Ethical, Educational, Social, Legal and Technological Risk Assessment and Value Analysis of the AI Leap Learning Application and Educational Programme

Project: “Ethical, Social, Legal and Technological Risk Assessment and Value Analysis of the AI Leap Learning Application and Educational Programme”

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Commissioned by: AI Leap Foundation (Sihtasutus TI-Hüpe)

Prepared by: Working group of the Centre for Ethics, University of Tartu: Margit Sutrop (Principal Investigator), Dan Bogdanov, Katrin Laas-Mikko, Liina Kamm, Andra Siibak, Henrik Trasberg

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Executive Summary

“An Ethical, Educational, Social, Legal and Technological Risk Assessment and Value Analysis of the AI Leap Educational Innovation Programme and AI-Based Learning Application”

Purpose and Scope of the Analysis

This report analyses the AI Leap (*TI-Hüpe*) educational innovation programme, the AI-based learning application being developed for use in Estonian schools, and the pedagogical, organisational and technological framework supporting its use. It examines the associated ethical, educational, social, legal and technological risks, as well as the value choices they entail. The analysis was commissioned by the AI Leap Foundation and conducted between January and June 2026 by an interdisciplinary working group at the Centre for Ethics, University of Tartu.

AI Leap is a public–private educational innovation programme combining teacher training and professional support, the development of a learning application designed to support learning, and evaluation of the programme’s impact. The purpose of the learning application is not to provide ready-made answers, but to help learners arrive at solutions themselves through questions, hints and feedback, while developing metacognition and self-regulation.

Participation in the programme and use of the learning application are voluntary for schools. Once a school adopts the application for teaching and learning, however, its use becomes part of the organisation of instruction and the fulfilment of the public educational task entrusted to the school. The school retains responsibility for the quality and safety of the learning environment, for supporting students’ development, and for protecting their rights. Artificial intelligence is already part of how Estonian students learn. The central question is how its use can be guided so that it supports learner autonomy and general competences, helps reduce inequality, strengthens the teacher’s professional role, and preserves the strengths of Estonian education.

Methodology and Basis for Assessment

The risk assessment used an approach adapted from the risk assessment methodology developed by the Cybersecurity Committee of the Estonian Academy of Sciences. For each risk, the assessment describes the potential adverse event, its preconditions, and existing and additional measures. The risk scenarios are not predictions, but possible developments intended to support informed value, policy and governance decisions. The learning application is treated as part of a sociotechnical system that also includes teaching practices, school culture, human relationships, data flows, public responsibility and technology partners.

The assessment combines two normative frameworks. The normative framework of Estonian education defines the aims that the use of AI should serve: learners' holistic development, autonomy, critical thinking, general competences, development as democratic citizens, and the sustainability of the Estonian language and culture. The Trustworthy AI framework specifies the conditions that must be met: human autonomy and oversight, robustness, privacy, transparency, fairness, societal and environmental well-being, and accountability. Educational goals determine what AI should be used for; the principles of Trustworthy AI determine how it should be used lawfully, safely and ethically.

Main Risks

The assessment identifies twelve major risks, grouped into educational risks, societal risks, and infrastructure and governance risks.

Educational risks arise from the possibility that AI may support the rapid completion of tasks without contributing sufficiently to the broader aims of education. Deep thinking, social learning, values education and general competences may be pushed into the background. Equal access does not necessarily produce equitable outcomes: learners with strong study skills may use AI to enhance their learning, while those with weaker study skills may use it to avoid cognitive effort.

The use of AI also places pressure on academic integrity and the reliability of assessment. If learners present work generated with AI as their own achievement, grades no longer accurately reflect their knowledge, skills and development. Rules of use, learning tasks and assessment practices must therefore be updated, with greater attention given to the work process, oral justification, reflection and work completed in controlled settings.

The learning application may also weaken the teacher's pedagogical leadership and the teacher–student relationship if guidance and feedback move into a system whose operation the teacher cannot sufficiently see or control. At the same time, teachers' workload and change fatigue may increase. Schools remain responsible for the quality of teaching and the protection of learners' rights, yet may have limited ability to influence the operation of a system controlled by an external technology provider. This may create a mismatch between responsibility and actual control.

Societal risks concern the Estonian language and culture, value alignment and human relationships. International large language models may not draw sufficiently on the Estonian curriculum, Estonian-language learning resources, accurate terminology or the local cultural context. Estonian may consequently become merely the language of the user interface, while more complex concepts and modes of reasoning are derived predominantly from English-language data environments.

The outputs of language models are shaped by training data, developers' choices, content policies and commercial objectives. Conversational AI may also encourage anthropomorphism and reduce human contact with teachers and fellow learners.

Technology and governance risks include data breaches, rising costs, disruptions to operational continuity and technological dependence. Learners may enter sensitive information about themselves or others into the application, and a data breach could harm both individuals and public trust in Estonian education and the digital state.

Dependence on external technology providers makes education vulnerable to price increases, changes to terms of use, service outages, cyber incidents and geopolitical disruptions. A domestic solution is not automatically better: it may be more expensive, less capable or more difficult to secure. The aim should be to maintain sufficient public control, viable alternatives and the ability to switch providers.

Value Choices and Key Recommendations

Not all of these problems can be resolved through technical measures or legal rules. Decisions must be made about how to balance the efficiency of learning with learners' holistic development; personalisation with autonomy and privacy; teachers' professional judgement with the growing role of AI; global innovation with Estonia's educational self-determination; and cooperation with private companies with public control over education.

The report's principal recommendation is to treat AI Leap as a long-term, research-informed educational innovation rather than merely the introduction of a new digital tool. AI should support learners' cognitive effort, teachers' professional judgement and meaningful learning relationships, not replace them. Teachers must receive subject-specific didactic support, practical examples of use and dedicated working time for professional learning. Learning situations must also be preserved in which students read, write, calculate, reason and solve problems without AI assistance.

Schools need common principles for AI use, a clear allocation of responsibilities, and adequate legal and technical support. Teachers must remain the principal designers of the learning process, and their responsibilities must be matched by the ability to understand how the learning application affects learning and, where necessary, to guide or restrict its use. Data protection, meaningful human oversight and incident management must be addressed throughout the entire technological chain. Contracts should specify requirements concerning security, transparency, data use, the quality of Estonian-language outputs, alignment with the Estonian curriculum, operational continuity, auditability and the possibility of switching providers.

High-quality Estonian-language learning resources, terminology and cultural knowledge must be made available in forms that can be used in developing and evaluating the

learning application. The application's outputs should be assessed regularly for linguistic quality, subject-matter accuracy, cultural appropriateness, and alignment with Estonia's constitutional and educational values. Universities and research institutions should have a permanent role in the pedagogical design of the application, teacher education, independent impact assessment and risk monitoring. In addition to levels of use, the programme's success should be evaluated in terms of the depth of learning, independent thinking, educational equality, teachers' workload, and its impact on language and culture.

AI Leap has the potential to strengthen Estonian education significantly and become an international model, but only if educational goals guide the design and use of technology - not the other way around.

1. Introduction

The purpose of this analysis is to assess the ethical, educational, social, legal and technological risks associated with the AI Leap (*TI-Hüpe*) educational innovation programme and the use of the AI-based learning application being developed within it, as well as their potential impact on Estonian education and society. The analysis treats artificial intelligence not merely as a technology, but as part of the organisational and social context of the education system. Accordingly, in addition to legal and ethical requirements concerning AI, the analysis takes the aims, values and principles of education as its point of departure and examines the possible impact of AI use on learners' development, the role of teachers, the protection of fundamental rights, the societal values, and the sustainability of the Estonian language and cultural space.

The analysis proceeds from the assumption that the introduction of AI-based learning applications can, depending on their design, management and use, create both significant opportunities and significant risks. The risk scenarios described in this report should be understood as possible development scenarios, not as predictions that the described impacts will necessarily materialise. The purpose of the analysis is to identify value choices and areas requiring attention, and to propose additional measures and recommended governance decisions so that the potential benefits of introducing AI can be realised while possible harms remain under control.

The analysis was carried out between 22 January and 30 June 2026 by a working group of the Centre for Ethics, University of Tartu, and was commissioned by the AI Leap Foundation (*Sihtasutus TI-Hüpe*). The work was led by Margit Sutrop, Head of the Centre for Ethics and Professor of Practical Philosophy at the University of Tartu, and Katrin Laas-Mikko, AI ethics specialist at the Centre for Ethics (University of Tartu, SK ID Solutions AS). The expert team also included Dan Bogdanov, Research Director at Cybernetica AS; Liina Kamm, Senior Researcher; Henrik Trasberg, Legal and Policy Officer at the European Commission AI Office; and Andra Siibak, Professor of Media Studies at the University of Tartu. The management and staff of the AI Leap Foundation contributed background information at different stages of the analysis and provided information about the development and operation of the learning application.

The analysis was conducted in the following stages and the report is structured accordingly:

1. describing the context (object of study, starting points);
2. defining the normative basis for assessment, including ethical values, legal foundations, educational principles and cybersecurity frameworks;
3. risk assessment, including:
   - describing the risk-assessment methodology;
   - mapping possible risk scenarios;

   - describing, analysing and assessing selected risks, and proposing possible mitigation measures;
4. mapping of value choices;
5. providing recommendations for further development.

2. Description of the Context

This chapter describes the AI Leap learning application and educational programme from five perspectives. It first examines the AI Leap educational programme, its central technological component (the learning application), and the framework supporting its use. It then describes the programme's institutional structure, the technological solution, the chain of responsibility and legal framework, and finally the educational context.

2.1 AI Leap Educational Programme, AI-Based Learning Application and the Framework Supporting Its Use

2.1.1 AI Leap Educational Programme: Development and Objectives

On 25 February 2025, President of the Republic of Estonia Alar Karis, together with representatives of the Ministry of Education and Research and the private sector, announced the AI Leap educational programme.[1] The idea originated at a round-table meeting of technology entrepreneurs convened by the President of the Republic at the end of 2024 and was inspired by the Tiger Leap project, which had significantly influenced the development of e-Estonia thirty years earlier.[2] The launch of the AI Leap was supported by the President's Digital Council and its members, the Ministry of Education and Research and its AI Council led by researchers, as well as several entrepreneurs.

The programme was prompted by the rapid development of generative AI and the need to adapt the Estonian education system to a changed technological environment. The starting assumption was that a large proportion of Estonian students were already making extensive use of AI assistance in learning and that, without knowledgeable pedagogical intervention, this could begin to hinder the development of thinking and learning skills.[3]

When the programme was announced, its objective was described as maintaining the quality of Estonian education, equipping students and teachers with modern AI learning tools, and smoothly integrating technology into the education system. It was later specified that the central idea is not merely to bring new AI tools into schools, but to reshape teaching and learning practices and to use AI not to replace thinking but to develop it.

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[1] Ministry of Education and Research. (2025, February 25). *Estonia announces a groundbreaking national initiative: AI Leap programme to bring AI tools to all schools*. https://www.hm.ee/en/news/estonia-announces-groundbreaking-national-initiative-ai-leap-programme-bring-ai-tools-all

[2] Petrone, J. (2025). *AI Leap 2025: Estonia sets the global standard for AI in education*. e-Estonia. https://e-estonia.com/ai-leap-2025-estonia-sets-ai-standard-in-education/

[3] AI Leap Foundation. (n.d.). *About AI Leap*. https://tihupe.ee/en/organisatsioon-ja-osapooled/

According to the AI Leap concept document[4] published on 5 September 2025, the educational innovation programme aims to support the Estonian education system in adapting to the spread of generative AI. To achieve this, the programme envisages simultaneous intervention in teaching and learning practices and the development and introduction of an AI application designed to support learning.

The programme consists of three interrelated components.

First, a teacher support programme. Teachers are offered training, learning circles, methodological materials and access to AI tools with the aim of developing new teaching practices that support learning in the age of AI. The concept document treats teachers as the principal agents of change, because it is the teacher who shapes the learning context and can guide students to use AI as a tool for learning rather than merely for completing tasks.

Second, development of an AI application to support learning. According to the concept document, existing chatbots are not well suited for learning because their purpose is to provide quick answers. The long-term objective of AI Leap is to create, together with developers of large models and researchers, a specialised educational application that supports students' thinking, metacognition and self-regulation. Before such an application is introduced, it must undergo scientific evaluation and piloting.

Third, systematic evaluation of the programme's impact, both in terms of short-term performance and long-term effects on learners.

The success of the AI Leap educational programme is evaluated through agreed indicators for the achievement of three objectives and the monitoring of short-term performance[5]:

6. **Ensuring equality and accessibility**
   - All students and teachers are provided free access to leading AI tools so that the benefits of technology are available to everyone, not only to better-resourced educational institutions.
   - The application complies with guidelines concerning the Estonian language and culture.
   - The application complies with accessibility guidelines, including accessibility for people with special needs.
7. **Supporting the adoption of AI and developing AI literacy**
   - AI tools are created and their adoption supported. Progress is assessed, among other things, by the number of activated user accounts and unique users and the proportion of teachers who perceive AI as useful.

[4] Kruup, K., Aru, J., Arro, G., & Mäeots, M. (2025, September 5). *TI-Hüppe kontseptsioon* [AI Leap concept]. AI Leap Foundation. https://tihupe.ee/wp-content/uploads/2025/11/TI-Huppe-kontseptsioonidokument.pdf

[5] AI Leap Foundation. (n.d.). *Measuring effectiveness*. https://tihupe.ee/en/tulemuslikkuse-mootmine/

- Teachers and students are supported in becoming more informed and capable users of AI through training, development of learning materials and engagement activities.

8. **Improving learning skills and creating a positive learning and teaching experience**
   - Training is organised for students and teachers, and schools are supported in running learning circles, co-creation workshops and student AI programmes. These activities aim to reinterprete teaching, implement changes in learning and teaching methods, and develop subject-specific sample materials.
   - Students' and teachers' readiness to use AI (knowledge, access, etc.), satisfaction with AI use, and changes in teaching methods (self-reported) are assessed.
   - School leaders and/or heads of studies are supported through continuing professional development.

Regular updates on the programme's progress and the results of its activities are published on the AI Leap website.[6]

Data published as of 31 March 2026 indicate that making the technology available has progressed successfully. Ninety-five per cent of students in grades 10-11 (20,000 students) had received access to the learning application. Free premium accounts had also been created for 100 per cent of teachers in grades 10-11 (4,700 teachers). However, the rate of account activation had been slower than expected, particularly among students (50%), and growth in the number of users of the environments had also been slower (28%). Results were also below expectations for the organisation of AI learning circles (25% of schools) and changes in teaching methods (42%).[7]

A large-scale impact study has been commissioned to evaluate the programme's long-term effects. It is being conducted by researchers at the University of Tartu in cooperation with researchers from Stanford University and OpenAI. Among other things, the study assesses the programme's impact on learners' autonomous motivation, learning strategies, development of thinking, beliefs about learning, self-regulation skills, metacognition, persistence and AI literacy.

2.1.2 AI-Based Learning Application

One of the most ambitious parts of AI Leap is the creation of an AI application adapted specifically for learning. The concept document emphasises its fundamental difference from an ordinary chatbot.

Whereas conventional large language models are designed to solve the user's problem quickly, the purpose of the learning application is to support deep learning. The

[6] AI Leap Foundation. (n.d.). *Measuring effectiveness*. https://tihupe.ee/en/tulemuslikkuse-mootmine/
[7] AI Leap Foundation. (n.d.). *Measuring effectiveness*. https://tihupe.ee/en/tulemuslikkuse-mootmine/

application should not provide ready-made answers but should guide the student, through questions, hints and feedback, to arrive at a solution independently. This approach resembles a classical Socratic dialogue. In this conception, AI is neither an authority on knowledge nor a substitute for the teacher, but a dialogue partner that helps the learner structure their thinking, notice mistakes and develop metacognitive skills.

According to the concept document, the learning application is not designed as a product sold on the market for students to be used independently. On the contrary, it is intended to reach students through the school. The programme's stated intention is that the teacher should remain the central designer of the learning process and that the learning application should support the teacher's work rather than function as an independent service. The concept document repeatedly stresses that even a very good application cannot produce the formation of desired learning practices unless teaching practices also change.

2.1.3 Framework Supporting the Use of the Learning Application

In this analysis, the AI-based learning application is not treated as an isolated digital learning tool, but together with the pedagogical, organisational and technological framework that enables and supports its introduction and purposeful use. This framework includes, among other things, development and deployment of the application, teacher preparation and professional support, user support, involvement of technology partners, data management and evaluation of the programme's impact.

Participation in the programme and use of the learning application are voluntary for schools. If a school decides to introduce the application into teaching, its use becomes part of the organisation of the school's instructional work and the fulfilment of the public education mission. It is therefore not sufficient to assess only the technological properties of the application. It is also necessary to consider how the application is integrated into the learning process, what changes it requires in teaching and assessment practices, how tasks and responsibilities are distributed among the parties, and how user support, data protection and evaluation of continuous impact are ensured.

The analysis therefore distinguishes three interrelated levels. AI Leap is an **educational innovation programme** intended to support the transformation of teaching and learning practices in the age of AI. One of the programme's central components is an **AI-based learning application** designed to support learning. The third level is the **framework supporting the use of the learning application**, whose pedagogical, organisational and technological solutions are designed, implemented and governed by a range of public- and private-sector partners.

The following sections examine the institutional structure, governance and funding model, and partner roles of the AI Leap programme and the framework supporting it.

2.2 Governance, Funding and Partners of the AI Leap Programme

2.2.1 Institutional Structure and Governance of the AI Leap Programme

The policy concerning AI-related changes in the education system and their implementation is led by the Ministry of Education and Research.

The AI Leap cooperation programme was launched by the President's Digital Council, the Ministry of Education and Research, several universities and private-sector representatives – Telia Eesti AS, Targa Tuleviku Fond SA and Skaala Investments OÜ.[8] The AI Leap Foundation (registry code 90016335) was established on 4 April 2025 to fulfil the objectives of the AI Leap educational programme.[9] The foundation was established by Linnar Viik and Oleg Švaikovski.

Under its statutes, the task of the AI Leap Foundation (hereafter also "the Foundation") is to engage and cooperate with research and educational institutions and with private- and public-sector persons and organisations specialising in AI development, thereby making learning smarter and more personalised and teaching more effective and aligned with best evidence-based practices.[10] According to the statutes, the Foundation has been established for an indefinite period. Under an oral agreement with the Ministry of Education and Research, its activities have initially been planned for a three-year period.[11] The governing bodies of the Foundation are the Supervisory Board and the Management Board.[12] The Supervisory Board plans the Foundation's activities, organises its governance and supervises the Management Board in matters falling outside the Foundation's ordinary day-to-day activities, such as appointment and dismissal of Management Board members. Under the statutes, the Supervisory Board consists of 5-11 members elected for three-year terms. The members of the Supervisory Board elect a chair from among themselves. The Ministry of Education and Research has the right to appoint two members of the Supervisory Board; the other members are appointed and dismissed by the Supervisory Board.

At the time of the analysis, the members of the Supervisory Board were Linnar Viik, Oleg Švaikovski, Hannes Tammjärv, Andre Visse, Kristina Siimar and Kristi Vinter; Riin

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[8] AI Leap Foundation. (n.d.). *Public-private partnership*. Retrieved March 15, 2026, from https://tihupe.ee/en/funding/

[9] Estonian e-Business Register. (n.d.). *Sihtasutus TI-Hüpe (registry code 90016335)*. https://ariregister.rik.ee/eng/company/90016335/Sihtasutus-TI-H%C3%BCpe

[10] Sihtasutus TI-Hüpe. (2025, August 15). *Sihtasutuse TI-Hüpe põhikiri* [Articles of association of the AI Leap Foundation]. Estonian e-Business Register. https://ariregister.rik.ee/eng/company/90016335/Sihtasutus-TI-H%C3%BCpe

[11] Interview with Laura Kalda, 03.03.2026.

[12] Sihtasutus TI-Hüpe. (2025, August 15). *Sihtasutuse TI-Hüpe põhikiri* [The statutes of association of the AI Leap Foundation]. Estonian e-Business Register. https://ariregister.rik.ee/eng/company/90016335/Sihtasutus-TI-H%C3%BCpe

Saadjärv and Vallo Koppel had been appointed as representatives of the Ministry of Education and Research. The Supervisory Board was chaired by Kristi Vinter.[13] The Management Board represents and manages the Foundation on a day-to-day basis, except for matters within the competence of the Supervisory Board. A Management Board member is appointed for up to three years. Siim Sikkut was initially appointed on 11 April 2025; since 3 June 2025, the Foundation has been led by Ivo Visak.

2.2.2 Cooperation and Funding Model of AI Leap

The Foundation's activities rely on cooperation and funding from the state and the private sector.

The cooperation programme is implemented together with schools and school leaders, teachers and students, educational psychologists, researchers in education, neuroscience, IT and educational sciences, universities, technology and education experts, teacher and youth organisations, private entrepreneurs and producers of technology.

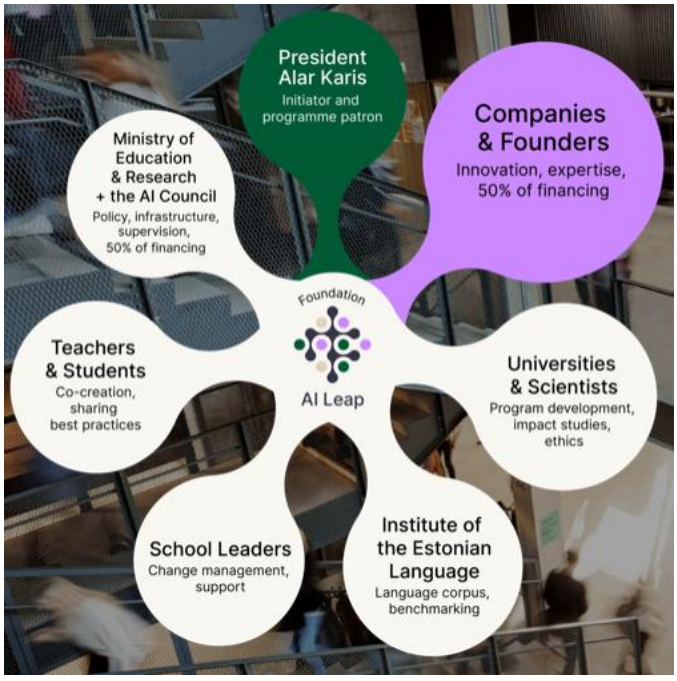


Figure 1. Main stakeholders and their roles. https://tihupe.ee/en/funding/

The funding model is based on partnership: 50% is expected to come from private-sector donations, both monetary donations and services provided free of charge, such as legal services; the remaining 50% is funded by the state through targeted grants from the Ministry of Education and Research. Donors may choose which line of activity they

[13] Estonian e-Business Register. (n.d.). *Sihtasutus TI-Hüpe (registry code 90016335)*. https://ariregister.rik.ee/eng/company/90016335/Sihtasutus-TI-H%C3%BCpe

wish to support. A short-term funding agreement has been concluded with the Ministry of Education and Research. A significant part of the Management Board's work is related to fundraising.

If AI Leap ceases operations, its assets will be transferred to the Ministry of Education and Research.

2.2.3 Technology Partners

AI Leap's technology partners are OpenAI and Google, together with Google's partner AppsEdu. The project also uses various collaboration and work-management environments, including Microsoft SharePoint, Microsoft 365, Slack and Figma.

The selection of partners took into account technical and administrative needs and costs. Involving two principal technology partners also aimed to create a valuable basis for comparison for assessment of the strengths and limitations of different technical solutions.[14]

OpenAI provides applications intended for students and teachers as a service based on OpenAI's large language model GPT.

Google fulfils three different roles in the project: service provider, provider of an identity-management solution, and operator of the automated testing environment. Like OpenAI, Google provides applications for students and teachers based on its Gemini large language model. Student identity management is carried out using Google Sheets, regardless whether the OpenAI or Google model is used. Google BigQuery is also used for automated evaluation of the learning application's outputs. This means that all inputs sent to OpenAI and the corresponding OpenAI outputs are transmitted to the BigQuery environment.

Teacher identity management is carried out using Google Sheets when the OpenAI model is used. Where a school uses the Google ecosystem, teachers are provided with Google Workspace for Education Plus or Google AI Pro for Education licences, which provide additional functionality. In such cases, licence and identity management is handled through the Czech branch of AppsEDU.

Both OpenAI and Google may use third-party partners as additional service providers whose services can be used in the process. On the basis of the information available, it has not been possible to assess those partners.

[14] AI Leap Foundation. (2025, July 20). *'AI Leap' testing two large artificial intelligence platforms this summer*. https://tihupe.ee/en/ai-leap-testing-two-large-artificial-intelligence-platforms-this-summer/

2.3 Parties Involved in Technology Use and Data Processing

2.3.1 Parties Involved in the Student and Teacher Applications

The parties involved in the use of the student and teacher applications are:

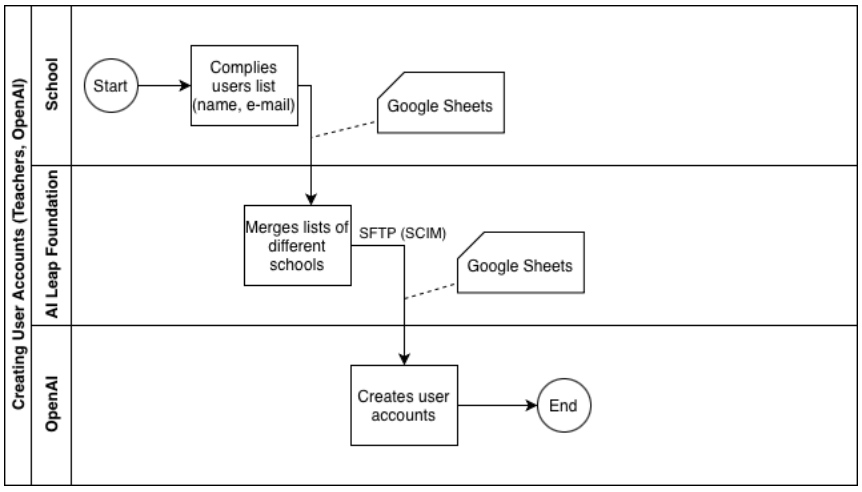
- AI Leap Foundation;
- school;
- teacher;
- student;
- OpenAI;
- Google (application provider);
- Google (identity management);
- Google (automated testing).

For data analysis, the following are added:

- researcher;
- researcher's analysis environment (currently the HPC cluster of the Institute of Computer Science, University of Tartu, but it may also be, for example, Google BigQuery, in which case Google acquires an additional role).

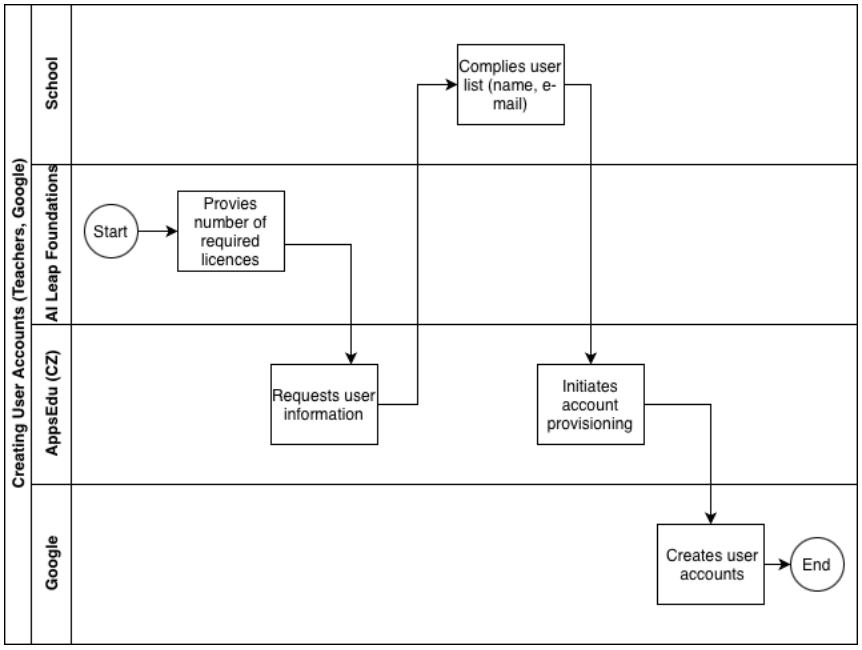
2.3.2 Description of Data Flows

Creating User Accounts: Teachers and OpenAI



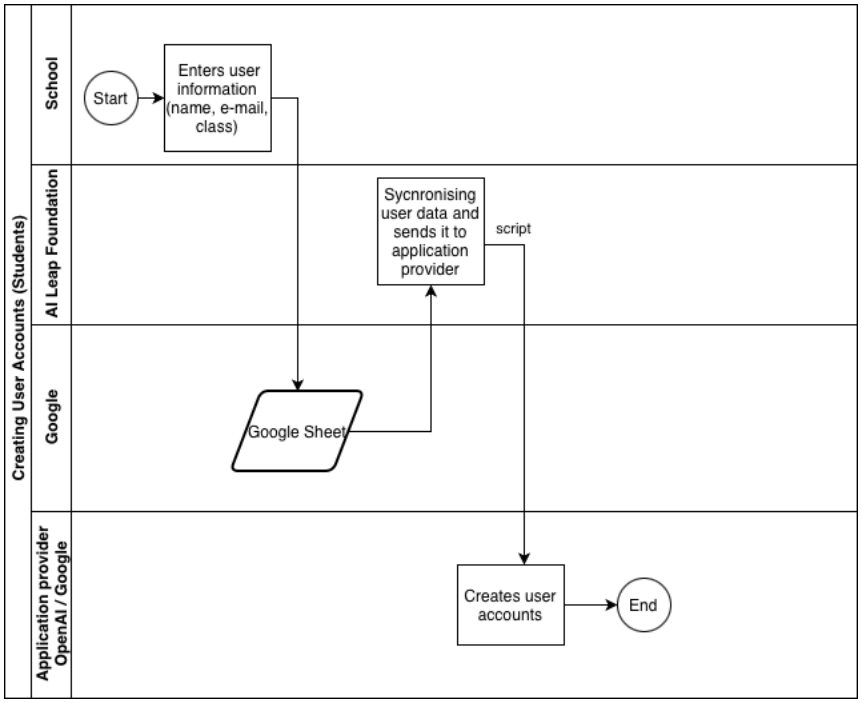
The school compiles a list of teachers as an Excel table. The table is created in Google Sheets. The tables from different schools are merged by script and sent to OpenAI for account creation.

Creating User Accounts: Teachers and Google



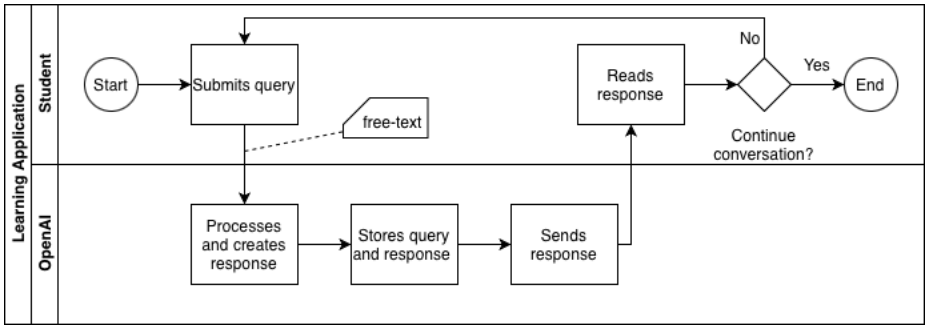
If a school uses the Google ecosystem, AI Leap informs AppsEdu of the number of teacher-application licences required for each school. Identity management for Estonian schools' Google accounts takes place through AppsEdu's Czech branch. The school compiles the teacher list for AppsEdu, which then provides the relevant access to the teacher application.

Creating User Accounts: Students



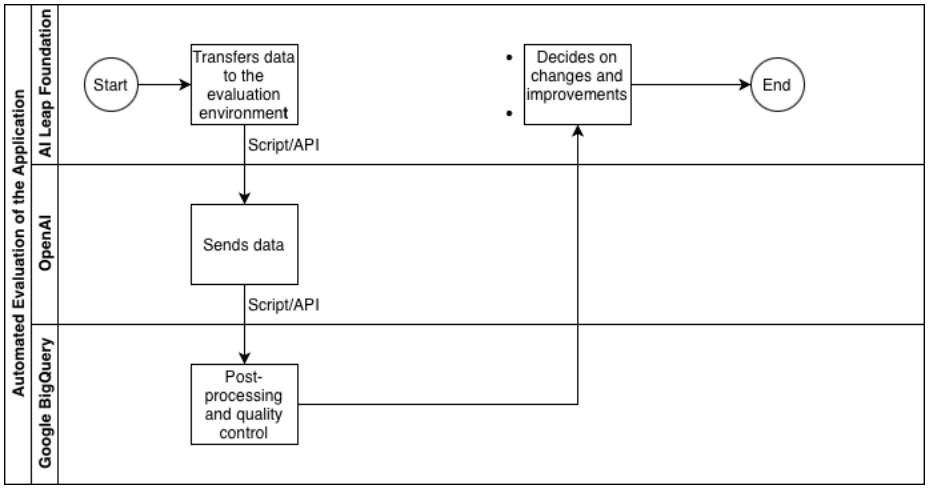
The school enters the user list into a Google Sheets worksheet; identity management takes place through Google's environment. AI Leap sends the data to the application provider, currently either OpenAI or Google. The application provider creates the accounts.

Learning Application



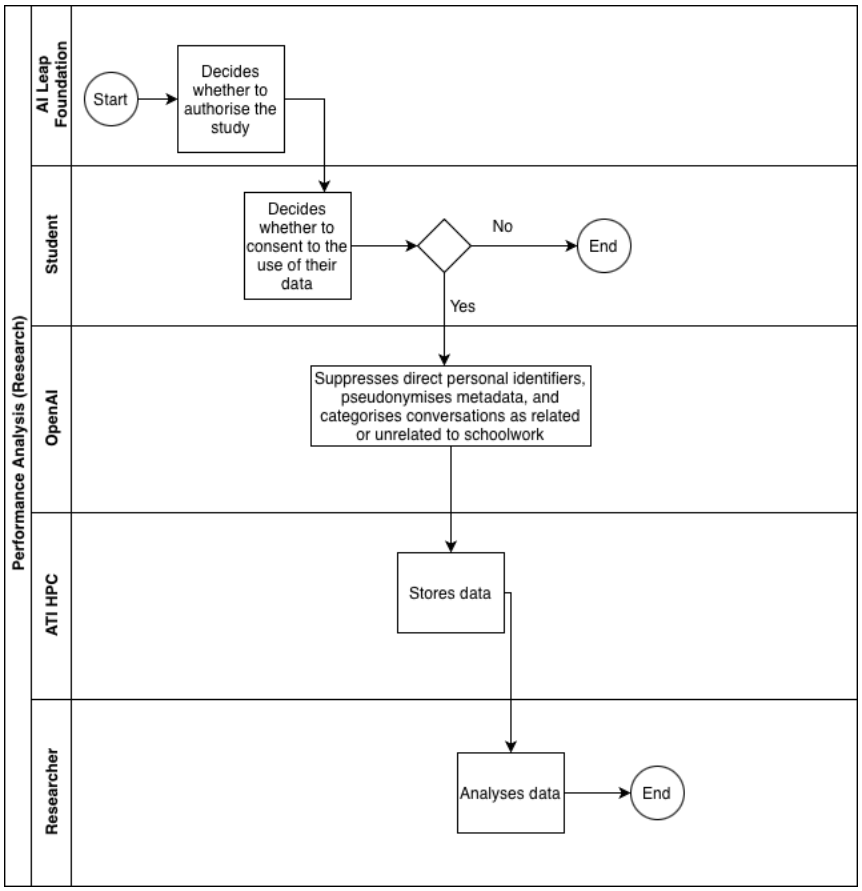
The student sends a free-text query to the learning application. The application stores the query, processes it, stores the response and sends the response to the student. The student decides whether to continue the conversation. If so, the student submits a new query; if not, the session ends.

Automated Evaluation of the Application



For automated quality evaluation, stored query-response pairs from the learning application are used. The application provider sends the query-response pairs to the Google BigQuery platform, where AI Leap staff can assess the quality of the results and make decisions about changes or improvements to the application.

Performance Analysis



Programme performance is analysed by researchers. The researcher applies the ethics committee for permission to use the data. If the ethics committee grants permission, AI Leap must decide whether to authorise the study. The student must also consent to the

use of their data in the research. During the authorisation process, OpenAI pseudonymises the data in the selected sample by suppressing direct personal identifiers and pseudonymising metadata. OpenAI also categorises conversations as related or unrelated to schoolwork. The data are then sent to the computing centre of the Institute of Computer Science, University of Tartu (HPC), where the researcher can access and analyse them.

2.3.3 Visibility Tables

The visibility tables show which parties can see which types of data. The tables were prepared on the basis of the described data flows. The first table concerns the situation in which a school uses OpenAI's student and teacher applications. The second concerns the situation in which a school uses the OpenAI student application and Google's teacher application. In both cases, researchers see only the data concerning the students who have consented to participate in the study.

OpenAI Student and Teacher Application

Party	Student personal data	Teacher personal data	Student queries
AI Leap Foundation	yes	yes	yes
School	yes (outside the application)	yes (outside the application)	-
Teacher	yes (outside the application)	yes (outside the application)	-
Student	yes (outside the application)	yes (outside the application)	yes
OpenAI	yes	yes	yes
Google – identity management	yes	yes	-
Google – automated testing	yes	yes	yes
Researcher	pseudonymised (with consent)	-	pseudonymised (with consent)
Researcher's analysis environment (UT ICS HPC)	pseudonymised (with consent)	-	pseudonymised (with consent)

OpenAI Student Application and Google Teacher Application

Party	Student personal data	Teacher personal data
AI Leap Foundation	yes	yes
School	yes (outside the application)	yes (outside the application)
Teacher	yes (outside the application)	yes (outside the application)
Student	yes (outside the application)	yes (outside the application)
OpenAI	yes	-
Google – application provider	-	yes
Google - identity management	yes	-
Google – automated testing	yes	-
AppsEdu	-	yes
Researcher	pseudonymised (with consent)	-
Researcher's analysis environment (UT ICS HPC)	pseudonymised (with consent)	-

2.4 Chain of Responsibility and Legal Framework

This section examines the legal context of the AI Leap project, and it maps:

1. the division of tasks between the Foundation, schools and technology providers, and which party has competence and control over the different functions of the AI Leap project, based on contractual relations and obligations arising from law;
2. the division of obligations and responsibility in following the requirements of the EU Artificial Intelligence Act (AI Act) concerning the safety and security of AI systems and the protection of fundamental rights;
3. the roles and responsibilities of the parties in the context of personal-data processing.

2.4.1 Provision of the Learning Application as Part of Teaching and Studies: Statutory Duties and Responsibility

Making learning applications available to students in the course of their studies is not merely the distribution of private-sector software. The AI Leap programme is not mandatory for schools, and participation is voluntary. If a school decides to introduce the learning application into teaching, provision of the application takes place in the course of performing a public task, bringing with it statutory duties and responsibilities for both the school and the state.

Under the Basic Schools and Upper Secondary Schools Act (PGS), a school is a public authority responsible for organising day-to-day educational activities. The learning application made available within AI Leap is, in substance, a teaching tool used in the

school's daily educational activities. Its use may affect several obligations imposed on schools, including the duty to ensure:

- a learning environment that meets safety, health-protection and curriculum requirements;
- support for the student's development;
- students' rights in participation in studies.[15]

In addition to organising educational activities, provision of the learning application may affect the school's duties to ensure mental and physical safety, identification and provision of necessary support to students, and complying with other requirements arising from the PGS.[16]

The school remains obliged to ensure that making the learning application available and using it remain consistent with the requirements applicable to the school. This obligation is not removed by the fact that procurement of the application is organised by the Foundation or that the technological solution is provided by a private company. If an AI solution used in teaching and studies causes an unlawful consequence for a student, responsibility generally remains with the school.[17]

It should also be noted that the contracts between the Foundation, schools and technology providers within AI Leap contain no agreement under which the performance of teaching activities through the learning application would constitute delegation to the Foundation or technology provider of the school's duties relating to the organisation of teaching.

The AI Leap programme and provision of the AI-based learning application fall not only within the sphere of the school's performance of a public task but also constitute a state education-policy decision and relate to the state's responsibilities under the PGS in organising education. Decisions concerning the launch of AI Leap, selection of suitable AI solutions, design of the funding model, and conditions relating to access, quality and risk management may therefore relate to the state's obligations in education policy and the organisation of teaching. If such decisions or their implementation are unlawful and result in negative consequences, those consequences may be attributable to the state.

[15] See, for example, the Basic Schools and Upper Secondary Schools Act §§ 7[1], 35, and 37.

[16] See, inter alia, the Basic Schools and Upper Secondary Schools Act §§ 44 and 46.

[17] Under § 12(1) of the State Liability Act, the public authority whose activity caused the damage is required to compensate the injured person. A person whose rights have been infringed in a public-law relationship by the unlawful activity of a public authority may claim compensation for the damage caused if the damage could not be avoided and cannot be remedied by protecting or restoring the rights in the manner provided for in §§ 3, 4 or 6 of the State Liability Act (§ 7(1)). Compensation may include compensation for both pecuniary and non-pecuniary damage, as well as the elimination of unlawful consequences.

This is not altered by the fact that practical implementation tasks have, in substance, been delegated to the Foundation.[18]

2.4.2 Contractual Duties and Responsibility of the Parties in Providing the Learning Application

In addition to statutory requirements, the duties, roles and responsibilities of the Foundation, schools and technology providers are shaped by their contracts. The contracts define how the learning application is made available in practice, what service and cooperation obligations exist between the parties, and how internal liability is allocated if obligations are breached.

Contracts Between the Foundation and Technology Providers

The Foundation has concluded contracts with technology providers under which licences for the learning application are procured, conditions of use and access are established, technical support obligations by the technology provider are specified, conditions for personal data processing are agreed, and limitations of liability between the parties are set. The central significance of these contracts is that they create a service relationship between the Foundation and the technology provider through which the Foundation can make AI applications available to schools.

Contracts Between the Foundation and Schools

There are also contracts between the Foundation and schools. These require schools to enable students, teachers and other persons involved in organising teaching and studies to access the technology provider's AI applications. The Foundation undertakes to organise and manage the AI Leap programme, within which access to the applications is ensured and the necessary skills for their meaningful and purposeful use in teaching are provided. Among other things, the Foundation undertakes to procure and distribute the licences needed for use of the learning application and to provide training and technical support.

The contract between a school and the Foundation also includes data processing conditions under which the Foundation acts, at least for certain processing operations, as a processor on behalf of the school. The precise legal significance of this depends on the specific data flows and purposes of processing and is discussed further in the data protection subsection.

[18] At the time of preparing this analysis, no information was available on how, or under what conditions, activities relating to the performance of public-authority functions had been delegated to the Foundation.

Contractual Relationship of Technology Providers and the Foundation with Students and Teachers

Use of the service may also create a legal relationship between the technology provider and the application user if students and teachers are required to accept the provider's terms of service in order to use the application.[19]

Roles and Allocation of Responsibility

The following allocation of roles and responsibilities emerges within the framework supporting the use of the AI Leap learning application:

The Foundation performs an organising and intermediary role, linking technology providers and schools and ensuring that the learning applications are usable by schools from technical, organisational and know-how perspectives. The Foundation is also the programme manager of AI Leap, making decisions about the architecture of the framework, selection of technology providers and conditions of use.

To the extent that the Foundation's activities constitute the exercise of public authority and involve unlawfulness that leads to negative consequences, responsibility may be attributable to the state. In its internal relationships with schools and technology providers, the Foundation bears contractual liability for non-performance or improper performance of contractual obligations. Under the contract between the Foundation and a school, the parties are liable to one another for damage caused through fault, that is, where breach of an obligation is due to negligence, gross negligence or intent.

The school decides how the application is used in specific teaching and learning activities, provides students and teachers with access, and is responsible for ensuring that use complies with the cooperation agreement and the school's own internal rules.

As the public authority responsible for organising day-to-day educational activities, the school is also obliged to ensure the quality of teaching tools used in instruction. This means that, as a rule, primary responsibility for unlawful consequences caused to a student or teacher by an AI solution used in teaching lies with the school as the public authority, irrespective of the fact that the technical solution was procured by the Foundation and is supplied by a private technology provider. In certain cases, the school may have the right to file a claim against the technology provider or the Foundation if the damage was caused by their breach of contract. Under the State Liability Act, after compensation has been paid the public authority may in turn have a right of recourse against the person whose unlawful conduct caused the damage.[20]

The technology provider supplies the AI-based learning application, ensures that it operates according to agreed conditions and provides technical support. Technology providers have a service contract with the Foundation covering licence acquisition,

[19] For example, OpenAI's ChatGPT service terms: https://openai.com/policies/services-agreement/.
[20] See State Liability Act § 19.

technical support, service quality and other conditions. In addition, the technology provider concludes a service agreement with each user of the learning application, including students and teachers.

The technology provider's liability is limited by the service agreements concluded with the Foundation, schools and users, to the maximum extent permitted by law, both with respect to service quality and the occurrence of harmful consequences. In particular, technology providers may be liable for harm caused by the learning application resulting from gross negligence or intent. This means that a larger share of liability risk lies with the Foundation, the state and schools rather than the technology provider, even though it is the technology provider that controls the quality and functioning of the model. Contractual limitations of liability, however, do not affect statutory obligations: among other things, they do not limit liability under the GDPR and do not remove obligations arising under the AI Act.

2.4.3 Compliance with AI Act Requirements Concerning Safety, Security and Fundamental Rights

The European Union AI Act establishes quality, transparency and risk-management requirements intended to protect health, safety and fundamental rights in the use of AI. The learning application made available within AI Leap is an AI system falling within the scope of the AI Act, making it necessary to map which requirements apply and to which party.

The content of the requirements depends on the system's risk category under the AI Act and on the operator's role in the AI value chain, in particular, whether the party is the system's service provider or deployer. The risk category in turn depends on the intended uses of the AI system.

Based on the information available for this mapping, the intended purpose of the AI-based learning application does not place it in the prohibited or high-risk categories. It is important to note that AI systems used in education and vocational training are high-risk if they are used in the ways listed in Annex III, point 3 of the AI Act, including for evaluating learning outcomes, determining access or admission to educational or vocational-training institutions, assessing the appropriate educational level for a student, or monitoring and detecting of prohibited behaviour by the students. As long as the intended purpose of the system remains narrowly focused on supporting the student and not on enabling the educational institution to make the above-mentioned educational decisions, it is not a high-risk AI system.

Certain transparency obligations under Article 50 of the AI Act nevertheless apply to the learning application. First, it is a chatbot within the meaning of Article 50(1), meaning that users must be informed that they are interacting with AI. Second, to the extent that the solution generates synthetic audio, image, video or text output, the output must be

marked in machine-readable form and identifiable as artificially generated or manipulated content. These are obligations of the AI system provider. In the current organisational model of AI Leap, the technology provider is the AI-system provider and, therefore, the person responsible for compliance, because access to the learning application takes place in the technology provider's service environment and user interface.

2.4.4 Compliance with the General Data Protection Regulation

Section 20[1] of the Basic Schools and Upper Secondary Schools Act provides a legal basis enabling schools to process students' personal data for use of an AI application in educational activities. On this basis, schools may process:

1. students' general personal data;
2. personal data, including special-category data, entered by the student into the application for the purpose of completing the curriculum applicable to them;
3. other personal data, including special-category data, entered by the student when using the application.

A data-processing agreement has been concluded between the Foundation and schools under which the school is the data controller and the Foundation the data processor. This allocation of roles is based on the assumption that processing takes place within the framework of the school's organisation of educational activities, while the Foundation performs the technical and organisational tasks necessary to enable the service on behalf of the school.

The data accessible to the Foundation include registration data of teachers and students – including names, contact details, personal identification codes, school and class information – as well as data entered into the learning application during teaching and studies and the technical data necessary for operation and security, such as logs and usage statistics. The processing therefore includes not only account and access management but also substantive and technical data generated during use of the learning application.

Under the agreement, the Foundation has the right to process personal data for the purpose of enabling the service, including storage and temporary retention, provision of technical support, development and security, and use of anonymised or pseudonymised data for statistical purposes and service improvement. This shows that the purposes of processing extend beyond immediate operation of the service and also include analysis of use and quality improvement.

In addition to the Foundation, the technology provider participates in processing as a processor, because its service enables the technical operation of the learning application. Its role consists in processing data to the extent necessary to provide the

service, ensure availability, implement security measures and technically enable the application.

From a legal perspective, the allocation of obligations and rights described above is based on the contractual model, but its precise meaning also depends on who actually determines the purposes and means of processing, including the extent to which the Foundation and technology provider act on the school's instructions.

2.5 Educational Context

2.5.1 Strengths and Challenges of the Estonian Education System

AI Leap is being introduced into an education system characterised both by very strong results in international comparison and by serious development challenges. Estonia's international success in education provides a favourable starting point for the programme but also raises the question whether AI will preserve and further develop the existing strengths of Estonian education and support its long-term aims. It is equally important to assess whether the introduction of the AI-based learning application helps address the challenges facing Estonian education.

PISA 2022[21] confirms that the knowledge and skills of Estonian students remain among the best in Europe and the world. Although learning outcomes have declined somewhat since 2018, the decline has been smaller than in most OECD countries, and Estonia has maintained a leading position in Europe in mathematics, reading and science. Strengths of Estonian education also include the high level of teachers' professional autonomy, learners' strong knowledge base and the development of self-directed learning skills.

At the same time, PISA, TALIS[22] and the Estonian Human Development Report 2026[23] point to several interrelated challenges that also form part of the background to AI Leap. These challenges can be grouped into four themes.

First, educational inequality is increasing. PISA 2022[24] results show that the impact of students' socioeconomic background on learning outcomes has increased in Estonia in

[21] Ministry of Education and Research. (2023). *Kokkuvõte PISA 2022 tulemustest ja põhisõnumid* [Summary of PISA 2022 results and key messages]. https://hm.ee/sites/default/files/documents/2023-12/Kokkuv%C3%B5te.pdf , see in English also: https://www.hm.ee/en/ministry/statistics-and-analysis/pisa

[22] Leijen, Ä., Jõgi, A., Pedaste, M., Poom-Valickis, K., Uibu, K., Eisenschmidt, E., Oppi, P., Taimalu, M., Tinn, M., & Kalle, V. (2025). *OECD rahvusvahelise õpetamise ja õppimise uuringu TALIS 2024 Eesti tulemused* [Estonian results of the OECD Teaching and Learning International Survey TALIS 2024]. Estonian Education and Youth Board. https://harno.ee/sites/default/files/documents/2025-11/TALIS2024_UURING_Eesti_tulemused.pdf

[23] Kindsiko, E. (Ed.). (2026). *Estonian human development report 2026: Education reflected in society*. Estonian Cooperation Assembly. https://2026.inimareng.ee/en/

[24] Ministry of Education and Research. (2023). *Kokkuvõte PISA 2022 tulemustest ja põhisõnumid* [Summary of PISA 2022 results and key messages]. https://hm.ee/sites/default/files/documents/2023-12/Kokkuv%C3%B5te.pdf , see in English also: https://www.hm.ee/en/ministry/statistics-and-analysis/pisa

recent years, and differences have widened both between Estonian- and Russian-medium schools and between urban and rural schools. For example, students in Estonian-medium schools scored on average 32 points – approximately one school year – higher in mathematics than students in Russian-medium schools; the difference was 36 points in science and 23 points in reading. At the same time, students' persistence has declined and difficulties in coping with learning have become more frequent. The transition to Estonian-language education is expected to reduce some of these differences. The Estonian Human Development Report 2026 warns that education may increasingly reproduce inequality if support cannot be directed to the learners who need it most.

Second, learners' well-being and the quality of learning are a concern. International studies[25] point to declining enjoyment of learning and persistence, problems with learners' mental well-being[26], and a weakening sense of belonging at school. Bullying and relationships between teachers and students and among students themselves are also problematic. Inclusive education has brought increasing diversity into classrooms, but teachers do not always have sufficient time, support or preparation to respond to diverse learner needs.

Third, pressure on teachers' professional capacity has increased markedly. Shortages of teachers and support specialists are worsening, the teaching workforce is ageing, and, in many schools, teachers work without the required qualifications. At the same time, several extensive educational reforms are being implemented simultaneously: the transition to Estonian-language education, implementation of inclusive-education principles, and introduction of digital technologies and AI. Teaching an increasingly diverse student population and bearing greater responsibility for learners' social and emotional well-being have increased perceived workload, stress and risk of burnout. Although Estonian teachers enjoy a high degree of professional autonomy by international standards, many do not yet feel sufficiently prepared for purposeful use of AI and consider additional training necessary.[27]

Fourth, technological changes require reinterpreting of learning and teaching. The Estonian Human Development Report 2026 emphasises that technology does not solve educational problems by itself and may even exacerbate them if it primarily supports learners who already possess strong self-regulation skills. At the same time, the report highlights a paradox: while Estonia's e-state data infrastructure is world class, educational data are not used sufficiently for early identification of learning difficulties

[25] PISA 2022 and the Estonian Human Development Report 2023.
[26] Sisask, M. (Ed.). (2023). *Estonian human development report 2023: Mental health and well-being*. Estonian Cooperation Assembly. https://doi.org/10.58009/aere-perennius0044
[27] Leijen, Ä., Jõgi, A., Pedaste, M., Poom-Valickis, K., Uibu, K., Eisenschmidt, E., Oppi, P., Taimalu, M., Tinn, M., & Kalle, V. (2025).

and needs for support. Data-protection barriers, fragmented data and low data literacy hinder the use of the e-state's potential in education. Introducing AI, therefore, requires not only new technological solutions but also conscious development of teaching practices, assessment, school culture and data-driven management.

These challenges form the background to the present risk assessment. The main question for AI Leap is, therefore, not simply whether to use AI, but whether its use helps address Estonia's principal educational challenges. In particular, this analysis asks whether AI use in teaching can reduce educational inequality, support learner autonomy and the development of general competences, strengthen the professional role of teachers, and preserve the strengths of Estonian education in the age of AI.

2.5.2 Societal Attitudes Towards Artificial Intelligence

This section provides an overview of AI use among Estonian students and of the attitudes of students, parents and schools towards AI. The purpose of the section is to describe the usage and attitudinal environment in which the AI Leap educational programme is being implemented.

2.5.2.1 Use of Artificial Intelligence Among Estonian Students

A representative EU Kids Online survey conducted in Estonian schools in spring 2025 among students aged 9-16 (N=2,475), with funding from the Ministry of Social Affairs and the University of Tartu Social Sciences Development Fund, shows that many young people have already discovered generative AI applications. Such applications had been used by 64% of respondents; among 15-16-year-olds, 83% had tried them.[28] Girls stood out in terms of usage (68% compared with 62% of boys), as did students who responded in Russian (75% compared with 61% of respondents in Estonian).

Interviews with AI users aged 13-17 (n=16) showed that ChatGPT was the most frequently used application, although My AI (Snapchat), Gemini and Copilot were also popular. Young people generally use free Estonian-language versions of applications, but, for some topics and questions, they consider English-language applications more substantive and their answers better.

Empirical studies from different cultural contexts, including the United Kingdom[29] and the United States[30], show that using GenAI tools for educational purposes and schoolwork is

[28] Siibak, A., Kalmus, V., & Kikerpill, K. (2026). Tehisaru kasutamine [Use of artificial intelligence]. In V. Kalmus, S. Opermann, & R. Kurvits (Eds.), *EU Kids Online'i Eesti 2025. aasta uuringu esialgsed tulemused* [Preliminary results of the EU Kids Online Estonia 2025 study] (pp. 64–79). University of Tartu, Institute of Social Studies. https://doi.org/10.5281/zenodo.18668024

[29] Freeman, J. (2025). *Student generative AI survey 2025*. Higher Education Policy Institute. https://www.hepi.ac.uk/wp-content/uploads/2025/02/HEPI-Kortext-Student-Generative-AI-Survey-2025.pdf

[30] Madden, M., Calvin, A., Hasse, A., & Lenhart, A. (2024). *The dawn of the AI era: Teens, parents, and the adoption of generative AI at home and school*. Common Sense Media. https://www.commonsensemedia.org/sites/default/files/research/report/2024-the-dawn-of-the-ai-

by far the most common activity among both minors and young adults.[31] The same trend was found in the EU Kids Online survey: Estonian young people use AI mainly for practical school-related reasons, such as summarising longer texts or obtaining explanations (34% of respondents), and writing essays and stories (29%).[32]

Interviews with Estonian young people likewise confirmed that AI can be used in almost all school subjects – from humanities and sciences to languages and creative subjects. AI assistance is actively used for writing, editing and translating texts in both the native language and foreign languages, as well as for generating ideas. Some young people noted that generative AI applications allow them to catch up on missed material, for example after absences, and to close gaps in knowledge. ChatGPT and similar tools have thus become important sources of instrumental support and practical assistance.[33]

Several interviewees described how ChatGPT supports them in STEM subjects, mainly mathematics, chemistry and physics, but also in languages or biology when they do not fully understand a task.[34] Young people also seek help from AI with everyday questions. For example, a 17-year-old participant had asked ChatGPT for breakfast ideas and recipes, while a 15-year-old footballer had used ChatGPT as a personal trainer for advice on training different muscle groups. Young people have also used ChatGPT for personal questions or sensitive topics such as health or relationships that they would not want to discuss with parents or teachers.[35] In other words, roles previously associated with teachers, parents, coaches and other adults are partly being transferred to AI.

Some young people also admitted that they use AI simply to complete unpleasant or difficult homework quickly and with little effort. EU Kids Online survey results confirm that young people (N=1,174) justify their use of AI by the desire to save time and make tasks easier – 62% and 59%, respectively.[36] Twenty-two per cent admitted that they use AI so that things will be done for them. Several interviewees said they had copied and pasted AI-generated material unchanged and submitted it for assessment. Some simply photographed an assignment and asked ChatGPT to produce the answer. For 33% of respondents, the desire to obtain a better grade was a reason for turning to AI.[37]

Interviews showed how easy it is to entrust thinking, reading and writing to a smart machine and thereby become reliant on AI tools. One 16-year-old student who had used

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era_final-release-for-web.pdf ja Sidoti, O., Park, E., & Gottfried, J. (2025, January 15). *About a quarter of U.S. teens have used ChatGPT for schoolwork – double the share in 2023*. Pew Research Center.

[31] Freeman, J. (2025). *Student generative AI survey 2025*. Higher Education Policy Institute. https://www.hepi.ac.uk/wp-content/uploads/2025/02/HEPI-Kortext-Student-Generative-AI-Survey-2025.pdf

[32] Siibak, A., Kalmus, V., & Kikerpill, K. (2026).

[33] Siibak, A., & Mascheroni, G. (in press 2026). *Children and AI: Changing digital childhoods?* Palgrave.

[34] Siibak, A., & Mascheroni, G. (in press 2026).

[35] Siibak, A., & Mascheroni, G. (in press 2026).

[36] Siibak, A., Kalmus, V., & Kikerpill, K. (2026).

[37] Siibak, A., Kalmus, V., & Kikerpill, K. (2026).

ChatGPT to solve chemistry problems for three years said she had become so accustomed to ChatGPT solving them that she would no longer be able to solve the problems independently.[38]

Many interviewees felt that obtaining answers from AI required minimal effort because the applications are so easy to use. Interviews thus revealed a tendency towards "abbreviated thinking": young people assess what they "actually need to know in life" and consequently tend to think rapidly and incompletely in order to cope with possible overload and time pressure.[39] There is, therefore, reason to assume that student deskilling is becoming a significant problem.[40]

The interviews also suggest that young people value GenAI tools because they allow them to manage time.[41] Students operate under time constraints set by teachers or parents, while time management is their own responsibility. Interviews with Estonian young people showed that GenAI tools allow them to act efficiently and get things done quickly. One 17-year-old participant noted that young people value ChatGPT and similar applications because they can provide answers "almost immediately", removing the need to search textbooks or the internet. All interviewees had used ChatGPT as a substitute for Google Search. Often this use was motivated by the claim that they could not find the desired information elsewhere: 53% of AI users in the EU Kids Online survey (N=1,174) cited this reason, while 13% said they trusted AI more than other sources.[42]

EU Kids Online survey results and interviews also indicate that AI tools provide emotional support. Eleven per cent of 9-17-year-olds in the survey said they had used AI in the previous 30 days to talk about their worries and obtain advice.[43] Interviews likewise confirmed that young people turn to AI to reduce stress or when they need an empathetic and non-judgemental conversational partner.[44]

Thirty per cent of young people used AI for creative self-expression and 15% simply for leisure. Not all students use AI. Non-users aged 11-16 (n=409) explained non-use primarily by pragmatic reasons: almost half reported lack of interest or need (47% and 44% respectively), and 20% saw no usefulness.[45] Smaller proportions cited critical concerns: 14% believed AI provides fabricated or false information; 8% thought using AI was like cheating or stealing someone else's work; 7% were concerned about privacy and sharing their data with AI; and 5% were afraid of using AI.

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[38] Siibak, A., & Mascheroni, G. (in press 2026).
[39] Hassan, R. (2003). Network Time and the New Knowledge Epoch', *Time and Society*, 12(2/3), pp. 225 – 241. https://doi.org/10.1177/0961463X030122004
[40] Carr, N. (2014). *The glass cage: how computers are changing us*. W.W. Norton & Company.
[41] Siibak, A., & Mascheroni, G. (in press 2026).
[42] Siibak, A., Kalmus, V., & Kikerpill, K. (2026).
[43] Siibak, A., Kalmus, V., & Kikerpill, K. (2026).
[44] Siibak, A., & Mascheroni, G. (in press 2026).
[45] Siibak, A., Kalmus, V., & Kikerpill, K. (2026).

In interviews, young people identified unreliable answers or hallucinations and possible privacy infringements as the principal risks of AI use.[46] None mentioned longer-term harm to the natural environment or climate arising from AI use. In relation to privacy, young people were particularly concerned about how shared information is stored and subsequently used. At the same time, responses showed that they lack a clear understanding of how AI works and whether and how content created by one user may later be used. Young people do not understand how companies in the AI sector may benefit from their content and shared data. Several said that they "have nothing to hide" or doubted that anyone would be interested in what they had entered.[47]

2.5.2.2 Adults' Attitudes Towards Artificial Intelligence

Parents' attitudes to AI applications vary across cultures and depend on parents' own attitudes, values and understanding of technology. Some parents encourage their children to start using generative AI applications at an early age because they want them to be "prepared"[48] and believe such use may benefit the child. At the same time, many parents tend to view ChatGPT and similar applications primarily as sources of information or tools for completing school-related tasks[49] rather than as communication or entertainment tools[50]; their view of both the opportunities and risks is therefore relatively limited.

For example, a US study of parents of children under eight (N=1,578) found that nearly a quarter (23%) believed AI had had a mostly positive effect on their children's understanding of school material; 20% believed AI tools had helped develop their children's creativity, and 17% reported a positive effect on well-being.[51]

Although some young Estonian interviewees said they had discussed GenAI use with parents or that teachers or experts had given lectures on GenAI at their schools, adults were not regarded as important sources of information on the topic.[52] These observations are consistent with the findings of McLoughlin and McMullen[53], showing that young

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[46] Siibak, A., Kalmus, V., & Kikerpill, K. (2026).
[47] Siibak, A., Kalmus, V., & Kikerpill, K. (2026).
[48] Mok, A. (2025, March 1). „I want him to be prepared": why parents are teaching their gen Alpha kids to use AI. *The Guardian*, https://www.theguardian.com/technology/2025/mar/01/parents-children-artificial-intelligence
[49] Eira, M., Rasouli, A., & Charisi, V. (2025). *Parent's perceptions about the use of generative AI systems by adolescents*. In *Proceedings of the 24th Interaction Design and Children Conference (IDC '25)*. Association for Computing Machinery. https://doi.org/10.1145/3713043.3731508
[50] Zhang, S., Li, J., Cagiltay, B., Kirkorian, H., Mutlu, B., & Fawaz, K. (2025). A qualitative exploration of parents and their children's uses and gratifications of ChatGPT. *Family Relations*, 1056-1071. DOI: 10.1111/fare.13171
[51] Mann, S., Calvin, A., Lenhart, A., & Robb, M. B. (2025). *The Common Sense census: Media use by kids zero to eight*. Common Sense Media.
[52] Siibak, A. & Mascheroni, G. (ilmumas 2026).
[53] McLoughlin, N. & McMullen, S. (2024). Exploring AI with children and young people. Barnadors Online Safety Programme. https://www.barnardos.ie/wp-content/uploads/2024/10/Barnardos-OSP-Report-Exploring-AI-with-Children-and-Young-People.pdf

people do not wish to turn to adults for help with AI-related questions: 57% of children in one study said they had received no help about AI from parents or teachers.

2.5.2.3 Schools' Attitudes and Readiness

Interviews with Estonian young people showed that schools lack a unified approach or overarching rules for AI use in lessons, leading each teacher to adapt their own approach, practices and rules. The same trend is confirmed by a study by Liisa Asso, Maris Männiste and Andra Siibak of the internal rules of Estonian schools (N=475), which examined the extent to which AI-use practices or prohibitions have become part of shared school agreements. Content analysis of publicly available internal rules showed that 13 schools had incorporated rules concerning AI.[54]

Schools that had such principles shared several common features. Most required any use of AI in learning tasks to be clearly acknowledged or cited. Seven schools adopted a cautious institutional approach aimed at ensuring that technology supports rather than replaces learning: their internal rules stipulated that AI tools could be used only with the teacher's permission and under their supervision.

Only one of the 475 schools examined had developed a separate, comprehensive document on AI use, defining relevant tools, obligations and acceptable practices. The document explained what AI is, listed specific tools such as text generators, image generators and automated assessment systems, and specified conditions for their use. It also described principles of good practice, including legal considerations concerning authorship and citation, student obligations, and criteria for distinguishing appropriate educational use from academic misconduct.[55]

One school that did not regulate AI use separately had nonetheless developed an exceptionally detailed list of digital environments permitted for students. The list was extensive and systematic, covering Google-based tools (e.g., Google My Maps), educational and subject-specific platforms, social or communication platforms such as Discord, and other extracurricular digital resources such as eTwinning. In a further 15 schools, internal rules prohibited the use of "external assistance" in completing schoolwork, but none defined what "external assistance" meant. It was therefore unclear whether the prohibition applied only to help from people, such as parents, peers or tutors, or also to AI-based tools.[56]

The findings suggest that ambiguous language concerning AI use creates institutional uncertainty rather than regulatory flexibility. Although teachers can set expectations at classroom level, the absence of explicit institutional agreements leads to inconsistent

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[54] Asso, L., Männiste, M., & Siibak, A. (2026). Between control and adaptation: regulating smartphone and GenAI use in Estonian schools. *International Journal of Adolescence and Youth*, *31*(1). https://doi.org/10.1080/02673843.2026.2652280

[55] Asso, L., Männiste, M., & Siibak, A. (2026).

[56] Asso, L., Männiste, M., & Siibak, A. (2026).

interpretations across subjects and schools. Such ambiguity undermines fairness and consistent application of rules, making enforcement more discretionary than rule-based.[57]

The limited presence of AI-related internal rules may also reflect broader uncertainty in national policy documents. Previous analyses indicate that the translation of strategic visions into workable solutions is hindered primarily by challenges relating to data management, privacy, responsibility and organisational readiness.[58] This can cause schools to postpone formalising AI-related agreements in their internal rules until national guidelines, training systems and support structures have been established. The absence of clear and authoritative reference points at national level is likely to contribute to a regulatory gap: schools are expected to respond to new technologies but lack sufficient clarity on what constitutes appropriate, safe and pedagogically sound AI use. The limited treatment of AI in schools' internal rules may therefore indicate not indifference but cautious responses to changing national policies and AI initiatives.

Earlier international research emphasises the importance of clear, transparent and rights-based frameworks for regulating AI use in education.[59] Schools that have developed comprehensive AI-use documents illustrate one possible model, while the absence of such agreements in most schools demonstrates limited institutional capacity to address the issue.[60]

3. Normative Foundations of the Risk Assessment

The normative foundations of the risk assessment define the values, principles and legal requirements against which the potential impacts of the AI Leap educational programme and the AI-based learning application are assessed. A risk is considered significant where the design, implementation or use of AI may undermine the aims of Estonian education, fundamental rights, or the requirements applicable to trustworthy AI.

The normative framework used in this risk assessment rests on two complementary foundations: the normative framework of education and the normative framework of trustworthy AI. In addition, the assessment draws on relevant legislation and other

[57] Asso, L., Männiste, M., & Siibak, A. (2026).

[58] Nõmmik, S. (2025). Challenges with the design and use of AI-based tools in public sector in Estonia: Moving beyond the potential of a great idea on paper. Teoses *Governance and public management: Digital transformation in European public services* (lk 129–154). Springer. https://doi.org/10.1007/978-3-031-81425-9_7

[59] Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI*, *7*(1), 52–62. https://doi.org/10.61969/jai.1337500; Selwyn, N. (2024). On the limits of artificial intelligence (AI) in education. *Nordisk tidsskrift for pedagogikk og kritikk*, *10*(1), 3–14. https://doi.org/10.23865/ntpk.v10.6062; UNESCO. (2025). *AI and education: Protecting the rights of learners*. https://www.unesco.org/en/articles/ai-and-education-protecting-rights-learners

[60] Asso, L., Männiste, M., & Siibak, A. (2026).

binding normative requirements. These include the protection of fundamental rights and freedoms[61], the protection of children's rights[62], educational aims, core values and general competences[63], AI safety and security[64], the General Data Protection Regulation[65], relevant information-security standards such as the Estonian Information Security Standard (E-ITS)[66], and rules governing public liability[67].

This assessment does not treat AI merely as a technological solution but as part of the organisational and social context of the education system. It is therefore not sufficient to assess the technology only against requirements for trustworthy AI. It is equally important to ask whether the use of AI in teaching and learning supports the aims and values of education.

The normative framework of education and the principles of trustworthy AI complement one another. The normative framework of education determines the aims that AI use in education should serve, while the principles of trustworthy AI define the conditions the technological solution must meet. In the current assessment, the AI Leap educational programme, the AI-based learning application and the framework supporting its use are assessed from both perspectives: whether they support educational aims and whether they meet the requirements of trustworthy AI.

3.1 Normative Framework of Education

The normative framework of education has developed through legislation regulating Estonian education, strategic documents and the evolution of education policy thinking.

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[61] The Constitution of the Republic of Estonia. (1992). Riigi Teataja. https://www.riigiteataja.ee/en/compare_wordings?grupiId=100002&vasakAktId=523042025001; Charter of Fundamental Rights of the European Union. (2016). https://eur-lex.europa.eu/eli/treaty/char_2016/oj/eng

[62] Child Protection Act. (2014). Riigi Teataja. https://www.riigiteataja.ee/en/eli/ee/Riigikogu/act/516112022003/consolide

[63] Basic Schools and Upper Secondary Schools Act. (2010). Riigi Teataja. https://www.riigiteataja.ee/en/compare_wordings?grupiId=100021&vasakAktId=501092025002; National curriculum for upper secondary schools. (2011). Riigi Teataja. https://www.riigiteataja.ee/en/compare_wordings?grupiId=100386

[64] European Parliament & Council of the European Union. (2024). *Regulation (EU) 2024/1689 of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act)*. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202401689

[65] European Parliament & Council of the European Union. (2016). *Regulation (EU) 2016/679 of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)*. Official Journal of the European Union, L 119, 1–88. https://eur-lex.europa.eu/eli/reg/2016/679/

[66] Estonian Information Security Standard. (2022). Riigi Teataja. https://www.riigiteataja.ee/et/akt/121122022034

[67] State Liability Act. (2001). Riigi Teataja. https://www.riigiteataja.ee/en/compare_wordings?grupiId=100251&vasakAktId=516052025004

Its principal sources include the Basic Schools and Upper Secondary Schools Act[68], the National Curriculum for Upper Secondary Schools[69], the document *Five Challenges of Estonian Education*[70], *Smart and Active Estonia 2035*[71], and the Education Strategy 2021-2035[72]. These documents express an evolving but consistent understanding of the kind of persons and society education should help to shape.

The normative framework defines the aims and values that education should serve. According to the foundational documents of Estonian education, education should support the learners' individual and social development and their growth into independently thinking, self-directed, responsible and cooperative persons who understand their cultural environment.

Educational aims are grounded in a defined framework of values. According to the National Curriculum for Upper Secondary Schools, the core values of education derive from the Constitution of the Republic of Estonia[73], the Universal Declaration of Human Rights[74], the United Nations Convention on the Rights of the Child[75], and ethical principles set out in the founding documents of the European Union[76]. On this basis, education gives importance to universal human values such as honesty, care, justice, human dignity and respect, and to societal values such as freedom, democracy, respect for the Estonian language and culture, cultural diversity, solidarity, responsibility and the rule of law. These values form the normative foundation of education and are also used in this risk assessment.

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[68] Basic Schools and Upper Secondary Schools Act. (2010). Riigi Teataja. https://www.riigiteataja.ee/en/compare_wordings?grupiId=100021&vasakAktId=501092025002

[69] National curriculum for upper secondary schools. (2011). Riigi Teataja. https://www.riigiteataja.ee/en/compare_wordings?grupiId=100386

[70] Haridus- ja Teadusministeerium. (2019, April). *Kolme ekspertrühma visioonidokumentide kokkuvõte: Tark ja tegus Eesti 2035* [Summary of the vision documents of three expert groups: Smart and active Estonia 2035]. https://haridusfoorum.ee/images/2020/Tark_ja_tegus_kokkuvote.pdf, Haridus- ja Teadusministeerium. (2019, May). *Ekspertrühmade tulevikuvisioonid ja ettepanekud Eesti haridus-, teadus-, noorte- ja keelevaldkonna arendamiseks aastatel 2021–2035: Tark ja tegus Eesti 2035* [Expert groups' future visions and proposals for the development of Estonia's education, research, youth and language sectors for 2021–2035: Smart and active Estonia 2035]. https://haridusfoorum.ee/images/2020/Tark_ja_tegus_Eesti_2035.pdf

[71] Ministry of Education and Research. (2019). *Estonian education and research strategy 2021–2035: Smart and active Estonia 2035*. https://www.hm.ee/sites/default/files/tark_ja_tegus_eng_a43mm.pdf

[72] Ministry of Education and Research. (2021). *Education strategy 2021–2035*. https://www.hm.ee/sites/default/files/documents/2022-10/haridusvaldkonna_arengukava_2035_kinnittaud_vv_eng_0.pdf

[73] The Constitution of the Republic of Estonia. (1992). Riigi Teataja. https://www.riigiteataja.ee/en/compare_wordings?grupiId=100002&vasakAktId=523042025001

[74] United Nations. (1948). *Universal Declaration of Human Rights*. https://www.un.org/en/about-us/universal-declaration-of-human-rights

[75] Lapse õiguste konventsioon [*Convention on the Rights of the Child*] (1991). https://www.riigiteataja.ee/et/akt/24016?leiaKehtiv

[76] Euroopa Liidu leping ja Euroopa Liidu toimimise lepingu konsolideeritud versioonid. Euroopa Liidu põhiõiguste harta (2016). https://eur-lex.europa.eu/legal-content/ET/TXT/PDF/?uri=OJ:C:2016:202:FULL&from=ET

The normative framework of education can be characterised through five interrelated points of departure.

First, the aim of education is the learner's holistic development. The Basic Schools and Upper Secondary Schools Act and the National Curriculum emphasise that schools have both an educational and a developmental role. Education is not limited to acquiring knowledge; it includes the learners' intellectual, social, emotional and moral development and their growth into a creative, responsible persons who are conscious of their aims.

Second, the Estonian concept of education has moved towards greater learner and teacher autonomy while also valuing cooperation and partnership. The Estonian Education Strategy 2012-2020 already made a development- and cooperation-oriented approach to learning a central aim. In this approach, the teacher is not merely a transmitter of knowledge but a designer of learning and a partner to the learner. Learner autonomy, self-direction, cooperation, critical thinking and values education are central.

Third, contemporary educational thinking understands learning as a social process. The National Curriculum treats learning as active construction of knowledge in cooperation with teachers, fellow students, parents and the broader living environment. The teacher's task is to create a learning environment that supports learning and to provide feedback that moves the learner forward. School culture is likewise regarded as an important condition of learning.

Fourth, education must develop general competences in addition to subject knowledge. These include cultural and value competence, social and civic competence, self-determination competence, learning competence, communication competence, mathematical, scientific and technological competence, entrepreneurship competence and digital competence. They develop throughout the educational and developmental process and require both deliberate teacher guidance and cooperation among learners.

Fifth, international educational thinking increasingly emphasises human flourishing. The OECD's 2025 concept *Education for Human Flourishing*[77] stresses that the role of education is not only to prepare learners for the labour market but to support human flourishing and the development of ethically responsible, cooperative people who participate actively in society. This approach is consistent with the long-term direction of Estonian education, in which education is a foundation for personal development, cultural sustainability and societal development.

Values to Be Assessed in the Use of AI in Education

Holistic development of the learner. The central aim of education is not merely the acquisition of knowledge and skills, but holistic development. According to the National

[77] OECD. (2025). *Education for human flourishing: A conceptual framework*. OECD Publishing. https://doi.org/10.1787/73d7cb96-en

Curriculum for Upper Secondary Schools, education must support intellectual, social, emotional, moral and physical development and create conditions for learners to develop their abilities to the fullest, realise themselves creatively and form a scientific worldview. Education should develop an independently thinking, responsible and cooperative person who understands their cultural environment, can make informed choices and cope in different areas of life.

When an AI-based learning application is used in teaching, it is therefore necessary to ask whether its use supports the learner's development as a whole or focuses mainly on knowledge acquisition and better performance. AI can support development when it helps learners understand difficult topics, develop learning skills, self-regulation and critical thinking. Holistic development may, however, be pushed into the background if learning is reduced primarily to task completion, individual interaction with AI or short-term achievement, while social, moral and emotional development receives insufficient support.

Learner autonomy and agency. Learner autonomy means the ability to understand one's strengths and weaknesses and manage them, and to direct one's learning by setting goals, selecting appropriate learning strategies and learning from feedback. It also means the capacity to reflect on one's values, make considered choices, justify them and gradually assume responsibility for one's life. The AI Leap learning application can support autonomy when it helps students ask better questions, plan their learning and understand their mistakes. It can also weaken autonomy if it replaces cognitive effort, hiddenly directs the learner or makes them dependent on constant external assistance.

Teacher professional autonomy. A teacher is not merely a mediator of knowledge and developer of skills, but also a guide to the learner's development who is responsible for supporting development, creating the learning environment and ensuring that learning is meaningful. It is therefore necessary to assess whether the AI Leap application strengthens the teacher's professional role or transfers part of pedagogical decision-making to a technological system whose operation the teacher does not fully understand or control.

Equality and fairness. One of the central promises of AI Leap is equal access to high-quality AI-based tools. Equality cannot, however, be understood only as providing access through accounts or licences. Substantive equality requires that students with different backgrounds, languages, motivation, digital competence and learning skills actually derive comparable benefit from the application. If AI amplifies the advantages of stronger students and makes weaker students more dependent, the formally equal access may increase existing inequality.

Privacy, trust and a safe learning space. In education, privacy is more than compliance with data-protection requirements. Learning requires the possibility to make mistakes,

ask immature questions, express incomplete thoughts and seek help without fear. It is therefore necessary to assess whether the AI Leap learning application gives students greater confidence to ask questions and share their thoughts without fear of appearing foolish, or whether it makes learning excessively monitored and datafied.

The Estonian language, culture and cultural self-determination. One of the responsibilities of the Estonian education system is to ensure the sustainability of the Estonian language, culture and the values of a democratic society. In the case of the AI Leap learning application, it is necessary to assess whether it draws on Estonian curricula, high-quality Estonian-language learning resources and the local cultural context or mainly mediates generalised knowledge and value patterns formed in predominantly English-language global data environments.

Responsibility, transparency and control. In public education it must be clear who is responsible for the quality and safety of a learning tool, the use of data and the resulting impacts. Where the functioning of the AI Leap learning application depends on a closed model controlled by a private company, it is particularly important to ask whether the state, school and teacher have a real possibility to understand, assess, audit and, where necessary, suspend its operation.

3.2 Normative Framework of Trustworthy Artificial Intelligence

Numerous guidelines have been developed on the ethical principles and values relevant to AI[78], including by international institutions such as the OECD and UNESCO. This risk assessment takes as a principal point of reference the European Commission High-Level Expert Group on AI's *Ethics Guidelines for Trustworthy AI*[79], which has become a central framework for ethical AI assessment in the European Union.

The guidelines define the conditions an AI system should meet for its use to respect human rights, autonomy, safety, fairness, transparency and accountability. The principal requirements, which express ethical, legal and technological values, are as follows.

1. **Human autonomy and oversight.** The use of AI systems must measure the fundamental rights, autonomy and freedom of decision of affected persons, and ensure a meaningful human ability to monitor and evaluate the use of AI systems and intervene where necessary.
2. **Technical robustness and safety.** This includes resilience to attack, and information security, the availability of fallback plans, general safety, accuracy, reliability and reproducibility.

[78] Corrêa, N. K., Galvão, C., Santos, J. W., Del Pino, C., Pinto, E. P., Barbosa, C., Massmann, D., Mambrini, R., Galvão, L., Terem, E., & de Oliveira, N. (2023). Worldwide AI ethics: A review of 200 guidelines and recommendations for AI governance. *Patterns, 4*(10). https://doi.org/10.1016/j.patter.2023.100857

[79] High-Level Expert Group on Artificial Intelligence. (2019). *Ethics guidlines for trustworthy AI*. https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai

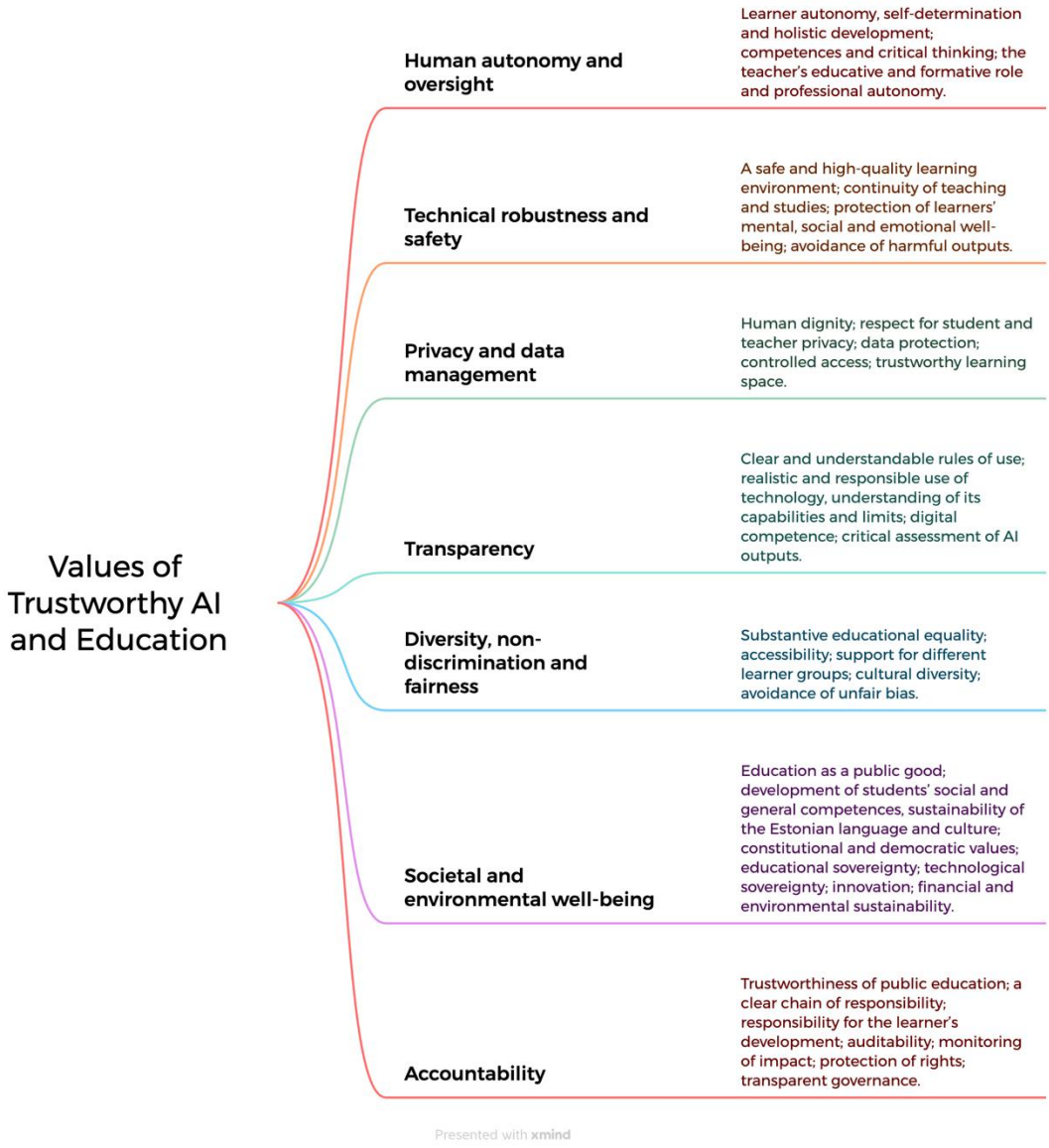
3. **Privacy and data management.** The privacy and personal data of affected persons must be protected. Data quality and integrity and controlled access to data must also be ensured.
4. **Transparency.** This includes traceability and explainability of AI systems, and appropriate information for users about the system's capabilities, limitations and the interpretation of its outputs. People must also be informed when they are interacting with an AI system.
5. **Diversity, non-discrimination and fairness.** This includes preventing and mitigating unfair bias, ensuring that systems are accessible to as broad a user base as possible, following relevant accessibility standards, and involving stakeholders who may be directly or indirectly affected by a system during its life cycle.
6. **Societal and environmental well-being.** This includes sustainability and consideration of environmental impacts, assessment of wider societal effects on social relations and human well-being, and the impact of AI systems on institutions, democracy, the rule of law and shared interests.
7. **Accountability.** AI systems must be auditable. Negative impacts related to their use must be identified, mitigated and communicated; trade-offs between values and interests must be considered; and effective remedies must be available to affected persons.

3.3 Linking the Normative Frameworks of Education and Trustworthy AI

The principles of trustworthy AI primarily describe the conditions that a technological solution should satisfy but do not determine which educational aims AI use should support. They must therefore be interpreted in an educational context and linked to the aims of Estonian education, fundamental rights and societal values. The aims and core values of Estonian education determine which educational, social and cultural objectives are regarded as important.

In this assessment, the normative framework of education and the principles of trustworthy AI are used as a single assessment framework. The normative framework of education defines the aims that AI use in education should serve; the principles of trustworthy AI define the conditions that the technological solution must meet in order to serve those aims.

The following figure connects these two frameworks and shows how the requirements for trustworthy AI acquire a concrete meaning in the educational context, and the protection of which values is assessed in the current risk assessment.



On the basis of these two normative frameworks, each risk scenario is assessed in the current risk assessment in terms of whether the AI Leap educational programme, the AI-based learning application and the supporting framework promote the learner's holistic development, autonomy and formation of general competences; strengthen the teacher's professional role; contribute to educational equality; and support the sustainability of the Estonian language, culture and democratic values. At the same time, the assessment considers whether the learning application and the framework supporting its use satisfy the requirements of trustworthy AI, including autonomy, fairness, transparency, privacy, safety and accountability.

4. Assessment of the Main Threats and Mitigation Measures

4.1 Risk Assessment Methodology

This assessment uses an approach adapted from the risk-assessment methodology developed by the Cybersecurity Committee of the Estonian Academy of Sciences.[80] The purpose of the methodology is to describe possible risk scenarios, the conditions under which they may arise, existing measures and possible additional mitigation measures.

Risk assessment in the current analysis is not limited to internal risks of a particular organisation or project but draws on broader approaches to technology and impact assessment. Technology assessment is an interdisciplinary and systematic process for analysing the possible effects of the development, introduction or modification of a technology as a sociotechnical system on society, people, relationships, institutions and the environment, including protected ethical values and objectives.[81] The analysis also draws in part on the Z-Inspection ethical assessment framework[82], in which the assessment goes beyond describing of risks and examines their relationship to ethical values, tensions between values and possible value conflicts. These questions are addressed separately in Chapter 5. The values and normative foundations used in the risk assessment and subsequent value analysis are described in Chapter 3.

The description of each risk scenario contains the following elements:

- a short description of the threat event, including the principal affected objects, the scope and type of the threat, other related threats, and the ethical values and objectives affected;
- preconditions for the threat event to arise or intensify;
- existing measures;
- assumptions necessary for the existing measures to succeed;

[80] Since 2023, the Cyber Security Committee of the Estonian Academy of Sciences has been developing a methodology for analysing risks to the e-state and has, for example, prepared a published catalogue of election-related threats. See *Valimiste tehnoloogia riskianalüüs 2023–2025* [Election technology risk analysis 2023–2025]. https://koodivaramu.eesti.ee/riigi-valimisteenistus/valimised-turve/

[81] Hansson, S. O. (2024). Ethics and technology assessment. Teoses M. R. Redclift (Toim.), *Handbook of technology assessment* (lk 249–258). Edward Elgar Publishing. https://doi.org/10.4337/9781035310685.00037; Brey, P. A. E. (2026). Ethical Impact Assessment: Theoretical Foundations, Methodology, and Applications. *Science and Engineering Ethics*, *32*(1). https://doi.org/10.1007/s11948-025-00574-9

[82] Zicari, R. V, Brodersen, J., Brusseau, J., Düdder, B., Eichhorn, T., Ivanov, T., Kararigas, G., Kringen, P., McCullough, M., Möslein, F., Mushtaq, N., Roig, G., Stürtz, N., Tolle, K., Tithi, J. J., van Halem, I., & Westerlund, M. (2021). Z-Inspection®: A Process to Assess Trustworthy AI. *IEEE Transactions on Technology and Society, 2*(2), 83–97. https://doi.org/10.1109/TTS.2021.3066209

- possible additional measures.

The risk descriptions are intended to support decision-makers in assessing the acceptability of risks, reconsidering current action and planning additional measures.

In identifying and analysing risks, the expert group:

9. reviewed the AI Leap programme, the learning application and the supporting framework, including relevant documents, and interviewed key persons at the Foundation to map the context and existing measures;
10. identified the principal threat events;
11. prepared initial drafts of the risk descriptions;
12. discussed and refined the risk descriptions;
13. described existing and possible additional measures;
14. discussed the completeness and adequacy of the measures and refined them;
15. harmonised the structure and wording of the risk descriptions.

The responsibility level primarily responsible for developing and leading implementation of each possible additional measure is indicated in parentheses. The responsibility levels are:

- **AI Leap** – responsibility at the level of the AI Leap programme;
- **State** – responsibility for education policy and governance, for example the Ministry of Education and Research, the Ministry of Justice and Digital Affairs, the Riigikogu, the Education and Youth Board (HARNO), and other relevant state institutions;
- **School** – responsibility at school level, including through school management, teachers, support specialists and students;
- **Universities/research institutions** – responsibility through research, teacher education, continuing education and development of didactic support;
- **School owner** – responsibility for running the school, resources, support structures and organisational conditions; depending on the school, this may be the state, a local authority or a private entity;
- **Home** – the role of parents and the home environment in supporting the student.

The responsibility levels used in this assessment do not determine the legal liability of particular institutions or persons. They distinguish the levels at which mitigation measures can be designed and their implementation led. A more precise division of tasks within each responsibility level should be agreed among the relevant parties.

4.2 Overview of the Main Risks

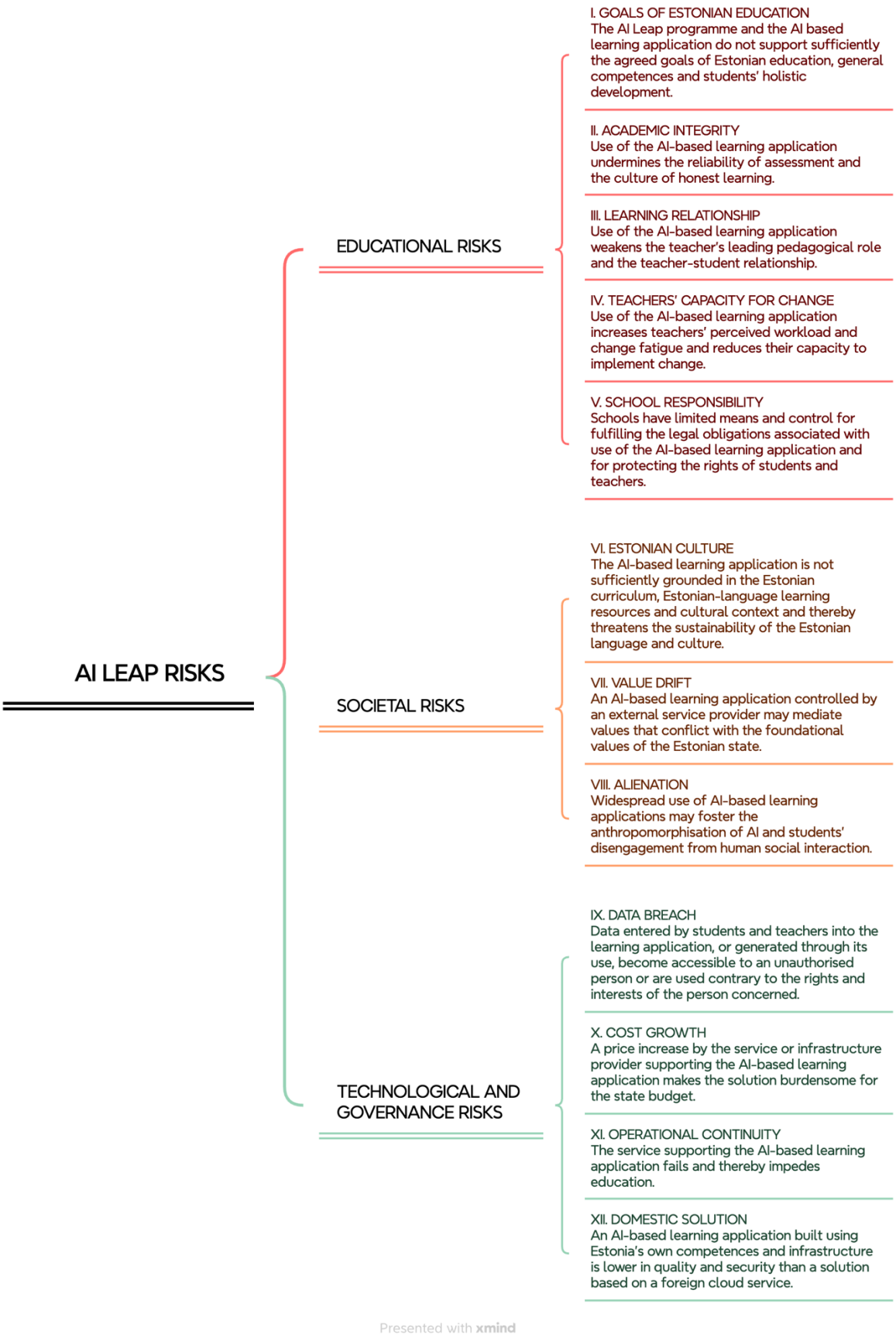
The assessment covers risks associated with implementation of the AI-based learning application and the AI Leap educational programme and supporting framework as a whole. Risks are grouped according to their principal object of impact.

The first group consists of **educational risks**, concerning teaching, learning, assessment, and the ability of teachers and schools to implement AI purposefully in education.

The second group consists of **societal risks**, concerning the possible impact of AI on the Estonian language and culture, societal values, learner autonomy and social cohesion.

The third group consists of **technological, legal and governance risks**, including technological and legal dimensions associated with data protection, cybersecurity, continuity, responsibility, funding and Estonia's technological independence.

The assessment identified twelve risks:


AI LEAP RISKS
EDUCATIONAL RISKS
I. GOALS OF ESTONIAN EDUCATION
The AI Leap programme and the AI based learning application do not support sufficiently the agreed goals of Estonian education, general competences and students' holistic development.
II. ACADEMIC INTEGRITY
Use of the AI-based learning application undermines the reliability of assessment and the culture of honest learning.
III. LEARNING RELATIONSHIP
Use of the AI-based learning application weakens the teacher's leading pedagogical role and the teacher-student relationship.
IV. TEACHERS' CAPACITY FOR CHANGE
Use of the AI-based learning application increases teachers' perceived workload and change fatigue and reduces their capacity to implement change.
V. SCHOOL RESPONSIBILITY
Schools have limited means and control for fulfilling the legal obligations associated with use of the AI-based learning application and for protecting the rights of students and teachers.
SOCIETAL RISKS
VI. ESTONIAN CULTURE
The AI-based learning application is not sufficiently grounded in the Estonian curriculum, Estonian-language learning resources and cultural context and thereby threatens the sustainability of the Estonian language and culture.
VII. VALUE DRIFT
An AI-based learning application controlled by an external service provider may mediate values that conflict with the foundational values of the Estonian state.
VIII. ALIENATION
Widespread use of AI-based learning applications may foster the anthropomorphisation of AI and students' disengagement from human social interaction.
TECHNOLOGICAL AND GOVERNANCE RISKS
IX. DATA BREACH
Data entered by students and teachers into the learning application, or generated through its use, become accessible to an unauthorised person or are used contrary to the rights and interests of the person concerned.
X. COST GROWTH
A price increase by the service or infrastructure provider supporting the AI-based learning application makes the solution burdensome for the state budget.
XI. OPERATIONAL CONTINUITY
The service supporting the AI-based learning application fails and thereby impedes education.
XII. DOMESTIC SOLUTION
An AI-based learning application built using Estonia's own competences and infrastructure is lower in quality and security than a solution based on a foreign cloud service.
Presented with xmind

4.3 Risk scenarios

EDUCATIONAL RISKS

I. GOALS OF ESTONIAN EDUCATION

Does the use of AI in teaching support the goals of Estonian education?

RISK: The AI Leap programme and the AI-based learning application do not sufficiently support the agreed goals of Estonian education, general competences and the student's holistic development

Short description of the threat event[83]

The use of AI in teaching may lead to a situation in which the agreed aims of Estonian education are not realised to a sufficient degree. The goal of upper secondary education is the learner's development into a creative, versatile, socially mature, responsible and self-realising person. The risk therefore does not concern only a possible weakening of learning skills or independent thinking. More broadly, a student's intellectual, social, moral, emotional and cultural development may be overshadowed in an AI-mediated learning environment by narrowly understood achievement of learning outcomes.

The National Curriculum identifies universal values such as honesty, care, reverence for life, justice, human dignity and respect for oneself and others, as well as societal values including freedom, democracy, respect for one's native language and culture, patriotism, cultural diversity, tolerance, environmental sustainability, the rule of law, solidarity, responsibility and gender equality. Upper secondary schools are tasked with developing both subject-specific and general competences, including self-determination, cultural and value competence, social and civic competence, communication competence and learning competence.

If AI Leap focuses mainly on learning skills and digital competence, a question arises as to how it affects the full spectrum of competences. The risk is not limited to the AI Leap learning application but concerns more broadly all large-language-model-based services used in education.

Related risks: TEACHER'S CAPACITY FOR CHANGE, ACADEMIC INTEGRITY, ESTONIAN CULTURE and VALUE DRIFT.

[83] The threat description "GOALS OF ESTONIAN EDUCATION" was originally adapted from the threat analysis prepared by the Cyber Security Committee of the Estonian Academy of Sciences. The content has been substantially revised, and parts of it have been moved to other threat descriptions.

Main values or objectives affected: learner autonomy, self-determination and holistic development; competences; critical thinking; education as a public good; social and general competence development; substantive educational equality.

Detailed description

The AI Leap educational innovation programme is based on the assumption that the AI-based learning application designed to support learning can help achieve the aims of Estonian education more effectively. The central question is under what conditions that assumption may fail.

The first danger is that the learning application remains an isolated pedagogical innovation while the rest of the education system continues to operate on its previous foundations. AI Leap assumes that teachers, schools and learners are autonomous in their use of the AI-based learning application. This also means, however, that AI use is not necessarily guided systemically and risks may remain unmanaged. If teaching, learning materials and assessment continue to focus primarily on factual knowledge rather than the development of learning skills, general competences and thinking skills, a contradiction may arise between the pedagogical aims of the learning application and everyday school practices.

The same problem may arise if the application is not sufficiently grounded in the Estonian curriculum, high-quality Estonian-language learning resources and subject-teaching practices. Students may then receive guidance or answers from the application that do not match the teacher's expectations, or they may receive a lower assessment because the approach suggested by the application does not correspond to Estonian learning materials or assessment criteria. This may reduce both student trust in the application and teachers' willingness to use it.

The second danger is weakening of the social dimension of learning and the development of general competences. In addition to subject knowledge, education must develop cultural and value competence, social and civic competence, self-determination, learning competence, communication competence, entrepreneurship competence and digital competence. The risk does not result from supporting individual learning paths as such, but from shifting the centre of gravity of learning away from the learner-teacher relationship towards learner-AI interaction. If a significant part of learning takes place in an individually mediated AI environment, cooperation between learners and teachers, shared discussion, resolution of disagreements, consideration of others, and social learning that supports the development of values may decrease. Competences that require direct communication, cooperation and social participation may then receive less attention.

The third danger is increasing educational stratification. Motivated students with strong learning skills may use AI to amplify their learning by broadening their knowledge, learning from feedback, checking their understanding and developing critical thinking.

Students with weaker learning skills, lower motivation or less support at home may instead use AI primarily to avoid effort or to have work done for them. Formally equal access to AI can therefore increase substantive educational inequality. Inequality may also grow if schools and teachers use the learning application to different extents or with different pedagogical quality, and if learners do not have comparable opportunities to obtain teacher support in purposeful use of the application.

In summary, whether this risk materialises does not depend only on the quality of the learning application, but on whether the use of AI in teaching becomes part of a comprehensive educational innovation. This requires simultaneous changes in teaching and assessment practices, learning materials, school culture and teachers' professional development. If only the technology changes but not the way how learning and teaching are organised, the educational aims of AI Leap may remain unfulfilled.

Objects affected: all students, teachers and schools in Estonian general education. More broadly, the capacity of the Estonian education system to fulfil its educational and developmental mission and develop people with knowledge, skills, attitudes and general competences.

Particularly vulnerable groups include: – students with low learning motivation; – students with weaker learning skills; – students with special educational needs; – students whose home language is not Estonian; – students without strong support at home or from teachers; – schools without clear agreements on AI use.

Scope: global, because generative AI is changing learning practices everywhere. The Estonia-specific question is whether AI Leap can guide that change pedagogically and ethically, or whether it legitimises AI use in education before the Estonian education system has adapted.

Type of threat agent: this is not a malicious attack. The risk emerges from the interaction of technological, pedagogical and institutional factors: the possibilities of AI applications, user behaviour, the assessment system, school culture, teacher workload and education-policy choices.

Preconditions for the threat event to arise or intensify

1. Students use the AI-based learning application mainly to obtain answers, texts or solution paths rather than for deeper learning.
2. Schools and teachers lack clear agreements on when and how AI supports learning and when it replaces learning.
3. Assessment remains primarily outcome-oriented rather than process-oriented.
4. Teachers have insufficient digital competence and AI literacy.
5. Teachers lack sufficient methodological support for integrating AI into subject teaching.
6. Teachers lack an overview of how and for what purposes students use AI in their schoolwork.

7. Students do not sufficiently understand AI's limitations and cannot distinguish when they are actually learning from when they are merely delegating cognitive effort, creating an illusion of learning.
8. The education system does not monitor the impact of AI across the full spectrum of competences and instead evaluates primarily usage, satisfaction or short-term performance.

Existing measures

1. Training materials and videos have been developed for users of the AI Leap learning application.
2. Schools are supported in establishing learning circles and teacher learning communities for creating new practices and exchanging of experience.
3. A quality-control process is being developed for the learning application and the programme supporting it.
4. A long-term impact study has been commissioned and is being conducted by University of Tartu researchers in cooperation with Stanford University and OpenAI researchers.
5. The programme emphasises meaningful learning and AI literacy.
6. In its current version, the learning application does not profile student progress or make decisions on that basis.
7. Information about measures for other AI-based systems used in teaching and studies is lacking.

Preconditions for the success of existing measures

1. Strong substantive and material support from the Ministry of Education and Research for managing pedagogical changes associated with AI use.
2. Willingness of schools and teachers to review and, where necessary, change learning and teaching, including assessment, homework and task design.
3. Clear national and school-level agreements on permitted, recommended and prohibited uses of AI.
4. Teacher training that addresses not only use of the tool but also didactics, assessment, development of learning skills and understanding of AI limitations.
5. Impact assessment that measures not only use and satisfaction, but also retention of knowledge, independent thinking, general competences, social development and educational equality.

Possible additional measures

1. Define the pedagogical objective of AI Leap clearly through the core values and general competences of Estonian education. *(AI Leap, State)*
2. Develop guidance enabling teachers and students to distinguish learning situations in which AI supports learning from those in which it replaces learning. *(AI Leap, universities)*
3. Update assessment so that a greater proportion is process-based, oral, collaborative, practical and conducted in controlled environments. *(State, universities/research institutions, school)*

4. Preserve learning situations in which students must think, write, calculate, reason and solve problems without AI assistance. *(State, school)*
5. Involve didacticians, educational researchers, subject associations and teachers in developing sample task types in which AI is part of learning but the student's own contribution remains visible. *(State, universities/research institutions, school)*
6. Assess the impact of AI Leap on all general competences, not only learning competence and digital competence. *(AI Leap, school, universities/research institutions)*
7. Develop students' metacognitive skills: how to tell whether AI helped me learn or did the work for me. *(AI Leap, school)*
8. Create subject-specific scenarios for teachers that distinguish AI use supporting learning from delegation of ready-made answers. *(State, AI Leap, universities/research institutions)*
9. Treat AI use as part of broader educational reform, not only as the introduction of a digital tool. *(State, school)*
10. Involve universities and subject-area experts in interpreting inclusive-education principles in the context of the AI Leap programme. *(State, universities/research institutions, AI Leap)*
11. Prepare and involve support specialists at school level to help students with special educational needs, including students with a different home language, use AI in learning. *(State, school, universities/research institutions)*

II. ACADEMIC INTEGRITY

Will assessment remain reliable?

RISK: Use of the AI-based learning application undermines the reliability of assessment and the culture of honest learning

Short description of the threat event

A student may submit work created by AI, or substantially shaped by AI, as their own independent work. The grade then no longer reliably reflects the student's knowledge, skills, effort or development. It becomes more difficult for the teacher to distinguish the student's actual contribution from an AI-produced result, while the student may develop a habit of treating learning not as the acquisition of knowledge and skills but as achievement of an outcome by any available means.

Related risks: TEACHERS' CAPACITY FOR CHANGE, LEARNING RELATIONSHIP and GOALS OF ESTONIAN EDUCATION.

Main values or objectives affected: critical thinking; holistic development; responsible technology use; critical evaluation of AI outputs; academic integrity; fairness; trustworthiness of public education and assessment.

Detailed description

The academic-integrity risk is closely connected to the reliability of assessment. If a student uses AI to produce a text, translation, summary, solution path, analysis or essay in a way the teacher cannot see, the result may appear to be the student's own work without reflecting their actual understanding or skills. Assessment then no longer fulfils its primary function of giving the student, teacher and school reliable information about the state and development of learning.

A deeper problem is that AI can blur the boundary between permitted assistance, cooperation, editing, ideation and a student's own work. If those boundaries remain unclear, students are placed in unequal situations: some use AI extensively, others do not use it or do not know how to; teachers interpret rules differently; and grades become less comparable.

Inequality may also be amplified by differences in access to AI-based services. The AI Leap learning application may contain functions specifically designed to guide a learner, which some students may experience as restrictive or inconvenient, leading them to use other AI services that provide direct answers and over which teachers have no control. Differences in household income and technical resources can further amplify unequal access to such services.

Academic-integrity risks also have longer-term pedagogical effects. If teachers abandon written homework or independent work because they can no longer verify the student's

contribution, students may have fewer opportunities to practise writing, argumentation, problem solving and independent expression. This increases the future risk of dependence on AI for writing. If such tasks continue without rethinking assessment, dishonest practices may increase and trust in assessment may decline. If grades can no longer be trusted, subsequent levels of education and employers may no longer be able to rely on educational institutions' assessments of whether learning objectives have been achieved. The value of school-leaving certificates, professional qualifications and diplomas may decline.

Objects affected: students, teachers, schools and the assessment system as a whole. Grades and feedback may cease to represent students' actual knowledge, skills, development and achievement of learning objectives.

Scope: global, but in Estonia the risk is intensified if schools lack common rules, teachers lack support for redesigning assessment, and AI Leap legitimises AI use without a clear academic-integrity framework.

Type of threat agent: an educational, organisational and cultural risk resulting from the interaction of student motivation, pressure for grades, AI availability, unclear rules and limited teacher control.

Preconditions for the threat event to arise or intensify

1. The school lacks clear agreements on permitted and prohibited AI use.
2. Students are not required to disclose AI use or do not understand what should be disclosed.
3. Assessment is based on tasks that AI can easily complete for the student.
4. Teachers lack tools and methodology for assessing the student's actual contribution.
5. Teachers lack an overview of how students use the AI Leap application or other AI tools.
6. School culture values outcomes and grades more than the learning process.
7. AI-use detection is mistakenly treated as a sufficient solution even though detection tools are not fully reliable.

Existing measures

1. Some schools require AI use to be cited and the manner of use explained.
2. Some schools permit AI use only with teacher permission and under teacher supervision.
3. AI Leap training materials and learning circles can support a shared understanding among teachers.

4. Public debate increasingly recognises that assessment must be reconsidered in the age of AI.

Preconditions for the success of existing measures

1. Schools agree on common principles rather than leaving rules entirely to individual teachers.
2. All students are taught what constitutes permitted AI support and what constitutes academic misconduct.
3. Assessment moves towards greater emphasis on process, reasoning, oral defence, drafts, reflection and controlled environments where AI systems are unavailable.
4. Teachers receive methodological support for redesigning tasks and assessment instruments.
5. The purpose of assessment remains supporting learning, rather than merely detecting violations.

Possible additional measures

1. Develop an AI Leap-wide academic-integrity framework for schools. *(State, universities/research institutions)*
2. Distinguish at least four levels of AI use: prohibited use; permitted technical assistance; permitted substantive assistance with disclosure; and teacher-guided AI use as part of learning. *(State, universities/research institutions, AI Leap)*
3. Add a requirement to learning tasks that students describe their work process: what they asked AI, what they changed, what they checked and what they learned. Establish a simple AI-use documentation form to be completed during the task rather than retrospectively. *(State, AI Leap, school)*
4. Use more oral self-expression, short in-class writing, process-based assessment and work completed in controlled environments. *(School)*
5. Provide teachers with sample tasks better suited to the age of AI. *(State, universities/research institutions, AI Leap, school)*
6. Avoid excessive reliance on AI-detection tools because they do not work with 100% reliability. *(State, AI Leap, school)*
7. Link the teaching of academic integrity to values education, learning competence and digital competence. *(State, universities/research institutions, AI Leap, school, home)*

8. Explain to students that delegating learning to AI is not only a rule violation but also a loss of one's own opportunity to learn and benefit from learning. *(School, home)*
9. Involve parents so that pressure at home to obtain good grades does not encourage students to delegate work to AI. *(School, home)*

III. LEARNING RELATIONSHIP

Does the teacher remain in charge of the learning process?

RISK: Use of the AI-based learning application weakens the teacher's pedagogical leadership and the teacher-student relationship

Short description of the threat event

The AI-based learning application may weaken the teacher's pedagogical leadership and the quality of the teacher-student relationship if a significant share of explanation, guidance, feedback and development of learning strategies moves from the teacher's field of view into the application. Student participation in a teacher-led learning process may decrease, while the teacher may find it harder to understand the student's actual development, misconceptions, learning habits and need for support.

The risk is not merely that the student uses a new digital tool, but that a parallel pedagogical guide may emerge in the learning process whose operation the teacher cannot sufficiently see, understand or direct. The teacher may retain responsibility for the student's development and the quality of teaching while part of the actual shaping of learning occurs in a technological system beyond meaningful teacher control.

The teacher-student relationship is central to achieving many educational aims.

Related risks: TEACHERS' CAPACITY FOR CHANGE, ACADEMIC INTEGRITY, VALUE DRIFT, ALIENATION and ESTONIAN CULTURE.

Main values or objectives affected: the teacher's educational and developmental role; teacher professional autonomy and responsibility; student social and emotional well-being; a trusting learning space; social and general competence development.

Detailed description

The teacher's role is not limited to transmitting knowledge. Teachers design the learning process, choose methods, monitor student development, notice misunderstandings, support motivation, guide values and create a relational and learning environment that supports development. If an AI-based learning application begins to provide explanations, guidance, feedback and learning strategies, it assumes some functions that have traditionally belonged to teachers' pedagogical judgement and professional responsibility.

The application can support learning if it functions as an additional tool within teacher-led education: it can help students practise, ask clarifying questions, obtain additional explanations or reflect on their learning. The risk arises when the application shapes the student's learning independently of the teacher, and the teacher can no longer see what questions the student asks, what explanations they receive, what misconceptions they acquire or how they complete their tasks.

Learning may then move partly outside the teacher's field of view. The teacher may see the final result but not the learning process: where the student went wrong, what assistance they received, whether they understood the explanation, or whether AI performed the substantive work for them. This weakens the teacher's ability to provide formative feedback, identify recurring difficulties in the class and adapt teaching to students' actual needs.

The risk is intensified if the AI-based application does not follow the Estonian curriculum and its aims, uses incorrect Estonian terminology or makes factual errors, for example about literature or history. In such cases, teacher time may increasingly be spent on debating with students what is true and what constitutes correct Estonian usage.

The risk to the learning relationship concerns not only the teacher's professional role but also the human relationship between the teacher and the student. If AI convincingly simulates empathy, provides immediate support and appears less judgemental than a human being, it may become a more comfortable and psychologically safe conversational partner for a student than the teacher. This may be useful in the short term, particularly when a student needs quick help or is afraid to make mistakes. At the same time, it may reduce willingness to engage in demanding dialogue with a teacher, tolerate constructive criticism, develop communication skills and take responsibility for learning.

This is particularly problematic for students with low learning motivation or students whose relationship with school or a teacher is already weak. The learning application may then become not a tool that strengthens the student's connection with the teacher and school, but an alternative learning environment into which the student withdraws. The teacher-student relationship may become secondary even though namely this relation supports motivation, self-confidence, the development of values, social development and a sense of belonging.

The risk operates through three principal mechanisms.

First, learning moves out of the teacher's field of view. If students receive a large share of explanations, feedback and learning strategies from the application, teachers have less opportunity to observe their actual thinking and learning processes. They may not know whether the student understood the topic, what help they used or what misconceptions they had.

Second, the teacher's professional role and skills may weaken. If the teacher delegates too much explanation, feedback, task design or recommendation of learning strategies to the technological system, their own subject-didactic competence, creativity and professional judgement may diminish over time. The role may shift from pedagogical leader to manager of a technology-mediated learning process.

Third, the teacher-student relationship may weaken. If students experience AI as more patient, more immediately available and less judgemental than the teacher, they may become less willing to seek help from teachers, discuss difficulties with people and participate in teacher-led learning. Trust, mutual understanding and the human contact needed for learning may decline.

Objects affected: teachers, students, the organisation of teaching and the quality of the learning process. The primary bearer of harm is the learner, whose learning may become more fragmented and technologically mediated rather than a holistic development process guided by a teacher. Teacher professional autonomy, the meaningfulness of work and responsibility for student development are also affected.

Scope: global, because AI-based learning applications alter the role of the teacher and the learning relationship in all education systems. The Estonia-specific question is whether AI Leap can support teacher's pedagogical leadership or accelerates the movement of learning outside the teacher's field of view in a situation where schools and teachers may not have sufficient methodological support.

Type of threat agent: not an individual but a changing learning environment in which some teacher's functions can move into AI applications without adequate pedagogical guidance and transparency. The risk arises through the interaction of technological capabilities, user behaviour, teacher's workload, school readiness and educational organisation.

Preconditions for the threat event to arise or intensify

1. Students use the AI-based learning application substantially for guidance, explanation and feedback without a teacher-directed pedagogical framework.
2. Teachers lack an overview of what support students receive from the application and how it affects learning.
3. Use of the application does not generate pedagogically useful, generalised feedback for teachers about class learning patterns, typical errors and learning patterns.
4. Teachers lack sufficient methodological, technical and up-to-date didactic support for integrating AI into subject teaching.
5. The school lacks clear agreements and shared understanding of when AI supports teacher-led learning and when it replaces it.
6. Students perceive AI as a more convenient, faster and less judgemental communication partner than the teacher.
7. Teacher workload and teacher shortages create pressure to delegate increasing numbers of pedagogical functions to technology.

8. The learning process values rapid performance more highly than teacher-guided discussion, feedback, cooperation and deepening understanding.
9. The AI-based learning application uses incorrect terminology or makes false claims that the teacher must correct, potentially straining the relationship further.

Existing measures

1. Training materials and videos have been prepared for AI Leap users – teachers, students and parents – and are being supplemented.
2. Schools are supported in developing learning circles so that teachers can exchange experience and good practices.
3. The AI Leap Foundation organises competitions for high-quality subject-specific learning materials and examples.
4. The AI Leap programme emphasises meaningful learning with AI and critical AI literacy.
5. A long-term impact study has been commissioned and is being conducted by University of Tartu researchers with Stanford University and OpenAI researchers. It is not yet known to what extent it focuses on the teacher-student relationship.

Preconditions for the success of existing measures

1. The teacher's role is defined clearly in AI Leap implementation: AI must support teacher-led learning rather than become a parallel pedagogical authority.
2. The Ministry of Education and Research, the AI Leap Foundation and schools provide teachers with substantive methodological support, not only technical instructions.
3. Schools create common agreements for AI use in teaching, including when a student should turn to a teacher rather than AI.
4. Teacher training includes subject didactics, formative assessment, AI literacy and changes in the teacher's role in addition to use of the application.
5. Introduction of the learning application does not increase teacher responsibility without a corresponding increase in control, visibility and support.
6. Students are told that AI is not a teacher, friend or moral authority but a limited tool requiring critical reflection.
7. Teaching preserves sufficient space for human contact, mistakes, discussion, cooperation and trusting feedback from teachers.

Possible additional measures

1. Formulate and implement the principle of teacher pedagogical leadership. AI Leap guidance should state clearly that the learning application supports

teacher-led learning and does not replace teacher's pedagogical judgement, feedback or responsibility for student development. *(State, universities/research institutions, AI Leap, school)*

2. Create a framework for pedagogical feedback visible to teachers. Consider what generalised, privacy-preserving feedback teachers can receive from application use about class learning patterns, typical errors and difficult topics. Such feedback must not become individual monitoring or profiling of students. *(State, universities/research institutions, AI Leap, school)*
3. Develop subject-specific usage scenarios showing how AI can be used to support the teacher's aims rather than replace teacher guidance, distinguishing learning-supportive use, neutral technical assistance and use that replaces learning. *(State, AI Leap, universities/research institutions, school)*
4. Emphasise skills for deliberately strengthening the teacher-student relationship in teacher education and school practice. As AI use increases, deliberately strengthen teacher-student interaction, social learning, cooperation, discussion, trusting feedback and the classroom as a space of human contact. *(State, universities/research institutions, school)*
5. Reinterpret learning tasks and assessment in syllabi and learning materials. Reduce tasks that AI can perform for the student and increase tasks where the thinking process, oral justification, cooperation, practical activity, reflection and teacher-guided discussion are central. *(State, universities/research institutions, school)*
6. Extend teacher education with AI modules covering professional autonomy, didactics, formative assessment, maintenance of the learning relationship and AI's impact on student development, not merely technical use. *(State, AI Leap, universities/research institutions, school)*
7. Involve didacticians and teachers more broadly in the development of the AI-based learning application. Subject teachers, didacticians, educationists and school heads should be included in the development of the learning application and compilation of user instructions so that the application supports real pedagogical aims. *(AI Leap, universities/research institutions, school)*
8. Set clear boundaries for the emotional support permitted from the learning application and explain them. Students and teachers should understand that AI can provide limited learning support but does not replace a teacher, counsellor, psychologist or trustworthy adult. *(AI Leap, universities/research institutions, school, home)*
9. Align teacher responsibility and control over AI-supported learning. If teachers are expected to be responsible for student learning and development, they must have

sufficient ability to understand how the learning application affects the learning process and, where necessary, guide or restrict its use. *(State, AI Leap, school)*

10. Regularly assess AI's impact on the teacher's role. AI Leap impact assessment should specifically examine the effects on teacher workload, professional autonomy, interaction with students, feedback and management of the learning process. *(State, AI Leap, universities/research institutions, school)*

IV. TEACHERS' CAPACITY FOR CHANGE

Can teachers implement the changes?

RISK: Use of the AI-based learning application increases teachers' perceived workload and fatigue caused by changes, and reduces their capacity to implement change

Short description of the threat event

Although the AI Leap educational programme gives teachers considerable autonomy in deciding how to use AI in teaching, that autonomy may become an additional burden if teachers lack sufficient resources – time, knowledge, skills, didactic support and methodological materials – to implement the changes. Programme implementation may consequently become uneven, increase workload and deepen differences between schools and teachers.

Related risks: GOALS OF ESTONIAN EDUCATION, LEARNING RELATIONSHIP and ACADEMIC INTEGRITY.

Main values or objectives affected: quality of education; teacher professional autonomy; the teacher's educational and developmental role; continuity of teaching; a clear chain of responsibility; trustworthiness of public education; sustainability of education; student development; impact monitoring.

Detailed description

The workload of Estonian teachers is already high in international comparison and is associated with a significant intention to leave the profession. In this context, AI Leap is another extensive educational innovation requiring teachers to reinterpret teaching, learning and assessment, adopt new technologies and acquire new didactic competences. If sufficient support and resources do not accompany those changes, the programme may increase teachers' cognitive load and deepen the existing change fatigue.

TALIS 2024[84] results show that Estonian teachers' readiness to use AI is uneven. Teachers most frequently explain non-use by lack of knowledge and skills (78%). Sixty per cent of teachers do not believe AI should be used in teaching, 30% feel that integrating new technologies is beyond their capacity, and approximately a quarter identify inadequate digital infrastructure as an obstacle. This indicates that adoption is constrained not merely by technical conditions but above all by professional readiness, self-efficacy and beliefs about the pedagogical value of technology. A significant proportion of teachers

[84] Leijen, Ä., Jõgi, A., Pedaste, M., Poom-Valickis, K., Uibu, K., Eisenschmidt, E., Oppi, P., Taimalu, M., Tinn., M. & Kalle, V. (2025). *OECD rahvusvahelise õpetamise ja õppimise uuringu TALIS 2024 Eesti tulemused*. HARNO. https://harno.ee/talis#talis-2024

may therefore continue to have little confidence in AI's usefulness and ease of use. In such conditions, an obligation or strong pressure to use AI could increase resistance and perceived workload.

Open responses in TALIS 2024 describe teachers' "change fatigue". The risk is therefore not only that some teachers will not use AI, but that the programme will deepen perceived workload, reduce self-efficacy, increase resistance to change and strengthen intentions to leave the profession. AI Leap may then be implemented unevenly: schools with greater readiness and resources derive more benefit than others, widening differences among schools and teachers and weakening equal opportunities for learners.

Objects affected: teachers (workload, well-being, self-efficacy, motivation and retention in profession); schools' capacity to implement high-quality educational innovation; quality and continuity of teaching; students (through the quality of teaching and learning opportunities); and effective implementation of AI Leap.

Scope: primarily Estonia-specific, although teachers' change fatigue is internationally recognised.

Type of threat agent: organisational factors associated with education policy and programme implementation, not a malicious actor.

Preconditions for the threat event to arise or intensify

1. Teacher workload and teacher shortages create pressure to delegate increasing pedagogical functions to technology.
2. Teachers lack sufficient methodological, technical and up-to-date didactic support for integrating AI into subjects.
3. Schools lack clear agreements and shared understanding of when AI supports teacher-led learning and when it replaces it.
4. AI Leap requires reinterpreting of teaching methods, learning, assessment and tasks, but teachers are not given sufficient working time, resources and professional support.
5. Schools lack systematic change management and designated leaders, leaving implementation to individual teachers.

Existing measures

1. AI Leap provides teachers with training, guidance materials and instructional videos.
2. Schools are supported in creating professional learning communities and learning circles for exchanging experience and good practices.
3. Subject-specific sample materials and good practices are being developed.

4. The programme emphasises the teacher's central role and purposeful, pedagogically justified AI use.

Preconditions for success

1. School owners and school leaders should create real time and opportunities for teachers' professional learning.
2. Initial and continuing teacher education should address AI use primarily as a didactic rather than merely technical question.
3. Teachers should retain the right to decide when and how AI use is pedagogically justified.
4. Programme impacts should be assessed regularly, involving teachers and using their feedback to adapt the programme.

Possible additional measures

1. Implement the programme gradually, avoiding the simultaneous burden of several major educational reforms. *(State, AI Leap)*
2. Provide teachers with working time to develop AI literacy, create and differentiate learning materials, experiment and share experience. *(State, school)*
3. Designate AI leaders in schools and allow them to perform this role within working time. *(School)*
4. Strengthen didactic support nationally. With universities, teacher representative organisations and subject associations, focus not only on using AI tools but on how they support learning, assessment and teachers' work organisation. *(State, AI Leap, universities/research institutions)*
5. Develop school leaders' change-management competence so that AI Leap implementation is systematic and does not depend on isolated enthusiasts. *(State, school owners, universities/research institutions)*
6. Regularly monitor teacher workload, well-being and self-efficacy and adapt the programme accordingly. *(State, AI Leap, universities/research institutions)*
7. Link AI Leap implementation to existing curricula and school development plans so that it is not perceived as another separate reform. *(School owner, school, AI Leap)*

V. SCHOOL RESPONSIBILITY

Can schools govern the use of artificial intelligence?

RISK: Schools have limited means and control for fulfilling the legal obligations associated with use of the AI-based learning application and for protecting the rights of students and teachers

Short description of the threat event

Schools are responsible for organising everyday teaching, including when an AI-based learning application is used. At the same time, a school has limited capacity and control to ensure that the application's actual operation complies with legal requirements arising from legislation and contracts. The threat event includes both situations in which unlawful school conduct results in supervisory proceedings or other legal violations and situations in which unlawful conduct infringes the rights of a student or teacher. Consequences may include legal and procedural costs, reputational damage to the school or the state, and reduced trust in AI-based learning applications.

Related risks: DATA BREACH, COST GROWTH, OPERATIONAL CONTINUITY and DOMESTIC SOLUTION.

Main values or objectives affected: clear allocation and chain of responsibility; responsibility for student development; protection of rights; transparent governance; understandable rules of use; trustworthiness of public education; safety of the learning environment; supervision.

Detailed description

In the AI Leap organisational model, the school is a stakeholder that integrates the use of the learning application into teaching. The school, therefore, has an obligation to ensure that all activities associated with the learning application comply with applicable law. The legality of school action is shaped by several legal and regulatory frameworks.

Unlawfulness may arise from some of the following circumstances:

12. the school fails to ensure that use of the learning application complies with requirements under the Basic Schools and Upper Secondary Schools Act concerning a safe learning environment and support for student development;
13. the school, as controller of personal data, fails to comply with obligations under the GDPR, for example by failing to conduct a data-protection impact assessment or where actual processing exceeds the limits of the legal basis established in Section 20[1] of the Basic Schools and Upper Secondary Schools Act;

14. the school provides the learning application in a manner that makes it a provider of a high-risk AI system within the meaning of the EU AI Act without complying with the corresponding requirements;
15. use of the application results in unequal treatment of different student groups, for example where the application provides a service of different quality depending on the student's language, special needs or another protected characteristic, thereby placing the school in a situation where the service it provides may infringe the requirements of equal treatment.

The threat is intensified by the fact that the school remains responsible for a service whose technical operation it does not control and whose legal compliance it may not be able to assess independently.

A threat event can lead to supervisory proceedings and violation of law even where no individual suffers damage, for example because of inadequate documentation or failure to conduct a data-protection impact assessment. It may also result in an infringement of a particular person's rights, including pecuniary or non-pecuniary harm, for example unequal treatment caused by the application or unlawful use of personal data. If a cybersecurity incident occurs in connection with the application, a school may also incur associated liability for which it lacks resources.

Objects affected: the school; students and teachers whose rights may be infringed; and the state, which has specific obligations relating to provision of education and may, like a school, incur costs associated with compensation, judicial or supervisory proceedings and reputational damage. Reduced trust in the learning application may also lower public willingness to use AI-based learning tools in education.

Scope: primarily Estonia-specific, although reputational damage to the state may have international consequences.

Type of threat agent: schools that adopt the AI-based learning application without being prepared for the associated responsibilities; the AI Leap Foundation in its role as deployer which places responsibilities on schools; and any actor whose conduct leads to a rights violation.

Preconditions for the threat event to arise or intensify

16. The school lacks sufficient legal and technological competence to independently assess compliance of the learning application.
17. Internal processes of the school for data protection, risk management and supervision have not been adapted to the specific characteristics of an AI-based learning tool.
18. The application's use expands in practice beyond its intended boundaries.

19. Teachers and students have not received sufficiently concrete guidance about the purposes for which the application may be used and the types of data that must not be entered, and other measures against unauthorised use of the application are absent.

Existing measures

20. Cooperation agreements between the AI Leap Foundation, schools and technology providers governing use of the AI-based learning application and defining obligations and conditions, including data-processing conditions.
21. A data protection impact assessment conducted by the AI Leap Foundation.
22. Training organised by the AI Leap Foundation for teachers and other school personnel.
23. Section 20[1] of the Basic Schools and Upper Secondary Schools Act, which establishes a legal basis for processing data in an AI learning application.
24. The functionality of the learning application presented to the risk-assessment team supports learning rather than assessing students, directing them or automation other educational decisions. The teacher application, however, was not presented for assessment.
25. Some schools already have internal data-protection arrangements, including data-protection officers and established processes.
26. Some schools have internal rules governing use of learning tools and technology.

Preconditions for the success of existing measures

27. Contractual allocation of roles realistically reflects which stakeholder actually has the power to direct, control and, where necessary, limit application use. The contractual obligations of technology developers ensure lawful conduct.
28. The AI Leap Foundation's data protection impact assessment accurately and comprehensively addresses data-processing operations, associated risks and risk-management measures, and is based on the actual contracts between the Foundation and the companies providing AI services.
29. Schools have the resources and competence to implement AI Leap guidance, including access to support personnel who understand AI characteristics, cybersecurity, data protection and associated legal requirements.
30. Actual use of the application remains within its intended scope and does not expand to functions that exceed the legal basis for processing or alter its risk classification under the AI Act.

Possible additional measures

1. The deployer of the AI-based learning application and the Ministry of Education and Research provide schools with extensive technical and legal support for compliance. *(State, school owner, AI Leap)*
2. The further design and development of AI-based learning applications place explicit emphasis on legality. Contracts with technology developers and other service partners, terms of use and other documentation should contain comprehensive treatment of legal risks, and processes should be designed to minimise them. Data protection by design and cybersecurity by design should be applied. *(AI Leap)*
3. The deployer and the Ministry of Education and Research establish a clear procedure and provide schools with support for managing incidents related to the learning application. *(State, AI Leap)*

SOCIETAL RISKS

VI. ESTONIAN CULTURE

Does the AI-based learning application support the Estonian language and culture?

RISK: The AI-based learning application is not sufficiently grounded in the Estonian curriculum, Estonian-language learning resources and cultural context and thereby threatens the sustainability of the Estonian language and culture

Short description of the threat event

The learning application used within AI Leap may not draw sufficiently on Estonian curricula, high-quality Estonian-language educational resources, Estonia's cultural context or the core values of education. As a result, learning may become partly grounded in a global, predominantly English-language space of concepts, terminology and thought that is detached from the Estonian context.

Large language models in widespread use today have generally not been trained on Estonian curricula, school learning resources or Estonian cultural materials. Tests indicate that widely used large language models, including those underlying the AI Leap application, may make mistakes about Estonian literature and use direct translations of subject terminology, for example incorrect translations of mathematical terms.

In the long term, the risk is not merely that the learning application produces poorer or less accurate answers in Estonian than in English. A deeper risk is that Estonian becomes merely the language of the interface while more complex concepts, examples, explanations, modes of argument and value patterns are imported from elsewhere. This may weaken the substantive sovereignty of the Estonian language, Estonian culture and Estonia's education system.

Related risks: GOALS OF ESTONIAN EDUCATION and VALUE DRIFT.

Main values or objectives affected: sustainability of the Estonian language and culture; cultural diversity; values education; democratic civic education; education as a public good; educational sovereignty; technological sovereignty.

Detailed description

AI Leap creates an important value choice between the convenience and efficiency of the learning application and the protection of the quality of the Estonian language, culture and education. The application may make learning more accessible and flexible, but it is necessary to ask what linguistic, cultural and curricular foundations underlie its explanations, examples, concepts and learning strategies.

Quality of the Estonian language in the application is not merely a matter of user convenience. The language used in education shapes thinking, conceptual vocabulary, subject accuracy and cultural belonging. If the application works significantly worse in Estonian than in English, it may create subtle pressure to move towards English terminology, sources and modes of reasoning. The risk is then not merely that a student receives a poorer answer: Estonian may weaken as a language for complex knowledge, science and reasoned thought.

The problem is intensified by the fact that high-quality Estonian learning materials may not be sufficiently available for developing, adapting or testing AI models. Use of Estonian-language data may be constrained by legal and technical barriers. Official and high-quality educational resources – textbooks, workbooks, teacher materials and other learning tools – are not integrated into models primarily because of copyright and licensing conditions. The autonomy of schools and teachers in selecting learning materials must also be respected. Content in the e-Koolikott repository is available, but its quality, up-to-dateness and methodological consistency are insufficient for AI use.

A situation may therefore arise in which the learning application communicates in Estonian but does not draw sufficiently on the Estonian curriculum, high-quality Estonian-language learning resources or cultural context. Estonian then functions mainly as an interface language, while more complex explanations, examples, concepts, value choices and argument patterns derive from global models' generalised data environments. In the longer term, this can weaken the substantive sovereignty of the Estonian education system.

Linguistic availability of teaching materials must also be distinguished from their cultural and pedagogical suitability. It is not enough for the application to answer in Estonian. It must use concepts consistent with the Estonian curriculum, connect knowledge to Estonian society and culture, support reasoning in Estonian on complex issues, and avoid relying mainly on examples and explanations rooted in English-language cultural contexts.

Separate attention is required for the values and cultural assumptions that the application mediates. Education does not transmit knowledge alone; it also shapes understandings of the human person, society, responsibility, nature, democracy and cultural belonging. If the application is not transparently linked to the core values, general competences and Estonian-language educational tradition of the national curriculum, it may influence learners' value worlds in ways that schools, teachers and the state do not sufficiently notice or control.

The risk does not depend only on the capacity of the Estonian state and AI Leap to make Estonian learning materials available. It also depends on the choices, priorities and resources of service providers. International AI providers may have little commercial incentive to invest in Estonian data because they optimise products for larger languages,

markets and cultural environments. The needs of a small language and culture may therefore remain secondary in technological development. This dependency can be described as technological or linguistic asymmetry: the Estonian education space depends on systems whose central directions of development are determined outside Estonian public control.

The value choice is whether the learning application is treated merely as a universal technological tool or as a component of the Estonian education space that must satisfy linguistic, cultural and pedagogical quality requirements. Educational technology should not dissolve language and culture but should support the development of Estonian as a language of learning, thinking and knowledge creation.

Objects affected: students, teachers and schools in Estonian general education; more broadly, the Estonian language, Estonian cultural space, the sovereignty of the education system, and the state's ability to ensure that education supports the knowledge, skills, attitudes and values set out in Estonian curricula.

Particularly vulnerable groups and areas: – students whose Estonian-language skills require support; – students with another home language; – students who use AI as their main source of explanations and concepts; – teachers and schools unable to systematically check the quality of AI outputs; – smaller subject areas with fewer high-quality Estonian-language resources; – fields where terminological accuracy and cultural context are especially important.

Scope: partly global because large language models and AI services tend to support larger languages, markets and cultural environments better. The Estonia-specific question is whether AI Leap can ensure that AI use in Estonian schools strengthens rather than weakens the Estonian language, curriculum, cultural space and Estonian-language knowledge.

Type of threat agent: the deployer of the learning application with low-quality language and cultural support.

Preconditions for the threat event to arise or intensify

1. The learning application is insufficiently connected to Estonian curricula, subject terminology and high-quality Estonian-language learning resources.
2. High-quality Estonian learning resources are not legally or technologically available for development or evaluation of AI applications.
3. The application performs significantly worse in Estonian than in English.
4. Students use AI as their principal source of explanations, concepts, examples and arguments.
5. Teachers have insufficient ability to verify whether AI outputs correspond to the Estonian curriculum, correct subject terminology and cultural context.

6. Service providers optimise the development of models primarily for larger languages and markets.
7. Separate quality criteria for Estonian language, culture and curriculum alignment are absent.
8. Students begin to prefer English-language answers because they appear more thorough, precise or useful.

Existing measures

1. The learning application has access to content in e-Koolikott, although its quality, consistency and coverage are uneven.
2. The AI Leap Foundation organises competitions for high-quality, methodologically sound, subject-specific learning materials.
3. Cooperation is under way with the Institute of the Estonian Language to evaluate conformity with Estonian-language and cultural criteria and improve the availability of Estonian-language material to large language models.[85]

Assumptions for success

1. Protection of the Estonian language and culture is treated within AI Leap as a substantive educational quality criterion rather than a secondary usability matter.
2. The Ministry of Education and Research, AI Leap, the Institute of the Estonian Language, universities, subject associations and teachers cooperate to ensure the quality of the Estonian-language AI learning environment.
3. The Estonian language combined corpus and language infrastructure are developed in ways that support Estonian-language AI, large language models and language technology.
4. Teachers have sufficient competence and time to notice and correct linguistic, conceptual and cultural inaccuracies spread by the AI-based learning application.

Possible additional measures

1. Create legal solutions enabling high-quality Estonian learning resources to be used for adapting, testing or evaluating AI applications. *(State, universities/research institutions)*
2. Include requirements for Estonian-language quality, alignment with the Estonian curriculum and testing of model outputs in contracts governing use of the AI-based learning application. *(State, AI Leap)*

[85] Eesti Keele Instituut. (2026, 4. juuni). *Keelemudelite mõõdupuu*. https://moodupuu.eki.ee

3. Connect AI-based learning applications to Estonian curricula, subject terminologies, high-quality Estonian learning resources and controlled educational materials. Appropriate copyright and licensing solutions are required. *(State, AI Leap, universities/research institutions)*
4. Regularly assess achievement of language- and culture-related quality objectives. Create test sets for evaluating linguistic quality, terminological accuracy, subject correctness, curriculum alignment and cultural suitability of Estonian-language outputs. Conduct quality tests in both Estonian and English to establish what is technologically possible. *(State, AI Leap, universities/research institutions)*
5. Create automated tests to verify that quality is maintained when the large language model used in teaching is replaced or updated. *(Universities/research institutions, AI Leap)*
6. As part of monitoring use of the learning application, assess whether the application supports thinking, reasoning, problem solving and knowledge creation in Estonian, not merely whether it can communicate in Estonian. Standard forms of assessment, including examinations, can be used to monitor changes in trends compared to the pre-AI period. *(State, universities/research institutions, AI Leap)*
7. Involve the Institute of the Estonian Language, university didacticians, subject associations, teachers and educational researchers in evaluating language, terminology, subject accuracy and cultural context. *(State, universities/research institutions, AI Leap)*
8. Develop a model enabling high-quality Estonian learning resources to support or test AI applications while respecting authors' rights and the autonomy of schools in selecting learning resources. *(State, universities/research institutions, AI Leap)*
9. Give teachers and, where possible, students a clear overview of the extent to which the application relies on the Estonian curriculum, e-Koolikott, other Estonian learning resources or the underlying general language models. *(AI Leap)*
10. Strengthen Estonian cultural context in learning materials used with the application by including examples connecting knowledge with Estonian society, history, nature, culture, democracy and local living environments. *(State, universities/research institutions, AI Leap)*
11. Establish an exit and alternative strategy. If an international provider cannot ensure sufficient Estonian-language and curriculum quality, it must be possible to use alternative solutions, including domestic or European language-technology solutions. *(State, AI Leap)*

VII. VALUE DRIFT

Does AI mediate values consistent with shared societal values in Estonia?

RISK: An AI-based learning application controlled by an external service provider may mediate values that conflict with the fundamental values of the Estonian state

Short description of the threat event

The AI-based learning application may begin to mediate patterns of value, conceptions of society and normative assumptions that are not consistent with the core values of Estonian education, democratic civic education or Estonia's constitutional and societal values. The risk is particularly significant if the model underlying the application, its safety mechanisms, content policies or development decisions are controlled by an external service provider and the Estonian state, schools and teachers have no real ability to fully understand, audit or direct them.[86]

The risk does not require malicious influence or deliberate value propaganda. It follows from the fact that AI systems inevitably reflect cultural, legal and normative choices made during their creation. Value influence may also be indirect and gradual, through repeated biased examples, explanations, framings of problems, modes of argument and default assumptions. Because an AI application may appear to students as a neutral, objective and authoritative source of knowledge, its influence on value attitudes can be especially sensitive in education.

Related risks: TEACHERS' CAPACITY FOR CHANGE, GOALS OF ESTONIAN EDUCATION, ESTONIAN CULTURE, LEARNING RELATIONSHIP and DOMESTIC SOLUTION.

Main values or objectives affected: values education; constitutional and democratic values of Estonia; sustainability of the Estonian language and culture; critical evaluation of AI outputs; transparency; educational sovereignty; technological sovereignty.

Detailed description

Education is a public task of central importance to Estonia's constitutional order. Education does not transmit only knowledge and skills; it shapes understandings of people, the environment, society, responsibility, freedom, democracy, cultural belonging and the state. The National Curriculum emphasises both the educational and developmental task of schools, and students should grow into creative, versatile, socially mature, and reliable personalities who are aware of their goals. The effect of a

[86] Institute of the Estonian Language. (2026, June 4). *EKI värske uuring: paljusid tehisaru mudeleid on lihtne propagandaga mõjutada* [New EKI study: Many AI models are easily influenced by propaganda]. https://eki.ee/uudis/eki-varske-uuring-paljusid-tehisaru-mudeleid-on-lihtne-propagandaga-mojutada/

learning application, therefore, cannot be assessed only in terms of subject knowledge or learning skills; it is also necessary to examine the values and social model it mediates.

The risk of value influence arises principally because large language models are not value neutral. Their answers emerge from the interaction of training data, developer choices, model alignment, content policies, safety filters, product decisions and user-interface design. These choices may have been made in a legal, geopolitical, cultural, political and economic environment different from Estonia's public education space. The default assumptions of the model may, therefore, not coincide with Estonia's constitutional principles or the aims of democratic civic education.

The constitutional concern is that the value worlds of minors in public education may partly be shaped through systems whose substantive normative assumptions are outside Estonian public control. If the application directs students to think in certain ways, frame questions, interpret social problems or weigh moral choices, it is not merely providing technical learning assistance; it participates in educational formation and civic development.

The risk can appear in several ways. The application may privilege certain conceptions of society; value individual success and efficiency over other goods; treat moral conflicts too simplistically; avoid democratically important controversies; or present political, cultural or worldview assumptions as neutral. It may also use examples and explanations that are not grounded in Estonian historical experience, constitutional order or local civic culture.

Value influence is unlikely to be visible in a single answer and is, therefore, difficult to diagnose. More probably, it develops through repeated exposure: students encounter similar examples, argument patterns and value priorities across many learning situations. Over time, this can affect what students regard as normal, reasonable, trustworthy or desirable. This is particularly sensitive because students are at a developmental stage in which self-determination, moral judgement, civic position and sense of belonging are taking shape.

This risk differs from ESTONIAN CULTURE because the focus is not only on language, learning resources or cultural context, but on whether a system controlled by an external technology provider can influence student values in ways inconsistent with Estonia's constitutional order, democratic society and educational core values. It differs from GOALS OF ESTONIAN EDUCATION because it focuses more narrowly on the normative and constitutional values rather than on achievement of all educational aims.

At the same time, the existence of value influence does not mean that AI use is necessarily harmful to values education. Used thoughtfully, AI can help students compare perspectives, analyse arguments, value conflicts and disagreements, notice bias and practise ethical reasoning. The risk arises when AI's value influence is externally

controlled, separated from teacher-led discussion and disconnected from the core values of Estonian education.

Objects affected: value attitudes, worldview, moral judgement, civic competence, cultural and value competence of students using AI-based learning applications, and trust in Estonia's constitutional order and democratic institutions.

Particularly vulnerable groups and fields include: – students whose value attitudes and critical judgement are still developing; – students who frequently use AI for explanations, evaluations or advice; – students who perceive AI as a neutral and objective authority; – students with fewer opportunities to discuss value questions with people at home or school; – teachers and schools lacking means to assess the value influence of AI; – subjects addressing society, history, justice, ethics, identity, culture, democracy and citizenship.

Scope: global, because large language models mediate value patterns shaped by global training data, technology companies' content policies and product decisions. The Estonia-specific question is whether the AI Leap programme can ensure that applications used in schools do not mediate patterns of value detached from or contrary to the core values of Estonian education.

Type of threat agent: the developer of the AI-based learning application through selection of an unsuitable model, or the company or institution training the large language model through commercial, political or ideological value choices.

Preconditions for the threat event to arise or intensify

1. The underlying model, content policies and safety mechanisms are controlled by an external service provider.
2. Value assumptions, biases and content policies of the model are not transparent to Estonian schools and teachers.
3. Changes in the model occur without evaluation of their impact in the Estonian educational context.
4. The application is regularly used in topics involving value conflicts, social issues, ethical dilemmas or civic education.
5. Students perceive the application as a neutral or objective authority and do not understand that its outputs are not value neutral.
6. Because of workload or lack of skill, teachers do not use AI outputs as starting points for values discussion and critical analysis; students consume them independently.
7. The learning application is not tested against the core values of Estonian education, the constitutional values and democratic citizenship education.

8. Schools lack guidance for AI use in values questions, social issues and sensitive topics.

Existing measures

1. The AI Leap programme treats the development of critical AI literacy as important.
2. Training materials for teachers, students and parents are planned, and teacher learning circles are supported.
3. The Estonian education system has existing experience in values education, ethics, civic education and development of general competences on which AI guidance can build.

Preconditions for the success of existing measures

1. A human space for discussion is retained for students in which AI answers can be challenged, compared and interpreted.

Possible additional measures

1. When creating an AI-based learning application for Estonia, treat the values of the machine-learning model as a distinct constitutional and ethical risk rather than merely a language, quality or usability issue. *(State, universities/research institutions, AI Leap)*
2. Develop a framework for assessing the value influence of the learning application, examining the values, conceptions of society and humanity, and normative assumptions mediated by its answers. *(State, universities/research institutions, AI Leap)*
3. Establish testing mechanisms for how the application treats democracy, human dignity, freedom, responsibility, the rule of law, equality, Estonian culture, citizenship and social conflict. Use these tests continuously to detect changes caused by model updates or foreign cloud services, assessing planned changes before deployment where possible and afterwards in case of emergency. *(State, universities/research institutions, AI Leap)*
4. Where there is reason to believe that the nature of the service has changed, conduct an independent ethics audit assessing the value-related suitability of outputs for the Estonian educational context. *(State, universities/research institutions, AI Leap)*
5. Include adherence to the core values of Estonian education and constitutional values among the quality indicators in contracts governing the learning application. Agree on transparency and monitoring provisions that make quality observable. *(State, AI Leap)*

6. Explain in user guidance and training materials how AI use can support cultural and value competence, social and civic competence, self-determination and the values of democratic society. *(Universities/research institutions, AI Leap)*
7. Create school-level agreements for AI use in sensitive values, social, historical, identity and civic topics. Explain to teachers and students that AI is not a neutral moral, political or social authority, and that responses depend on training data, model-development choices and provider's content policies. *(School)*
8. Develop specific guidance for AI use in social studies, history, literature, ethics, philosophy, human studies and other subjects dealing with identity, morality, politics, culture, conflicts or societal values. *(Universities/research institutions, AI Leap, school)*
9. Provide teachers with guidance on using AI-generated situations and answers to develop values discussion, source criticism and argumentation. Encourage students to compare perspectives, justify positions, identify conflicts and understand why value questions in democratic societies are matters for discussion rather than dogma. *(Universities/research institutions, AI Leap, school)*
10. Provide sample tasks for teachers in which students analyse AI answers by asking what values the answer assumes, which perspectives it highlights, which assumptions it contains and which viewpoints remain absent. *(Universities/research institutions, AI Leap, school)*
11. Include in AI literacy for students the ability to notice value assumptions, bias, missing perspectives and the normative framework of argumentation. *(Universities/research institutions, school)*

VIII. ALIENATION

Does AI change the relationship between humans and technology and what it means to be human?

RISK: Widespread use of AI-based learning applications may foster the anthropomorphisation of AI and students' disengagement from human social interaction.

Short description of the threat event

Chatbot-style AI application design can contribute to emotional bonding and forms of dependency between users and systems. Inadequate or deliberately engaging design choices, combined with low AI literacy among members of the school community, may blur the boundary between human communication and interaction with AI. The human traits attributed to AI can reinforce individualistic patterns of behaviour and potentially contribute to growing social alienation among members of a generation.

Related risks: TEACHERS' CAPACITY FOR CHANGE and LEARNING RELATIONSHIP.

Main values or objectives affected: learner autonomy, self-determination and holistic development; mental, social and emotional well-being; development of social and general competences; safe and trusting learning environment; critical thinking.

Detailed description

Research on human-machine communication[87] has concluded that people tend to relate emotionally and socially not only through technology but also to technology itself. One of the principal risks in human-chatbot interaction is that users may perceive such agents as human-like.[88] Chatbots, digital assistants and social robots encourage anthropomorphism: users tend to attribute human traits, emotions and intentions to technologies.[89] Although AI can simulate expressions such as empathy, it does not possess the emotional weight that gives human expressions their meaning.[90]

Empirical studies show that children are particularly ready to search for human social and emotional qualities in conversations with AI.[91] Compared with most adults, children

[87] Mays, K. K. & Katz, J. E. (2023). Machines are us: an excursion in the history of HMC. In Guzman, A. L., McEwan, R., & Jones, S. (eds.) *The Sage Handbook of Human-Machine Communication*. Sage.
[88] Shum, H-Y., He, X-d., Li, D. (2018). From Eliza to XiaoIce: challanges and opportunities with social chatbots. *Frontier of Technology & Electorinic Engineering*. 19(1), 10-26. https://link.springer.com/content/pdf/10.1631/FITEE.1700826.pdf
[89] Darling, K. (2017). „Who's Johnny?" Antropomorphic framing in human-robot interaction, integration, and policy. In: Lin, P., Jenkins, R., Abney, K. (eds). *Robot ethics 2.0. From autonomous cars to artificial intelligence.* (pp. 173- 192). Oxford University Press.
[90] Shteynberg, G. (2024). The psychology of collective consciousness. *Journal of Consumer Psychology,* 34(4), 678-686. https://doi.org/10.1002/jcpy.1434
[91] Garg, R. & Sengupta, S. (2020). "He Is Just Like Me": A Study of the Long-Term Use of Smart Speakers by Parents and Children. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 4 (1), Article 11. https://doi.org/10.1145/3381002

have less developed skills for distinguishing conversations with people from conversations with AI.[92] In recent years, children's interaction with synthetic companions has been linked to cases involving serious danger and, in some instances, tragic outcomes.[93]

Synthetic companions can be especially intriguing and attractive to young people because they are available every day and at any time. Unlike humans, they do not become tired, withdraw or refuse engagement. They are always available to listen and respond and can provide a sense of emotional connection. Research has found that interaction with synthetic companions can reduce feelings of loneliness[94] and create positive emotions[95]. However, studies show that the reduction in loneliness appears temporary; compared with human contact, regular interaction with AI applications does not reduce loneliness over longer periods[96].

Empirical research in Estonia[97] and internationally[98] indicates that young people are becoming increasingly reliant on AI applications for social support and decision-making. They may value chatbots as spaces in which to practise social skills and may also use synthetic companions as support networks that provide mental-health support or help them cope with grief.[99]

Some young people have begun to see chatbots as friends and confidants, and others as romantic partners[100]. Situations in which young people previously sought advice, support and assistance from people such as teachers, parents, friends and doctors are therefore increasingly becoming situations in which they turn to AI. Anthropomorphism can

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[92] Gabriel, I., A. Manzini, G. Keeling, L. A. Hendricks, V. Rieser, H. Iqbal, N. Tomašev, et al. 2024. "*The Ethics of Advanced AI Assistants*." arXiv preprint arXiv 2404: 16244.

[93] Matthew Raine et al vs. OpenAI, Inc, A Delaware Corporation et al https://www.law.berkeley.edu/wp-content/uploads/2025/09/Raine-v-OpenAI.pdf

[94] De Freitas, J., Uguralp, A. K., Uguralp, Z. O., & Puntoni, S. (2024). AI companions reduce loneliness. https://arxiv.org/abs/2407.19096v1

[95] Folk, D., Yu, S., Dunn, E. (2024). Can chatbots ever provide more social connection than humans?. *Collabra* Psychology, 10(1), Article 117083, 10.1525/collabra.117083

[96] Folk, D., Yu, S., Dunn, E. (2024). Can chatbots ever provide more social connection than humans?. *Collabra* Psychology, 10(1), Article 117083, 10.1525/collabra.117083

[97] Siibak, A., Kalmus, V., & Kikerpill, K. (2026). Tehisaru kasutamine [Use of artificial intelligence]. In V. Kalmus, S. Opermann, & R. Kurvits (Eds.), *EU Kids Online'i Eesti 2025. aasta uuringu esialgsed tulemused* [Preliminary results of the EU Kids Online Estonia 2025 study] (pp. 64–79). University of Tartu, Institute of Social Studies. https://doi.org/10.5281/zenodo.18668024

[98] Brandtzaeg, P., Følstad, A. & Skjuve, M. (2025). Emerging AI individualism: how young people integrate social AI into everyday life. *Commun. Change* 1 (11). https://doi.org/10.1007/s44382-025-00011-2

[99] VoiceBox (2023). *Coded Companions: Young People's Relationships with AI Chatbots*.https://voicebox.site/sites/default/files/2023-10/Coded%20Companions%20VoiceBox%20Report.pdf

[100] Willoughby, B. J., Carroll, J. S., Dover, C. R. & Hakala, R. H. (2025). Counterfeit connections. The rise of romantic AI companions and AI sexualized media among the rising generation. Wheatley Institute. https://brightspotcdn.byu.edu/a6/a1/c3036cf14686accdae72a4861dd1/counterfeit-connections-report.pdf

increase trust in AI products and thereby further increase their use. At the same time, it can create misconceptions about AI capabilities. A student who believes that AI "understands" them in a human way may rely on it uncritically, accept its outputs without verification or form attachments that reshape expectations of teachers and peers. Research suggests that this risk may be particularly pronounced among younger students[101].

Public discussion and media coverage frequently use anthropomorphic language about AI, which can strengthen the impression among young people that AI systems are self-aware. Research[102] suggests that Estonian young people usually describe AI as a tool or aid rather than necessarily as a "friend", "mentor" or other personified entity and understand in abstract terms that AI has no feelings or human memory. Interviews nevertheless show that in particular contexts young people may forget this knowledge in practice and behave as though AI possessed human beliefs, intentions and emotions. Young people's interactions reflect a series of false conceptions, there is a gap between abstract knowledge and situated behaviour.

Because the AI learning application is an example of personalised learning, it also changes habits and practices in an education system traditionally viewed as relatively rigid. Students can engage in learning at a distance and learning tasks are no longer tied to a particular physical setting. While using the AI learning application, students mainly engaged in measurable tasks while producing auditable data[103]. Such data may measure work discipline but cannot establish whether students are genuinely interested in understanding something or merely completing assignments.

Empirical research suggests that the temptation to use the learning application merely to obtain answers without engaging in learning is substantial[104]. Students' willingness to understand a topic deeply and make full use of learning-supportive mechanisms may be limited when other popular generative AI applications such as ChatGPT, Copilot and My AI remain freely available and are less demanding in their interaction style.

When an AI learning application is used directly in a classroom, elements associated with remote or distance learning during the COVID-19 pandemic enter face-to-face teaching. This resembles what Sherry Turkle[105] has called being "alone together". Students and teachers may be physically present in the same room while students learn "alone, but

[101] Alasgarova, R. & Rzayev, J. (2025). Managing anthropomorphism in student-AI interaction. *International Journal of Information Technology and Education*, 5(1), 139-160.
[102] Siibak, A.; Kalmus, V.; Kikerpill, K. (2026).
[103] Erickson, I., & Wajcman, J. (2022). Optimizing temporal capital: How Big Tech imagines time as auditable. *American Behavioral Scientist*. https://doi.org/10.1177/00027642221127243
[104] Siibak, A.; Kalmus, V.; Kikerpill, K. (2026).
[105] Turkle, S. (2011). Alone together: why we expect more from technology and less from each other. Basic Books.

together". Students' perceived need to communicate with classmates or turn to the teacher for assistance may diminish.

Potential harms are multifarious:

- students may overestimate the application's ability to understand them and accept false claims or biased input, reducing independent judgement;
- students may develop emotional attachment to the application, weakening critical thinking;
- students may fail to acquire or may lose foundational skills required for coping in society and the economy;
- students may increasingly prefer feedback, advice and support from AI applications and withdraw from human contact, potentially leading in the long term to wider social alienation;
- social and civic competence may develop weakly because a large share of learning occurs individually, with less direct cooperation and shared responsibility with classmates and teachers;
- students' self-esteem may be negatively affected if they conclude that effort is unnecessary because AI can always do things better and provide answers;
- highly personalised learning may reduce opportunities for comparison with peers and contribute to unrealistic self-assessment.

Objects affected: students, teachers and society as a whole.

Scope: global, although potentially intensified in Estonia by rapid and broad implementation of AI-based learning applications.

Type of threat agent: the deployer of the AI-based learning application.

Preconditions for the threat event to arise or intensity

4. Teachers and students do not receive sufficiently concrete guidance about the purposes for which the application may be used and the data that must not be entered; they begin using it for non-educational questions, advice, social situations and emotional support.
5. The service design cannot effectively limit its use to educational content.
6. Teachers lack measures for preventing unauthorised use of the application.
7. Use of the application becomes an important and everyday part of students' completion of school tasks.

Existing measures

8. AI Leap organises training for teachers and school personnel, although it is not known whether anthropomorphism is systematically addressed.

9. Some schools have internal rules governing the use of learning tools, including AI.

Preconditions for the success of existing measures

10. Schools and school communities are motivated to participate in training and acquisition of AI literacy.
11. Public debate about the possibilities and capabilities of AI applications is balanced and evidence-based.
12. The AI-based learning application is not given a name or identity that makes attribution of human characteristics easier.

Possible additional measures

13. The Ministry of Education and Research develops solutions for systematically building AI literacy across education levels and among teachers and teacher-education students, specifically reducing the risk of anthropomorphism. *(State, universities/research institutions)*
14. Documentation and language used for the AI-based learning application should deliberately emphasise the machine nature of the AI service and avoid wording that implies human capacities, for example saying that AI "thinks", "understands" or "lies". *(AI Leap)*
15. Avoid design elements that increase anthropomorphic interpretations, such as human-like avatars, emotional mirroring or interaction patterns designed to create intimacy. Add cues that make the technological basis visible and, where feasible, indicate what materials or sources underlie outputs. *(AI Leap)*
16. Developers of AI-based learning applications should include functional and non-functional requirements reducing anthropomorphism when selecting providers and procuring development. *(AI Leap)*
17. Technically limit use of the learning application for non-educational purposes or introduce proportionate monitoring mechanisms. *(AI Leap)*
18. Provide didactic guidance that helps students challenge myths about AI. For example, present common anthropomorphic claims such as "AI learns from me like a human" and guide students in evaluating and discussing them. *(Universities/research institutions, AI Leap, school)*

TECHNOLOGY AND GOVERNANCE RISKS

IX. DATA BREACH

Are students' data protected?

RISK: Data entered by students and teachers into the learning application, or generated through its use, become accessible to unauthorised persons or are used contrary to the rights and interests of the persons concerned

Short description of the threat event

The learning application supporting Estonian education is implemented in chatbot form, enabling users – students and teachers – to enter a very broad range of questions and prompts. Although the purpose of the service is to support education, it cannot be ruled out that it will also be used for other purposes, particularly where there are no effective mechanisms preventing entry of personal or sensitive information.

Related risks: SCHOOL RESPONSIBILITY, DOMESTIC SOLUTION, COST GROWTH and OPERATIONAL CONTINUITY.

Main values or objectives affected: human dignity; respect for student and teacher privacy; data protection; controlled access; a safe and trusting learning environment; protection of rights; auditability.

Detailed description

Research and practice show that users of chatbots may enter information revealing their beliefs, health or private life, learning difficulties, personal convictions, insecurities or other sensitive matters. The provider of the learning application, which may be a foreign company, can store such information in a form associated with an identifiable person.

A leak of conversation histories is a significant threat in itself. It can expose personal circumstances, vulnerabilities and private thoughts in a context where users expected protection against access by others. This may constitute a serious interference with private life and, in certain circumstances, with human dignity, because disclosure can result in humiliation, stigmatisation, pressure or exploitation. Leakage or misuse of a broader profile and dataset can also create long-term consequences, such as reputational harm, restricted career opportunities, blackmail or manipulation.

The latter risk is particularly serious if a student or teacher later occupies a position of responsibility or a role involving state secrets and their historical profile or other data fall into the hands of a hostile foreign state or other malicious actor.

Several kinds of events may lead to disclosure:

1. leakage caused by errors or misconduct of the learning-application provider, including employee mistakes, malicious insiders or external attackers;
2. leakage at a provider of AI, data-storage or data-processing infrastructure;
3. leakage at partners carrying out quality control or analytics on learning-application data.

Harm can arise even when leaked data are not subsequently misused. Knowledge that a leak has occurred can itself cause distress to affected persons. A leak would also seriously damage trust in the AI-based learning application and the reputation of Estonia's digital state, potentially reducing willingness to use AI in education.

The scale of the programme amplifies the threat. Bringing large numbers of students and teachers into a common service means that a single leak could affect a substantial share of one or more generations in Estonia.

Objects affected: students and teachers using the AI-based learning application, and trust in the application.

Scope: global; all modern societies using large-scale AI services face comparable risks.

Type of threat agent: employees of learning-application service providers or partners, cyber attackers and state-level attackers.

Preconditions for the threat event to arise or intensify

1. Users enter personal information into the chatbot, and the information is stored in a form that can be linked to a particular user.
2. Access, transfer or storage is insufficiently restricted or protected, for example because of inadequate access controls, cybersecurity measures, retention periods or security arrangements across service providers and partners.
3. Information entered into the chatbot becomes public or accessible to a threat actor through the service, infrastructure, downstream analysis or data transfers among stakeholders.
4. In a more serious case, a threat actor uses leaked or unlawfully obtained data to harm a student or teacher.

Existing measures

1. Actors involved in provision, quality control or post-processing of the AI-based learning application apply data-protection and cybersecurity measures. The Estonian service provider is known to apply at least access controls; cloud providers can be expected to apply strong and audited measures, while information about measures at schools and downstream analysis infrastructure remains incomplete.

2. Some applications and user interfaces display warnings or explicit requests not to enter sensitive information or personal data.
3. Contracts governing service use regulate, at least at a general level, the roles of parties, data processing, technical-support obligations and conditions of data use.
4. The provider of the AI-based learning application can restrict access, manage accounts and introduce additional rules or guidance for schools and users where necessary.

Preconditions for the success of existing measures

1. Cybersecurity and data-protection measures are strong throughout the entire service chain and sufficient to prevent data breaches.
2. Users understand that entered data may be stored for a long time and comply with instructions not to enter sensitive information.
3. Technology companies, the deployer of the learning application, schools and other parties have a clear responsibility and notification chain for incident management, ensuring rapid detection, escalation and, where required, notification of users and supervisory authorities.

Possible additional measures

1. Provide students and teachers with education and training on data and AI literacy and associated risks as part of teaching. *(State, universities/research institutions, AI Leap, school)*
2. Transfer data for quality control only for strictly defined purposes and to the minimum extent necessary, and use privacy-enhancing technologies to make it more difficult to link conversations with individuals, for example by reducing names and other identifiers in conversation texts. *(AI Leap)*
3. Prefer infrastructure and service providers located in the European Union or another jurisdiction providing an adequate level of protection for provision of the learning application, quality control and post-processing. *(State, AI Leap)*
4. Establish short retention periods for conversation data. *(AI Leap)*
5. Establish a procedure for handling data breaches and cybersecurity incidents, including detection, impact assessment, notification of parties, support for users and public communication in accordance with applicable law. *(State, AI Leap)*

X. COST GROWTH

Will the AI-based learning application remain affordable for the state?

RISK: A price increase by a service or infrastructure provider supporting the AI-based learning application makes the solution burdensome for the state budget

Short description of the threat event

Development of AI services has largely been driven by the private sector and amplified by the availability of venture capital. A characteristic pattern in such technology development is rapid market expansion at favourable prices, followed by price increases as providers seek to recover investment costs.

Related risks: DATA BREACH, SCHOOL RESPONSIBILITY, OPERATIONAL CONTINUITY and DOMESTIC SOLUTION.

Main values or objectives affected: education as a public good; educational sovereignty; financial sustainability; continuity of teaching and studies; trustworthiness of public education; allocation of responsibility.

Detailed description

Providing an AI-based learning application to large numbers of students in Estonian basic and upper secondary schools requires substantial hardware infrastructure to run large language models. Such infrastructure is being built by both states and private companies. A provider serving Estonian schools can choose which infrastructure the application relies upon.

Companies selling AI and associated infrastructure as cloud services have made their services easy to use. At the time this threat description was prepared, the AI-service market was characterised by aggressive customer acquisition and low pricing. In several products, including AI-assisted software development, prices have already begun to rise, or included compute allowances have been reduced in order to cover internal costs.

If Estonia's AI-based learning application depends on infrastructure or machine-learning and language models supplied by a foreign private company, price increases imposed by that company can increase Estonian educational expenditure. These payments flow permanently out of Estonia and do not themselves create domestic added value. Given market prices for AI services and the number of students in lower secondary and upper secondary education, annual costs can plausibly reach tens of millions of euros for cheaper services and many tens of millions for higher-quality large language models or multi-agent systems.

Object affected: the Estonian education budget.

Scope: Estonia-specific, although all countries implementing AI at scale face similar problems.

Type of threat agent: AI-infrastructure providers and/or procurers, infrastructure providers and model-service providers.

Preconditions for the threat event to arise or intensify

1. The learning application uses infrastructure for running a large language model whose price is outside the control of the deployer.
2. The price of running the language model used in the application rises.
3. Funding for the application does not increase sufficiently to cover costs, or other educational activities are reduced to finance the increase.

Existing measures

1. The initial technical implementation of the AI-based learning application is relatively simple.
2. In the initial implementation, the teacher application uses two providers, which makes it possible to move away from a provider that raises prices.

Preconditions for the success of existing measures

1. Ensuring sufficient quality does not require major increases in technical complexity, such as substantially more complex models or multi-agent technologies.
2. Implementation avoids infrastructure- or provider-specific technical solutions that make switching providers expensive or difficult.

Possible additional measures

1. Host the AI-based learning application on national AI infrastructure over which Estonia has greater control. *(State, AI Leap)*
2. Fix prices in long-term contracts with providers. *(AI Leap)*
3. Maintain a clear plan for replacing the infrastructure or model provider if commercial conditions become unsuitable. *(AI Leap)*
4. Ensure that schools remain permanently able to provide education and assess learning without continuous assistance from AI-based services. *(School)*

XI. OPERATIONAL CONTINUITY

Will education continue to function if the AI-based learning application becomes unavailable?

RISK: A service supporting the AI-based learning application fails and thereby impedes education

Short description of the threat event

The AI Leap learning application may become partly or completely unavailable to schools because of technical, organisational, cybersecurity, supply-chain or geopolitical disruption. Because the service depends on AI, cloud, DNS and authentication services located outside Estonia, a disruption or substantial deterioration in any of them may interfere with the application and with teaching that depends on it.

Related risks: DATA BREACH, COST GROWTH and DOMESTIC SOLUTION.

Main values or objectives affected: continuity of teaching and studies; a safe and high-quality learning environment; technical robustness and safety; clear responsibility; transparency; trustworthiness of public education.

Detailed description

The learning application made available to schools through the AI Leap Foundation depends on several technical and organisational conditions. It relies on services supplied by AI technology companies and on supporting services such as cloud infrastructure, API connections, DNS and authentication.

Operation of these services also depends on data connections to Estonia and on school and user devices having internet access.

The principal risk is growing dependence of schools and the education system on an AI-based learning application where schools have no control over the technical supply chain, provider decisions or external dependencies. If teaching assumes application availability, extensive or prolonged interruptions can affect achievement of learning objectives and continuity of education.

One possible continuity disruption scenario is activation of “island mode” or extensive disruption to external connections. Access to services required for the application could be limited or lost even if those services continue to operate normally outside Estonia. Such a situation could result from simultaneous failures of submarine or terrestrial cables, security-of-supply problems, threats of military conflict, hybrid attacks, state-sponsored cyber-attacks or other extensive communication and infrastructure disruptions. In such cases, availability depends in part on Estonia’s capacity to maintain international data links and internet connectivity.

Objects affected: students and teachers as end users; schools as organisers of education; the AI Leap Foundation as deployer; and the application and its technical supply chain, including AI services, cloud services, service-provider APIs, DNS and authentication.

Scope: dependencies are predominantly global and disruptions may occur at provider, cloud-platform or supply-chain level. Effects nevertheless materialise in Estonia's education system. Estonia-specific scenarios include failures of international connectivity and infrastructure, simultaneous cable failures and wider data-communication or security-of-supply disruptions. Threats can also be linked to geopolitical escalation, including armed conflict, hybrid attacks, state-sponsored cyber-attacks and denial-of-service attacks.

Type of threat agent: state-sponsored attackers, cybercriminals, organised groups, AI providers, cloud providers, communications operators, and malicious or negligent employees of providers or subcontractors.

Preconditions for the threat event to arise or intensify

1. The AI Leap learning application is used as a normal or compulsory part of teaching and studies.
2. Teaching has not been designed to tolerate application outages and there is no practical alternative for completing learning activities without it.
3. The education system and schools have not agreed what constitutes a significant interruption in terms of scale and duration.
4. Application use depends on internet connectivity, a foreign cloud service, an AI-technology provider API and central authentication services.

Existing measures

1. A partial measure consists in cooperation agreements with schools include a commitment by the AI Leap Foundation to provide technical support and address technical failures.
2. Use of the learning application has not yet become a compulsory or critical part of teaching and studies.

Preconditions for the success of existing measures

1. Support from the Ministry of Education and Research, national strategic planning and adequate resources.
2. School awareness and capacity to design and implement continuity measures.

Possible additional measures

1. Agree nationally a minimum availability level for the AI-based learning application, thresholds for critical outages, and a process for notification of interruptions and disruptions. *(State, AI Leap)*
2. Apply a cybersecurity and risk-management system to the AI-based learning application and assign responsibilities. *(AI Leap)*
3. Map dependencies of the AI-based learning application mediated by AI Leap and agree recovery priorities for critical components. *(AI Leap)*
4. Schools should prepare plans and guidance for replacing the learning application or ensuring teaching without AI-based services. Achievement of learning objectives must not depend on the availability of the AI service. Every learning scenario and activity should remain possible without the learning application and external service. *(School)*
5. In the longer term, consider reducing dependence on external AI providers and continue development of sovereign AI infrastructure in Estonia. *(State, AI Leap)*

XII. DOMESTIC SOLUTION

Can Estonia create a trustworthy AI-based learning application?

RISK: An AI-based learning application built using Estonia's own competences and infrastructure is lower in quality and security than a solution based on a foreign cloud service

Short description of the threat event

This scenario considers a situation in which, in order to reduce risks associated with COST GROWTH, OPERATIONAL CONTINUITY, VALUE DRIFT, DATA BREACH or legal uncertainty, the AI-based learning application is deployed on Estonian infrastructure. Estonia would then need to ensure sufficient computing capacity, availability of appropriate models and cybersecurity.

Main values or objectives affected: educational sovereignty; technological sovereignty; sustainability of the Estonian language and culture; a safe and high-quality learning environment; controlled access; responsibility and supervision; transparency; trustworthiness of public education.

Detailed description

Estonia has extensive experience implementing and protecting business- and mission-critical digital services, including X-Road, digital identity and internet voting. AI services, however, involve new forms of technical complexity, and principles for protecting them are still developing in Estonia and internationally. This includes the need to build measures against machine-learning-specific attacks such as prompt injection, model poisoning and regressions between model versions.

Estonia has begun developing sovereign AI infrastructure, but its capacity may not be sufficient to run a service covering an entire national target population. At the same time, such infrastructure will not emerge unless it is made a policy goal and gradually built. For some period, availability of suitable machine-learning models may also be problematic. At the time this threat description was prepared, OpenAI models could not be run on Estonian infrastructure. Running models domestically could, however, create stronger incentives to use models trained or fine-tuned on Estonian-language and cultural material.

Objects affected: users of the AI-based learning application and the reputation of Estonia's digital state.

Scope: primarily Estonia-specific, although comparable issues arise in other countries.

Type of threat agent: providers of infrastructure or computing services for an AI-based learning application in Estonia.

Preconditions for the threat event to arise or intensify

1. The AI-based learning-application solution is deployed on Estonian infrastructure.
2. In a cybersecurity scenario, the Estonian infrastructure operator cannot adequately protect the infrastructure against cyber threats.
3. In a capacity scenario, Estonian infrastructure is not powerful enough for the machine-learning models required to operate the service.
4. In a quality scenario, a model of sufficient quality cannot be licensed for operation on Estonian infrastructure.

Existing measures

1. Estonia has strong cybersecurity competence and a successful record of running e-state services.
2. Estonia has rapidly developing competence in training, fine-tuning and operating AI models.
3. Initial investments have been made in sovereign AI infrastructure, although current capacity is not sufficient to host the full nationwide learning-application service.

Preconditions for the success of existing measures

1. Estonia has infrastructure of sufficient scale to provide the AI-based learning application to all target students and teachers.
2. Estonia maintains sufficient expertise to operate AI infrastructure and models.
3. A large language model of sufficient quality is available to Estonia and can support a high-quality learning application.

Possible additional measures

1. Continue building sovereign AI infrastructure in Estonia until it reaches a scale capable of running a nationwide learning application on domestic infrastructure. *(State)*
2. Continue efforts to develop large language models that understand Estonian culture and literature and can provide a foundation for a sovereign AI-based learning application and supporting infrastructure. *(State)*
3. Continue developing and teaching competences in cybersecurity, artificial intelligence and infrastructure operation. *(State)*

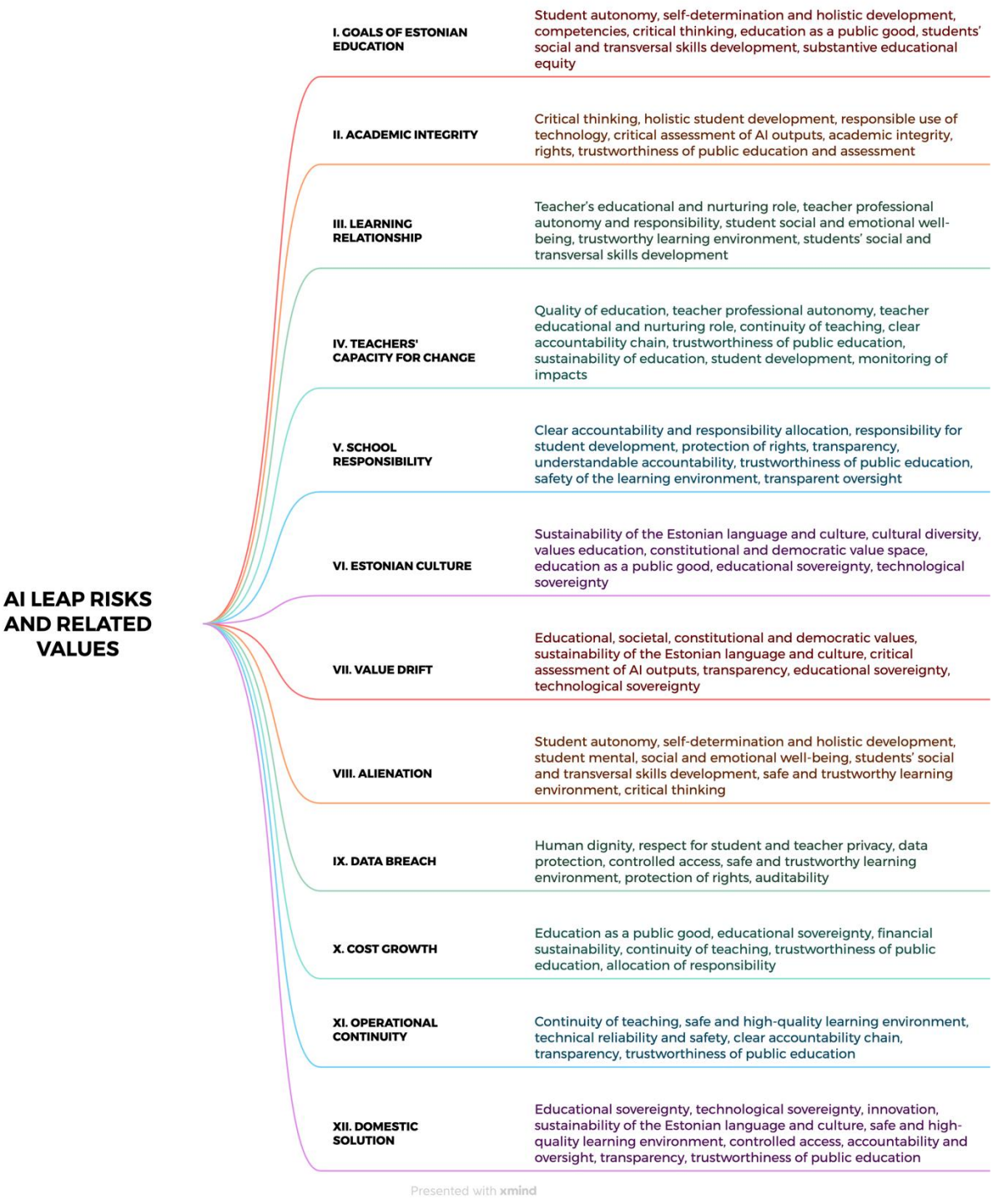
5. Principal Value Choices Revealed by the Risk Assessment

No technological solution is value-neutral. The risk assessment shows that many questions raised by AI Leap cannot be reduced to technical, legal or organisational risks. Even when appropriate measures are introduced, value choices remain that cannot be resolved by scientific or technological evidence alone.

Use of an AI-based learning application in public education raises fundamental questions such as which educational aims should receive priority, how the roles of teachers and AI should be divided, what forms of data use are justified in education, and to what extent it is acceptable for the organisation of public education to depend on technologies controlled by international private companies.

Chapter 3 defined the normative framework used to identify and assess risks. Each risk description considered the educational aims, fundamental rights, societal values and trustworthy AI requirements potentially affected. The risk assessment is therefore not value-neutral: identifying something as a significant risk already presupposes a judgement about which values deserve protection.

The following figure summarises which values or goals are affected by risks.


AI LEAP RISKS AND RELATED VALUES
I. GOALS OF ESTONIAN EDUCATION
Student autonomy, self-determination and holistic development, competencies, critical thinking, education as a public good, students' social and transversal skills development, substantive educational equity
II. ACADEMIC INTEGRITY
Critical thinking, holistic student development, responsible use of technology, critical assessment of AI outputs, academic integrity, rights, trustworthiness of public education and assessment
III. LEARNING RELATIONSHIP
Teacher's educational and nurturing role, teacher professional autonomy and responsibility, student social and emotional well-being, trustworthy learning environment, students' social and transversal skills development
IV. TEACHERS' CAPACITY FOR CHANGE
Quality of education, teacher professional autonomy, teacher educational and nurturing role, continuity of teaching, clear accountability chain, trustworthiness of public education, sustainability of education, student development, monitoring of impacts
V. SCHOOL RESPONSIBILITY
Clear accountability and responsibility allocation, responsibility for student development, protection of rights, transparency, understandable accountability, trustworthiness of public education, safety of the learning environment, transparent oversight
VI. ESTONIAN CULTURE
Sustainability of the Estonian language and culture, cultural diversity, values education, constitutional and democratic value space, education as a public good, educational sovereignty, technological sovereignty
VII. VALUE DRIFT
Educational, societal, constitutional and democratic values, sustainability of the Estonian language and culture, critical assessment of AI outputs, transparency, educational sovereignty, technological sovereignty
VIII. ALIENATION
Student autonomy, self-determination and holistic development, student mental, social and emotional well-being, students' social and transversal skills development, safe and trustworthy learning environment, critical thinking
IX. DATA BREACH
Human dignity, respect for student and teacher privacy, data protection, controlled access, safe and trustworthy learning environment, protection of rights, auditability
X. COST GROWTH
Education as a public good, educational sovereignty, financial sustainability, continuity of teaching, trustworthiness of public education, allocation of responsibility
XI. OPERATIONAL CONTINUITY
Continuity of teaching, safe and high-quality learning environment, technical reliability and safety, clear accountability chain, transparency, trustworthiness of public education
XII. DOMESTIC SOLUTION
Educational sovereignty, technological sovereignty, innovation, sustainability of the Estonian language and culture, safe and high-quality learning environment, controlled access, accountability and oversight, transparency, trustworthiness of public education
Presented with xmind

Assessment of the scenarios and expert discussions showed that not all questions can be solved through technological, legal or organisational measures. Further implementation of AI Leap requires principled decisions about which forms of AI use are educationally desirable and ethically justified. The principal value choices that emerged are set out below.

Efficiency of Learning or the Learner's Holistic Development

One of the central promises of the AI Leap educational innovation programme is to make learning more personalised, faster and more efficient. The aim of education, however, is not limited to knowledge acquisition or improved performance. Education shapes the person: their self-understanding, values, general competences, critical thinking and readiness to participate responsibly in society.

The value choice is not a simple opposition between learning efficiency and holistic development. The question is how AI can be used so that increased efficiency is not achieved at the expense of deep learning or the developmental role of education.

Related risks: GOALS OF ESTONIAN EDUCATION, ACADEMIC INTEGRITY, LEARNING RELATIONSHIP.

Teacher's Professional Autonomy or the Growing Pedagogical Role of AI

AI can support teachers' work but can also begin performing tasks that have traditionally belonged to teachers' professional judgement. This raises the question of how the teacher's role changes in the design of learning, guidance and formative assessment.

The value choice concerns the division of roles between the teacher and AI in public education. The issue is not whether the teacher or AI is a better tutor, but how to ensure that the teacher retains an overview of the learning process, professional autonomy and responsibility for the student's development.

Related risks: GOALS OF ESTONIAN EDUCATION, LEARNING RELATIONSHIP, TEACHERS' CAPACITY FOR CHANGE, SCHOOL RESPONSIBILITY.

Learner Autonomy or Personalisation of Learning

One of the strongest advantages of AI in education is personalisation. The learning application can adapt learning to individual needs and provide tailored support. Personalisation, however, can require increasing amounts of data about the learner and continuing analysis of their learning.

The value choice is how to combine personalisation with protection of learner autonomy, self-determination and privacy. The more the application adapts and directs learning based on learner data, the more important it becomes to ask whether the learner retains real control over their learning or whether choices are increasingly shaped by algorithmic decisions.

Related risks: GOALS OF ESTONIAN EDUCATION, DATA BREACH, ALIENATION.

Global Innovation or Estonia's Educational Self-Determination

International AI models provide rapidly developing technological capabilities, but their knowledge, value assumptions and development decisions are formed largely outside the Estonian education space.

The value choice is how to use global technology while preserving the substantive self-determination and educational thinking of Estonia. The question is not only whether Estonian is used as a language, but whether AI draws on the Estonian curriculum, cultural context and educational core values and helps develop learners as members of Estonian society.

Related risks: ESTONIAN CULTURE, VALUE DRIFT, COST GROWTH, OPERATIONAL CONTINUITY, DOMESTIC SOLUTION.

Technological Innovation or Environmental Sustainability

AI use in education can improve learning quality, increase access and support teachers and learners. At the same time, training, operating and extensively using large language models requires significant computing power and increases energy consumption and the environmental footprint of digital infrastructure.

Environmental sustainability is one of the core values of Estonian education, and the trustworthy AI framework also emphasises societal and environmental well-being. This raises the question of how to develop environmental awareness and sustainable-development values among learners while the digital technologies used in education themselves have significant environmental impacts.

The value choice is how to use AI in education in ways that support learning and innovation while remaining consistent with sustainability principles and avoiding unjustified increases in energy consumption and natural-resource use.

Related risks: GOALS OF ESTONIAN EDUCATION, ALIENATION, SCHOOL RESPONSIBILITY, DOMESTIC SOLUTION.

Public Control or Dependence on International Technology Companies

Introducing AI into public education inevitably involves cooperation with international technology companies. This raises the question of how much of the operation of public education may depend on technologies whose development, pricing and operation are not fully under the control of the Estonian state.

The value choice concerns the balance between responsibility, transparency and controllability of public education on the one hand and technological innovation on the other. The question is not only whether technology works, but what level of real control the state must retain over technologies used in education, and how much of the core

functioning of public education may legitimately be delegated to private actors, including foreign technology companies.

Related risks: SCHOOL RESPONSIBILITY, DATA BREACH, COST GROWTH, OPERATIONAL CONTINUITY, DOMESTIC SOLUTION.

In summary, the risk assessment shows that AI use in education is not merely a technological or legal question. Every significant decision also involves a value choice concerning the kind of education and society we wish to shape. Further development of AI Leap should, therefore, be understood not only as technological innovation but as an education-policy and ethical decision-making process that will influence the future of Estonian education.

6. Main Recommendations for the Further Development of the AI Leap Educational Innovation Programme

1. The use of artificial intelligence in education is primarily an education-policy and ethical question, not a technological one.

AI Leap should be evaluated not only according to whether the AI used is safe, fair and robust, but also according to whether it helps achieve the aims of Estonian education and supports the learner's holistic development, the teacher's professional role and the sustainability of Estonia's cultural space.

2. AI Leap can significantly strengthen Estonian education, but only if it develops into a comprehensive educational innovation.

The learning application alone will not transform learning. Success depends on whether teaching practices, assessment, learning materials, teacher education, school culture and governance develop together with the technology.

3. Successful implementation of the AI-based learning application requires a clear division of responsibility and a sustainable national governance and funding model.

Development and implementation of the AI-based learning application should be treated as public educational infrastructure rather than a one-off development project. Responsibilities of the different parties must be defined clearly, and sustainable funding must make it possible to develop, evaluate and update the service throughout its life cycle. Responsibility must correspond to actual decision-making power and the ability to exercise control. Large-scale changes in education should be designed, piloted and implemented on a research-informed basis and their impacts evaluated continuously.

4. To preserve education in Estonian and its alignment with Estonia's cultural and societal values, limits must be established that leave decisive control over the AI-based learning application with the Estonian state and education system.

Core functions of Estonian education should not become completely dependent on decisions made by foreign technology companies. The state must retain the ability to audit the service, redesign it where necessary and switch providers.

5. The greatest risks do not arise from the technology itself, but from the way it is integrated into learning, teaching and the education system as a whole.

Risks emerge when AI begins to replace teachers' pedagogical judgement, learners' independent thinking or the developmental role of education rather than supporting them.

6. The teacher remains the central designer of education in the age of artificial intelligence.

AI should strengthen teachers' professional autonomy and the teacher-student relationship, not become a parallel pedagogical authority.

7. The strengths of Estonian education must be preserved in the age of artificial intelligence.

The aim of introducing AI into an internationally successful education system is not to replace the existing system, but to preserve and further develop its strengths: learner autonomy, teacher professionalism, quality of education and equal opportunities.

8. The Estonian language, culture and educational self-determination require deliberate protection.

AI used in education must be grounded in the Estonian curriculum, high-quality Estonian-language learning resources and Estonia's cultural context. Otherwise, Estonian may be reduced to the language of the interface while the substantive content of learning is increasingly shaped by global models.

9. Risk mitigation does not eliminate value choices.

Even where all relevant technical, legal and organisational measures are implemented, fundamental value choices remain and must be considered in context.

10. The role of universities and research institutions in the development and implementation of the AI-based learning application should be strengthened.

Designing and implementing the AI-based learning application is not merely a technological development task but a long-term educational innovation requiring educational, didactic, philosophical, psychological, ethical and legal knowledge. Universities and research institutions should, therefore, be systematically involved in pedagogical design, development of learning materials and methodological guidance, teacher education, impact assessment, and continuous monitoring and mitigation of risks.

Conclusion

AI Leap can take Estonian education to a new level of development and become an international model for responsible implementation of AI in education. This requires treating the programme not merely as the introduction of a new technological tool but as a long-term educational reform centred on holistic learner development, deep learning, teacher professionalism and preservation of the values and aims of Estonian education in the age of AI.

The central conclusion of the risk assessment is that AI can significantly strengthen Estonian education, but only if educational goals guide the use of technology, not the other way around.

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