Leaders for Sustainable Pedagogical and Digital Change in Education

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Sustainable pedagogical and digital change in schools is frequently addressed through discrete initiatives or the introduction of technological solutions. However, such changes increasingly emerge in response to demands generated by multi-level educational governance systems. Within a capability-oriented framework, change is understood as the development of organisational capacity – that is, a school's ability to systematically plan, implement, and sustain improvement processes over time in response to these governance requirements. The purpose of this study is to examine how capability development supports sustainable change in schools and how the same underlying principle applies to the implementation of digital initiatives.

The study was conducted as a design-based research project employing qualitative data analysis. It investigates an ongoing and iteratively refined professional support programme involving 11 trained coaches and 18 school leaders organised into two cohorts (n = 10; n = 8). Coaches work individually with school leaders over an extended period. In parallel with individual coaching sessions, targeted and interconnected professional development activities are provided to strengthen coaching competences. Monthly group sessions are organised for case analysis, reflective dialogue, and collaborative problem-solving in complex situations. In addition, four face-to-face training days and eight online sessions have been implemented. The programme is continuously improved based on interim analysis and participant feedback. Data collection includes semi-structured interviews with both coaches and school leaders, as well as analysis of schools' progress towards strategic goals. Particular attention is paid to coaching interventions, professional competences, and factors that enable or constrain sustainable change.

The findings suggest that the combination of leadership coaching and structured professional learning contributes not only to the acquisition of knowledge but also to shifts in leadership practices and decision-making processes, thereby strengthening schools' capacity to initiate and sustain pedagogical and digital change. The study advances a capability-based approach to school development by demonstrating that digital transformation should not be treated as a separate domain of reform but rather as an expression of a school's broader capacity for managing change within a multi-level governance system. The results indicate that systematically designed and complementary forms of professional support enhance sustainable pedagogical and digital development and reinforce schools' ability to function coherently within governance-driven reform environments.

The research was conducted within the project "Operational framework to support capacity building of educational professionals for school improvement solution development in schools and municipalities" VPP-IZM-Izglītība-2024/1-0001

Advancing Needs-based Teacher Professional Development: Design of an AI-Based Model

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Teacher professional development (TPD) for in-service teachers is increasingly required to address continuously evolving curricular, technological, and organisational expectations. However, many professional development initiatives continue to face difficulties in identifying teachers' specific development needs, supporting the transfer of learning into classroom practice, and maintaining long-term improvement. This position paper contends that stronger personalisation can be achieved when teacher competencies are evaluated through a well-operationalised framework, resulting in a transparent competence profile that serves as a basis for planning focused development interventions. Drawing on conceptual perspectives that view learning transfer as a key unresolved mechanism in TPD effectiveness, the paper introduces an initial functional model for automated, AI-supported, and personalised in-service TPD from the standpoint of teacher educators. The proposed model follows a dynamic input–process–output logic and illustrates how artificial intelligence can be employed to (1) facilitate preparation and pre-learning activities, (2) support experimentation and reflective practice in authentic classroom settings, and (3) generate feedback and evaluation cycles that strengthen ongoing implementation and inform future professional development processes. To enhance structural clarity and practical applicability, the paper identifies the Structured Analysis and Design Technique (SADT) as an appropriate method for breaking down the TPD process into core functions, participant roles, and information flows. The paper's contribution lies in presenting a coherent, design-oriented rationale for competence-based personalisation and AI-enabled support for learning transfer, with the aim of informing future prototyping and empirical testing.

The research was supported by Latvian Council of Science, Fundamental and Applied Research Programme project "Functional Model for Personalized and Automated Teacher Professional Development Solutions". Project number: lzp-2023/1-0122

Physics lessons with Khan Academy videos in secondary school

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We present the results of integrating videos from the globally recognised digital learning platform Khan Academy into blended learning practices within the Latvian educational system.
Hundreds of Khan Academy videos are freely available on YouTube; however, they are in English and do not align with the Latvian school curriculum, which complicates their direct use in formal education. To address this, we developed an iterative AI-assisted adaptation process involving curriculum mapping, subtitle translation, and teacher expert validation. The results are available on the open-access platform luka.lu.lv, which currently provides more than one hundred adapted videos, along with expert commentaries for students and teachers, and physics terminology with explanations in Latvian.
Three in-service teachers involved in the project developed and tested different blended learning models, including the flipped classroom, flex model, and project-based learning, in real classroom settings throughout the school year with their Grade 12 students. Our initial results show that video-supported instruction can achieve learning outcomes comparable to those of traditional teaching in the advanced-level course Physics II. At the same time, blended learning required time investments into lesson redesign and rethinking the teacher's role, especially regarding classroom control and student motivation.
With this presentation, we aim to inspire more teachers to experiment with blended learning, share our experience using AI tools to adapt international learning materials, and highlight the importance of STEM education in Latvia.

Defining problem-solving and reasoning processes for learning in STEM effectively

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Training problem-solving in everyday class practice is crucial for students to develop in-depth scientific reasoning and to foster their understanding of science study content. Clear theoretical definitions and guidelines for practical implementation are relevant; therefore, we offer a view of problem-solving in STEM classes, integrating several perspectives. First, following the idea described in the "Brandon's matrix", there are four distinctive methods used in science, based on various types of problems in sciences. This means that teachers can offer students one of four types of how to approach a scientific problem (for example, with or without an aim to manipulate a variable). Second, once approaching any of the problems offered, the student goes through generally defined process or "steps" of problem-solving, starting from understanding the problem, planning and executing the solution and reflecting on it. Third, in each step of problem-solving, a specific reasoning activity (or combination of several activities) is activated in the mind (analysis, evaluation or synthesis) to produce an outcome – a conclusion, a comparison, a division of categories, a plan, a model or other. By following, combining and explicitly acknowledging the disciple-driven and cognitive processes during solving a task in sciences effective and deliberate problem-solving can be developed for students.

The research was conducted within the project "Individualized and personalized support system for students' reading, mathematical and scientific literacy development". VPP-IZM-Izglītība-2023/1-0001

Literacy as a Universal Skill: A STEM Perspective

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Aim of the Research

The research aims to conceptualise literacy as a universal competence embedded across STEM subjects and to develop a structured trajectory model for its progressive development from Grade 1 onwards. The study examines how students decode, interpret, analyse, and apply disciplinary texts, symbols, and multimodal representations in STEM contexts.

Relevance of the Study

In STEM education, literacy extends beyond reading written text. It involves understanding graphs, formulas, diagrams, models, data tables, and problem situations. Literacy functions as the cognitive infrastructure of STEM learning. A major educational challenge is distinguishing between general reading difficulties and insufficient mastery of disciplinary language and symbolic systems. Without a clear framework, students' struggles in STEM may be misinterpreted as content gaps rather than literacy development issues. From a pluriliteracy perspective, subject learning and language development are inseparable. Therefore, literacy should be understood as a universal skill that underpins reasoning, modelling, explaining, and argumentation in STEM.

Results, conclusions and/or discussion

The findings demonstrate that literacy functions as a transversal competence shaping students' performance across all STEM subjects. Analysis of trajectory-based assessment tasks shows that students' difficulties often stem not from a lack of conceptual knowledge, but from challenges in decoding symbolic representations, interpreting problem situations, and articulating reasoning.

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Teaching for Understanding: Changing the Mathematics Classroom Culture in Latvia

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In the context of Latvia's educational digital transformation, the fundamental challenge remains the qualitative evolution of mathematics classroom culture. Current performance metrics indicate a critical necessity for systemic change: 22,2% of Latvian students fail to achieve basic mathematical literacy, while only 6,4% demonstrate high proficiency in PISA assessments. Addressing these disparities requires a paradigm shift from teacher-centered, routine-oriented instruction toward a pedagogical culture that prioritizes deep conceptual understanding and mathematical reasoning.

Empirical analysis of lessons shows that there are big gaps in helping students use metacognition and meaningful discussion, which are both necessary for students to take charge of their own learning. To enhance primary mathematics education, instruction must transcend the assumption that instructional materials alone facilitate learning. Instead, it must implement inclusive strategies that integrate mathematical concepts with real-world contexts and socio-technical processes. A primary methodological objective is the systematic integration of multiple representations - bridging physical, visual, verbal, contextual and symbolic to ensure that procedural "doing" translates into conceptual "understanding."

Furthermore, the instructional focus must transition from immediate performance outcomes to the intrinsic value of the learning process, maintaining high cognitive expectations for all learners. By balancing foundational skills with complex problem-solving and mathematical modelling, Latvian educators can cultivate a more analytically proficient society. This cultural transformation is imperative to equip students with the competencies required to interpret data and execute informed, responsible decision-making in a complex 21st-century landscape.

The research was conducted within the project "Individualized and personalized support system for students' reading, mathematical and scientific literacy development". VPP-IZM-Izglītība-2023/1-0001