



Educational Technology Use in Uzbek Schools

The outcomes of a 12-week pilot introduction of a
Mathematics Learning Platform in 17 schools

June 2025

Cover photo: A Grade 5 student at a Primary School in Tashkent, Uzbekistan using the Eduten digital learning platform as part of her maths class. ©UNICEF Uzbekistan/2024

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Executive summary

The COVID-19 pandemic has worsened the global learning crisis. To tackle learning gaps and to assess the effectiveness of technology on improving the learning journey of children, a 12-week pilot project was conducted in Uzbekistan. The project involved collaboration between the Ministry of Preschool and School Education (MoPSE) of the Republic of Uzbekistan, Eduten Ltd, UNICEF Uzbekistan and the UNICEF Global Learning Innovation Hub.

The project aimed to evaluate the efficacy of the Eduten digital learning platform in improving numeracy skills among Grade 5 students in Uzbekistan. The Eduten platform is an artificial intelligence (AI)-driven educational tool, featuring over 200,000 quality maths tasks that can be aligned with any curriculum, along with comprehensive assessment tools and learning analytics. It primarily serves teachers, offering pedagogical and gamified activities for students alongside automated analytics to gauge student progress. It also provides insights for educational leaders at all levels, supports multiple subjects, and is accessible via web browsers on various devices.

Eduten stems from nearly 20 years of research at Turku Research Institute for Learning Analytics (TRILA) at the University of Turku, Finland. The Eduten platform received the UNESCO ICT for Education Prize in 2020 and the UNICEF EdTech Award in 2022.

UNICEF supported this project in Uzbekistan as part of its broader efforts to assist countries in addressing the learning crisis and leverage high-quality and high-impact educational technology (EdTech) to transform learning for all children. This pilot project focused on measuring Eduten's effect on student learning outcomes in basic mathematics, student motivation, and its ability to reduce teacher workloads through automation and personalised learning approaches.

Before the pilot, the exercise programs were curated and aligned with the national mathematics curriculum by MoPSE. This was followed by a three-day teacher and school manager orientation on digital pedagogy and the use of the Eduten platform in Tashkent. Next, 1,046 Grade 5 students in 17 schools were divided into two groups: the **treatment group** (N=527 from 17 Grade 5 classes), which replaced one mathematics lesson a week (45 minutes + homework) with Eduten; and the **comparison group** (N=519 from the same 17 school's Grade 5 classes), which continued to have their typical maths lessons with no additional intervention.

Both groups received the same amount of maths instruction. The students in both groups were tested to gauge their numeracy skills with two assessments before and after the 12-week period. One of the assessments was designed by MoPSE according to Uzbek mathematics assessment standards, and the second assessment was designed by the University of Turku to measure arithmetic fluency.

During each week of the 12-week period, teachers opened a new set of digital exercises for the students in the treatment group, who worked on them during class and – optionally – also at home. The teacher observed the students' progress through Eduten's learning analytics, and provided support and differentiation for each student as needed. In addition, several stakeholder surveys were conducted during the project to collect insights on the readiness and attitudes of teachers, students and school managers towards digital classroom tools.

The leadership of MoPSE was critical throughout the pilot, providing regular support and communication for the participating teachers and school managers.

Key findings

The results showed minimal improvement in the comparison group between the pre- and post-test, while the treatment group demonstrated significantly higher improvement. There was a

- **+16.9 per cent** increase in *mathematics skills*, and
- **+10.2 per cent** improvement in *arithmetic fluency*.

The effect size for the maths test was 0.42 standard deviations, which can be considered a medium effect. The results are based on the pre- and post-tests the students took before and after the 12-week period of using the Eduten platform in the treatment schools.

The attitudes towards digital learning of the significant stakeholders – and specifically towards using Eduten – were evaluated through several surveys. The consensus was clearly positive, indicating that Eduten aligns well with the Uzbek education system and its needs. Some challenges related to infrastructure readiness were also noted.

- **School Managers** acknowledged Eduten as a good fit for Uzbek schools and recognized its potential to significantly improve the education system.
- **Teachers** expressed strong satisfaction with Eduten's positive impact on maths education. Their main suggestions were improvements in technical equipment and increased caregiver engagement. Overall, the teachers support Eduten's wider national adoption (scored 4.7 out of 5.0).
- **Teachers** also reported that the parents' attitudes towards Eduten were generally very positive (scored 4.5 out of 5.0).
- **Students** reported increased interest in maths, a better understanding of mathematical concepts, and an appreciation for effective teacher support using Eduten.

Key takeaways were that high-quality teacher training and support is vital for successful implementation, and that Eduten enables teachers to provide tailored support for every student regardless of their skill level. Its effectiveness suggests potential for broader adoption in educational settings, particularly in schools with conditions similar to those in this pilot.

It is hoped that this report can add to the global evidence base on digital learning using an EdTech tool that supports personalised learning and puts the teacher and pedagogy at the heart of technology's integration into teaching-learning.

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List of acronyms

AI	Artificial Intelligence
EdTech	Educational technology
GDPR	European Union General Data Protection Regulation
MoPSE	Ministry of Preschool and School Education (Uzbekistan)
PII	Personally Identifiable Information
STEM	Science, Technology, Engineering and Mathematics
TRILA	Turku Research Institute for Learning Analytics, a unit of the University of Turku
UNICEF	United Nations Children's Fund



Introduction

The Uzbekistan Ministry of Preschool and School Education seeks to build an education system that places great value on the contribution of educators, while simultaneously prioritizing student growth. To achieve this, MoPSE is focused on creating opportunities for teachers to obtain high-quality knowledge and advanced international experience in line with modern global education standards.

According to Sardor Radjabov, Uzbekistan's Deputy Minister of Preschool and School Education:

*"Over the past couple of years, we have been striving to integrate more technological approaches into the teaching and learning process, an essential requirement of our era. Instead of resisting new technologies, the best approach is to use them effectively to streamline the learning process and make it more interactive. I am confident that through joint efforts and collaboration with our international partners, we will be able to achieve significant results in this field."*¹

As part of its mission to support countries leverage high-impact and highly scalable EdTech tools to transform learning, the UNICEF Learning Innovation Hub partnered with UNICEF Uzbekistan and the Uzbekistan MoPSE to introduce the Eduten platform in a pilot project, as part of a broader pilot-iterate-accelerate-scale model.

Research was embedded in the pilot introduction of the Eduten platform in schools to measure the viability of using the platform in Uzbekistan, its impact on students' mathematical skills, and to inform decision-making on next steps for strengthening digital learning and integrating technology into teaching and learning. MoPSE led the implementation of the pilot with the support of Eduten and UNICEF.

¹<https://www.unicef.org/digitaleducation/blog/architects-learning-explore-digital-horizons-uzbek-education>

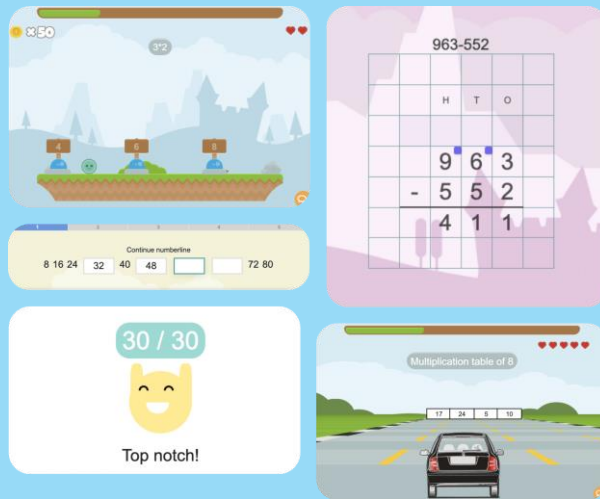
UNICEF also supported the piloting Eduten in Bhutan and Laos with the respective Ministries of Education and UNICEF Country Offices. See *Box 1: The Eduten platform* for more about the digital solution.

Box 1. The Eduten platform

Eduten is an AI-based exercise, assessment, and learning analytics platform. It is based on over 18 years of research at the University of Turku, and is currently used in over 70 per cent of all schools in Finland. The Eduten platform received the UNESCO ICT For Education prize in 2020 and the UNICEF 'Blue Unicorn' Award in 2022.

Eduten includes more than 200,000 tasks for grades 1-12 that are organized in weekly practice programs and aligned with the local curriculum. The primary users are teachers, who use it to coordinate pedagogical and gamified curriculum-based exercise activities for their students. In return, teachers receive automated, real-time learning analytics to help the teacher understand the current strengths and challenges of each student. Eduten can be accessed with computers, laptops, tablets and smartphones.

The Eduten platform is provided to millions of students in more than 50 countries by Eduten Ltd., a spin-off company of University of Turku. Find out more at www.eduten.com/about.



Overview of Uzbekistan

With a population of 36.8 million, the Republic of Uzbekistan is the most populous country in Central Asia, accounting for nearly half of the region's total population. The population is distributed fairly evenly between urban and rural areas.

The government prioritizes education, achieving high enrolment rates in general education (Grades 1-9) and consistently maintaining an average of 11-12 years of schooling over the past three decades. By 2015, Uzbekistan met the Millennium Development Goals (MDGs) for enrolment, and since then, efforts



Photo: © UNICEF Uzbekistan

have shifted towards enhancing quality and access across all educational sectors, aligning with the Sustainable Development Goals (SDGs) related to education².

With its strong commitment to the digital transformation of Education, Uzbekistan was selected in 2024 as one of six 'Global Champions' that will participate in the UNICEF Learning Pioneer Programme³.

Within the framework of the UNICEF Giga Initiative, Uzbekistan was able to expand its internet connectivity to at least 10 Mbps in almost all schools. UNICEF supported the process of mapping the locations and quality of internet connectivity in these schools in real time with an open-source visualisation of available connectivity. The tracking of school connectivity status supports the transparency and accountability of service provision, as well as the efficiency of state resources utilization. Since the adoption of the Digital Uzbekistan 2030 Strategy which aims to transform Uzbekistan into a digitally-driven economy by 2030,⁴ schools are also being equipped with computer labs.

Global learning crisis

Even before the COVID-19 pandemic, the world was facing a learning crisis, with nearly 6 out of every 10 ten-year-olds in low- and middle-income countries suffering from learning poverty—meaning they were unable to read and understand a simple story. The COVID-19 pandemic school closures and disruptions deepened the crisis, sharply increasing learning poverty to 7 out of every 10 ten-year-olds, and exacerbating the inequalities in education (World Bank, et al. 2022).

Without urgent action to reduce learning poverty, the world faces a learning and human capital catastrophe. If children do not acquire the basics of literacy together with numeracy and other foundational skills, the futures of hundreds of millions of children around the world, and their societies, are at grave risk.

² https://uzbekistan.un.org/sites/default/files/2022-05/Edu%20Sit%20An_UNICEF%202022_0.pdf

³ <https://www.unicef.org/uzbekistan/en/stories/supporting-republic-uzbekistan-shaping-future-learning>

⁴ <https://strategy.uz/index.php?news=1518&lang=en>

When the COVID-19 pandemic struck, about 6.2 million learners in Uzbekistan experienced education disruptions. Inconsistent access to and ineffectiveness of distance learning modalities across student groups resulted in substantial learning losses, exacerbating existing inequalities in learning opportunities and outcomes. When schools reopened in November and December 2020, UNICEF advocated for inclusivity. This complemented the ongoing changes in the country's education system such as the curriculum reform, the increased use of learning assessment, teacher training on inclusive education, and emphasis on tailoring instruction in the classroom for students at different learning levels.

To assess and compensate for the learning losses, the Government, with UNICEF support, developed blended learning programmes as well as individualized learning remedial and catch-up programmes, which are currently being rolled out. These programmes aim to remedy lost learning and reorient instruction in the long-term, with a focus on grouping and teaching students according to their learning levels. UNICEF provided support to identify priority learning outcomes and metrics for success, assess learning loss and knowledge gaps, and design catch-up plans for students.⁵

Digital transformation to help address the learning crisis

Digital transformation has huge potential to improve the learning outcomes of students (Kurvinen, 2020).

When applied properly and with care, modern digital tools can revolutionise traditional educational methods and enhance student engagement, collaboration and access to knowledge. It involves leveraging digital tools and devices, such as online learning platforms, educational apps, and AI to create immersive and personalised learning experiences.

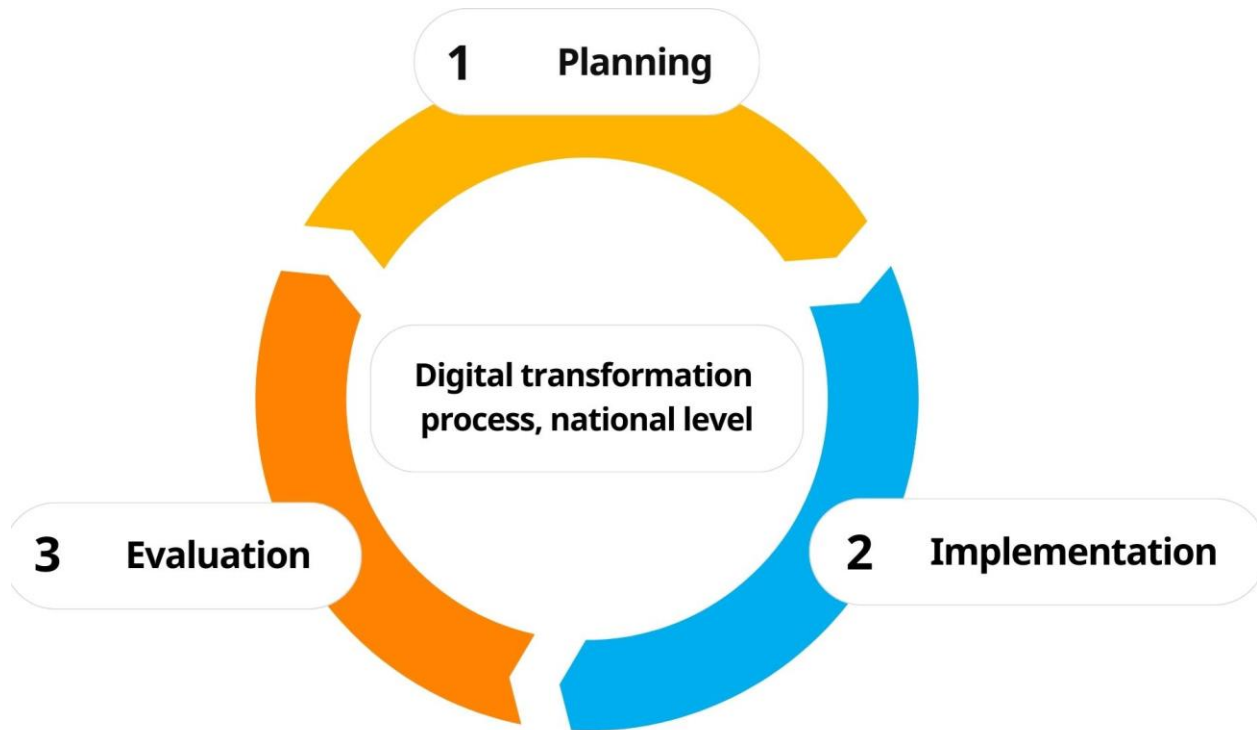
Digital transformation in education refers to the comprehensive integration of technology into all aspects of the learning and teaching processes in order to radically improve them.

Digital transformation enables educators to

- adopt innovative teaching approaches that easily facilitate remote and blended learning;
- customise learning paths to cater to individual student needs;
- gain a deeper understanding of the learning processes of individual students through learning analytics; and
- empower learners with essential digital skills required for the future.

⁵<https://www.unicef.org/media/107911/file/Curriculum%20reform%20to%20meet%20the%20individual%20needs%20of%20students%20%28Uzbekistan%29.pdf>

By embracing digital transformation with the right enabling conditions, education becomes more accessible, interactive and adaptable, fostering a dynamic and inclusive learning environment that prepares students for the challenges and opportunities of the digital age.



Digital transformation isn't a single, isolated action or phase that can simply be finished and completed, and there are many tools and methods (such as the emerging area of generative AI [Holmes, et al., 2023]) that can be applied. Digital transformation is a continuous cycle involving meticulous planning, practical implementation, and consistent evaluation. For it to be effective, successful and cost-efficient, digital transformation must include the entire educational infrastructure. This requires that the needs, desires, and demands from all layers of the educational system be heard and taken into account.

It is imperative to engage everyone, from the government to the students, parents, and all other stakeholders in between. Furthermore, it is crucial for all parties to comprehend the purpose behind the digital transformation and to recognize the personal benefits they stand to gain from it. There is compelling evidence supporting the advantages of digital learning (e.g., Kurvinen, 2020), but without appropriate implementation, training and resources, these benefits may not be fully realized.

Methodology

Evidence generation was embedded in the pilot launch of the Eduten platform in schools in Uzbekistan to assess its viability in the country, impact on students' mathematical skills, and to inform decision-making on next steps for strengthening digital learning and integrating technology into teaching and learning. This is consistent with the UNICEF Global Learning Innovation Hub's 'modelling to scale' approach, starting with a small-scale pilot, learning and iterating before expanding the coverage of implementation.

Specifically, the research sought to:

- Measure how use of the Eduten platform in schools impacts student learning outcomes in mathematics;
- Assess stakeholder attitudes – teachers, school managers and students – to the use of the Eduten platform;
- Document and assess the day-to-day usage of the Eduten platform, focusing on both the quantity and quality of student engagement as a key metric for Eduten's usability in the Uzbekistan context and how well it fits in the existing routines of the school;
- Identify lessons learnt and good practices to inform next steps after the pilot.

The Uzbekistan Eduten pilot project started in late 2023, kicking off with the training of teachers and school managers from the schools where the Eduten platform was used. The process for the selection of schools is detailed below. At the core of the pilot are 12 weekly digital mathematics lessons using the Eduten platform. Every week, the teachers opened a new set of digital exercises for the students, and the students worked on them during class, and also – optionally – at home. The maths exercises were curated and aligned with the national mathematics curriculum by MoPSE.

A total of 1,046 Grade 5 students in 17 schools in the Tashkent area participated in the pilot. They were divided into two groups: the **treatment group** covering 17 schools (N=527) replaced one mathematics lesson a week (45 minutes) with Eduten, while the **comparison group** (N=519) used only traditional learning methods and no added instructions. Both groups received the same amount of maths instruction. The groups were tested before and after the 12-week period.

The data collection was organized into three main components:

- Pre- and Post-tests: Measuring students' learning outcomes;
- Surveys: Assessing the attitudes of management, teachers and students;
- Platform Activity Analysis: Monitoring the day-to-day usage of the Eduten platform.

Each of these methods is detailed in the following subsections.

MoPSE was responsible for selecting the participants for the pilot and creating the test used to measure the curriculum-aligned mathematical skills of the students. The selection process was not randomised. Eduten provided quality assurance review to the mathematics test.

Evidence generation design and framework

The whole pilot project ran for 15 weeks, including weekly digital mathematics lessons using the Eduten platform from weeks 2 to 15 (a total of 12 weeks). Schools were on holiday during weeks 7-9 (school break started in the middle of week 7 and ended in the middle of week 9).

The research component of the pilot was structured as an intervention study with treatment and comparison groups, followed by a typical quasi-experimental design with a limited budget and scope. The design limitations meant that certain geographic or personal background variables were not collected or included in the analysis. Eduten is compliant with the European Union General Data Protection Regulation (EU GDPR). The platform and the surveys conducted did not collect personally identifiable information (PII) from participants. Only the maths class teacher had interactions with participating students, and Eduten personnel had no direct contact with the students during the whole pilot implementation period.

Schools in the Tashkent area were chosen taking into consideration infrastructure requirements ensuring the availability of devices and connectivity, which is a requirement for using Eduten. Proximity for ease of monitoring given a short pilot duration was also a consideration. It is recognized as well that the Tashkent area might not be representative of the conditions in other parts of the country, especially in the rural areas although two of the school represent typical rural area schools.

Teachers in the treatment group had a three-day training and oversaw the use of Eduten among their students for one lesson per week (45 minutes + homework) throughout the pilot duration. No additional classroom instruction was provided to students in the treatment group during the intervention. Furthermore, students were assigned homework from the Eduten platform in addition to their classroom lessons. Students in the comparison group continued receiving mathematics lessons from their teacher with no additional intervention.

Both groups took identical assessments at weeks 2 and 15 to establish a baseline and measure changes in student mathematical learning performance.

Figure 1. The pilot research timeline

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Training	3-day training workshop			Online Q&A session					Feedback session						
Testing		Pre-test										Survey collection			Post-test
Intervention		Weekly Eduten lessons						School holiday	Weekly Eduten lessons						

The use of Eduten in the treatment schools spanned a 12-week period, from 13 November 2023 to 18 February 2024. This period was preceded by a three-day training workshop for teachers and school managers from the treatment schools, and the pre-test covering students in both treatment and comparison groups. After the 12-week implementation of Eduten, a post-test in both treatment and comparison schools was conducted to measure the impact of the intervention on student maths learning outcomes.

Participant selection and description

The sample consisted of 1,046 fifth graders from 34 classes covering 17 different schools. The schools were selected by MoPSE to ensure a diverse and representative sample. 17 Grade 5 classes using the Eduten platform formed the treatment group, while another 17 Grade 5 classes served as the comparison group for research comparison. Students were divided into a treatment group (N=527) and a comparison group (N=519). Both the treatment and comparison classes were selected from the same school. The same school was favoured for the practical reasons of testing and possible school visits, but also to ensure a similar student base.

The school selection for the pilot was based on three key criteria:

1. The willingness to commit to the pilot, including teacher preparedness to make slight adjustments to their schedule and possibly commit to extra work related to the pilot;
2. The availability of devices for students and a good internet connection; and
3. The number of students in each class.

Each class had their own class teacher, which limited the spillover effect between the treatment and comparison groups. If there was any spillover, it could possibly decrease the difference between the groups and thus hinder any possible findings. Classes with similar academic performance were selected to ensure that no class across both the comparison and treatment groups was already more advanced than the other. No other observations were made around comparable characteristics between the two participant groups.

It should be underlined, that the control and treatment group selections were done based on the factors mentioned above, and the assignment was not random.

The schools selected for the pilot are relatively well-equipped considering connectivity and device availability. 15 schools had computer labs with computers and network connections, and two of the schools represent typical rural area schools with sub-optimal equipment and connectivity. In addition, many students used Eduten with their personal smartphones and other digital devices during the pilot.

In total, there were 505 females, 449 males, and 92 students of unknown gender in the data. Students with unknown gender were excluded from the gender-specific analysis but included in all other analysis. Students who did not attend both the pre- and post-test, or who scored zero points on the Arithmetic Fluency test, were omitted from the analysis. Students scoring zero points are assumed to have disengaged from measurable participation in the test, particularly in the Arithmetic Fluency test, where even minimal engagement typically results in at least some points. After discarding the data of 169 students, there were 251 males and 212 females in the treatment group and 222 females and 192 males in the comparison group. The treatment group has more male students than female students, while the comparison group has more female students than male students. Note that there were 92 students of unknown gender in the data. Students with unknown gender were excluded from the gender-specific analysis but included in all other analysis

Table 2 below summarises the type of devices and operating systems used by students to access Eduten. Most students (73.1 per cent) used a mobile device, including mobile phones and tablets, to use Eduten. The schools had computer labs with computers. The high number of mobile devices suggests that many students used personal devices to access Eduten. For mobile use, Android devices were the most popular by far, with 71.33 per cent of students using them at some point in the pilot.

Table 2. Distribution of devices and operating systems that were used to access Eduten

Device	Portion
Android	71.33%
iOS	1.79%
Windows	21.99%
Mac	2.04%
Linux	2.86%
Mobile	73.1%
Desktop	26.9%

Note: All students could access the platform with several devices, hence the total percentage is more than 100 per cent.

Test design

Two different tests were used to measure students' mathematical abilities. First, the Arithmetic Fluency test, or the three-minute test, was used to assess how quickly and accurately students could solve arithmetic problems before and after using Eduten.

The second test was the Mathematics test. This test was developed together with MoPSE and Eduten, ensuring it matched what students learn in their regular maths classes. Both tests were administered as pen-and-paper tests to ensure equity between the groups and not to favour the treatment group. For the same reason, MoPSE assumed the main responsibility of the test design. The test is designed to measure the students' mathematics skills and knowledge based on the curriculum learning objectives for Grade 5.

During the teacher training, it was emphasized that these tests are not high stakes and not at all linked to – or should not be seen as being linked to – teacher and school performance. Both the Arithmetic Fluency and Mathematics tests were administered by the respective maths teachers of each participating class. Eduten personnel did not have direct contact with students at any point of the pilot.

Arithmetic Fluency test

The Arithmetic Fluency test (three-minute test) measures how many one-digit basic arithmetic facts, or simple calculations, students can solve within a three-minute span. In total, there are 160 calculations in the test. The maximum score from this test is 160. This test has been developed at the University of Turku and used in multiple previous studies (e.g. Kurvinen, 2020). Good arithmetic fluency is linked with the usage of flexible problem-solving strategies and helps students' understanding on more advanced mathematical topics. (Varol, et al., 2007; Verschaffel, et al., 2007).

The Arithmetic Fluency test is not grade-specific. The higher grades usually complete more tasks than the lower grades. For this pilot project, the absolute number of tasks solved is not the focus, but rather the change between pre- and post-test.

Arithmetic fluency is not a direct competence mentioned in the national curriculum. It is a secondary skill with which the indirect impact of using the Eduten platform on broader arithmetic skills can be evaluated. It is expected that lower improvements in this test will be seen compared to the Mathematics test. Arithmetic fluency is, however, a critical skill needed when completing more complex arithmetic tasks later.

Mathematics test

The Mathematics test assessed students' knowledge and comprehension of topics covered in the local mathematics curriculum, which were taught over the course of the 12-week intervention.

The test contained 15 items (exercises), of which 11 were multiple-choice questions, and four were open-ended questions. The third item in the test had four questions. The maximum score of the test was hence 18. Items five and seven were detracted from the pre-test (see the 'Data Analysis' section for details), making the pre-test maximum score 16. The topics covered in the test included area, perimeter, angles, coordinate system and probability.

The post-test utilized the same topics and template as the pre-test; however, the questions were adjusted to be slightly more challenging in accordance with the requirements of MoPSE, who specifically designed this test for the pilot.

Data analysis

The post-test results of the Mathematics test were relatively low compared to the test maximum score - an average of 10.17 out of the maximum of 18. This might indicate that the test was difficult, and that students are not able to meet the curriculum criteria. This is likely due to students failing to master the fundamentals in the previous grades. This is in line with national assessments and captures the learning gap among students. Due to the low scores, however, the test results may not capture the full impact of the pilot.

The reliability of the measurement was assessed using Cronbach's alpha and omega. Alpha indicates acceptable reliability for the post-group, but the pre-group's alpha is lower (pre: $\alpha = 0.63$; post: $\alpha = 0.71$). Omega coefficients for one-factor solution (pre: 0.66; post 0.71) are almost as high as for 2-factor solution (pre: 0.68; post 0.72).

Based on the results of the item-total correlations, two questions with the lowest item-total correlations were removed from the pre-measurement. Question 5 had an item-total correlation of 0.24, and question 7 had a correlation of 0.010, both of which detracted from the overall reliability. They also had the lowest correlations with the other questions. In the post data, none of the questions were removed. The questions in the pre- and post-tests are different. The post-test questions did not have the same problems as in the pre-test. New Cronbach's alpha and omega for the pre-data were slightly higher after moving questions 5 and 7 ($\alpha = 0.67$, 1-factor omega = 0.67). All the analyses with the pre-data after this have been done without questions 5 and 7.

The statistical analysis was performed to better understand how different factors influence the results of a study, especially when comparing groups like treatment versus comparison. Exploratory and confirmatory factor analyses were used to uncover patterns in the data and ensure the questions were consistently measuring what they were supposed to. Testing for measurement invariance helped ensure that the results were comparable across genders. Finally, statistical tests like analysis of covariance (ANCOVA) and Tukey's Honestly Significant Difference (HSD) were used to compare groups and measure the impact of the treatment while controlling for other variables. This thorough approach helps ensure that the findings are both valid and reliable.

An underlying factor structure for the questions in both pre- and post-measurements was attempted to be found using exploratory factor analysis (EFA). Based on the results from parallel analysis and scree plots, 1 to 5 factors were tested, but none of the multiple-factor solutions yielded a clear factor structure. Therefore, a one-factor approach was chosen, and a confirmatory factor analysis (CFA) was conducted to ratify the structure. Mixed fit indices were exhibited by the model with the pre data with $\chi^2(65) = 219.263$; $p < .001$; Comparative Fit Index (CFI): .830; Tucker-Lewis Index (TLI): .796; Root Mean Square Error of Approximation (RMSEA): .052; Standardized Root Mean Squared Residual (SRMR): .047. Similar results were observed with the post data with $\chi^2(90) = 315.774$; $p < .001$; CFI: .803; TLI: .770; RMSEA: .054; SRMR: .049. In both datasets, low CFI and TLI values (<0.9) were indicative of poor fit, but low RMSEA and SRMR values (<0.08) indicated a reasonable fit.

The measurement invariance of the CFA model was tested to assess the consistency and comparability of a measurement model across gender. Results are presented in Table 1.

Table 1: Measurement invariance across gender

Time	Model	CFI	RMSEA	Δ CFI	Δ RMSEA
Pre	Configural	0.816	0.056	NA	NA
Pre	Metric	0.803	0.055	-0.013	-0.001
Pre	Scalar	0.806	0.053	0.003	-0.02
Post	Configural	0.778	0.059	NA	NA
Post	Metric	0.782	0.056	0.004	-0.003
Post	Scalar	0.767	0.056	-0.015	<0.001

Statistical analyses included an ANCOVA examining the impact of group (comparison vs. treatment) on post-test total scores, controlling for pre-test total scores and gender with items 5 (fraction) and 7 (area) excluded. Assumption of normality of residual was inspected visually, assumption homogeneity of regression slopes with interaction tests and assumption of homoscedasticity of variances with Levene's test. Additionally, Tukey's HSD test was performed to assess mean differences in total scores between treatment and comparison groups at the final assessment. Cohen's f statistics were employed to assess the effect size of differences between group means. By multiplying Cohen's f by two it can be transformed to Cohen's d (Cohen, 1988).

Not all participating students were able to attend or complete both the pre- and post-test, leading to some gaps in the data, though the number of such students was moderate. All students, who did not a) complete both tests, b) were marked absent, c) received 0 points from the three-minute test, or d) were labelled in a different group in pre- and post-test, were omitted from the data. The three-minute test contains easy one-digit arithmetic calculations, which are learnt in the 1st grade. If a 5th grader does not complete a single calculation correctly in three minutes, it is assumed to be a recording error or a

disengagement. Also, if there was any data missing on a particular student, the data would be discarded from the analysis. In total, 169 students altogether from both groups were excluded (64 students from the treatment group and 105 from the comparison group).

In the three-minute test, multiple classes got full or close to full scores (160 points). This indicates that the test was done without a time limit. Despite completing the test without the time limit, it was decided to include all data points. The same person conducted the test both for the treatment and comparison classes, likely repeating the same mistake for both groups.

Survey implementation

In addition to measuring learning outcomes, understanding the opinions and attitudes of stakeholders in this pilot is crucial when considering the scaling of digital learning solutions. Teachers, principals and/or vice-principals (otherwise noted as 'management' or 'school managers') from the treatment schools were surveyed twice during the pilot: once following the initial training workshop and again at the end of the pilot. Students were surveyed once at the conclusion of the pilot. All the surveys were anonymous, and no PII data were collected.

The survey questionnaires were collaboratively designed by Eduten and MoPSE. Surveys were conducted online using Google Forms. The student surveys were anonymous, although school names were collected in the survey. Teacher and management surveys also asked for respondents' email to track who answered the survey. All results are reported anonymously.

The response rates for each group were as follows:

- Training survey: 34 responses (100 per cent);
- Teacher Survey: 34 responses (100 per cent response rate). An unknown number of people from the management mistakenly answered this survey as well, instead of the separate 'Management' survey provided;
- Student Survey: 379 responses (73 per cent response rate).

All school managers responded to the teacher survey, while only half of them responded to the 'Management Survey' as well. The 'Management Survey' results are therefore discarded, and 'Teacher Survey' results are handled as combined teacher and management responses.

Comparison group teachers, students or management were not included in the surveys.

Localisation of Eduten mathematics exercises for the Uzbek context

A critical component of the project was localising the Eduten digital platform maths exercises to be used during the pilot to align with the national mathematics curriculum, standards and learning objectives. This process started with mapping the Eduten maths exercises with the relevant maths lessons expected to be delivered during the pilot period based on the national curriculum. Once mapped, the relevant Eduten maths exercises were reviewed for localisation, with gaps identified.

After the content alignment, 16 lessons were translated into Uzbek. The pilot duration was 12 weeks, but four additional lessons were included to help teachers adjust the pace in which they are learning. Five new exercises were developed to fill gaps, particularly in currencies and angles. A total of 744 exercises were used for the pilot. The process of curriculum alignment, localisation and developing new exercises was completed within four weeks.

Feedback during the pilot was minimal, highlighting Eduten's adaptability. Issues like incorrect translation in a few exercises were promptly addressed, demonstrating the ease of customising lesson contents and the responsiveness to teacher reports.

As previously mentioned, a three-day teacher and school management orientation on digital pedagogy and the use of the Eduten platform was organized prior to introducing Eduten in classrooms.

Details of training workshop and implementation

This section provides an overview of the training conducted, regular monitoring and other key steps taken during the pilot to ensure the seamless integration of the Eduten platform into the weekly maths lessons of teachers in the treatment classes and maximise the use of the learning analytics data from the platform.

Training workshop for teachers and school managers

To prepare the teachers and school managers for the pilot, a three-day hands-on training workshop was conducted in Tashkent, Uzbekistan on 6-9 November 2023. A total of 17 Grade 5 classroom teachers were trained on the Eduten platform and the best classroom practices of integrating the use of the platform in the Grade 5 maths lessons based on Finnish pedagogy⁶, using the Eduten learning analytics, and how to support their students to use the platform. Each teacher participating in the training taught one treatment class.

⁶ Best practices based on 20 years of research and learnings from implementation in >70 per cent of schools in Finland.

Another 17 school managers from schools involved in the pilot participated in a parallel training, as they play a critical role in supporting their teachers. The training program included a track for management on how to conduct the pre- and post-tests, on monitoring the success of the teachers, and how to support teachers in driving the digital transformation project at their school.

In addition, two representatives from MoPSE and three from UNICEF Uzbekistan took part in the training, to effectively provide support in the monitoring and coaching of participating teachers and school managers. The training was conducted face-to-face to build trust and cooperation among the participants and the organizers of the project. The training agenda and full results of the feedback survey conducted at the end of the event are available in Annex 2.

Monitoring and using the Eduten Platform learning analytics

Teachers were trained on how to use the Eduten platform for one lesson a week (45 minutes) at school, and to assign homework to students using Eduten maths exercises for the duration of the 12-week implementation period. During these 12 weeks, the teachers opened a set of digital exercises for students every week, who worked on them during class, and optionally at home as well. The students would achieve a digital 'trophy' each week by completing enough exercises successfully. The teacher tracked the progress of each student through Eduten's learning analytics and provided support and differentiation for each student as needed.

The pilot's success also depended on the use of the platform by the teacher during the maths lessons, and how students used the maths exercises in class and at home. This required regular monitoring using the platform's learning analytics dashboard where the performance of all participating classes and schools can be tracked. Monitoring the uptake focused on both the quantity and quality of student activity. The core MoPSE team leading the implementation had access to the Eduten platform dashboard, allowing for real-time monitoring.

The pilot implementation was enhanced through regular weekly meetings between the core team of MoPSE, Eduten and UNICEF, along with the establishment of a dedicated support line for MoPSE, school managers and teachers. This approach enabled effective collaboration and learning among all parties involved. The weekly monitoring meetings focused on understanding and applying analytics, fostering cooperation and sharing vital information. Initially, efforts were made to ensure that all teachers were properly onboarded and could use the Eduten platform seamlessly. Subsequently, the focus shifted to assessing the quality of their activities. These efforts aimed to facilitate both immediate improvements and future scalability, beginning with empowering teachers to effectively use the platform and progressing to address challenges faced by all the students in the class, reflected as 'schools' in the Eduten dashboard.

Teachers and school managers from the treatment schools were actively engaged by recognizing the achievements of high-performing schools and sharing their best practices. One school reported some difficulties with devices, but after hosting an event for parents and caregivers, many caregivers allowed

their children to use the family's device – or even purchased a new one. Schools did not report any other issues with infrastructure. Additionally, special online clinics were organized for all teachers and school managers, providing extra support and enabling the sharing of best practices and success stories.

A shared WhatsApp group for participants and the monitoring team was created for seamless communication, and struggling schools were contacted directly by phone. Multiple school visits during the pilot were also organized to a few schools for the monitoring team to experience the successes and challenges of the treatment classes.

These regular monitoring meetings, as well as online clinics with the teachers and school managers, were crucial for identifying and addressing implementation challenges, ultimately contributing to the pilot's overall success. The activity data collected from the platform is reported in the results section of this report, demonstrating the adaptation of the platform and the engagement of teachers and students.

The leadership of MoPSE throughout the pilot, and regular communication with teachers and school managers were also critical components of the implementation.

Limitations in research setup

This study did not measure or analyse the effect of various background variables of the schools, teachers or students. However, the sample size of this study (N=1,046) is substantial compared to a typical study covering the use of IT in learning (e.g. in Chauhan, 2017, the average sample size is 150 students). However, compared to the population of Uzbekistan (36.4 million in 2023), the sample size is modest. The schools were chosen from the Tashkent area, and there were various schools with both treatment and comparison classes (with no significant difference in pre-test scores) that should further mitigate the effect of the background variables. Two of the schools are classified as rural schools. However, while this means that the students had a similar background, all the results might not be transferable 'as is' to rural areas. It should be also noted that assigning classes to treatment and comparison was not randomized.

A 12-week pilot implementation period is relatively short, but still long enough for the data analysis to strongly suggest a statistically significant correlation with a medium effect size between the intervention and the improvement of student learning results. Furthermore, the 12-week period was long enough to test the suitability of the methodology in real classroom use. However, while subjective surveys are very useful in understanding stakeholder perceptions, they are subject to various biases (e.g., social desirability bias). Complementing these with more objective measures or qualitative data, like classroom observations or interviews, could provide an unbiased view of Eduten's impact and implementation. Future studies should consider widening the scope to dive deeper into the implementation process, test design and data analysis.

There is always the concern of the novelty effect of the new methodology increasing the motivation of the treatment students. On the other hand, 12 weeks of implementation (spread over 15 weeks) is long enough for students to lose interest purely based on the novelty effect. 12 weeks is also a short time for a teacher to effectively adapt a new methodology in the classroom. One could argue that introducing a new method could also cause some distraction and thus hinder the results for the treatment group.

Learning and teaching are complex processes influenced by many factors that affect student performance and well-being. Using a treatment/comparison and pre-test/post-test design aims to reduce the influence of external factors and focus on evaluating Eduten's effect on the students' numeracy skills. While there can still be other factors influencing the students' performance in both treatment and comparison groups, the large number of participants typically makes them insignificant.

Despite the 'Mathematics' test being developed in collaboration with Uzbek educational authorities to ensure a good match with the national curriculum standards, it posed some challenges for students in both the treatment and comparison groups. The scores remained relatively low even after the intervention, indicating that all participating students (comparison and treatment) did not acquire the knowledge and maths skills they were expected to acquire by Grade 5 as demonstrated by the overall low test scores. The increased difficulty level for the post-test further highlights this effect, reducing improvement further compared to the pre-test. The relatively low scores illustrate accumulated learning gaps from the first four years of primary education, including missed learning during the COVID-19 pandemic.

The relatively low scores means that the full effect of the pilot might not be visible in the data. The test consisted mostly of multiple-choice questions. In a difficult test there is always a chance of guessing, which might create noise in the data. The low scores could also indicate a mismatch between the curriculum taught in schools and the test. This could further suggest a widened learning gap after the COVID-19 pandemic due to school closures as evidenced as well by global learning poverty data.

Even after discarding two exercises from the pre-test to improve the internal consistency and reliability of the test, Cronbach's alpha remains on a modest .63 level, and the post-test on an acceptable 0.71 level. While the effect of Eduten on the test results can clearly be measured, the results could be underwhelming due to the floor effect seen on the test.

In the three-minute test there was a human error on how the test was conducted with multiple classes completing the test without a time limit when the test was supposed to be only for three minutes. However, the same person conducted the test for both treatment and comparison groups, repeating the same mistake for both groups. For this reason, the data was kept in the analysis. While this leads to the mean of solved calculations being relatively high compared to the usual fifth grade results, the difference between the groups follows a typical trend.

The survey responses from teachers and management are analysed together because management mistakenly completed the survey intended for teachers. As a result, some questions may show conflicting results, although the responses from management and teachers have been very similar in the other UNICEF-supported Eduten pilots in Bhutan and Laos.



Photo: © UNICEF Uzbekistan

Pilot findings

This section presents the pilot project's key findings across three main areas of investigation. First, the report explores students' learning outcomes in mathematics by comparing results between treatment and comparison groups. Second, the surveys provide insights into the attitudes and perceptions of management, teachers and students regarding the use of Eduten.

Finally, the Platform Activity Analysis examines the day-to-day usage of the Eduten platform, focusing on both the quantity and quality of student engagement. Lessons learnt and good practices to inform next steps after the pilot are reflected in the Conclusion and recommendations section below.

Measuring students' learning outcomes in mathematics

The pilot project focused on evaluating how well the Eduten learning platform works in improving students' learning outcomes in mathematics. The aim was to observe how students performed in mathematics and arithmetic tests before and after they used the Eduten platform. This was compared to a group of students who did not use Eduten but continued with their regular lessons. The group not using Eduten during the implementation period is called the **comparison group**, while the group using Eduten is called the **treatment group**. It should be noted that the treatment group did not receive more maths lessons than the comparison group; instead, one lesson per week was transformed into a digital Eduten lesson. A detailed description of the groups and their selections is given earlier in the section titled Participant selection and description.

Invalid data points from the results were omitted from the analysis (see section Data Analysis for details). In both groups, a small number of students were absent during either pre-test and/or post-test, or

scored a zero in the three-minute test. After omitting 169 students, the total final number of students used in analysis is 463 for the treatment group and 414 for the comparison group.

Arithmetic Fluency test

The Arithmetic Fluency test (three-minute test) measures how many one-digit basic arithmetic facts, or simple calculations, students can solve within a three-minute span.

In total, there are 160 calculations in the test. With one point per correct answer, the total maximum score from this test is 160. The results of the Arithmetic Fluency test are displayed in Table 3.

Table 3. Arithmetic Fluency pre- and post-tests results from the treatment and comparison groups

	Treatment (N=463)			Comparison (N=414)		
	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference
Mean	100.28	112.54	12.27	98.16	100.22	2.06
Std. dev.	37.67	37.89	34.20	40.61	41.62	35.76
Median	95	113	8	90	98	0

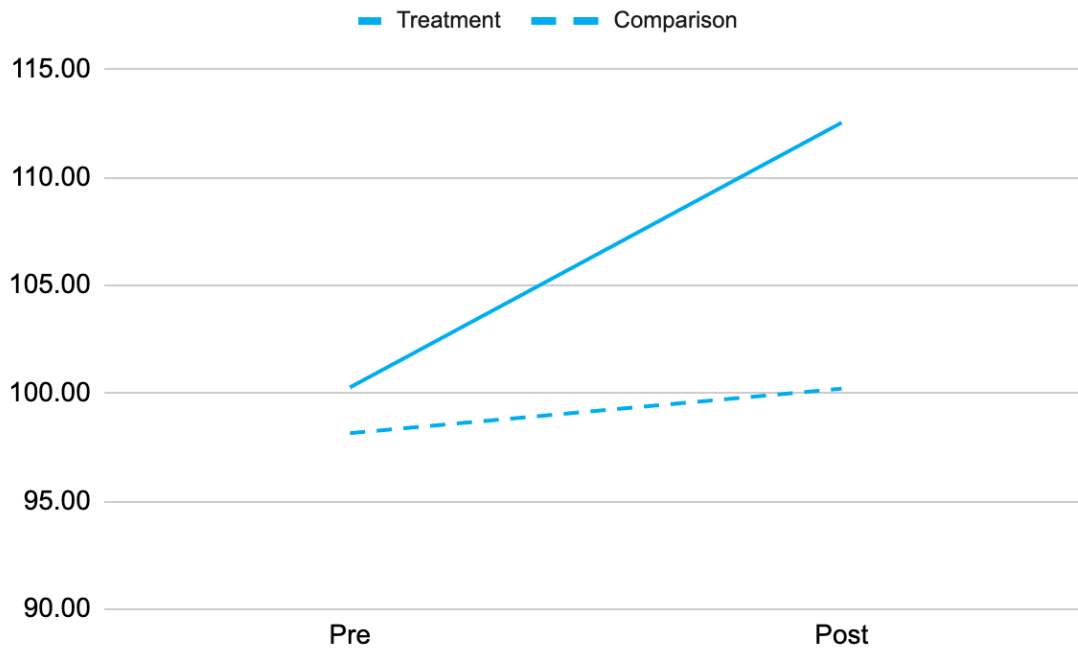
Note: The Difference was calculated only for students who took both pre- and post-test.

The *Difference* columns describe the difference of matched answers in the post- and pre-test (i.e. the result of subtracting a student's pre-test score from their post-test score). Hence, a positive difference means that the result was improved in the post-test. If a student did not complete a pre- or post-test, the difference was not calculated. It should also be noted that the table should be read to include a *median difference*, not a difference of medians.

The results from the pre-test indicated a minor advantage for the treatment group, yet this variation was not significant (calculated with two-tailed T-test, $p=0.42$; $p>0.05$). In the post-test, the gap widened, favouring the treatment group more clearly. The difference between the groups had now turned out to be statistically significant ($p<.001$, $p<0.05$), meaning that the treatment group had improved their result significantly more than the comparison group.

The overall mean scores for both groups are quite high because some participants went over the three-minute time limit. However, the results are still comparable since both the treatment and comparison groups either followed or didn't follow the time limit in the same way, depending on which school they were from. This ensures that any differences between the groups are not because of the time limit issue.

Figure 2. Improvement in the Arithmetic Fluency test between the treatment and the control groups



The improvement in the test is visualised in Figure 2. The treatment group improved their score by 12.3 points (12.2 per cent) between the pre- and post-test, whereas the comparison group improved by 2.1 points (2.1 per cent). The treatment group therefore improved their result by 10.2 per cent more than the comparison group.

A two-tailed independent samples T-test was conducted to compare the performance between genders. The results indicated no statistically significant difference in the mean scores between male and female participants. This was true for both the treatment and comparison groups, suggesting that gender did not have a significant impact on learning outcomes in either group. Both male and female participants performed similarly in the Arithmetic Fluency test. The students without reported gender were excluded from these analyses.

Mathematics test

The Mathematics test assessed students' knowledge and comprehension of topics covered in the local mathematics curriculum, which were taught over the course of the 12-week pilot. The maximum score of the pre-test was 16 (items 5 and 7 were omitted) and the maximum score of the post-test was 18.

Table 4. Mathematics test results from the pre- and post-tests of the treatment and comparison groups

	Treatment (N=463)			Comparison (N=414)		
	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference
Mean	8.60	10.17	1.56	8.58	8.66	0.08
Std. dev.	3.16	3.56	3.72	3.04	3.33	0
Median	9	10	2	9	8	3.64

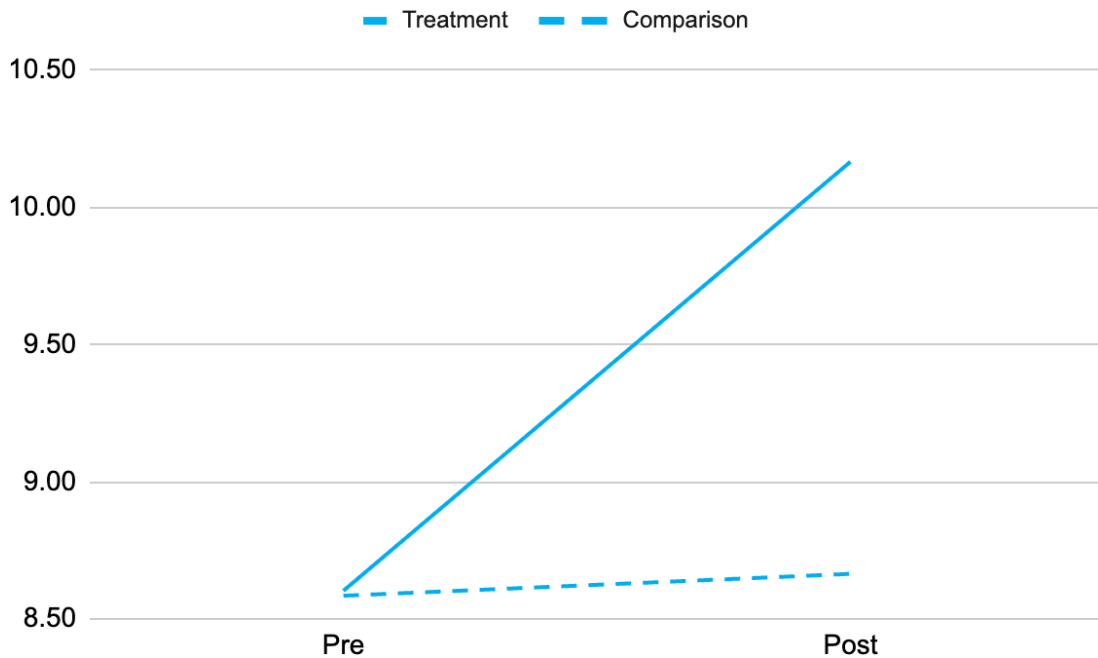
While there is practically no difference between the groups in the pre-test, there is a difference in the post-test in favour of the treatment group. This means that the treatment group had improved their results significantly more than the comparison group.

ANCOVA allows assessing the impact of the treatment while controlling for possibly pre-existing differences between the treatment and control groups. Assumptions of ANCOVA were met, as residuals seemed approximately normal based on a quantile-quantile (QQ) plot, interactions were non-significant (Group x Gender $F(1) = 1.81$, $p = 0.178$, Group x Pre score $F(1) = 0.78$, $p = 0.378$) and variances were equal across the groups (Levene's test $F(1) = 0.97$, $p = 0.324$).

The results of the ANCOVA indicated significant effects for the group ($F(1) = 47.05$, $p < 0.001$) and for pre-test total scores ($F(1) = 141.82$, $p < 0.001$). However, gender did not have a significant effect ($F(1) = 0.49$, $p = 0.483$). Tukey's HSD test revealed a significant difference in mean scores between the treatment and comparison groups (mean difference = 1.49, 95 per cent CI [1.06, 1.91], $p < 0.001$). For the two groups, Cohen's f was 0.21 (95 per cent CI [0.15, 0.28]), which corresponds to Cohen's d of 0.42.

These results mean that there was a significant difference between the treatment group and the comparison group, with the treatment group performing better. Students who performed well in the pre-test also performed better in the post-test, indicating that pre-existing knowledge plays a role in the outcome. A student's gender did not have a significant impact on the results.

Figure 3: Mean of the total score for pre- and post-measurement

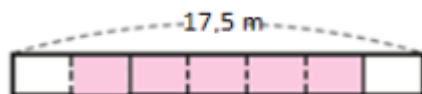


Note: Pre-total score does not include items 5 and 7.

The treatment group improved on average 1.56 points (18.2 per cent) from the pre-test, whereas the comparison group improved 0.08 points (0.9 per cent). The treatment group therefore improved 17.3 per cent more than the comparison group. Both groups demonstrated some improvement compared to their initial scores, indicating overall learning progress. However, the comparison group showed only minimal improvement between the pre- and post-test, falling short of the curriculum learning goals.

Among the post-test results for the treatment and comparison groups, question 6 showed one of the largest differences. Question 6 (Figure 4) was an open-ended fraction problem asking for the length of a coloured section, given the total length.

Figure 4: Question 6, what is the length of the coloured part?



In the treatment group, 48 per cent of students answered the question correctly in the post-test, while only 21 per cent of students in the comparison group got it right.

A student's gender did not have an impact on the results meaning both genders performed equally well in the mathematics test.

Surveys: Assessing the attitudes of management, teachers and students

In addition to measuring Eduten's specific impact on students' learning outcomes in mathematics, several surveys were conducted on the attitudes of the school managers, teachers and students towards digital learning – and Eduten in particular. The main purpose of these surveys is to map out the main developments that need to be addressed to ensure a successful rollout of Eduten across Uzbekistan. The results of these surveys provide many insights into the preparedness of management (combined with the teacher responses), teachers (N=34, 100 per cent response rate) and students (N=379, 73 per cent response rate) to adopt digital tools.

School managers view Eduten as a great fit for Uzbek schools, noting minor areas for improvement and an average satisfaction rate of 97 per cent across all questions. They recognize Eduten for its potential to enhance the overall effectiveness of the entire education system. They realize the value of Eduten in managing teachers and students, and acknowledge its potential to reduce the workload of the teachers. They further suggest a potential to increase Eduten's analytics utility for monitoring teacher and student performance at the school level.

School managers answered an open question: "How has Eduten impacted teachers, students, and your own work?" Most answers are very positive and well in line with the following quotes:

"This platform was very beneficial. It made it easier for the teacher to work. It is interesting and useful for the students. It is useful for me to follow and know the knowledge level of the students".

"It has been very effective in working with parents and involving them in the process to monitor what their children are busy with. It united the students of the class and strengthened friendly relations. We had less of boring and traditional lessons of teachers. Activity and creativity increased in the lesson. The main thing was to teach the students how to use the phone effectively in their spare time. The interest of other subject teachers increased."

Eduten has a highly positive reception among the teachers, who express strong approval and satisfaction with Eduten's impact on mathematics education. The average satisfaction rate of the teacher's answers was 93 per cent across all the questions.

To better understand the mindset of teachers, here are some quotes that answered an open question: "How has Eduten affected your teaching and students' learning?"

"It's a very good platform to cooperate with parents and encourage students to work independently, all my students have increased their interest, some of them even completed tasks ahead of time, helped their classmates, parents were also interested and worked together with their children. Thank you!"

"The compatibility of the topics in Eduten with our [lesson] plan led to very good results in working on it, that is, when I explained the theory of the topic, the students felt as if they had done a practical exercise in Eduten, and this platform was very useful."

In the eyes of teachers, Eduten had a positive impact on students' attitudes and mathematics learning performance, and the alignment of Eduten's content supported the curriculum used in the schools. The responses indicate that it seems using the platform also deepened the collaboration between students, teachers, and parents.

Students responded very positively to Eduten, noting improvements in their interest in maths, understanding of the mathematical concepts, and an increased interest and motivation for learning. Effective teacher assistance contributes to positive student reception.

Open responses to the question "How did you like using Eduten?" show similar trends as mentioned by management and teachers.

*"Each as a game is fun, cool, and highly beneficial in learning math.
It would be better if they were sent to other schools."*

"I liked more problems, questions, fun game tasks, more complex tasks, planning, etc."

"My interest in mathematics has increased and I am studying mathematics in depth."

"Math is more interesting [now]. The textbook is getting easier to understand."

At the same time, one student found the translation to be lacking in some exercises, important feedback to consider for future work.

"Incorrectly translated and incomprehensible questions are also found in Eduten tasks."

Students found it positive that Eduten provided more mathematical challenges than their normal mathematics lesson, and that implementing the platform into the weekly routine supported their learning in mathematics.

Overall, the feedback from management, teachers, students – and also parents – is positive and encouraging. Both teachers and school managers found that Eduten is effective in enhancing

mathematics education. All three groups found the schools' devices to be sufficient for using Eduten and are supportive of a wider adaptation of the platform.

Platform activity analysis: monitoring the day-to-day usage of the Eduten platform

How students use the Eduten platform, in terms of quantity and quality, is a key metric for evaluating the success of the pilot implementation. It directly indicates how successful each teacher was in driving their class to work on their maths skills in Eduten, how well Eduten fits into the existing routines of the school, and how effective the curriculum alignment is.

This section covers the activity data from Eduten based on how teachers used Eduten for one lesson a week (45 minutes) at school and assigned students to perform maths exercises using Eduten as homework. The activity data can be divided broadly into two categories: the *amount* of work and the *quality* of work completed. Metrics like time usage and number of tasks completed describe how much work was completed regardless of how many the student got correct or incorrect, or how many times exercises were tried. Trophies, scores and accuracy better describe the quality and outcome of the work. Often, both sides of the analytics are needed to make conclusions or predictions based on the data.

Eduten's learning analytics enables the comparison of various variables describing the performance and activity levels across participating schools. The following analytics offer insights into the discrepancies among different schools and their weekly achievements during the pilot. The schools in the graphs are ordered by the learning index (a calculated metric for overall student activity in the platform, their ability to fulfil goals, and accuracy) from highest to lowest, and this ordering is maintained in the subsequent charts.

Pair-mode

Eduten has a unique feature that allows two students to work together on one device. In this pair-mode, students take turns: one handles the device and enters answers, while the other solves the problems.

They can discuss and check their answers together, making sure they both understand the concept. After working together, each student can log into their own account and pick up where they left off.

Table 5. Number of students in treatment and control groups who completed the pre- and post-test

School	Submits made in pair-mode
School 11	32.87%
School 7	30.23%

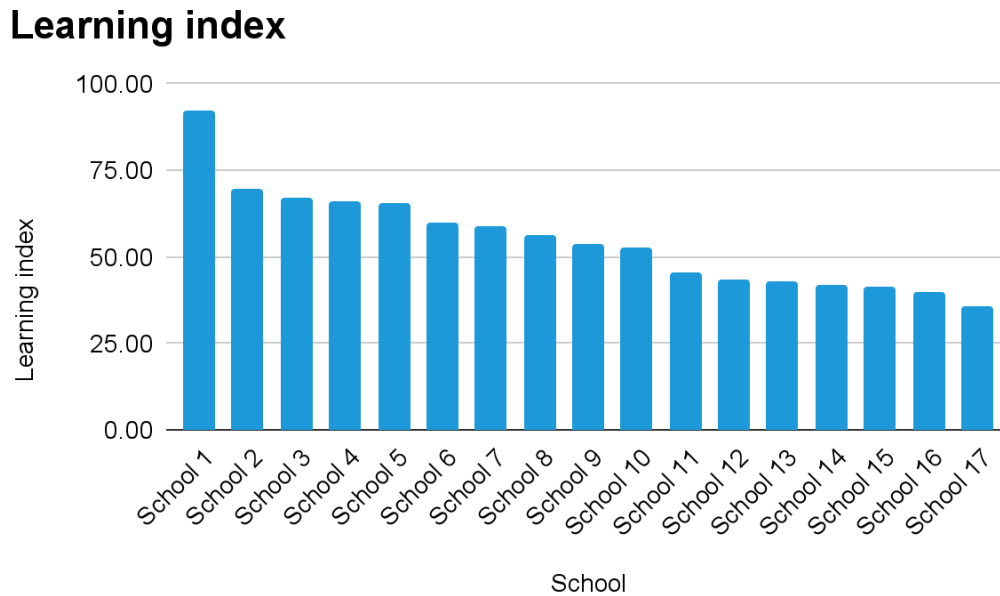
School 10	22.90%
School 15	12.84%
School 2	7.10%
School 1	4.57%
School 5	0.87%
School 6	0.71%
School 3	0.30%
School 8	0.25%
School 12	0.19%
School 9	0.18%
School 17	0.17%
School 13	0.10%
School 4	0.09%
School 14	0.08%
School 16	0.04%

Table 5 demonstrates that only 3 out of 17 schools substantially used the pair-mode feature in Eduten. Altogether, only 6 per cent of the submissions made during the pilot were done in pair-mode. This indicates that while pair-mode was useful and even necessary in some classes, most schools managed to arrange Eduten lessons by either having a 1:1 student-device ratio, or through using students' mobile phones. Using pair-mode did not seem to have a major impact on the post-test results. A key takeaway from this finding is that Eduten can deliver a strong learning opportunity even if there are two students working on one device during the weekly Eduten lesson.

Learning index

The learning index is calculated based on overall student activity in the platform, their ability to fulfil goals (achieve digital trophies), and accuracy. It shows the potential for improving students' maths learning outcomes in a class. The learning index is calibrated based on previous Eduten studies (e.g. Kurvinen, 2020). A learning index over 15 indicates a high probability of improving learning results. A zero learning index score predicts no improvement over traditional learning methods.

Figure 5. Learning Index of all participating schools



The learning index is higher than the recommended minimum 15 for all the schools. The average learning index is 54.88 (std dev. being 14.5). One school (School 1) reached a significantly higher level than the other schools. This school managed to maintain high activity and engagement throughout the whole pilot. Typically, a low learning index would be related to inconsistent routines in using Eduten. A major reason usually is the infrastructure; however, there might be other factors, like teacher's motivation and capacity, or support from management. In the Uzbek pilot schools, none of these are applicable as issues. Overall, the learning index shows good engagement and success among all schools that participated in the pilot.





School 1 shows a particularly good outcome in regard to the learning index. In this school, all the students had laptops to work on Eduten, the class specialised in mathematics, and the school arranged additional time for students to work on their homework on the school laptops. School 17 was one of the two schools lacking devices and connectivity, especially for homework. However, the third-best school, School 3, was also very similar compared to School 17. The difference shows the importance of the teacher's role and how it's possible to push the results up even with lacking resources. Schools 7, 10 and 11 had the highest use of pair-mode.

Trophies

Each student is expected to earn at least one bronze digital trophy every week. For bronze trophies, students are required to complete at least 50 per cent of the exercises in a lesson. Silver requires 70 per cent, gold 90 per cent and diamond 100 per cent. Failure to secure this trophy suggests that the student has not completed the tasks assigned by the teacher, which is analogous to not doing their homework. When students earn higher-level trophies such as silver, gold, or diamond, it demonstrates their

willingness to exceed the basic requirements and push their boundaries. Teachers are encouraged to motivate students to reach for higher trophies, especially those who effortlessly complete the bronze trophy weekly. The trophy correlates directly with the number of tasks completed. The more tasks a student completes, the more 'valuable' the trophy they will achieve.

Table 6. Trophies achieved during the pilot

				
Total	5,689	4,409	3,787	3,216
Share of students who achieved each week	77%	60%	51%	44%

The data in Table 6 clearly demonstrates student engagement in Eduten during the pilot. On average, most students completed the minimum requirement every week. This reflects not only a high level of engagement but also the effective implementation of the Eduten platform. A substantial number of students advanced to higher achievement levels. Almost half of the students achieved the diamond trophy, which represents the completion of all exercises, weekly.

The number of bronze trophies (50 per cent) earned each week per student serves as a strong indicator of how many students meet the minimum weekly goal. If the engagement percentage exceeds 100 per cent, it suggests that students, on average, secured more than one bronze trophy per week. This is possible if the students work on more than one lesson during the week.

Figure 6. Weekly average of bronze trophies achieved per student during the pilot

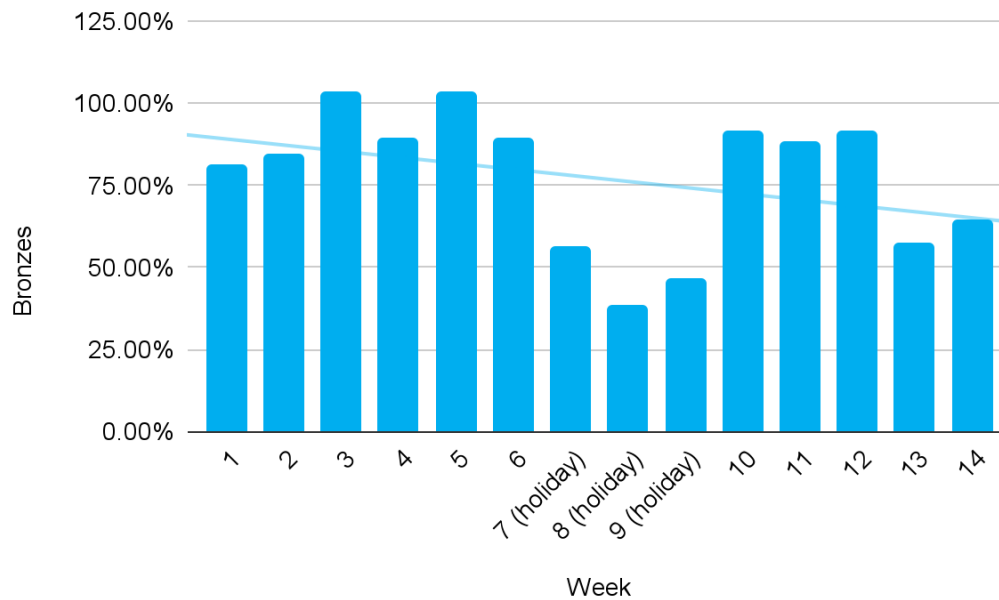


Figure 6 shows the average number of bronze trophies achieved per student for each week of the study. Typically, a bronze trophy indicates that at least 50 per cent of the available score was achieved. Numbers over 100 per cent reveal that some students were working on more than one lesson at a time during those weeks.

Before the school holidays, there was an increasing trend in the number of bronze trophies achieved by students. Even during the school break weeks, students still completed some trophies. After the school holidays, the activity level settled to the same level as before the school break. The last two weeks of the pilot show lower engagement. This is due to many schools finishing the designated pilot content earlier.

Accuracy

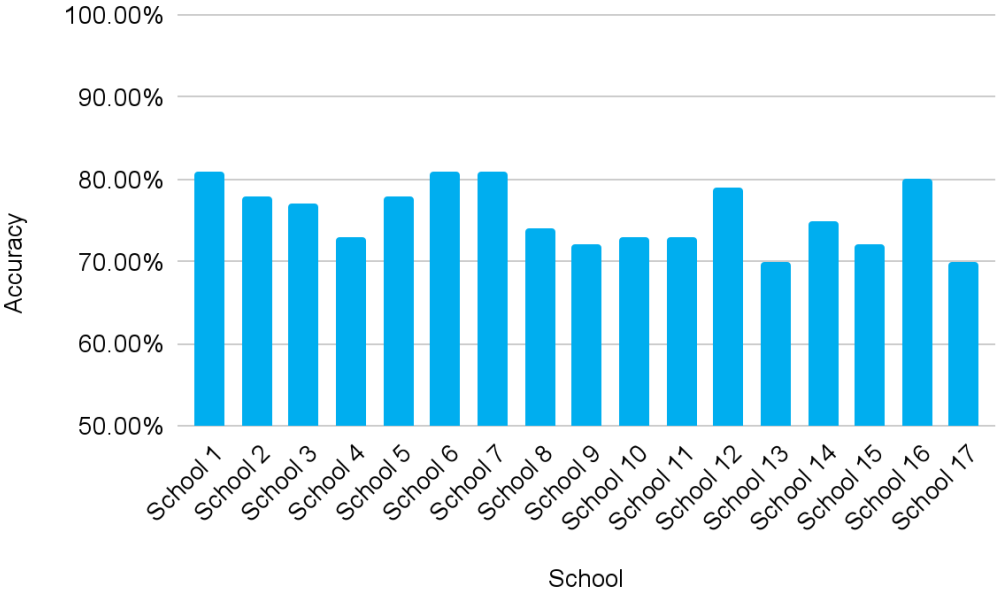
Accuracy reflects the ratio of correct to incorrect answers provided by students. Generally, this measure helps us gauge the overall difficulty level of exercises and their appropriateness for students. Ideally, the accuracy should range between 70 per cent and 90 per cent, with 85 per cent being the optimal level for achieving a flow state with sustained engagement, motivation, and enhanced learning outcomes through appropriate challenges (Nakamura, et. al, 2009).

If accuracy dips below 70 per cent, the exercises could be too challenging, potentially leading to frustration and anxiety. Conversely, if accuracy exceeds 90 per cent, the exercises may not be challenging enough. By following the differentiation actions that Eduten suggests, the teachers can easily fine-tune the actual difficulty level of the exercises on a per-student basis.

The average accuracy of the students in the pilot is 76 per cent. This is still in the recommended range, but on a lower side of the range. The range for accuracy in different schools varied from 81 per cent to 70 per cent (Figure 7).

Four schools achieved an average accuracy of 80 per cent or more. Rest of the schools had an accuracy between 70 per cent and 80 per cent. In the pilot 76 per cent of the teachers used the differentiation tools and suggestions provided by the Eduten AI to customise the content for students needing the personalisation. Even with this personalisation, however, the average accuracy indicates that the difficult level of the exercises is slightly challenging for the Uzbek students.

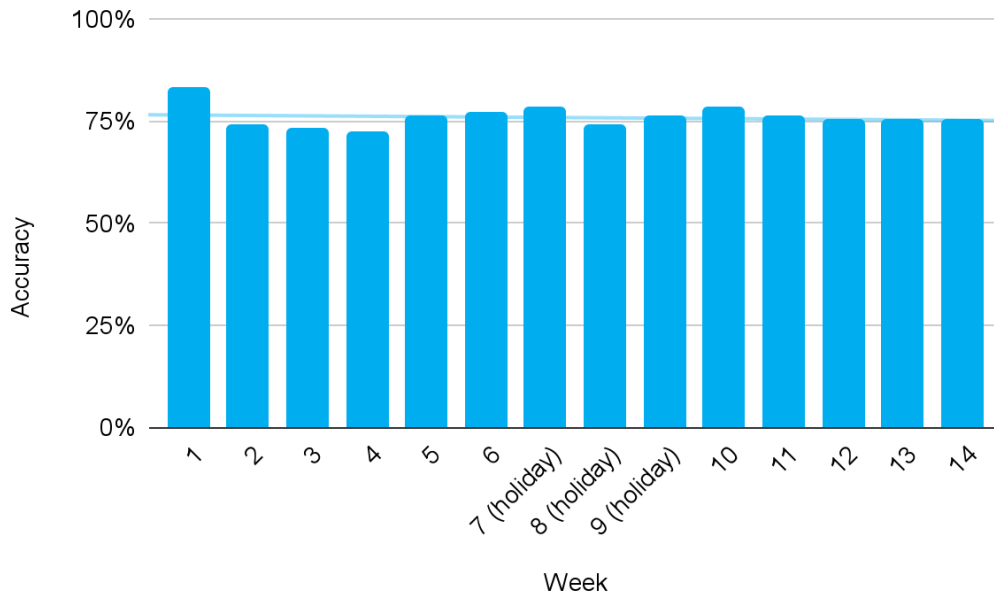
Figure 7. The Average accuracy in all schools participating in the study



It's important to remember that accuracy alone does not show how skilled the students are. This measure comes from practice activities. Making mistakes lowers the accuracy, but generally, when other metrics were considered, students were good at solving the problems.

Typically, weekly accuracy tends to stay relatively stable over time as long as the lessons match the students' skill level.

Figure 8. The average accuracy of all schools for each week of the study

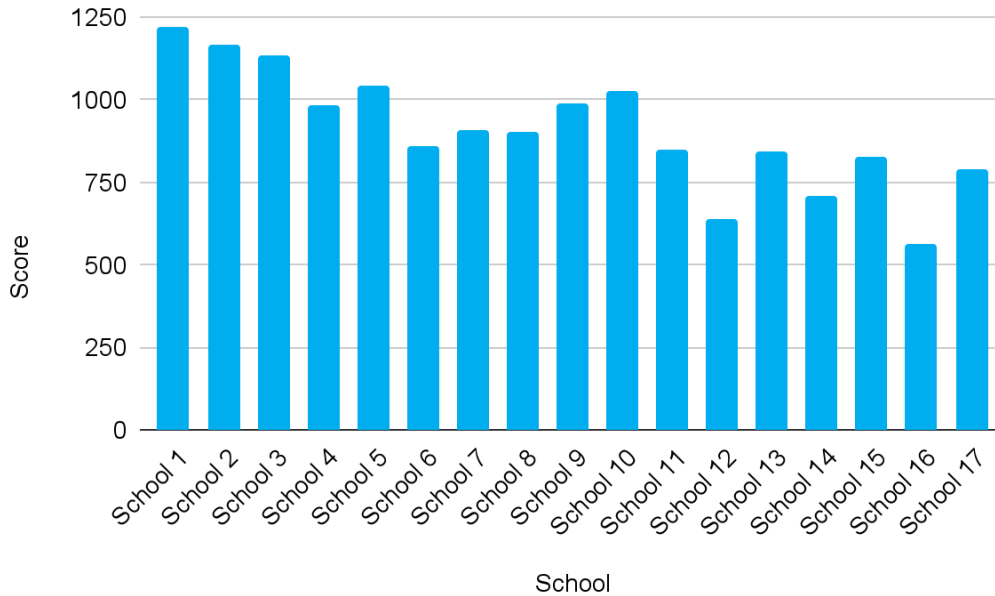


The data from the above graph indicates that the topic on week one was slightly easier for the students on average. The topic of the weekly lessons varied slightly from school to school, which means the exact topics cannot be pinpointed based on the data presented here.

Scores

Every correct answer a student provides in Eduten earns them points. Monitoring these scores per school provides a comprehensive overview of both the amount of work students are accomplishing and their level of success. The average weekly score per student in this pilot was 909 (std. dev. 181.3). The highest weekly score was 1,220 and the lowest was 561. The score is based on the correct answers provided by the students. Different lessons have slightly varying numbers of exercises and teachers have freedom to further customise their lessons by adding or removing exercises. The average weekly score between the schools provides an interesting insight into the amount of work completed relative to other schools.

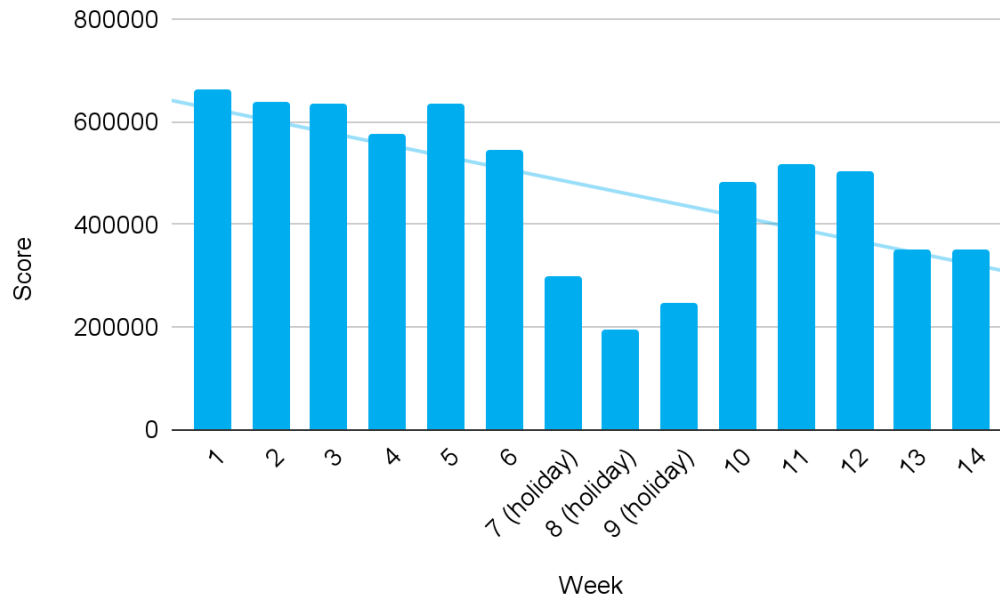
Figure 9. The average weekly score of all schools participating in the study



Scores are closely linked to the learning index, leading to similar outcomes in these two measures. Most participating schools perform considerably above the recommended level (>300), yet distinct differences exist among them.

Monitoring scores on a weekly basis provides a comprehensive overview of both the amount of work students are accomplishing and their level of success. While the number of exercises may vary from week to week, observing scores over an extended period allows us to identify trends.

Figure 10. The total weekly score in all participation schools combined for each week of the study



The declining pattern is something we usually see when students start to optimise their workload. However, in this case, the timing of the school break and the lower performance of the last two weeks emphasize this effect. Despite this, the average weekly score is well above the recommended minimum (300). The number of achievable scores also varies from lesson to lesson and week to week.

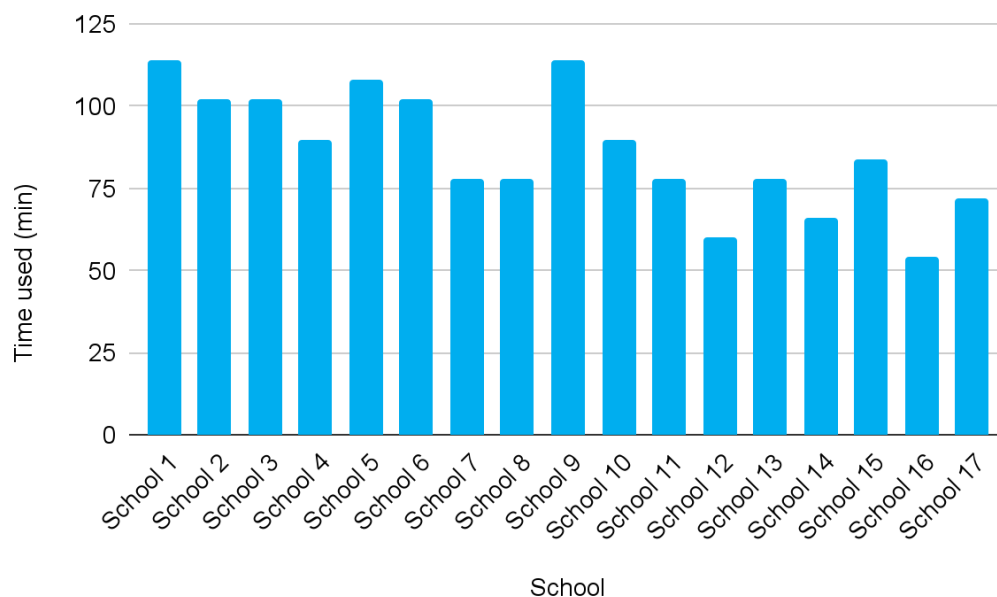
Time on task

Eduten keeps track of the time students spend on each exercise, from the moment they start until the moment they submit it. This effectively only captures the active learning time and does not account for the time spent exploring and selecting exercises. The minimum recommendation for using Eduten is 30 minutes weekly. It's better if students can spend 60-90 minutes per week learning on the platform. According to a study, students using one hour per day of screen time for learning had the best scores in mathematics on the PISA test (Schleicher, 2022).

The time on task described in this section means the time students spend working on problems, not just having the Eduten platform open.

Students spent cumulatively 10,411 hours and 35 minutes learning on the platform during the 15-week pilot period. For a more comprehensive understanding, refer to the weekly averages provided in Figure 11 below.

Figure 11. Average time spent working on Eduten weekly in all schools participating in the study



Every school in this pilot surpasses the recommended minimum weekly time on task of 30 minutes. On average, the students spent 1 hour and 24 minutes per week on the platform across different schools. This average varies, with some schools nearly reaching two hours, while the lowest recorded time was 54 minutes. Most schools with higher time on task yield a higher learning index, but there are also some exceptions. School 9 and School 1 have the same average time, but the learning index of School 9 is almost half of the learning index of School 1 (Figure 5). This indicates that the time spent on learning does not directly correlate with improved outcomes. For example, a student may spend a long time trying to answer the exercises without fully understanding the material, while another student who already has mastery of the topics may continue engaging with the tool, increasing their time on task without necessarily gaining new knowledge.

Similarly, students who have already mastered the material might stop early, despite having achieved the desired learning outcome. These examples show that time on task alone is not a reliable indicator of learning success; how the tool is used plays a critical role in determining the outcome.

Considering a lesson in school is 45 minutes, the average weekly time indicates high usage at home as well. Typically, time on task is initially higher, and decreases as students learn to optimise their learning process. This is typically achieved by getting more familiar with the platform, being more efficient in answering the questions and achieving points. This effect can be seen well after the third week of the pilot. The school break naturally affected the students' active learning time. After the holidays, time on task resumed nearly to its original level, but the last two weeks show lower results (Figure 10). This is likely due to some students answering all available exercises at this point.

Figure 10. Total weekly time on task in all participating schools combined for each week of the study

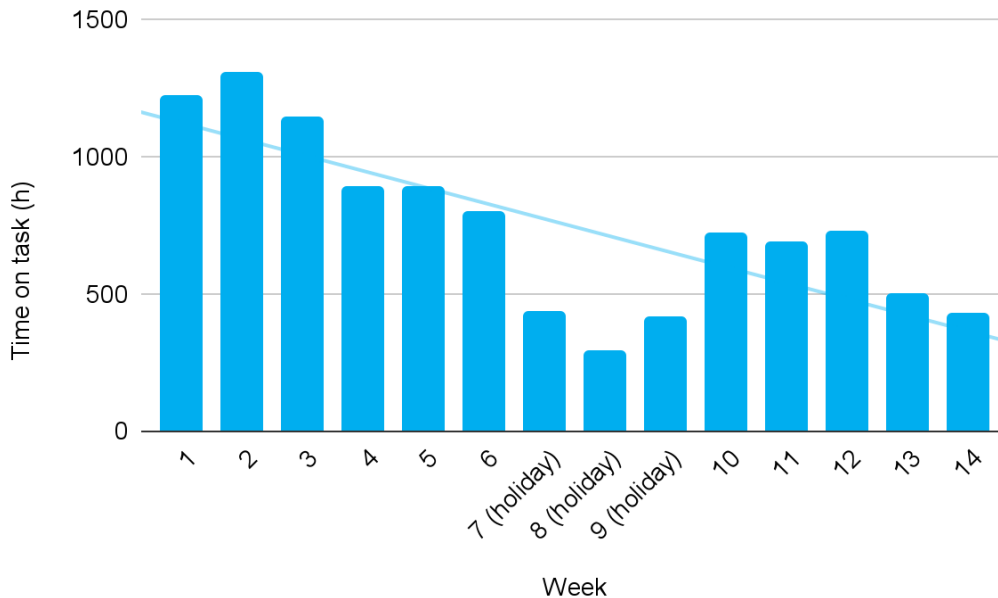


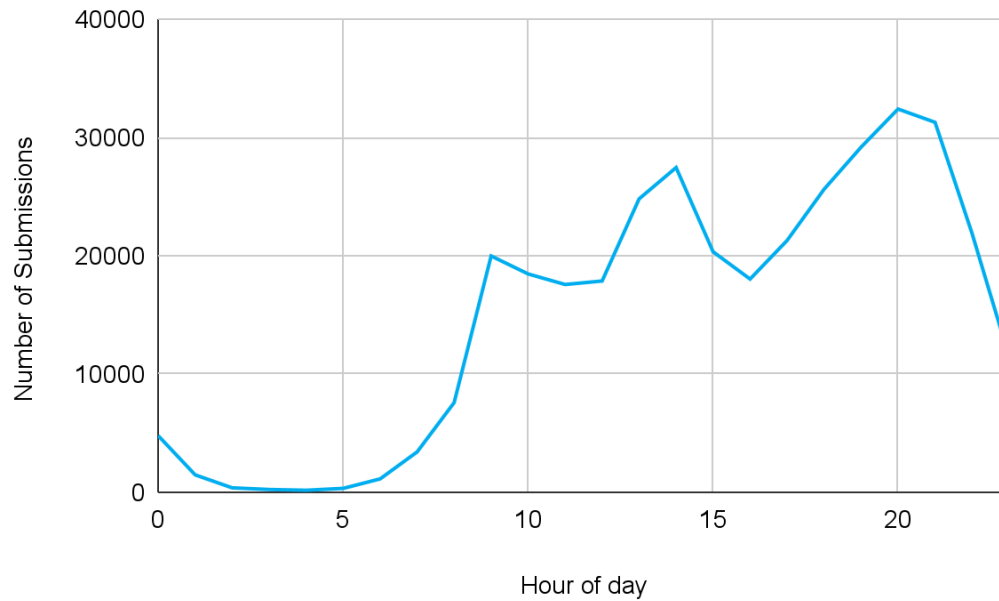
Figure 10 indicates that the students are spending a lot of time learning with Eduten. At the beginning, time on task is usually higher, but decreases as students become more familiar with the platform and learn to work more efficiently, answering questions and earning points with greater ease. This trend becomes particularly noticeable after week three of the pilot. The school break period naturally impacted students' active learning time, and while time on task returned to nearly its original level afterward, the final two weeks still show a decline, similar to the trend observed in scores.

Student activity by hour

Monitoring student activity by the hour provides valuable insight into the school practices and students' learning habits. It helps us discern the amount of work completed during school hours and the effort put in at home after school.

The following chart shows relatively high at-home learning, which indicates good digital readiness at home, at least in the Tashkent region. It's worth noting that students in Uzbekistan go to school in two shifts, which shows as two peaks in the chart. Eduten lessons typically start in school during a maths lesson. Students continue working on the exercises until they achieve a trophy. Working in school provides a more formal setup and an opportunity to ask questions from teachers and peers. Working from home is more individual and extends the time used for studying and practising a topic while also providing a pause between learning sessions, which can enable deeper learning. Notably, research supports online homework's general effectiveness (Dillard-Eggers, 2008; Bonham, et. al. 2001; Richards-Babb, 2011). Furthermore, teachers get platform analytics from their students' homework, which helps with planning future maths lessons.

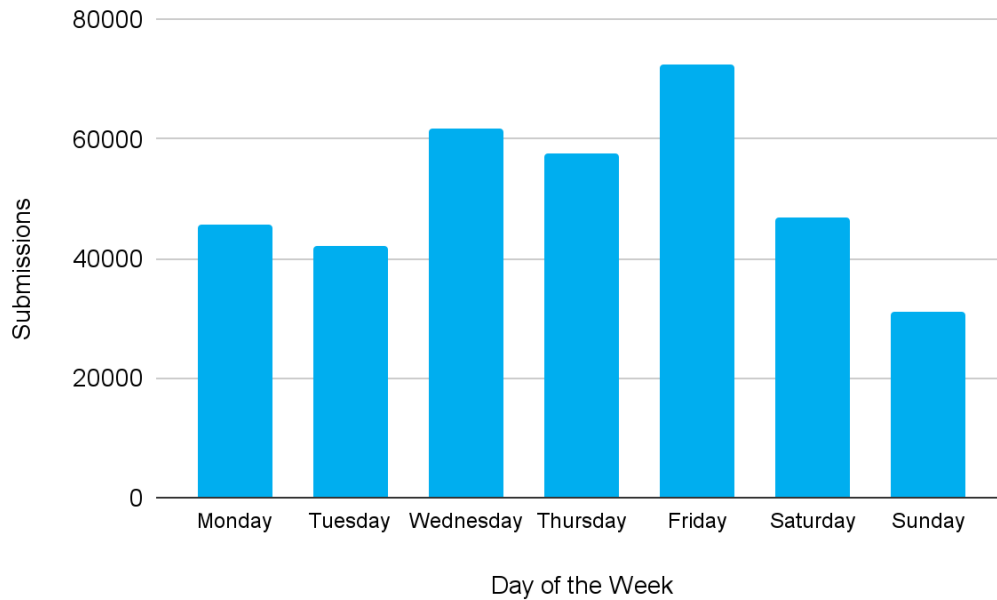
Figure 11. Average activity during all 24 hours of a day



Note: Students in Uzbekistan go to school in two shifts, which shows as two peaks in the chart.

Some schools made their computer resources – e.g. computer labs – available after school hours to students participating in the pilot. Additionally, caregivers were informed about this initiative, and teachers encouraged them to permit their children to use personal devices for homework, if they had access to a device. As a result of these measures, some students also got new devices from their caregivers.

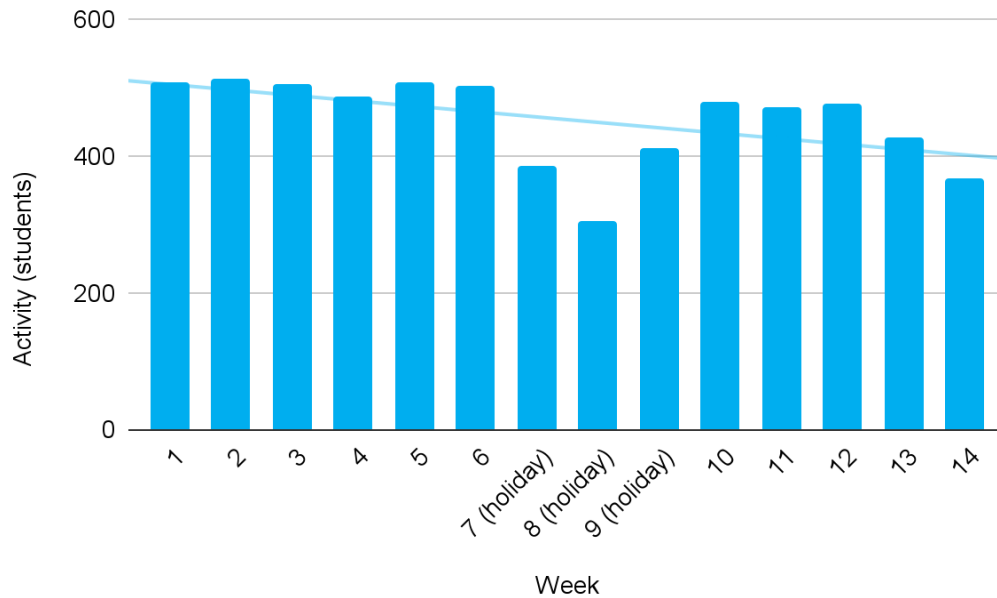
Figure 12. Average Student activity on the Eduten platform per day



It is up to the teacher to plan which day is the most suitable for working with Eduten. The data indicates that Friday is the most popular day for using Eduten. This trend is reasonable, as Eduten works effectively for revising and practising the topics learned throughout the week.

Weekly activity, as shown in Figure 13, signifies how many students interacted with Eduten on a weekly basis. A student is considered active if they submitted at least one answer to an exercise during that week.

Figure 13. Number of active students by week



In an ideal scenario, the bars in the chart should maintain an equal height throughout, suggesting steady usage. Some variability is inevitable due to factors such as illness of students, exams or other legitimate reasons such as holidays.

Discussion

This 12-week pilot study, while brief, provided a promising indication of Eduten’s suitability and effectiveness in Uzbek schools. The learning gap among students who have not yet acquired the foundational maths skills expected in Grade 5 is visible in the relatively low-test scores in relation to the Grade 5 curriculum learning goals. This is consistent with global data on the learning crisis and could be partly due to learning loss during the COVID-19 pandemic. There is a clear improvement in the treatment group, suggesting that Eduten helped to narrow the gap. The gap also highlights the need to further support students to acquire the foundational numeracy skills needed for further learning.

The results from this pilot suggest a positive effect of Eduten in both the curriculum aligned Mathematics test and in the three-minute Arithmetic Fluency test. In both tests there is a statistically significant improvement in the treatment group’s results compared to the comparison group. The effect size (Cohen’s d) was 0.42 in the Mathematics test, which is close to a medium effect. This effect size is relatively large when compared to a similar learning platform, ALEKS, which has an average effect size of 0.05 (Sun et al., 2021; Fang et al., 2019).

The positive results were achieved in 12 weeks by replacing one mathematics lesson per week with Eduten sessions, plus homework assigned to the students. It should be noted that this did not increase

the overall instructional time for the students compared to the traditional maths lessons. These results are in line with the previous studies of Eduten use conducted in Finland, Lithuania and Mongolia (Kurvinen, et al. 2014; Kurvinen, et al. 2015; Kurvinen, et al. 2018; Kurvinen, et al. 2020; Eduten & MNIER, 2023).

The overall result across all the participating students is positive. Further studies could be carried out to identify which groups of students get the most and least benefit from Eduten use, and how to ensure the most marginalized students in the Uzbek context benefit the most.

To account for the learning gap/learning loss, future studies should test the extent and variance of the students' mathematical skills in advance to make sure the assessment results of an intervention do not suffer from a flooring effect due to low student scores.

The results of the pilot project do not simply demonstrate the benefits of using technology for learning but the whole approach of motivating students to practice more, giving feedback to teachers in the form of learning analytics, and giving students interactive, gamified exercises with instant feedback.

In addition to the improved learning results in mathematics, the observed activity, performance and engagement seen on the platform analytics are on a good level. Challenges such as limited internet access and a shortage of devices were encountered, which are important considerations for the future implementation of digital learning tools. Despite these hurdles, the performance of each school surpassed the recommended standards set by Eduten.

15 out of the 17 schools were described to be well equipped with devices. Only two schools were considered low-resourced in this regard. To address the device problem, teachers informed parents about the Eduten pilot and encouraged them to let their children use their devices to access the platform at home. Many students were able to access Eduten from home with a mobile device. Some teachers also arranged with the school computer lab to allow students to work on their Eduten homework on the school premises. Eduten's pair-mode, which allows students to share devices, is also a feature that can be activated to help address any device shortage issues. Ensuring there are enough devices to support at least a pair-mode setup for the entire class is an important consideration for the broader implementation of digital solutions.

The gender analysis did not reveal any statistically significant difference between the genders in the mathematical test or in the arithmetic fluency test. The pilot results showed that using Eduten for learning benefits students regardless of their gender. However, when implementing digital learning, it's crucial to ensure that all genders have equal opportunities to learn using technology, especially in contrast to the general trend where girls are less interested in STEM subjects (Mostafa, 2019).

The activity levels of the students and schools were not correlated with the students' learning improvements due to the low test scores, which would yield unreliable further analysis. Even if the results

were correlated, there probably would not be a direct correlation between the time usage or scores to the improvement in the test. Just like with any learning method, Eduten benefits some students more than others, or some students are able to get the full benefit with less work than others.

At the end of the last training day, the Training Survey was conducted for the participating teachers. The training survey collected feedback for the training sessions and the thoughts of the teachers regarding using digital tools in their classrooms. In the Training Survey, almost 40 per cent of the teachers reported being experienced with digital tools (see Annex 1 for details). During the pilot, teachers exhibited proficiency, measured by observing the usage and activity patterns, in employing personalisation tools, including differentiation and learning analytics for formative assessment, thereby effectively enhancing their teaching methods. In the post-pilot teacher survey, 94.4 per cent of teachers indicated that Eduten is effective for teaching and learning (see Annex 1 for details).

Throughout the pilot, students displayed notable engagement and enthusiasm in their learning activities. 96.5 per cent of the students reported “liking learning with Eduten”. The great activity results back up this claim. Anecdotally, one teacher reported that the students did not need her help in the class. They either managed on their own or helped each other to solve the problems.

The expertise and commitment of the teachers in utilizing Eduten deserve high praise. The platform was successfully used not only in classrooms but also by many students at home. It's important to brief caregivers about new practices and learning tools. Before caregivers knew why their children needed devices for homework, there was some hesitation. Once explained, there was no more friction in using devices for homework. Many students even received new devices from their caregivers to work on the Eduten exercises.

The attitudes and opinions of school management, teachers and students were observed through a survey at the end of the pilot. The survey results are overwhelmingly positive and, based on answers, Eduten is a valuable and effective tool that is ready to bring improvements to the learning of mathematics for Uzbek students. It also aligns well with the needs of the education system out of the box, and presents opportunities for further improvements through bespoke development.

Even though the schools in Uzbekistan are relatively well connected (94.8 per cent of schools, average speed 11.5Mb/s), the need for improving the connectivity and especially the availability of devices for certain schools was indicated by the answers (Giga, 2022). Overall, it seems teachers gained confidence in using digital tools for teaching and learning when comparing the experience of using digital tools before the workshop and the results after the 12-week pilot than ran for 15 weeks.

In summary, Eduten significantly benefits students who use it for learning mathematics. We also note the data that points to the importance of teacher training and support. The teachers are the drivers of extrinsic motivation for their students, thus ensuring the students keep working on their skills for the long term. The data suggests important considerations for broader implementation, emphasizing the

need to ensure equitable access for both girls and boys, and tailored support for both low- and high-achievers. The effectiveness of Eduten in enhancing learning outcomes presents strong implications for its wider adoption in educational settings.

Conclusion and recommendations

The data analysis after the pilot introduction of the Eduten maths learning platform in Uzbekistan shows it has contributed to significant improvements in student mathematics performance compared to those not utilizing the platform. Despite the clearly visible learning gap among students as indicated in the Mathematics test scores, this result suggests that Eduten is able to help narrow the learning gap. There does not seem to be any difference between the genders while using Eduten. Feedback from students, teachers, and school management showcase high acceptance and enthusiasm towards Eduten. To extend these benefits across the education sector, specific challenges must be addressed.

Most of the pilot schools were well-equipped with devices and internet connectivity, a factor contributing to the success observed. Scaling requires addressing the variability in technology infrastructure across schools. For the success of the implementation, it is crucial to ensure reliable internet connectivity and the availability of necessary devices in all schools. Special attention should be paid to gender, ensuring both girls and boys have equal access and opportunity to use devices and access the platform.

The leadership of MoPSE was critical in the success of the pilot. For the successful implementation of an expanded rollout, it is crucial to establish a dedicated MoPSE-led support and training team. This team will be essential in enhancing teachers' digital competencies, which is especially important given the varying levels of connectivity and digital readiness across Uzbek schools. In addition to focusing on Eduten, training programs should broadly address improving digital skills and digital pedagogy. Leveraging the expertise of the 17 Eduten-trained pioneer teachers in Uzbekistan who have successfully used Eduten will be invaluable. These pioneers can share their insights and experiences to enrich the training programs, ensuring that new users can swiftly and effectively integrate Eduten into their teaching practices.

The correlation between the amount of time used with Eduten and the learning improvement was unclear in this study. That said, to fully benefit from digital learning with Eduten, it is important to allocate sufficient time each week specifically for Eduten activities in schools and potentially as optional homework. Prior experiences from Finland and many other countries indicate that dedicating one lesson/period per week is the most effective. Making this practice requisite will help standardize the implementation across all educational institutions, ensuring that every student benefits from consistent and structured digital learning sessions. The ability to work on homework after school hours and supporting the individual work is also very important to realize the full benefit of the platform. Moreover, requisite use of Eduten across all schools will unlock the possibility to utilize Eduten's national learning analytics and dashboards at the MoPSE level.

Some key observations from the implementation:

- The Eduten platform worked well under the pilot conditions, and the schools were able to integrate it as part of their existing workflow
- Technical infrastructure, while adequate in the pilot schools, remains one of the biggest challenges for scaling up.
- Teacher training is the biggest logistical challenge for scaling up. In the pilot phase, only an initial training was conducted. When scaling up, continuous support and training are important to make the implementation successful.
- Including and informing student parents is important. Parental support proved to be important in this pilot. According to our experience in other countries, screen time is one of the biggest worries of caregivers.

In conclusion: the pilot project shows the positive effect of the use of an EdTech tool that supports personalised learning and puts the teacher and pedagogy at the heart of technology's integration into teaching-learning.

Should MoPSE consider the wider use of Eduten in Uzbekistan, it is recommended they use Eduten's national learning analytics tools to monitor school performance and provide timely support for all schools. This data-driven approach will enable MoPSE to identify areas of need quickly and deploy resources and support effectively. Teachers can also use learning analytics to enhance their understanding and application of formative

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Annexes

Annex 1: Survey Results

Pre-pilot training survey results and data

The teacher training survey results were collected after the session held on 6-9 November 2023. When asked whether the training met their expectations, most participants responded positively, resulting in a 4.97 average score (1-5 scale). The participants were also asked whether they are prepared to take part in the pilot; the average score for that question is 4.6. It is interesting to note that after the pilot, the teachers rated this question at 4.7, indicating that the training was successful in preparing the teachers to conduct the pilot successfully. Finally, the participants rated the trainers' quality at an average of 5.0.

An important point from the survey relates to the experiences of teachers. Only one in three teachers felt experienced or very experienced in using digital tools. This suggests that the majority of teachers, about two-thirds, were not as comfortable with these tools. At the end of the pilot, 94.4 per cent of the teachers felt comfortable or very comfortable using Eduten.

These results indicate the training's success in effectively preparing the teachers to use the Eduten platform, despite the self-reported low experience level in using digital tools.

Table 7: Highlights from the open-ended question of the teacher training survey

What did you like about the workshop?
Digital pedagogy, strengthening of mathematics through games, behavior culture of our trainers, process of explaining the project, freedom during the lesson, ability to express opinions are all very interesting. I am interested in the project from teachers. I believe that, God willing, we will definitely achieve a positive result in this project.
Positive atmosphere, enthusiasm of trainers, motivational thoughts, the main thing is the opportunity to work with a program that can convey mathematics to students through a simplified game program.
I really liked the seminar. The trainers were able to convey all the information to us in a very clear way. The organizational processes are excellent. Thank you for everything.

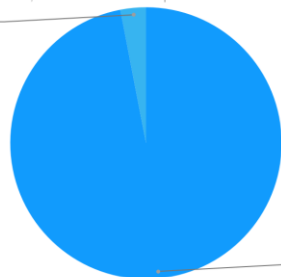
How would you improve the workshop?
Of course, I think there should be practical exercises after each stage, that is, after each topic.
No, in my opinion, the seminar was very good

Conduct more such seminars

Did the workshop meet your expectations?

1 = Far below expectations, 5 = Far exceeded expectations

Exceeded expectations
3.0%



What was your experience with digital tools before the workshop?

1 = Not at all experienced, 5 = Very experienced

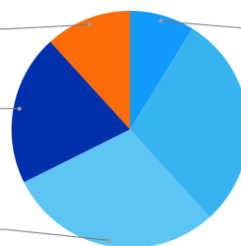
Not at all experienced
11.8%

Not that experienced
20.6%

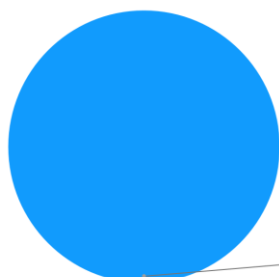
Neutral
29.4%

Very experienced
8.8%

Experienced
29.4%



How would you rate the trainers?



Far exceeded
100.0%

How prepared are you for the pilot?

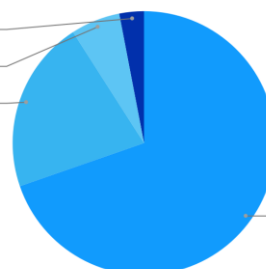
1 = Not at all prepared, 5 = Very prepared

Not that prepared
3.0%

Neutral
6.1%

Prepared
21.2%

Very prepared
69.7%



Teacher survey results and data

Below are the analysed results from the teacher survey, which includes responses from 34 respondents and reveals an average satisfaction rate of 93 per cent across all questions. Note that all of management also answered this survey.

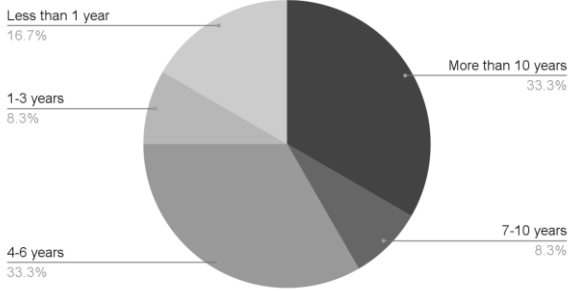
Question	Average rating (1-5)
Are you comfortable using the Eduten platform for teaching?	4.6
Teachers are largely comfortable using Eduten for teaching, indicating user-friendliness and effective integration into teaching practices.	
How well did the training prepare you to use Eduten?	4.7
Training sessions were effective in preparing teachers to use Eduten, though there may be some areas for enhancement in training.	
Do you think the Eduten platform is effective for teaching and learning?	4.4

There is a high level of agreement among teachers on the effectiveness of Eduten in teaching and learning.	
How would you rate your experience with the Eduten platform?	4.6
Teachers rate their experience with Eduten positively, reflecting general satisfaction with the platform.	
Please share your thoughts or experiences regarding parents' attitudes towards using Eduten.	4.5
Teachers positively perceive parents' attitudes towards Eduten, reflecting a strong endorsement of the platform.	
How sufficient are the school's computers and equipment for the Eduten platform?	4.3
The availability and sufficiency of computers and equipment for Eduten in schools are generally good, but there's potential for improvement.	
How good was the support from your school's management in adopting the Eduten platform?	4.8
There is strong support from school management in adopting Eduten, indicating effective leadership and organizational backing.	
How effective is the Eduten platform in enhancing math education?	4.7
Teachers highly regard Eduten's effectiveness in enhancing math education.	
How well does the Eduten platform align with the national math curriculum?	4.5
Eduten aligns well with the national math curriculum, suggesting its relevance and applicability in the current educational framework.	
How effectively does the Eduten platform engage and motivate students to study math?	4.6
The platform is perceived as effective in engaging and motivating students, enhancing their interest in math studies.	
How much does the Eduten platform promote independent learning in math?	4.4
Eduten is seen as a beneficial tool in promoting independent learning among students in math.	

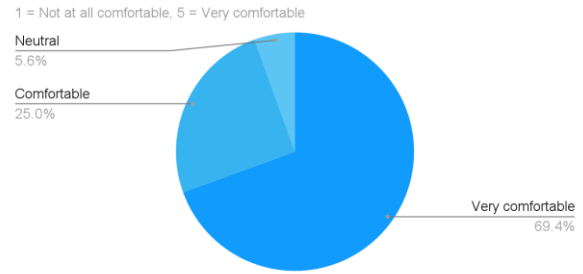
How helpful was the learning analytics in Eduten?	4.7
Learning analytics in Eduten are highly valued by teachers, indicating its utility in tracking and enhancing student learning.	
To what extent does the Eduten platform help in reducing the workload of teachers?	4.5
Eduten is considered helpful in reducing teachers' workload, though there may be areas for further reduction.	
Do you support the wider national adoption of this platform?	4.7
There is strong teacher support for the national adoption of Eduten, reflecting confidence in its broader applicability and benefits.	

How has Eduten affected your teaching and students' learning?	
It increased students' interest in mathematics.	
The compatibility of the topics in Eduten with our plan led to very good results in working on it, that is, when I explained the theory of the topic, the students felt as if they had done a practical exercise in Eduten, and this platform was very useful.	
Hello, it's a very good platform to cooperate with parents and encourage students to work independently. All my students have increased their interest, some of them even completed tasks ahead of time, helped their classmates, parents were also interested and worked together with their children. thank you for	
It helped me a lot for my teaching, the students learned many new things with interest.	
They worked very well and with interest. They also worked on examples and problems in their games with enthusiasm.	

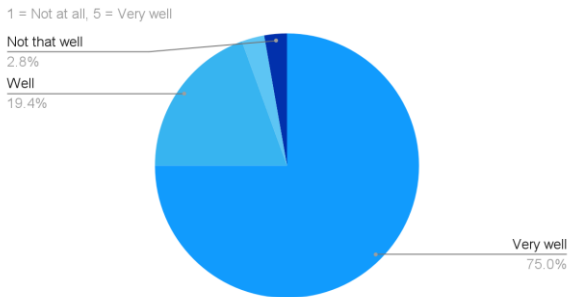
How long have you been working as a teacher?



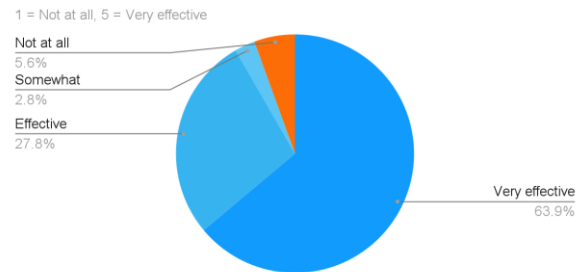
Are you comfortable using the Eduten platform for teaching?



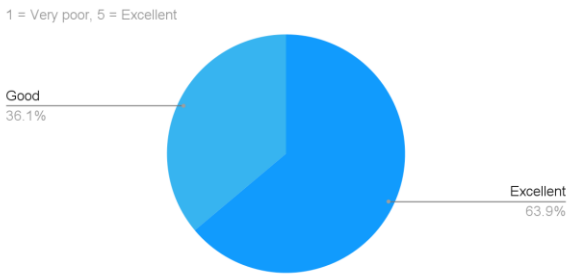
How well did the training prepare you to use Eduten?



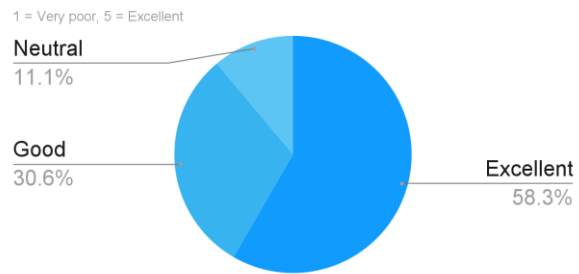
Do you think the Eduten platform is effective for teaching and learning?



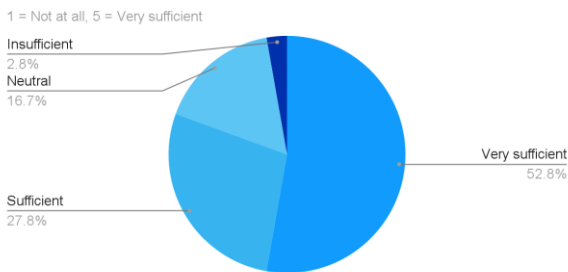
How would you rate your experience with the Eduten platform?



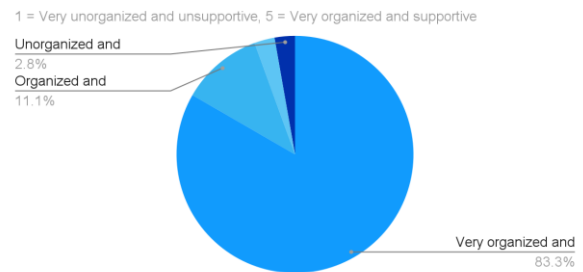
Please share your thoughts or experiences regarding parents' attitude towards using Eduten.



How sufficient are the school's computers and equipment for the Eduten platform?

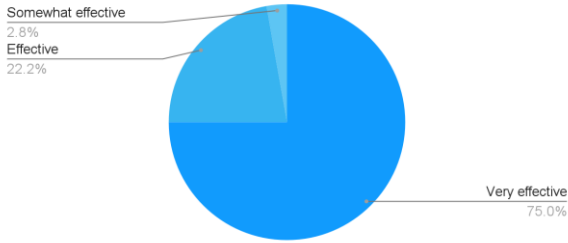


How good was the support from your school's management in adopting the Eduten platform?



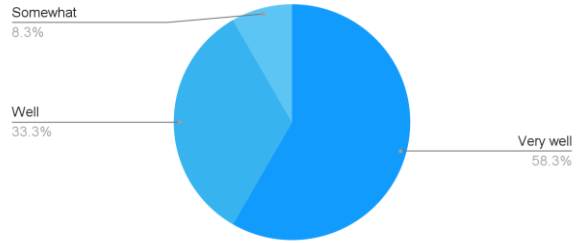
How effective is the Eduten platform in enhancing math education?

1 = Not at all, 5 = Very effective



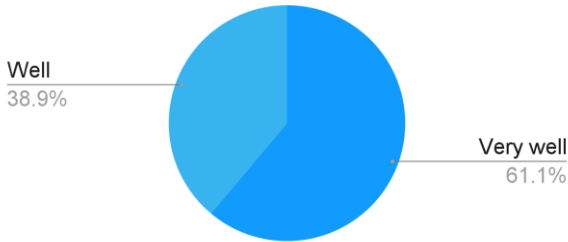
How well does the Eduten platform align with the national math curriculum?

1 = Not at all, 5 = Very well



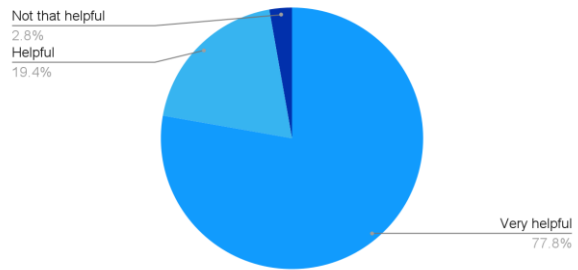
How effectively does the Eduten platform engage and motivate students in studying math?

1 = Very poorly, 5 = Very well



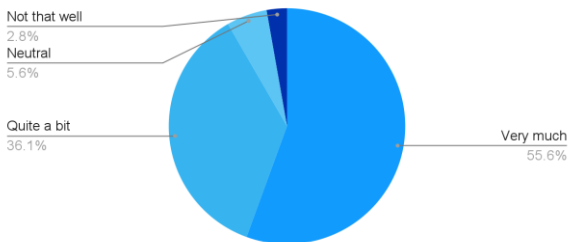
How helpful was the learning analytics in Eduten?

1 = Not at all, 5 = Very helpful



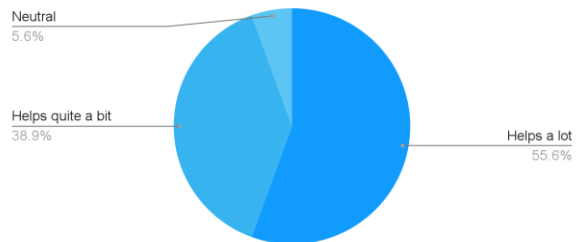
How much does the Eduten Platform promote independent learning in math?

1 = Not at all, 5 = Very much



To what extent does the Eduten platform help in reducing the workload of teachers?

1 = Not at all, 5 = Helps a lot



Student survey results and data

Below are the analysed results from the student survey, which includes responses from 378 participants. Some of the answers are clearly from caregivers based on the phrasing of the answer.

How did you like using Eduten?

I liked more problems, examples, fun game examples, more complex examples, planning, etc

The questions are understandable and the answers are given in the order of the game

Incorrectly translated and incomprehensible questions are also found in Eduten tasks.

Each as a game is fun, challenging, and highly beneficial in learning math.
It would be better if they were sent to other schools.

I tried to look at mathematics in a different way, before it was a boring subject, but now it has become a very interesting subject for me.

My interest in mathematics has increased and I am studying mathematics in depth

Solve examples without difficulty to quickly understand mathematics through an educational game

Interesting math

The textbook is getting easier to understand

On the Eduten platform, I am getting acquainted with the topics that I have not yet covered, in addition to the topics that I know well. In addition, topics that are difficult for many students to master are presented to us in the form of a mathematical game.

Very interesting, I gained new knowledge while working on puzzles and example problems

Eduten helps me understand math more than before.

I liked the examples, problems, and interesting tasks of "Eduten".

Individual questions of the student survey are in the below.

I like math

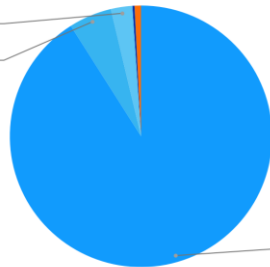
1 = , 5 =

3

2.6%

4

5.3%



I like learning with Eduten

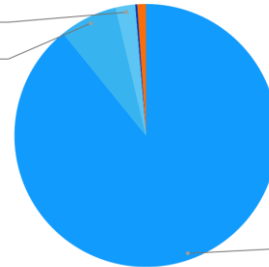
1 = , 5 =

3

2.4%

4

7.1%



Eduten is easy to use

1 = , 5 =

2

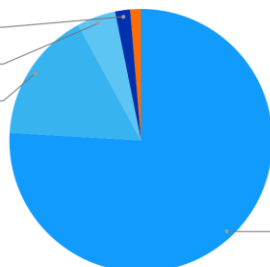
1.9%

3

4.8%

4

16.1%



I can use Eduten by myself without help of anyone

1 = , 5 =

1

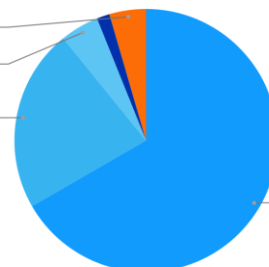
4.5%

3

4.8%

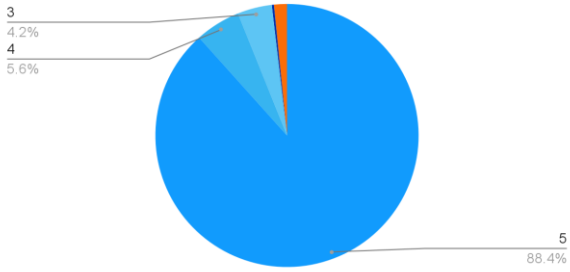
4

22.5%



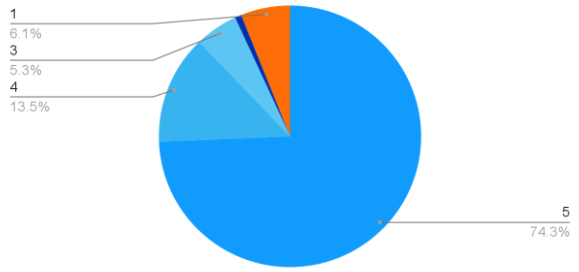
Eduten made math easier to understand

1 = , 5 =



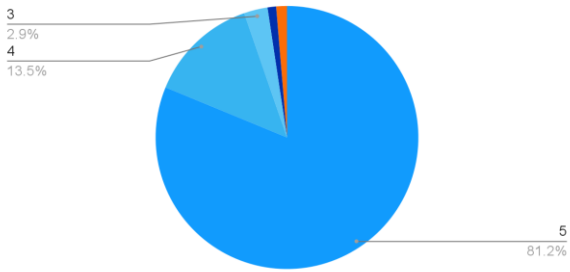
The school's computers and tools worked well for Eduten

1 = , 5 =



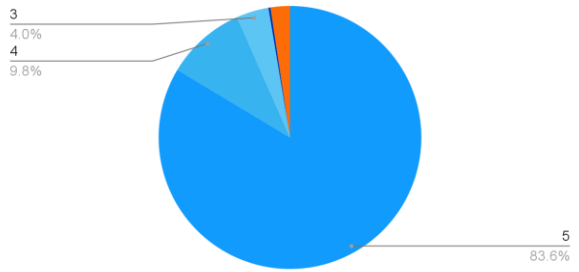
I study more math since I started to use Eduten

1 = , 5 =



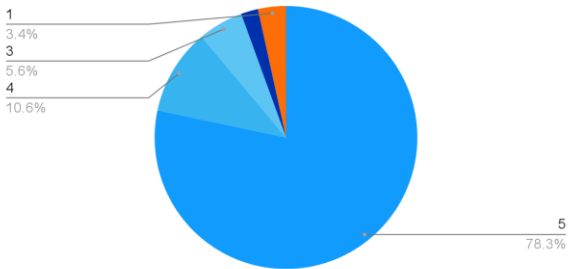
Teacher is able to help me more with Eduten?

1 = , 5 =



Do you think all schools should use Eduten for math?

1 = , 5 =



Annex 2: Teacher Training Workshop Agenda

The teacher training program was held on 6-8 November 2023. The training followed the agenda below.

	DAY 1		DAY 2		DAY 3	
	Teacher Stream	Management Stream	Teacher Stream	Management Stream	Teacher Stream	Management Stream
9:00	Breakfast: Coffee/tea		Breakfast: Coffee/tea		Breakfast: Coffee/tea	
9:30	Welcome to the Training		Opening the Day/Reflections		Opening the Day/Reflections	
10-11	Education in Finland		Weekly Schedule with Eduten Pilot		Advanced Training, Differentiation	Data-Based Leadership in Mathematics
11-12	The Pilot (Research)		Eduten Demo in a Classroom		Advanced Training, Motivation	
12-13	Lunch		Lunch		Lunch	
13-14	Eduten Basic Training, part 1		Q&A with the trainer	Educational Leadership in Finland	Summary for Teachers	Summary for Management
14-15	Eduten Basic Training, part 2		Closing the day		Closing ceremony	

The teacher training program was divided into modules. Below are listed some modules in the training program:

Module	Description and Notes
Basic Eduten training	Gives the teachers basic knowledge on how to get started with Eduten, including the underlying pedagogical principles based on best practices in Finnish classrooms.
Advanced learning analytics	Deepens teachers' knowledge of learning analytics. Shows examples of how and when to use the reports provided by Eduten. Drills into details of individual students in the analytics, and helps teachers decide the needed actions.
Building motivation with gamification	Best practices and tips & tricks for improving students' motivation and leveraging gamification efficiently.
Assessment	Learn the power of formative (continuous) assessment and the difference between summative assessment (typically exams), and how to improve learning results with timely interventions.
Exams with Eduten	Learn how to build and conduct exams in Eduten.
Co-teaching with Eduten	Best practices for co-teaching and using learning analytics to support planning and executing lessons with more than one teacher.

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UNICEF works in some of the world's toughest places, to reach the world's most disadvantaged children. Across more than 190 countries and territories, we work for every child, everywhere, to build a better world for everyone.

The Global Learning Innovation Hub is a part of UNICEF's Office of Innovation, an agile global architecture aligning with diverse partners to boldly explore and scale innovative approaches and technologies to deliver equitable impact and opportunity for every child today, and an accelerated pace of change for generations to come.

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