ARTIFICIAL INTELLIGENCE FOR EDUCATION IN BANGLADESH

INSIGHTS FROM THE FIRST SMALL-SCALE ARTIFICIAL INTELLIGENCE NEEDS ASSESSMENT AND TRAINING FOR PRIMARY EDUCATION TEACHERS

ByeongJo Kong, Zhigang Li, Sara Ratner, Erik Hemberg, and Shamsul Haque

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FOREWORD

Artificial intelligence (AI) is at the center of digital transformation in today's world, rapidly reshaping numerous sectors. In education, AI not only offers the promise of enhancing teaching practices but also addresses long-standing challenges that have impeded educational progress. This report explores the current state and the future potential of AI in primary education in Bangladesh, based on extensive online surveys and an in-person training that engaged primary school teachers, government officials, and education specialists.

Bangladesh, with its large population and diverse educational needs and environments, presents a unique landscape for AI integration in education. This report delves into teachers' readiness and willingness to embrace AI in their teaching environment. However, realizing AI's full potential in the education sector requires more than an openness to innovation. Adequate infrastructure investments, consistent teacher training, and culturally aligned AI tools are necessary to address challenges that lie on the path toward an AI-powered future.

The report aims to provide guidelines and a road map for educators, policymakers, and stakeholders in Bangladesh interested in integrating AI technologies in education. We hope the findings and recommendations will serve as an essential resource for anyone committed to advancing education in Bangladesh through AI. By laying this groundwork, we aspire to create a future where AI enhances educational outcomes and prepares the youth in Bangladesh with the skills needed to thrive in an AI-driven world.

We are grateful to the teachers who took part in this needs assessment and to the Directorate of Primary Education of Bangladesh and the Human and Social Development Division of ADB for their continued collaboration in supporting AI initiatives. Their contributions have been invaluable in shaping this comprehensive and in-depth exploration of AI's role in Bangladesh's education journey.

Bruno Carrasco
Director General
Climate Change and Sustainable Development Department
Asian Development Bank

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ByeongJo Kong, digital technology specialist (AI and data analytics), Climate Change and Sustainable Development Department (CCSD), ADB; Zhigang Li, principal economist, Economic Research and Development Impact Department (ERDI), ADB; Sara Ratner, research officer, Department of Education, University of Oxford; and Erik Hemberg, research scientist, MIT Computer Science and AI Laboratory led the study and authored the report with valuable inputs and feedback from Jian (Jeffrey) Xu, senior education specialist; Rose Sagun, education specialist; and Unika Shrestha, social sector economist, Human and Social Development, ADB.

The report greatly benefited from the support from the Directorate of Primary Education of Bangladesh and from Shamsul Haque, ADB consultant, for the administration of online surveys and in-person AI training for primary education teachers and educators in Bangladesh.

Special thanks to Genny Mabunga, senior operations assistant, CCSD for outstanding administrative support.

KEY LESSONS

(i) A significant majority of 1,253 surveyed teachers expressed a strong interest in adopting artificial intelligence (AI) tools in their teaching practices and recognized the potential of AI to enhance educational outcomes.

(ii) Many teachers indicated that they would feel comfortable using AI for tasks such as creating assessment questions, lesson planning, and preparing teaching materials. They acknowledged AI's potential to enhance efficiency in these activities and even inspire creativity.

(iii) Despite the openness to AI, teachers were cautious about using it for tasks that require human interaction, such as communicating with parents and engaging with students. They recognized these personal, human elements in education as one of their fundamental duties.

(iv) AI training noticeably enhanced teachers' confidence and elicited more positive perceptions toward AI. Those who underwent training showed a greater willingness to integrate AI into their teaching, indicating the importance of continuous capacity building and support for successful AI adoption.

(v) The survey also identified several key challenges in bringing AI to schools, including limited infrastructure (e.g., unreliable internet connectivity and power supply), insufficient training, and concerns about online safety for students.

(vi) Teachers recommended a few solutions, including the need for comprehensive training programs, investment in adequate infrastructure, development of AI tools in the local language (Bangla), and ensuring that AI tools are culturally relevant to the Bangladeshi context.

I. INTRODUCTION

Artificial intelligence (AI) is not new. The idea of a "thinking" computer was first introduced by the Turing Test in 1950, and the term "artificial intelligence" was first used at the Dartmouth conference in 1956. Decades later, in November 2022, OpenAI launched a new AI tool called ChatGPT and within 2 months it had amassed 100 million active monthly users (Gray 2021, Milmo 2023). AI is advancing at an unprecedented pace and is poised to revolutionize education as we know it (Luo 2024, p.12).

Despite the significant opportunities AI offers to transform education, it also brings challenges to the broader education landscape. Within schools, understanding the needs and perceptions of teachers is crucial for the safe and effective adoption of these innovative technologies for instructional purposes.

This report presents an analysis of survey data collected through an AI needs assessment survey and a training workshop conducted among primary education teachers from August 2023 to January 2024. This initiative was conducted under the Supporting Fourth Primary Education Development Program[1] of the Asian Development Bank (ADB), which aims to provide quality education for all children in Bangladesh.

The main objectives of the initiative are to

(i) examine the needs, perceptions, and readiness of primary education teachers in Bangladesh for incorporating AI into their teaching practices;
(ii) identify teaching tasks and processes where AI can help to reduce workload and improve teaching quality;
(iii) understand the technological limitations, training needs, and infrastructure requirements for effective AI adoption in education; and
(iv) offer guidance to policymakers, educators, and stakeholders on how to integrate AI into the primary education system of Bangladesh to maximize its benefits and tackle challenges.

Aligning with these objectives, the report seeks to offer a comprehensive insight into the integration of AI in primary education in Bangladesh, thereby supporting the country's goals of enhancing education quality, and equipping students and teachers with essential skills for the digital age.

Table 1: Key Technical Terms and Descriptions

Terms	Description
Artificial Intelligence (AI)	The ability of machines, particularly computer systems, to perform tasks that typically require human intelligence. This report focuses on the potential application of AI to automate complex teaching tasks with minimal human intervention.
Natural Language Processing	A subfield of AI concerned with giving computers the ability to understand, process, and analyze massive text data.
Preprocessing	A method for cleaning and denoising text data to optimize it for machine learning model input.
Topic Modelling	A method to extract topics from text corpus by automatically clustering word groups that best represent the topic.
Text Summarization	A method to shorten long sentences or paragraphs without omitting critical information.

Source: International Organization for Standardization (ISO) – https://www.iso.org/artificial-intelligence

[1] ADB. 2023. *Bangladesh: Supporting fourth Primary Education Development Program—Additional Financing*. https://www.adb.org/projects/50192-004/main

II. AI IN THE EDUCATION AND ECONOMY OF BANGLADESH

Bangladesh, with a population of approximately 168 million people and a literacy rate of 75.2% for individuals aged 7 and above (BANBEIS 2022), has one of the largest education systems in the world. Over the past decade, the country has made significant progress toward providing quality education for all (CRI 2018). However, with over 40 million students at school age, Bangladesh faces significant challenges regarding their future employability. Additionally, AI raises concerns for the labor market, particularly in key industries such as garment manufacturing, which are at high risk of automation (Ehsan 2021).

Recognizing both the opportunities and challenges presented by AI, Bangladesh is investing heavily in the infrastructure needed to harness the full potential of AI for its citizens. Notably, the country's information and communication technology (ICT) export earnings have surged from $26 million in 2007 to approximately $1.9 billion in 2023.[2] The Government of Bangladesh aims to increase ICT exports to $5 billion and ICT employment from 2 million to 3 million by 2025 (MTMPS 2023–2024).[3] To address the employability concerns posed by a large school-age population, Bangladesh aims to reskill its population for the Fourth Industrial Revolution. This strategy involves transitioning from a labor-intensive manufacturing base to developing knowledge-intensive ecosystems (Government of the People's Republic of Bangladesh, National Strategy for Artificial Intelligence Bangladesh 2020, p.3).

In March 2020, the government's ICT Division launched the National Strategy for Artificial Intelligence.[4] The report declared that: "Bangladesh is embracing Artificial Intelligence (AI) for the digitalization of the nation." AI holds strategic importance for Bangladesh for two primary reasons:

(i) **Economic growth and employability**: Creating new job opportunities and enhancing productivity across various sectors.
(ii) **Access to quality education for all**: Making high-quality learning resources accessible to a broader population.

Given Bangladesh's progress in improving its education system and its ambitious plans to leverage AI for economic growth, integrating AI into education becomes crucial. By investing in AI technologies and promoting digital literacy within the education sector, Bangladesh can equip students and teachers with essential skills for a digital world. This approach will help bridge knowledge gaps, foster a skilled workforce, and support the country's transition to a knowledge-intensive economy.

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2 D. Akter Mala. 2024. Tax breaks crucial for big ICT investments. *The Financial Express*. 7 April. https://thefinancialexpress.com.bd/economy/tax-breaks-crucial-for-big-ict-investments.

3 Government of Bangladesh, Ministry of Finance. 2023. *Medium Term Macroeconomic Policy Statement, 2023–2024.*

4 Government of Bangladesh, Information and Communication Technology Division. 2020. *National Strategy for Artificial Intelligence Bangladesh*.

III. SURVEY METHODS

The AI needs assessment survey aimed to evaluate the feasibility of introducing AI-enabled automation in primary education settings in Bangladesh. The survey focused on gathering opinions on education and teaching practices that could benefit from AI automation, as well as understanding teachers' perceptions of integrating AI and automation into their teaching tasks.

Survey questionnaires. The survey, which consists of six sections (Table 2), was created through a collaboration between ADB's Digital Technology for Development Division, Climate Change and Sustainable Development (CCSD), and the Anyscale Learning for All research group at Massachusetts Institute of Technology (MIT) Computer Science and Artificial Intelligence Laboratory. It also received peer review by ADB Human and Social Development. The survey was designed to address the following key question:

*For teachers of primary education in Bangladesh **[target population]**, what are the most time-consuming, tiresome, or difficult tasks that could be enhanced by AI-enabled automation **[intervention]** compared to traditional processes, tasks, or workflows **[comparator]**, that could (i) increase teaching efficiency; and (ii) lead to a more efficient implementation of education programs in school settings **[outcomes]**?*

Table 2: Survey Questionnaire Structure: Overview of Sections and Number of Questions

Description	Question Types	No. of Qs
Part 1. Demographics		
Gathers basic demographic information about the respondents to understand diverse needs based on variables such as gender, age, experience, and location	(i) Multiple choice (ii) Free-text	11
Part 2. Teaching Processes/Tasks		
Identifies the tasks that teachers are involved in, and how they perceive these tasks in terms of time consumption, difficulty, and fatigue	(i) Checkboxes (ii) Matrix Scale (iii) Free-text	6
Part 3. Automation and Artificial Intelligence		
Assesses teachers' familiarity, comfort, and concerns about integrating AI into their teaching tasks and workflow	(i) Checkboxes (ii) Slider scale (iii) Multiple choice (iv) Free-text	8
Part 4. Class Preparation and Student Assessment		
Identifies the methods and tools used for class preparation and student assessments to explore opportunities where AI can streamline processes	(i) Multiple choice (ii) Free-text	6
Part 5. Existing IT Tools and Others		
Gathers information on the digital infrastructure available in schools and potential barriers to AI adoption in schools	(i) Dropdown (ii) Multiple choice (iii) Matrix scale (iv) Free-text	7
Part 6. Suggestions for AI Features		
Gathers direct input from teachers on desired AI features that could assist them in teaching	(i) Checkboxes (ii) Free-text	2
	Total	**40**

Source: Author.

The survey aimed to gather insights on the following key areas:

(i) Teaching processes and tasks, and potential areas for AI interventions.
(ii) Teachers' levels of AI literacy and their perceptions of AI.
(iii) Access to IT devices and any connectivity issues.
(iv) Methods used by teachers for preparing lessons and assessing students.

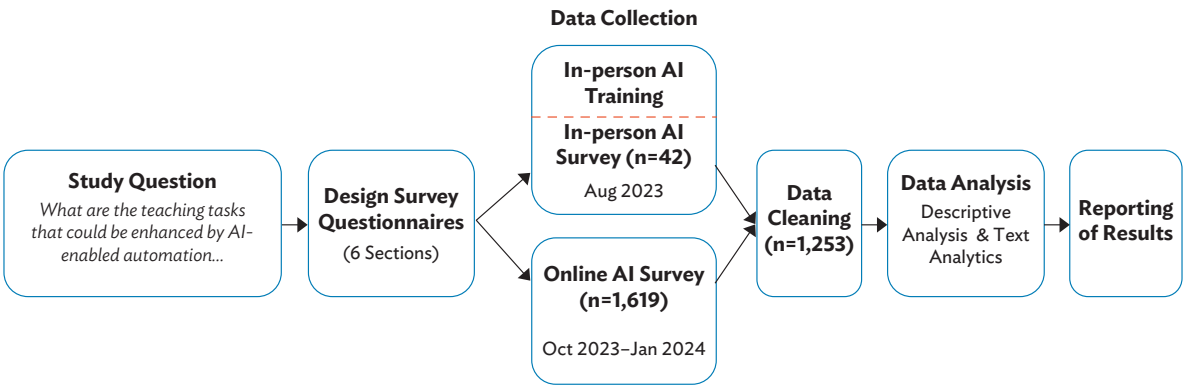
Data collection. The survey was administered to two different groups of primary school teachers in Bangladesh. The first group included 42 participants—comprising teachers, government officials, and curriculum specialists—who attended an in-person AI training workshop in September 2023 in Dhaka. The event was organized in collaboration with the Directorate of Primary Education (DPE) of Bangladesh. These participants completed the survey immediately after their training sessions.

Following this, the same survey was administered online to a broader group of teachers between October 2023 and January 2024, collecting a total of 1,619 online responses. For a detailed survey workflow, please see Figure 1.

Number of schools surveyed. Through DPE, survey requests were sent to schools across 513 *upazilas* (subdistricts) in Bangladesh. From each *upazila*, three schools were selected—each from an urban area, a rural area, and a hard-to-reach area—resulting in a total of 1,539 target schools (513 x 3). The survey aimed to reach approximately 7,695 teachers, assuming five teachers per school.

Rationale of school selection. The survey aimed to capture a comprehensive understanding of the diverse education environments across Bangladesh's 513 *upazilas* through a balanced representation of varying geographic and socioeconomic contexts. Urban schools often have better access to resources and infrastructure, while rural and hard-to-reach schools face unique challenges, such as limited access to technology and educational support. This approach allows a more complete assessment of the needs and potential impacts of AI interventions across all regions.

Figure 1: AI Needs Assessment Survey Workflow



Source: Author.

Data cleaning. To ensure the survey results were accurate and reliable, the data were carefully cleaned by removing any responses that did not meet quality standards. This involved filtering out noise from the dataset, including irrelevant or incomplete entries based on the following criteria:

Table 3: Survey Data Cleaning Criteria

Criteria	Description
Incomplete responses	Responses where participants did not answer all required questions or click "Done" on the final page of the survey were removed
Dummy responses	Entries with unrecognizable fonts, duplicating and dummy email addresses (e.g. test@te.com) were excluded
Response duration	Responses completed in less than 10 minutes, based on system timestamps, were removed as these were likely rushed and lacked sufficient information (the expected survey completion time is approx. 25–30 minutes)
Non-teacher occupations	Individuals who listed occupations unrelated to teaching (e.g., government official, superintendent, etc.) were excluded as their perspectives were outside the scope of our study

Source: Author.

After applying these criteria, we retained 1,253 valid responses (in-person: 29; online: 1,224) from the original 1,661 collected responses for analysis.

IV. DATA FEATURES

A. Who Are the Survey Participants?

The final dataset included 1,253 primary education teachers in Bangladesh, consisting of head and assistant teachers, with 74.9 % of them based in rural areas.

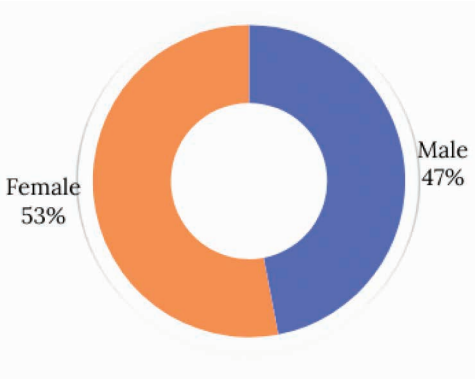
The group had a relatively balanced gender mix of male (47%) and female (53%) teachers (Figure 2). The percentage of female primary education teachers in 2022 in Bangladesh was 64.41%,[5] so the representation of males in the dataset is higher than the actual gender ratio.

Their educational qualifications mainly ranged from having bachelor's (29.8%) to master's (61.7%) degrees, and they varied widely in teaching experience: most notably, 43.5% of the group had 11–20 years of experience in the field (Figure 5).

[5] UNESCO Institute for Statistics. Stat Bulk Data Download Service (accessed 24 April 2024). https://apiportal.uis.unesco.org/bdds.

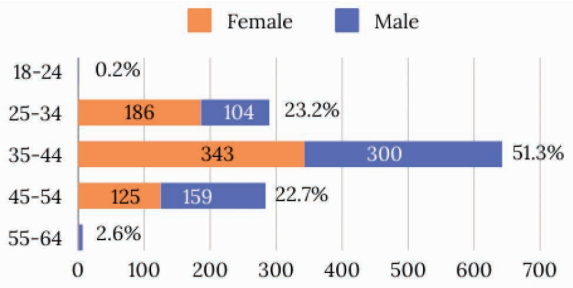
B. Demographic Distribution

Figure 2: Gender Representation (n=1,253)
(%)



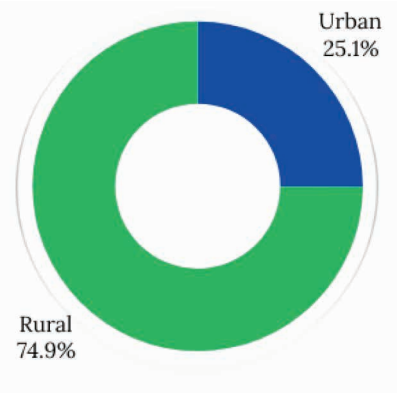
Source: Author's processing of collected data.

Figure 3: Age and Gender Distribution
(%)



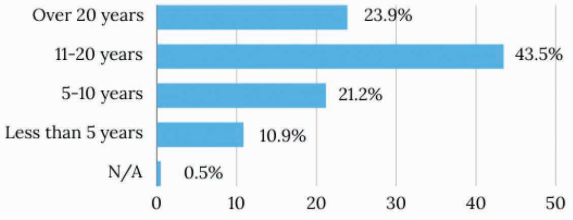
Source: Author's processing of collected data.

Figure 4: Geographic Distribution
(%)



Source: Author's processing of collected data.

Figure 5: Years of Teaching Experience
(%)



Source: Author's processing of collected data.

1. Age Ranges

Participants aged 35–44 years predominantly answered the survey, at 51.3% of respondents (Figure 3). The 25–34 age group made up the second-largest group of respondents, accounting for 23.2% of the total participants.

Given the established correlation between the uptake of new education technology tools and the age of classroom teachers, these data provide an important reference point. Several studies have shown that younger teachers are generally more inclined to adopt and integrate ICT tools into their teaching practices (Kuskaya and Usluel 2010, Zyad 2016, Krumsvik et al. 2016). Specifically, Bhat and Bashir (2018) found that educators under the age of 40 tend to believe more strongly in technology's capacity to ease their workload and enhance their teaching efficacy. Similarly, Lin (2014) reported that younger teachers are more receptive to the benefits of technology integration in education. In the survey, 74.7% of

the participants were under the age of 44, suggesting a potential openness among this group to adopting AI and other education technologies in their classrooms.

2. School Location and Teaching Experience

A significant majority of participants, approximately 75%, teach in rural areas of Bangladesh, with the remaining 25% working in urban centers (Figure 4). In terms of teaching experience, most of the respondents are experienced educators. Over two-thirds (67.4%) of the teachers surveyed have more than 10 years of experience, including 43.5% with 11–20 years and 23.9% with over 20 years of teaching experience (Figure 5). This suggests that the insights gathered are predominantly informed by seasoned educators who have spent significant time in the education system, particularly in rural settings.

These demographic factors are crucial in contextualizing the survey findings, as the location and experience levels of the participants likely influence their perspectives on the issues addressed in the survey. Understanding these aspects helps to better interpret the results and the recommendations derived from them.

V. KEY FINDINGS FROM THE SURVEY DATA

A. Teachers Showed Strong Interest in Adopting AI Tools

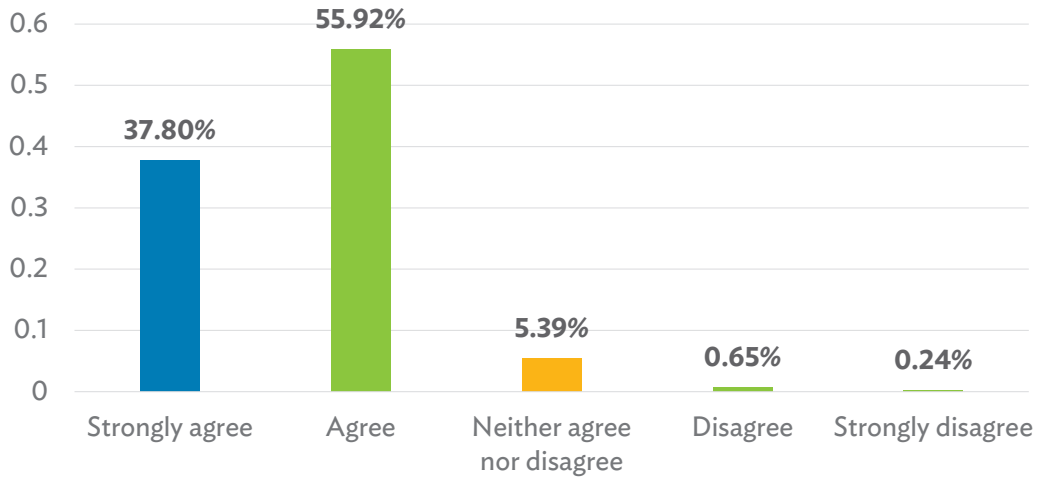
Many teachers expressed uncertainty about their understanding of AI. Nonetheless, a significant majority of surveyed teachers showed a strong interest in adopting AI tools in their teaching and learning environments, and an eagerness to improve their AI knowledge and understanding. As one participant shared, "It will improve overall education system. I can deliver quality education towards my students."

Another echoed this strongly saying, "AI-powered tools can offer interactive and adaptive learning modules, aiding teachers in delivering tailored lessons. In a country like Bangladesh, where access to quality education might be limited in rural areas, AI can bridge this gap."

The participants' responses demonstrated a strong level of willingness and a resounding request for further training to support them in enabling AI tools in their classrooms. The teachers clearly recognized AI's importance in their own work and for the future of their students and the country.

> **"AI will be very much helpful for teachers and students to achieve our goal in education system."** – Male teacher, Rural School (aged 25–34 years)
>
> **"I think the teaching process will become much easier if we are proficient in artificial intelligence"** – Male teacher, Rural School (aged 45–54 years)
>
> **"AI is an important element of education. Though I don't know about it very much, I want to know about it"** – Female teacher, Rural School (aged 25–34 years)

Figure 6: Responses to the Question:
"Do you believe AI can be beneficial for primary education?"



Note. The result suggests a strong overall belief in the benefits of AI for primary education among the respondents.
Source: Author's processing of collected data.

Teacher attitudes are powerful predictors of pedagogical actions. In response to the question "Do you believe AI can be beneficial for primary education?" an impressive 93.7% of the participants either "Agreed" or "Strongly Agreed" (Figure 6). Yet, **their beliefs may not necessarily translate into classroom practice as there are many external barriers to full adoption**. This underscores the importance of needs-based planning, which is why the insights and findings from this AI needs assessment survey are valuable for guiding effective adoption strategies.

While participants' responses to the perception of AI were overwhelmingly positive, there were also some concerns raised, which can be related to two distinct issues:

(i) online safety for children and
(ii) a lack of training or skills in using AI among teachers.

B. Where Do Teachers Need AI Support?

To better understand this matter, teachers' perceptions of their teaching tasks were examined in four angles:

The survey participants were asked to rate their perceptions of various teaching tasks across these angles on a five-level scale: "Not at all," "Slightly," "Moderately," "Very," and "Extremely." The heat map (Figure 7) visually depicts the percentage of participants who rated each task as either "Extremely" or "Very." Darker shades represent a higher percentage of agreement among teachers (see Annex 4 for the detailed survey results).

Figure 7: A Heatmap of Teachers' Perceptions
(%)

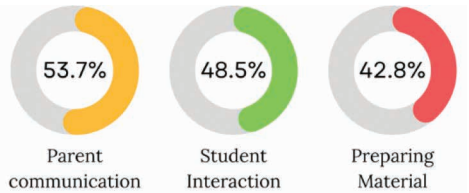
	Time-consuming	Difficult	Tiresome	AI-receptive	AI-resistant
Lesson planning	39.94	18.3	19.25	76.97	23.46
Preparing material	42.83	22.06	22.8	76.89	23.09
Creating questions	42.81	18.75	21.41	77.55	19.14
Grading	38	18.06	19.42	65.38	26.13
Preparing assignments	33.12	17.07	17.55	58.55	26.68
Tracking performance	44.32	18.37	18.86	61.27	27.41
Student interaction	48.53	21.39	22.6	57.4	32.84
Parent communication	53.7	21.8	25.76	51.23	46.18
Administrative tasks	32.85	19.96	22.03	44.41	31.92
Others	21.97	13.04	12.97	0.41	0.9

Note. This heatmap illustrates teachers' perceptions (indicated as percentages) of various teaching tasks across five dimensions: time consumption, difficulty, tiresomeness, AI receptiveness, and AI resistance. It highlights that tasks such as parent communication and student interaction are seen as both time-consuming and challenging. Tasks like lesson planning and creating questions are highly receptive to AI assistance, while interpersonal tasks like parent communication and student interaction are more resistant to AI intervention.

Source: Author's processing of collected data.

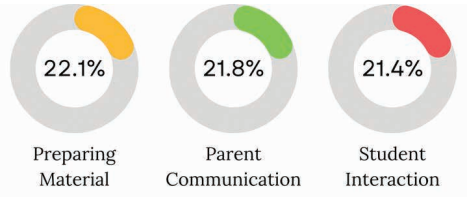
Key Insights from the Chart

(i) Time consumption



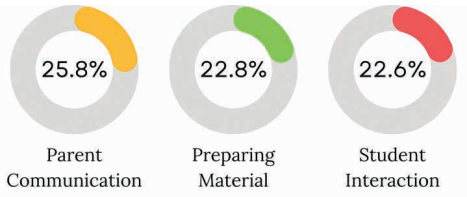
The most time-consuming tasks identified by teachers are "Parent Communication" (53.7%) and "Student Interaction" (48.53%), closely followed by "Preparing Material" (42.83%) and "Creating Questions" (42.81%). This indicates a significant portion of teachers' working time is spent on these activities, highlighting potential areas where efficiency could be improved.

(ii) Difficulty



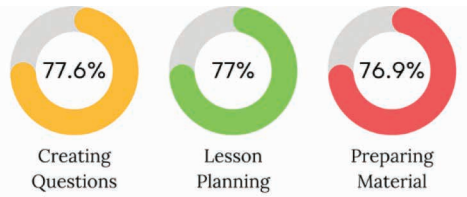
While time consumption is a major concern, difficulty levels add another layer of complexity, particularly for tasks like "Preparing Material" (22.06%), "Parent Communication" (21.8%) and "Student Interaction" (21.39%) which are perceived as challenging and may lead to increased workload stress and time demands. "Administrative Tasks" (19.96%) and "Creating Questions" (18.75%) were also identified as challenging by many teachers.

(iii) Tiresomeness



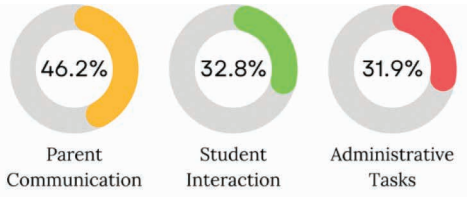
The tasks that teachers find most tiresome are "Parent Communication" (25.76%) and "Student Interaction" (22.6%), which may involve emotional labor. "Preparing Material" (22.8%), "Administrative Tasks" (22.03%), and "Creating Questions" (21.41%) are also seen as particularly tiresome, suggesting these tasks contribute to teacher fatigue.

(iv) AI receptiveness



Teachers are highly receptive to AI assistance in tasks such as "Creating Questions" (77.55%), "Lesson Planning" (76.97%), and "Preparing Material" (76.89%). This suggests that teachers recognize the potential for AI to reduce their workload in these areas, indicating that these tasks are potentially ideal for AI support. "Grading" (65.38%) and "Tracking Performance" (61.27%) also show significant AI receptiveness, pointing to an openness to AI helping with evaluative tasks.

(v) AI resistance



However, teachers express resistance to AI involvement in more interpersonal and nuanced tasks like "Parent Communication" (46.18%) and "Student Interaction" (32.84%). This reluctance suggests that while AI can help with certain tasks, there are areas that are seen as requiring a human touch that AI cannot easily replicate. "Administrative Tasks" (31.92%) also shows a notable level of AI resistance.

Certain tasks consistently appear at the top of the rankings for time consumption, difficulty, and tiresomeness, particularly "Parent Communication," "Student Interaction," "Preparing Material," and "Creating Questions." However, when looking at AI as a potential solution, **it's crucial to focus on areas where teachers are more open to AI assistance and find them particularly challenging and time-consuming.**

AI interventions in question creation, lesson planning, and preparing learning materials, where teachers are more receptive, can alleviate the workload in these high-effort areas while avoiding pushback from teachers.

C. Why Are Teachers Comfortable or Uncomfortable with AI Support?

1. Expectation for Enhanced Efficiency and Creativity

The majority of participants reported the top three uses for AI and automation as "Preparation of Teaching Materials", "Lesson Planning", and "Creating Assessment Questions." These are the tasks that the teachers felt the most comfortable for outsourcing to AI. The main reasons for this choice were the potential benefits to make teacher's work easier. Most respondents believed that AI would "ease the workload," "give teachers more time," "gain attention of students," "can think for new teaching techniques," and support with "known English grammar."

Beyond these general perceptions, there were notable comments. For instance, one respondent suggested that the use of AI could help promote "better representation of gender equity," while others believed it could better support "innovation" and "creativity in lesson planning" to better "engage the children."

2. Reluctance to Automate Human-Centric Tasks and Barriers to AI Adoption

However, when asked about the tasks they were not comfortable automating with AI tools, teachers were clear in their responses. "Communicating with Parents" (46.18%) and "Student Engagement and Interaction" (32.84%) were the top concerns.

Several reasons emerged for this reluctance to automate certain tasks. Many teachers believed that **personal interaction with students and parents is a fundamental part of their duty**, and that AI could potentially dilute this essential human connection. As one teacher noted, "preparing teaching materials requires a person's hand." The concern that relationships with parents might weaken if interactions are mediated by AI further reinforces their hesitation as one noted, "Relationship with parents will reduce [sic]."

Several other factors also contributed to this hesitation. Many teachers pointed to the "lack of IT-based classrooms" as a significant barrier to implementing AI tools effectively. Without the necessary infrastructure, integrating AI into daily tasks remains impractical. Additionally, "a lack of knowledge and expertise in using AI tools" further exacerbates their discomfort. Many teachers admitted they have "no training in AI," making the prospect of relying on these tools daunting. There were also fears that "constant use of AI might cause mental and physical problem," adding another layer of complexity to its adoption.

Interestingly, despite recognizing that administrative tasks are time-consuming and tiresome, there was little interest among teachers in automating these tasks with AI support. There is a need to better understand the specific nature of these administrative tasks to appreciate why teachers prefer to keep them manual, despite their burdensome nature.

3. Balancing AI Potential with Human Interaction

Overall, while there is optimism about the potential of AI to streamline certain tasks, the need for personal, human interaction in education remains a priority for many teachers. Their cautious approach reflects both the current limitations in technology and infrastructure, as well as a commitment to maintaining the human elements of teaching that they believe are irreplaceable.

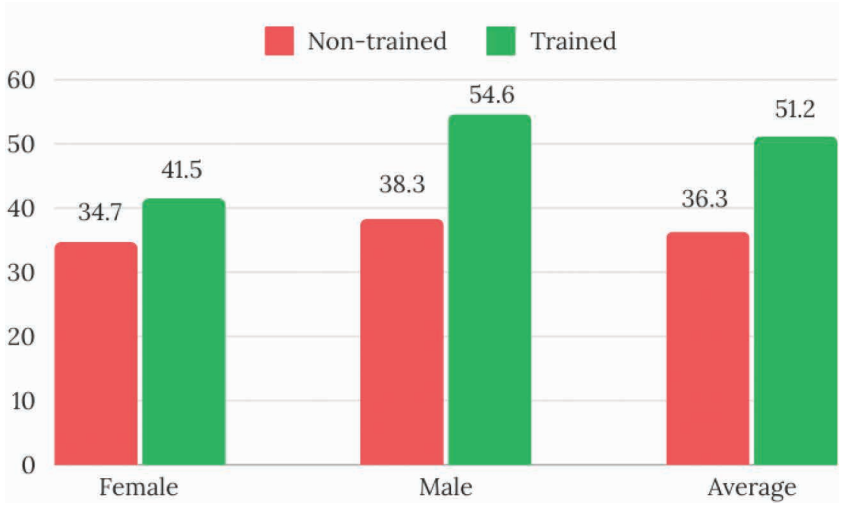
D. AI Training Enhances Confidence and Positive Perception of AI

We explored how AI training impacts individuals' confidence and perception of AI, focusing on respondents working in primary education, including teachers (96.7%), and education officers and others (3.3%). Respondents were asked to self-assess their AI competency on a scale of 1 to 100 (Figure 8) and to rate their agreement with the statement that AI is beneficial on a five-point scale ranging from "Strongly Disagree" to "Strongly Agree." (Figure 9). AI training notably enhances individuals' confidence in using AI technologies and improves their perception of AI, both of which are crucial for integrating AI into classroom environments.

Recent studies have highlighted that the use of emerging technologies such as AI to provide professional development for teachers has made a significant contribution to teacher quality, but they still lack the guidance needed on curriculum development and opportunities for collaboration with expert teachers (Cross, Chowdhury, and Khan 2022, p.885).

To prepare the youth of Bangladesh for an AI-enabled future, it is imperative to first ensure that every classroom is led by teachers trained in AI. The development of teacher training tools, whether AI-driven or not, is crucial. However, as Cross, Chowdhury, and Khan (2022), as well as the teachers in this survey highlight, the feasibility and effectiveness of the technology infrastructure for pedagogical purposes must be addressed first in order for Bangladesh to achieve advancements in teacher quality.

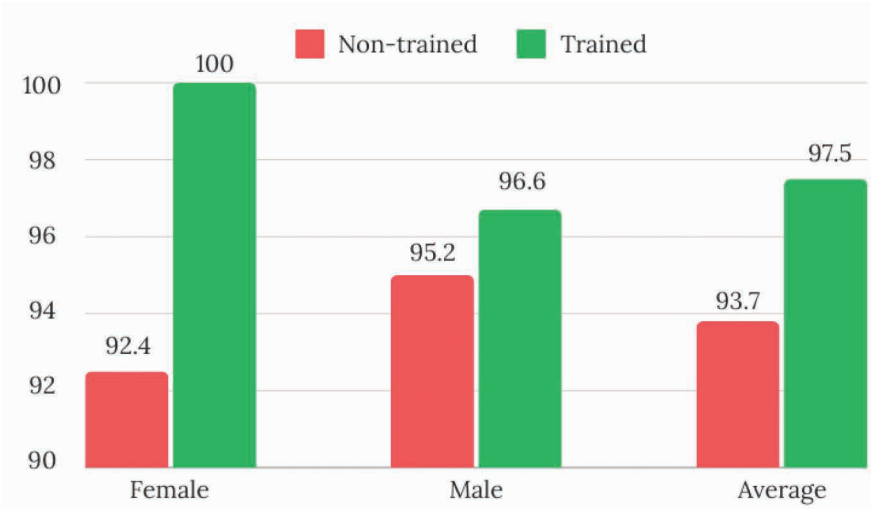
Figure 8: Self-Rated Competency Level of AI
(Non-trained vs. Trained Respondents)
(%)



Note: The figure illustrates the self-rated competency levels in understanding AI on a scale of 1-100, comparing two groups of respondents: those who did not receive any AI training (Non-trained; n=1,256) and those who received in-person AI training (Trained; n=40). The data are further categorized by gender.

Source: Author's processing of collected data.

Figure 9: Positive Perception of AI
(Non-trained vs. Trained Respondents)
(%)



Note. The figure shows the percentage of respondents with a positive perception of AI in response to the question, "Do you believe AI can be beneficial for primary education?" A response is considered positive if it is "Agree" or "Strongly agree" on a five-point scale. The chart compares two groups: those surveyed without any AI training (n=1,256) and those surveyed after in-person AI training (n=40).

Source: Author's processing of collected data.

Although the results indicate a promising increase in confidence and positive perception of AI among those who received AI training, the limited sample size (n=40) of trained respondents weakens the robustness and generalizability of the findings. Future studies should aim to include a larger sample size to provide more reliable conclusions.

The data clearly indicate that participants who completed the survey after a training session on AI scored higher on the self-assessed competency scale. This finding supports the belief that teachers' self-efficacy regarding AI and technology use may be enhanced through training.

Based on these insights, it is recommended that AI-enabled tools developed to support teachers should align with their competency levels and reinforced with ongoing training and instruction. In participants' responses and discussions during the training workshop, there was an overwhelming willingness to embrace AI technologies, though concerns were raised due to a significant lack of clarity about what AI can do and how it can best be used in teaching and learning. The importance of promoting quality teacher education is universally acknowledged, as high-quality teaching is the most effective means for schools to improve student outcomes (Education Endowment Foundation 2022).

E. What Teachers Need Most for the Future of AI in Bangladesh

When asked to share their perspectives on the future of AI in Bangladesh, participants identified several key needs that must be addressed:

1. The Need for Comprehensive Training

The majority of surveyed teachers emphasized the critical need for comprehensive training as a foundational step for AI integration. One teacher articulated this by stating, "(Directorate of Primary Education) should take part in in-depth research in AI. Making AI tools basis culture of primary education of Bangladesh." Additionally, many teachers emphasized the need for both "national and international training" opportunities, noting that "initiatives should be taken to inspire the use of AI in teaching process by providing training on AI."

2. The Need for the Development of AI Tools in Local Language and Context

The importance of preserving the Bangla language and ensuring that AI tools are accessible in the local language were strongly emphasized. Teachers expressed the need for AI tools to be available in Bangla, ensuring that they are culturally and linguistically relevant. As one teacher stated, "We want these AI tools in Bangali and our natural language," expressing the need for localized AI solutions that are easier for both teachers and students to use.

3. The Need for Speed to Action and Clear Guidance for All Stakeholders

Teachers stressed the need for swift actions to take advantages of the opportunities AI offers in education, coupled with clear guidance for all stakeholders. They emphasized the need for a well-defined pedagogical approach and stressed the importance of involving all stakeholders in the process. One teacher noted, "Guardians being aware and knowing their kids are using smartphone or laptop," highlighting the necessity of transparency and collaboration among educators, parents, and policymakers to create a supportive environment for AI integration in schools.

These insights reflect a strong recognition of AI's potential benefits in education, along with a call for thoughtful and culturally sensitive implementation. Teachers identified training, language preservation, swift action, and stakeholder involvement as key elements for the successful adoption of AI in Bangladesh's education system.

F. Teachers' Perceptions of AI as an English Language Tool

An intriguing finding from the survey data was the teachers' frequent perception of AI as a tool primarily associated with English language instruction and literacy. Many teachers expected AI to help improve their literacy and grammar skills. Common remarks included references to "grammar," "spelling," and broader language skills like "speaking, reading, writing," "pronunciation," and "vocabulary." Some teachers noted that AI could assist by ensuring "well-written" content and alleviating concerns about spelling and grammar errors.

Samples from the Survey Data

"helps us with grammar," "grammar" (repeated many times), "spelling" (repeated many times), "don't worry about spelling and grammar," "grammar skill develop (sic)," "speaking, reading, writing", "pronunciation", "well written," "I am not worry (sic) about myself spelling, grammar etc.," "vocabulary," "AI is machine which helps people to improve his skills, knowledge, and writing," "AI is an ultra-modern technology that is useful for present time like education and communication."

With 74.9% of survey respondents teaching in rural schools, the challenges they face may align with existing research, such as Hamid's (2011) findings on the difficulties of teaching English in rural areas. Although AI tools offer the potential to better support rural teachers through professional training and

the development of education materials, their effectiveness may be limited by the current infrastructure and lack of connectivity that many teachers reported.

G. Key Topic Detection and Sentiment Analysis Using Natural Language Processing

This section provides an in-depth analysis of key topics and sentiments embedded in teachers' responses to gain a more contextually rich understanding of their perceptions of AI. This qualitative study was conducted based on responses gathered from the following open-ended questions:

> *What do you think AI is? There is no answer. Focus on your thoughts and feelings, and don't worry about spelling, grammar, or how well written it is*

In order to ensure the quality and relevance of the data for deeper analysis, a filtering process was applied to the 1,127 initial responses. Of these, 797 well-structured responses were retained for further examination. The filtering criteria focused on removing responses that were poorly structured and/or provided minimal or incomplete information, ensuring that only responses with sufficient detail and clarity were included in the final dataset for analysis. Natural language processing (NLP) techniques, including preprocessing,[6] topic modelling,[7] keywords extraction,[8] and text summarization,[9] were employed to extract meaningful insights from the data. The analysis aimed to explore how teachers perceive AI, particularly with contextual information to its use, challenges, and potential benefits.

The survey responses revealed various sentiments of teachers toward AI, ranging from positive and neutral to a few negative ones (Table 4 and Figure 10). The majority of the responses exhibited positive sentiments toward AI, emphasizing its utility in **facilitating daily tasks, easing the teaching process, and enhancing educational efficiency**. Teachers particularly highlighted how AI could serve as a useful tool in the classroom, providing assistance with lesson planning and supporting students' learning processes.

A large portion of the responses were neutral, often reflecting a basic understanding of AI's concepts, such as defining it as a tool for simulating human intelligence or referencing it as a field of study within computer science.

On the negative side, a few respondents expressed concerns about AI, particularly in relation to the **substitution of human roles** and the **lack of understanding and training**. This underscores the need for more education and training on AI to alleviate fears and build confidence among educators in using these technologies effectively.

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6 Sentence tokenization; Stopwords removal; Spelling correction; Contraction expansion; Lemmatization; Bigram; POS inspection; and Key phrase extraction.

7 Bidirectional Encoder Representations from Transformers (BERT); and Density-based spatial clustering of applications with noise (DBSCAN).

8 Term Frequency – Inverse Document Frequency (TF-IDF).

9 Pre-training with Extracted Gap-sentences for Abstractive Summarization (PEGASUS); and Bidirectional and Auto-Regressive Transformer (BART).

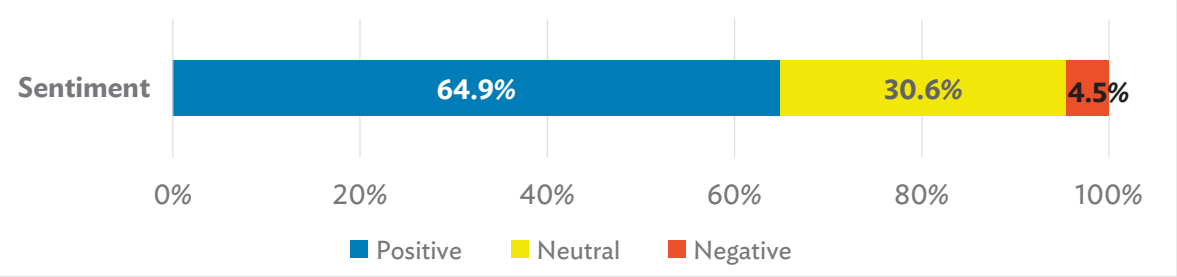
Table 4: Teachers' Definitions and Sentiments on AI

Topic	Counts	Summary of Key Ideas	Sentiment
1	145	It helps to work quickly in our daily basis work.	Positive
2	122	Artificial intelligence is a tool that can make our work easier.	Positive
3	113	It is important for the teacher to get any help of knowledge to teach the student.	Positive
4	100	A tool that every teacher needs to have in their classroom.	Positive
5	49	Artificial intelligence is the science of machines that can think like humans.	Neutral
6	45	I think artificial intelligence means a computerized system that can do complex tasks.	Neutral
7	33	It's important to cope with the modern world.	Neutral
8	31	I think artificial intelligence is the simulation of human intelligence process by computer system.	Neutral
9	20	I think artificial intelligence can help people in many ways.	Positive
10	19	Artificial intelligence be the intelligence of machine or software as opposed to the intelligence of human or animal.	Neutral
11	18	It is a field of study in computer science.	Neutral
12	14	I have heard of artificial intelligence but have no idea how it works.	Negative
13	13	These tasks include learning.	Neutral
14	13	Artificial intelligence is like a friend who know almost everything and is always ready to give answer or advice.	Positive
15	12	It can be used as the substitute of human being	Negative
16	11	Artificial intelligence stands for artificial intelligence.	Neutral
17	11	game building sketch wizard.	Neutral
18	10	We don't understand artificial intelligence and we need to train up us.	Negative
19	9	A reading robot.	Neutral
20	5	Artificial intelligence is a representation of one's desire action.	Neutral
21	4	Artificial intelligence can help me with any problem.	Positive

Note. This table summarizes the key topics and sentiments that emerged from teachers' responses to the survey question, "What do you think AI is?" (n=797). The "Topic" column represents thematic clusters identified through topic modelling, with "Counts" indicating the number of responses associated with each topic. The "Summary of Key Ideas" provides a concise synopsis of the central concepts within each topic, generated through text summarization. Lastly, the "Sentiment" column reflects the overall tone of the responses—positive, neutral, or negative.

Source: Author's processing of collected data.

Figure 10: Sentiment Distribution of Teachers' Responses on AI Perceptions



Note. This chart represents the sentiment distribution of teachers' responses to the survey question. The majority of responses (64.9%) express a positive sentiment, 30.6% are neutral, and 4.5% reflect a negative sentiment

Source: Author's processing of collected data.

1. Expected Positive Effects of AI in Education

In addition to exploring general perceptions, teachers were asked to share the positive impacts they expect from the integration of AI in education. An analysis of 624 responses uncovered a range of expected benefits, including enhanced teaching efficiency, personalized learning experiences, and considerable time-saving opportunities. Table 5 summarizes the frequency of occurrence, and key ideas expressed by the respondents.

Table 5: Summary of Teachers' Positive Expectations for AI in Education
(n=624)

Topic	Counts	Summary of Key Ideas
1	267	It will be easy for the teacher to teach and for the student to learn.
2	204	Positive change can occur in student's reading and learning as a result of the use of artificial intelligence.
3	107	All online relate work include all administrative work.
4	67	Easy to access available sources of information
5	65	Reduce of time waste and perform those tasks easily.
6	46	It is possible to improve the primary educational system.
7	40	Using this technology will make teaching easy
8	39	The advantage ranges from save time.
9	31	personalize the learning experience for individual student
10	30	It could benefit teach by giving easy to learn material.
11	24	I think it can save life.
12	24	Make perfect for future.
13	17	Artificial intelligence can collect and analyze data on student performance.
14	16	I think it will help us to do our work quickly.

Source: Author's processing of collected data.

2. Expected Negative Effects of AI in Education

Teachers also expressed their concerns regarding the possible negative consequences of the integration of AI in education. Various concerns emerged, including ethical issues, negative effects on creativity, overreliance on technology, and potential negative effects on student development. Table 6 summarizes the frequency, and key ideas shared by the respondents.

Table 6: Teachers' Concerns and Ethical Considerations of AI in Education
(n=624)

Topic	Counts	Summary of Key Ideas
1	230	The use of artificial intelligence in education raises ethical questions about privacy and data security.
2	123	Teacher and student may become dependent on it and lose their creativity.
3	56	Student will be addicted to electronic device.
4	32	I don't think there will be a negative or harmful effect.
5	30	I have lack of knowledge skill.
6	25	The barrier will be created in the intellectual development of the student.
7	22	I think it's a bad idea to lose student eyesight and mental health.
8	20	Underaged student will start to waste their time with technology.
9	15	Overreliance on automation may diminish the personal connection between educator and student.
10	12	Sometimes we get wrong information.
11	10	Artificial intelligence will make people lazy and they will become more dependent on it.
12	10	Reduce the emphasis on human interaction and the development of essential interpersonal skill in student
13	9	There is a lack of human like creativity and empathy.
14	7	While it promises personalized experience, the risks are real
15	7	Mechanical life may be detrimental to mental development.
16	6	The choice is ours to make artificial intelligence a force for good.
17	5	Dependency on artificial intelligence for teach task may lead to over reliance.
18	5	Job displacement and it can dehumanize the learning experience.

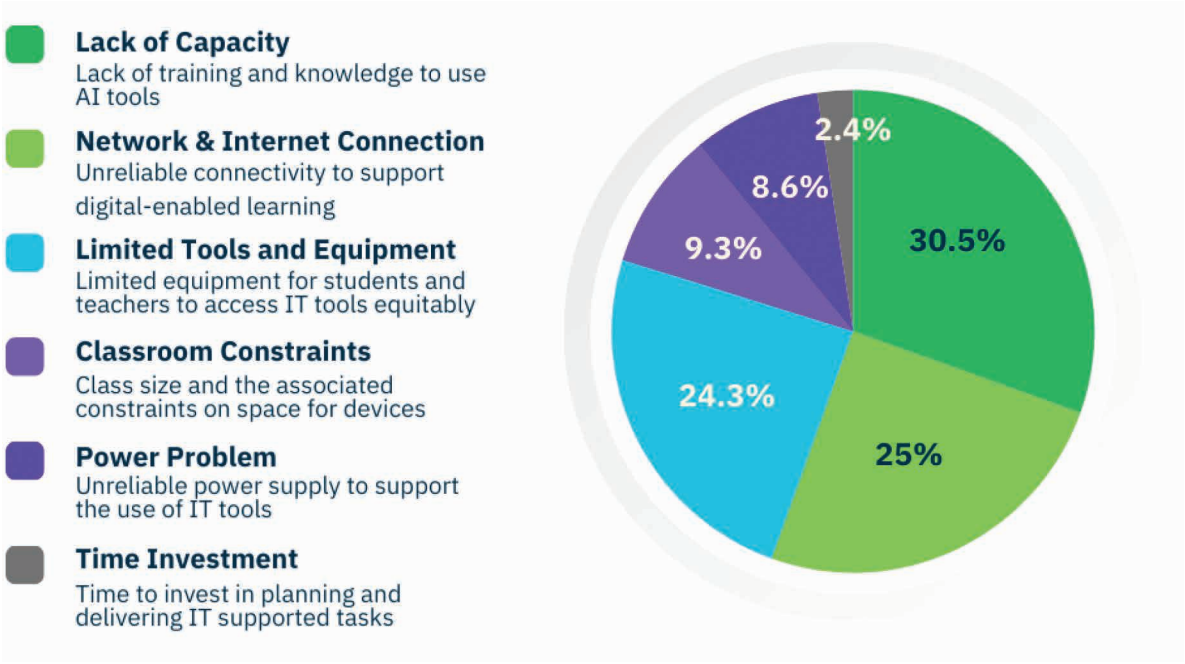
Source: Author's processing of collected data.

This qualitative analysis shows that while teachers generally hold positive views on the integration of AI in education, there are concerns related to its implementation. Teachers expect AI to improve teaching efficiency, personalize learning experiences, and reduce teaching burdens. However, issues like data privacy, loss of creativity, and overreliance on technology remain as key concerns. To fully realize the benefits of AI in education, these concerns must be addressed through **proper training, the provision of ethical guidelines, and a balanced integration of AI alongside human interaction.**

H. Challenges and Barriers to ICT Usage

When survey participants were asked to share their challenges with ICT usage in Bangladesh's primary schools, the participants revealed the following challenges (Figure 11):

Figure 11: Challenges Faced by Teachers with IT Use
(n=292)



Source: Author's processing of collected data.

Before bringing new technologies into the classroom, it is important to understand the current concerns of teachers and develop effective strategies to tackle them. Without establishing a solid foundation, such as offering training, improving infrastructure, and ensuring access to resources, the implementation of AI or other digital solutions may not meet expectations.

Needed assistance. To better understand their needs, teachers were asked to describe the support they need to overcome these challenges. Table 7 shows examples of their responses, offering more context on the specific assistance teachers are seeking.

Table 7: Teachers' Needs for Effective Technology Integration in Education
(n=439)

No.	Topic	Response Examples
1	Training	The most urgent need for support is access to professional development opportunities that focus on integrate technology effectively in the classroom
2		I need proper training and adequate tool
3		Training by the teacher because I cannot share my problem with Primary Teachers Training (PTT) trainer
4		We need to be very smart in ICT and be comfortable with it in the educational sector.
5		There should be sufficient skill and artificial intelligence educational setting.
6	Connectivity	Ensuring access to technology and a reliable internet connection is essential for effective teaching.
7	AI Tool	Artificial intelligence and automation support would help the student and teacher.
8	Technical assistance	Assistance to prepare teaching material
9		Measure to ensure data security and privacy
10		Learning management assistance and virtual classroom assistance

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Table 7 *continued*

11	Classroom	Extra building with classroom and furniture are needed
12		Create a classroom environment that is high quality.
13	Equipment	Every classroom needs a fixed high resolution projector system
14		All class should be equipped with multimedia system
15	Power	It is necessary for the classroom to have a constant power connection so that teaching is not interrupted.

Source: Author's processing of collected data.

I. Key Action Items Recommended by Teachers

Teachers were asked to propose potential next steps for implementing AI in education and emphasized several key actions. Figure 12 illustrates these proposed actions:

Figure 12: Teacher-Recommended Actions for Integrating AI in Education

Source: Author's processing of collected data.

Many of the recommended actions closely match the needs of teachers in overcoming the ICT challenges outlined in Figure 11. Teachers overwhelmingly identified the need for **training** as their top priority, stressing that without proper training, they would struggle to incorporate new technologies into their teaching practices. They also pointed out the importance of **connectivity**—without reliable internet access, any digital or AI tool would be rendered ineffective. Teachers also emphasized the need for the right **equipment** and **infrastructure**, such as AI tools and classroom resources.

Addressing these barriers through targeted interventions in training, infrastructure development, and community engagement will be critical for the effective implementation of AI in the education sector in Bangladesh.

VI. OPPORTUNITIES FOR AI IN EDUCATION THROUGH THE LENS OF TEACHERS

Integrating AI into education opens up a range of promising opportunities. Based on the insights gathered from teachers' survey responses, we aim to explore how AI can enhance the learning experience, support teaching, and create more inclusive educational environments.

In the following sections, we will delve into specific areas where AI has the potential to make a significant impact, guided by the feedback and ideas shared by these teachers.

A. Personalized Learning

As one respondent shared, "I believe AI's future is brimming with potential to improve our lives in various ways. Imagine learning tailored to your pace, or health care that predicts and prevents illnesses. AI can personalize many aspects of life, making them more effective and enjoyable. By harnessing its power wisely, we can unlock a future filled with positive possibilities."

Another respondent shared, "Educators can automate tasks, making their day-to-day easier and giving them more time to focus on their students and class. Students can easily receive personalized and differentiated approaches to instruction, fitting to their learning journey."

AI can tailor education content to individual student's needs, learning paces, and styles. This can help in addressing diverse learning requirements and improving overall student performance. AI can also be used to analyze student data to provide insights into strengths and weaknesses, allowing for more personalized interventions and support.

B. Enhanced Teaching Support

There is significant potential for AI tools and educational chatbots to support teachers' professional learning and development. AI may also help identify skill gaps in teachers and recommend personalized professional development programs, helping them stay updated with the latest education practices. One participant explored this saying, "In implementing automation and AI in educational settings in Bangladesh, it's crucial to prioritize infrastructure development, ensuring widespread access to technology and comprehensive digital literacy training. Additionally, fostering ethical AI practices, promoting public awareness, and encouraging public–private partnerships will contribute to a more inclusive and effective integration, aligning with national educational goals."

C. Curriculum and Content Development

"(AI) can enhance learning and teaching sectors for both students and teachers. In making lessons, preparing educational materials, grading assessments and in other educational sectors," according to one participant.

AI can assist teachers in creating and updating educational content, including interactive lessons, assessments, and multimedia resources. AI can also provide translation and language support tools, aiding in the delivery of content in multiple languages, which is particularly useful in a multilingual country like Bangladesh.

In terms of language and content, an appreciation for the local context is key as expressed by this participant: "It would be beneficial to prioritize teacher training to effectively integrate these tools into the curriculum, ensuring a balanced approach between technology and human interaction. Additionally, creating localized content and solutions that resonate with Bangladesh's cultural and linguistic diversity can amplify the impact of automation and AI in education."

D. Support for Special Needs Education

It has been shown that AI can develop tools to support students with disabilities, including speech-to-text applications, learning aids, and other assistive technologies. It may also help create more inclusive educational environments by providing tailored support to students with diverse learning needs. One participant echoed this saying, "AI can provide additional support and resources for students with special needs, helping them to learn in a way that best suits their individual requirements."

VII. RECOMMENDATIONS

Schools are part of a complex ecosystem of factors, which means that a positive attitude and increased teacher knowledge are not enough to fuel the uptake of AI tools for education. The "adoption of AI-based adaptive learning platforms, or any particular artefact as a matter of fact, is first and foremost likely to be influenced by the particular features of the artefact itself" (Cukurova, Miao, and Brooker 2022, p.153).

After exploring the survey findings and a literature review as described in Annex 3, we have developed a set of recommendations to guide the more effective adoption and use of AI in Bangladesh's educational settings.

These recommendations emphasize key areas such as training, infrastructure, technical support, curriculum integration, policy, and data security. Educators and policymakers can be better positioned to integrate AI into the education system by addressing these issues.

Table 8: Key Recommendations for Integrating AI in Education

Recommendations	Action Items	Relevant challenges[a] and concerns[b] raised
Training and Development	(i) Develop comprehensive training programs to enhance teachers' understanding and effective use of AI tools. (ii) Develop resources and workshops focusing on practical applications of AI in the classroom.	Lack of training and knowledge
Infrastructure Improvement	(iii) Invest in technological infrastructure to support the integration of AI, including reliable internet access and modern devices. (iv) Provide necessary equipment to facilitate the use of AI applications.	Unreliable connectivity and power supply
		Classroom size and space constraints
		Limited equipment and access to IT tools

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Table 8 *continued*

Technical Support and Sustainable Operation	(i) (ii)	Develop local expertise in AI technologies to provide ongoing support. Create sustainable models for maintenance and updating of AI systems/ tools.	Burden of delivering IT supported tasks Lack of cultural relevance in AI tools
AI Integration into Curriculum	(i) (ii) (iii)	Ensure that AI tools and applications align with the national curriculum and educational goals. Work on integrating AI-related content into the curriculum to equip students with essential AI knowledge Develop AI tools that are culturally and linguistically adapted to Bangladesh.	Lack of training and knowledge Burden of delivering IT supported tasks Lack of cultural relevance in AI tools
Policy and Support Measures	(i) (ii) (iii)	Develop and implement policies that encourage the adoption of AI in education while addressing privacy and ethical concerns. Provide continuous support and resources to educators for the successful integration of AI technologies. Involve parents, teachers, students in the policymaking and AI integration process to build trust and acceptance.	Limited equipment and access to IT tools Lack of training and knowledge Data privacy and online safety issues
Data Privacy and Security	(i) (ii) (iii)	Develop and enforce strict data protection policies to ensure the privacy and security of student and teacher data. Create guidelines for the ethical use of AI, focusing on issues such as bias, transparency, and accountability. Ensure that the use of AI tools is transparent, with informed consent obtained	Data privacy and online safety issues

[a] As detailed in sections V.H

[b] As detailed in section V.G.2

Source: Author's processing of collected data.

Box: Data Privacy and Ethics Frameworks by UNESCO and OECD

AI systems in education should ensure that data collection is conducted with informed consent, and personal data are protected against any misuse. These systems should also prevent discrimination or bias, especially when dealing with personal or sensitive data in education systems.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Organisation for Economic Co-operation and Development (OECD) have both developed guidelines to tackle the growing ethical concerns related to AI, with an aim to ensure that AI systems are designed responsibly, especially when it comes to data privacy and security.

UNESCO's Framework on AI Ethics and Privacy

In 2021, UNESCO introduced a set of standards to address the ethical issues of AI. This framework puts a strong emphasis on the following:

(i) **Human rights and privacy:** AI systems must respect human rights and the privacy of individuals, ensuring that data collection practices are ethical and consent-based.
(ii) **Transparency and accountability:** AI systems should be designed to operate transparently, meaning users should understand how their data are being used, and there should be clear accountability for any misuse,
(iii) **Bias avoidance:** Developers must be vigilant about biases in AI algorithms, particularly those based on personal data, to prevent unfair treatment of certain groups.

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Box 1 *continued*

OECD's AI Principles on Data Privacy and Ethics

In 2019, OECD released the AI principles to promote trustworthy AI systems by providing strong guidelines for data privacy and ethics. There are its key principles:

(i) **Privacy protection:** Robust data governance must be in place to protect individuals' privacy, advocating for the secure handling of data and limiting the collection and use of personal data to what is strictly necessary.
(ii) **Fairness and nondiscrimination:** Bias in AI systems must be prevented, and data governance should be structured to prevent discriminatory practices, ensuring that algorithms do not unfairly discriminate against individuals based on personal data.

Source: UNESCO. Recommendation on the Ethics of Artificial Intelligence. https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence; and OECD. AI Principles overview. https://oecd.ai/en/ai-principles.

VIII. COMPLEMENTARY INSIGHTS: KEY TAKEAWAYS FROM IN-PERSON AI TRAINING WORKSHOP

In addition to the online survey, ADB, in collaboration with the Training Division of the Directorate of Primary Education (DPE) of Bangladesh, organized an in-person AI training workshop for primary education teachers and educators in Dhaka on 12–13 September 2023. The workshop was attended by 42 participants, including teachers, government officials, and curriculum specialists.

The event featured AI awareness sessions and design thinking workshops to enhance participants' understanding of AI while fostering discussions on the challenges teachers face in delivering education. Participants also explored potential digital solutions to address these challenges. The workshop offered valuable insights into the current state of AI adoption in primary education and highlighted the specific needs of teachers in the region, which closely aligned with the findings of online needs assessment survey.

Table 9 summarizes teachers' awareness and perceptions of AI in education. Teachers showed a strong interest and optimism in adopting AI tools, though they feel more training is required and expressed concerns regarding online safety, data privacy, and ethical issues.

Table 9: Awareness and Perception of AI

Category	Description
Interest in AI	Teachers are keen to adopt AI tools but need further training.
Understanding of AI	Teachers are optimistic about AI but lack concrete understanding and hands-on experience to feel confident in using AI.
Potential of AI	Teachers recognized AI's potential to enhance personalized learning and resource creation.
Concerns	Online safety, data privacy, and ethical issues were raised as significant concerns.

Source: Author's processing of collected data.

Table 10 outlines key challenges in integrating AI into education. Infrastructure issues include unreliable internet, frequent power disruptions, and insufficient ICT resources, particularly in rural areas. Additionally, developing AI tools in Bangla and ensuring cultural relevance are essential for improving accessibility and effectiveness in the local context.

Table 10: Challenges Identified

Category	Description
Infrastructure	Lack of reliable internet, power disruptions, and inadequate ICT materials, especially in rural areas.
Training and Support	Need for ongoing national and international training programs to effectively integrate AI in classrooms.
Cultural and Linguistic	Emphasis on developing AI tools in Bangla and culturally relevant to the local context for better accessibility.

Source: Author's processing of collected data.

Table 11 presents key AI solutions generated during design thinking breakout sessions, including developing AI tools for real-time translation and personalized learning, creating AI-powered tools to assist teachers in generating quizzes and educational materials, and proposing an AI chatbot tailored for primary education to support both teachers and students.

Table 11: Design Thinking Breakout Sessions: Ideation of AI Solution

Key AI Solutions Proposed
(i) AI tools for real-time translation and personalized learning experiences.
(ii) AI assistant for teachers in generating quizzes, tests, and learning materials.
(iii) AI chatbot for primary education to support teachers and students by giving feedback.

Source: Author's processing of collected data.

Table 12 outlines key recommendations to support the effective adoption of AI in Bangladeshi education. These recommendations reinforce themes identified in the earlier sections, including the need for training, infrastructure improvements, and community involvement to address challenges and concerns.

Table 12: Actionable Recommendations

Category	Description
Training Programs	Comprehensive AI training tailored for Bangladeshi teachers with practical focus and continuous support.
Infrastructure Development	Investment in internet access and modern digital devices for successful AI integration.
Community Engagement	Involving parents, local leaders, and policymakers to build support and address misconceptions about AI.

Source: Author's processing of collected data.

The workshop concluded with a clear understanding that, while there is considerable interest and potential for AI in education, success will depend on addressing the infrastructure, training, and cultural challenges highlighted by the participants.

More importantly, the insights gained from the workshop closely match with the findings of the online survey, which emphasize the necessity for focused interventions. These insights can act as a guide

for creating future training programs, AI-driven solutions, and policy recommendations, all aimed at supporting the effective integration of AI in Bangladesh's education system.

Group discussion session. Teachers engaging in brainstorming ideas for integrating AI into their classrooms. The workshop emphasized the importance of teacher's input in the design of AI tools and strategies (photo by ByeongJo Kong).

Group presentation. A group of teachers presenting their proposed AI solution to their peers. It underlines the importance of collective learning and the exchange of innovative ideas that emerged from the workshop (photo by ByeongJo Kong).

The full presentation slides developed by the teachers are attached in Annex 2.

IX. CONCLUSION

The findings of this AI needs assessment survey and training initiatives indicate a strong interest and willingness among Bangladeshi teachers to embrace AI tools, along with a keen understanding of AI's potential to transform educational practices. Teachers view AI as a valuable resource for simplifying lesson planning, creating assessment questions, and providing personalized support to students. Yet, unlocking AI's full potential in Bangladeshi classrooms depends on addressing a set of pressing challenges: developing robust infrastructure, creating culturally relevant AI content, providing training, and fostering community support.

This report discusses several key themes and actionable recommendations. First, significant investments in **digital infrastructure** are essential to support reliable internet access, power supply, and modern digital devices, especially in rural and hard-to-reach areas. Teachers also emphasized the importance for continuous, practical **AI training** tailored to their specific needs, which would help build their confidence in effectively using AI tools. Integrating AI into education must be accompanied by **community engagement** efforts that involve parents, local leaders, and policymakers, creating a collaborative environment that dispels misconceptions and builds trust in AI's role in education.

Culturally and linguistically relevant **AI tools in Bangla** are also essential for accessibility and impact. Teachers pointed out that tools designed for the Bangladeshi context would resonate more and be more usable in classrooms, especially for those who are less familiar with English. Moreover, as emphasized

in the survey results, these efforts should be coupled with a **balanced integration of AI with human elements** in education.

UNESCO (2023) advocates for a human-centered and ethically guided approach to integrating AI in education, focusing on applications that are suitable for different age groups and grounded in sound pedagogical principles. This report aims to align with such international frameworks, highlighting the necessity of co-developing AI tools with Bangladeshi educators that can enhance teacher upskilling and ensure quality education, thereby equipping youth for the Fourth Industrial Revolution. However, this must be done in the context of a plan to provide a well-connected classroom infrastructure that can support the digital education needs of both students and teachers.

The Government of Bangladesh has prioritized expanding access, equity, and quality in education at all levels, as highlighted in the BANBEIS 2022 report. Over the past decade, significant progress has been made toward gender-equitable education. The country is now well positioned to progress toward leveraging AI's potential to enhance educational outcomes and improve employment opportunities for its youth.

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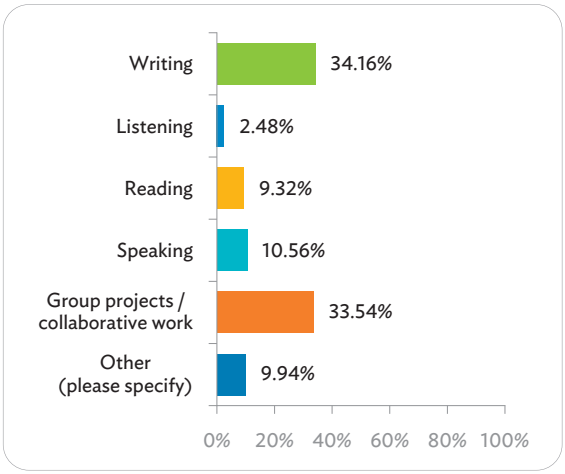
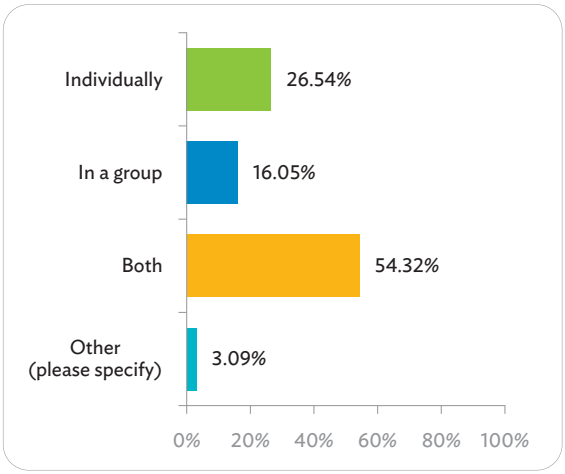
Annex 1: Survey Results on Class Preparation and Student Assessments

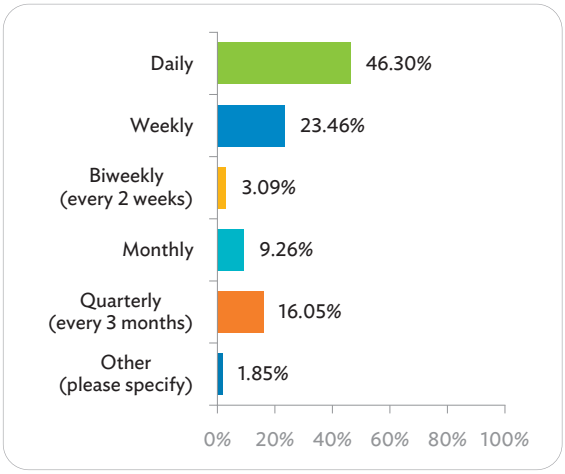
Q40: What is your method(s) of student assessment? Select all that apply.
Answered: 161 Skipped: 1,093



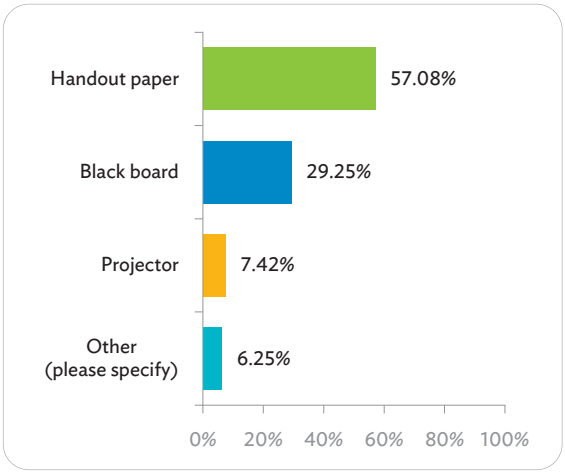
Q41: How are assessments typically conducted?
Answered: 162 Skipped: 1,092



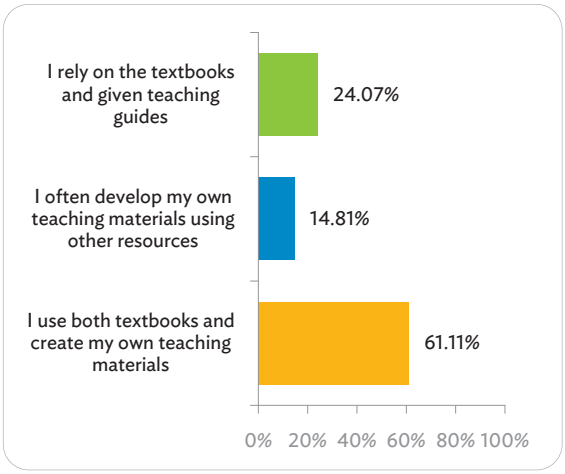
Q42: What is the frequency of formative assessment?
Answered: 162 Skipped: 1,092



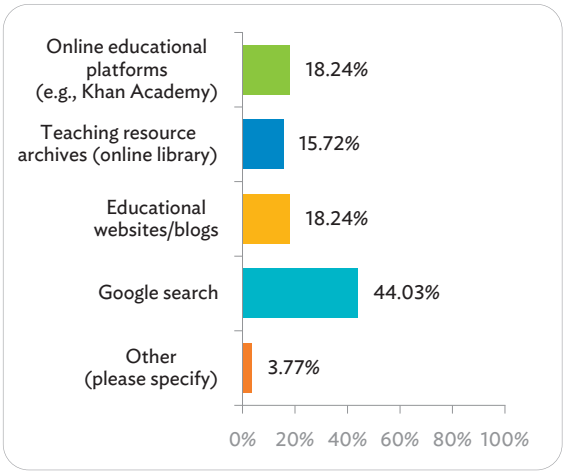
Q43: Through which medium do you conduct student assessment?
Answered: 1,200 Skipped: 54



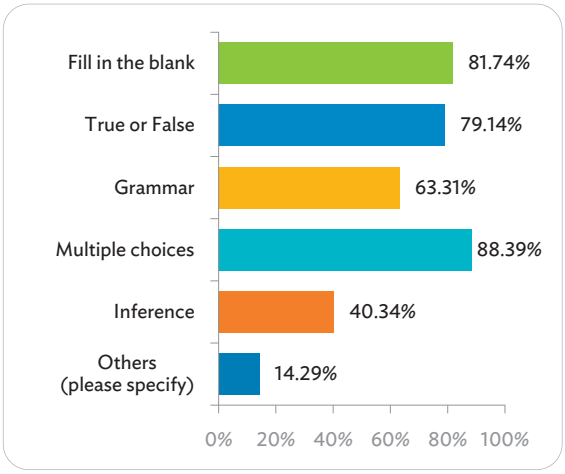
Q44: When preparing for classes, which of the following best describes your approach
Answered: 162 Skipped: 1,092



Q45: Select the types of resources you use for preparing classes (Check all that apply)
Answered: 159 Skipped: 1,095

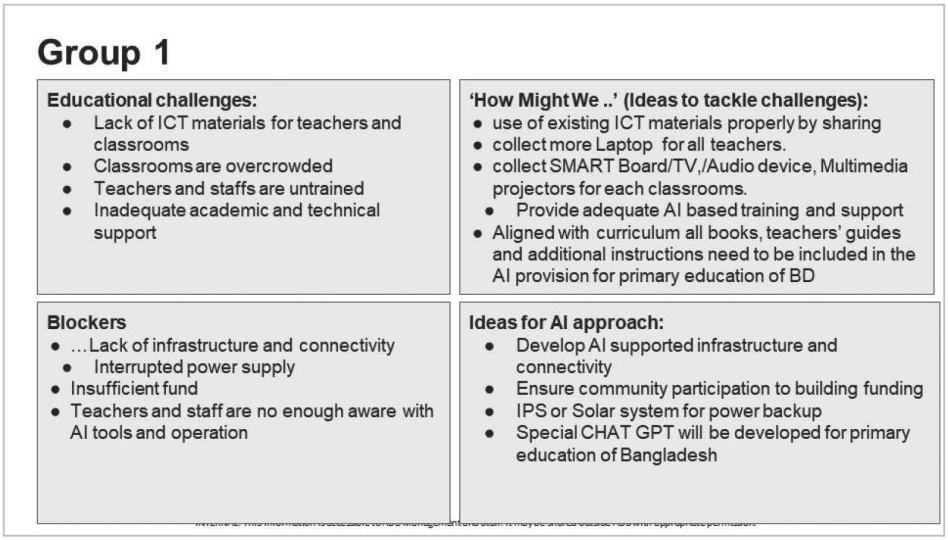


Q46: Please indicate what types of questions you need to create for the formative and summative questions (Select all that apply)
Answered: 1,232 Skipped: 22



Note: Questions 40, 41, 42, 44, and 45 were added later during the survey period, which resulted in reduced response rates for these items.

Annex 2: Group Breakout Session Slides from the AI Training Workshop (12–13 September 2023, Dhaka): Ideation of AI Approaches in Education by Primary Education Teachers



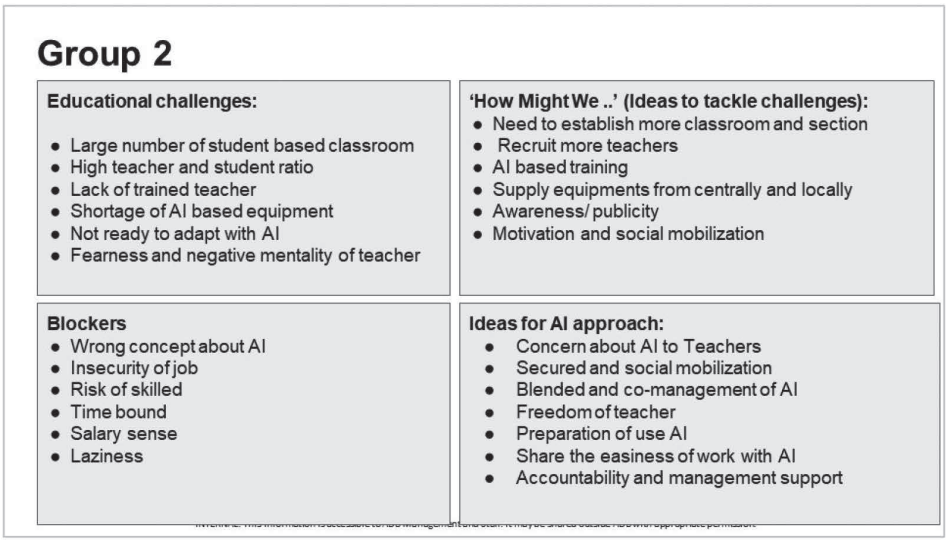
Group 1

Educational challenges:
- Lack of ICT materials for teachers and classrooms
- Classrooms are overcrowded
- Teachers and staffs are untrained
- Inadequate academic and technical support

'How Might We ..' (Ideas to tackle challenges):
- use of existing ICT materials properly by sharing
- collect more Laptop for all teachers.
- collect SMART Board/TV,/Audio device, Multimedia projectors for each classrooms.
- Provide adequate AI based training and support
- Aligned with curriculum all books, teachers' guides and additional instructions need to be included in the AI provision for primary education of BD

Blockers
- …Lack of infrastructure and connectivity
- Interrupted power supply
- Insufficient fund
- Teachers and staff are no enough aware with AI tools and operation

Ideas for AI approach:
- Develop AI supported infrastructure and connectivity
- Ensure community participation to building funding
- IPS or Solar system for power backup
- Special CHAT GPT will be developed for primary education of Bangladesh



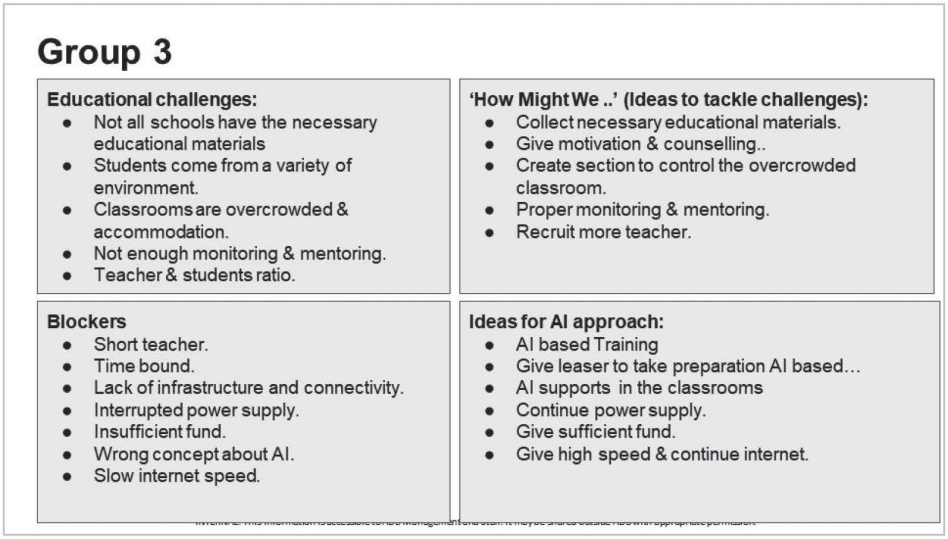
Group 2

Educational challenges:
- Large number of student based classroom
- High teacher and student ratio
- Lack of trained teacher
- Shortage of AI based equipment
- Not ready to adapt with AI
- Fearness and negative mentality of teacher

'How Might We ..' (Ideas to tackle challenges):
- Need to establish more classroom and section
- Recruit more teachers
- AI based training
- Supply equipments from centrally and locally
- Awareness/ publicity
- Motivation and social mobilization

Blockers
- Wrong concept about AI
- Insecurity of job
- Risk of skilled
- Time bound
- Salary sense
- Laziness

Ideas for AI approach:
- Concern about AI to Teachers
- Secured and social mobilization
- Blended and co-management of AI
- Freedom of teacher
- Preparation of use AI
- Share the easiness of work with AI
- Accountability and management support



Group 3

Educational challenges:
- Not all schools have the necessary educational materials
- Students come from a variety of environment.
- Classrooms are overcrowded & accommodation.
- Not enough monitoring & mentoring.
- Teacher & students ratio.

'How Might We ..' (Ideas to tackle challenges):
- Collect necessary educational materials.
- Give motivation & counselling..
- Create section to control the overcrowded classroom.
- Proper monitoring & mentoring.
- Recruit more teacher.

Blockers
- Short teacher.
- Time bound.
- Lack of infrastructure and connectivity.
- Interrupted power supply.
- Insufficient fund.
- Wrong concept about AI.
- Slow internet speed.

Ideas for AI approach:
- AI based Training
- Give leaser to take preparation AI based…
- AI supports in the classrooms
- Continue power supply.
- Give sufficient fund.
- Give high speed & continue internet.

Group 4

Educational challenges:
- Lacking of devices (laptop, projector, wifi connection, backup system, electricity,)
- Not enough class rooms.
- Not enough ICT trained teachers.
- Lacking of enough budget to maintain ICT education.
- Teachers students ratio.
- No facilities for disable ss.

'How Might We ..' (Ideas to tackle challenges):
- Govt. should be support by supplying devices and Need enough scopes to communicate to ICT experts.
- Taking classes by rotation in same multimedia room.
- By in house, foundation and repression training.
- Collecting fund from local community and stockholders.
- Appointing para teachers (part-time).
- Special caring for disable ss like extra helps.

Blockers
- Govt. has also financial problem to supply enough equipments.
- To taking class by rotation there are also not extra room.
- Rural public aslo no conscious to solve about schools problems.
- Appointing enough teachers with making enough buildings too.
- Sometimes disabisable ss also not capable

Ideas for AI approach:
- We can ask Chat GPT about solving the following problems and try to apply the suggested tips to solve our problems. We can also ask Chat GPT about teaching technology to apply in our class.

Group 5

Educational challenges:
- Shortage of IT Skilled Teachers and Trainers
- Limited digital equipment
- Unwillingness of teachers and parents to receive AI Tools
- Students are from diversified socio-economic background
- Students are from different geological area like char haor, costal and hill area etc.
- Teacher-students ratio

'How Might We ..' (Ideas to tackle challenges):
- We need to develop ICT experts to impart training the general teachers to conduct formative and summative tests.
- Increase the internet infrastructure all the nook and corner of the country.
- Government has to increase fund internet for all schools and education managers.
- Provide high quality devices for using the AI tools in the schools

Blockers
- interrupted electricity supply
- Poor network connectivity
- Very few research for AI in primary education
- AI is not familiar to most of the teachers
- Lack of Smart Phone or devices
- Misconception about security
- Data security, data storage
- Overloaded class
- Burden of Extra official work

Ideas for AI approach:
- Make students e-profile by AI
- Provide necessary feedback to students performance and development
- Customized chatbot development only for primary education in Bangladesh
- Increase teachers' awareness
- Develop adaptive mentality
- Develop mentoring and monitoring mechanism

Group 6

Educational challenges:
- …Lack of Trained Teachers
- Lack of Technology Access
- Infra structural shortage
- Big Teacher-students Ratio
- Less social awareness towards children education

'How Might We ..' (Ideas to tackle challenges):
- …Ensure Teachers Training regularly
- Supply and Provide with Tech equipment and skills
- Establish required infrastructure
- Recruit new Teachers to reduce the ratio
- Increase Number of Class rooms
- Ensure Community Participation
- Ensure Post training monitoring

Blockers
- …Schools have inadequate Resources
- Schools and learners mostly suffer from shortage of Teachers
- Teachers and students don't have enough scope to use technological supports

Ideas for AI approach:
- …AI based Training Need Assessment might be done
- Developing AI supported materials for teachers - training
- Create scope to reach teachers-students using Blended Learning and e-Learning system
- Introduce AI based Virtual Teachers

Annex 3: Literature Review: Factors Affecting Uptake of AI

Ilomäki and Lakkala (2018) found that change associated with the adoption of a new technology innovation does not simply happen at the classroom level. Rather, such change is connected to pedagogy, leadership, teacher perception, and attitude in addition to infrastructure and technical pedagogical support (Cukurova, Miao, and Brooker 2022). This finding was also evident in the responses to the AI needs assessment survey. The participants referenced large class sizes, lack of teacher training, and existing infrastructure as key barriers to the adoption of AI tools in Bangladesh.

Cukurova, Miao, and Brooker (2022) studied the factors influencing teacher's engagement with AI tools in schools and found that "although teachers' knowledge, confidence and product quality are all important factors, they are not necessarily the only, may not even be the most important factors influencing the teachers' engagement with AI platforms in schools."

Infrastructure and a lack of ICT materials and devices

In their mapping of Bangladesh's progress toward the achievement of the United Nations Sustainable Development Goals 4.a.1, the BENBAIS (2022) data show that in 2021, 98.39% of schools had access to electricity and 76.87% had access to computers for pedagogical purposes. By contrast, only 52.21% of schools had access to the internet for pedagogical purposes. These data are shown in Table A3.1.

Table A3.1: Progress in Access to Educational Infrastructure and Resources, 2015–2021

Goal: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Indicator: ***4.a.1 Proportion of schools with access to: (a) electricity; (b) the Internet for pedagogical purposes; (c) computers for pedagogical purposes; d) adapted infrastructure and materials for students with disabilities; (e) basic drinking water; (f) single-sex basic sanitation facilities; and (g) basic handwashing facilities (as per the WASH indicator definitions)***

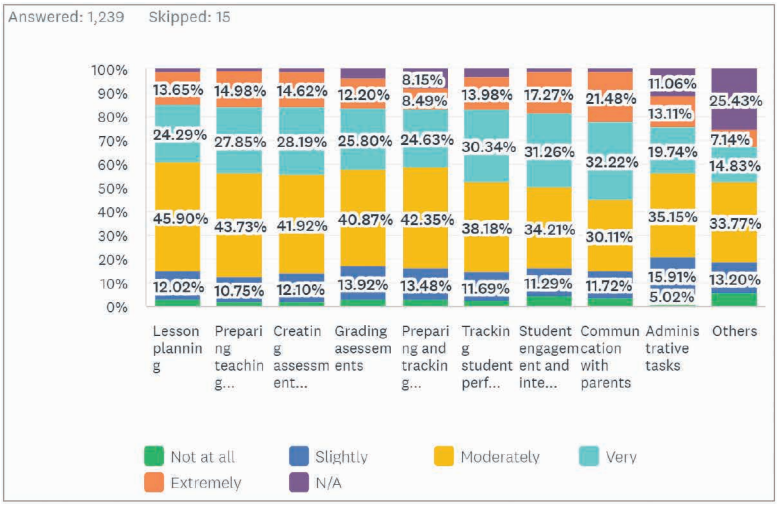
Year							Comments/ Remarks
Baseline Data 2015	2016	2017	2018	2019	2020	2021	
a) Electricity							
86.03	88.82	89.93	90.11	93.25	95.96	98.39	
b) Internet for pedagogical purposes							
26.49	29.24	34.56	35.21	37.64	47.50	52.21	
c) Computer for pedagogical purposes							
82.00	84.00	85.88	86.23	76.72	76.85	76.87	Partially (Includes School, College, Madrasah, TVET & Voc, independent & English Medium)
d) Ramp							
14.00	16.16	17.38	18.03	18.48	18.76	18.76	
e) Basic drinking water							
		96.61	97.05	97.07	97.48	97.48	
f) Single-sex basic sanitation facilities							
		95.55	95.88	95.93	96.59	96.62	
g) Basic hand washing facilities							
		19.68	20.25	28.66	54.90	88.08	

Source: BENBAIS, 2022, p.50.

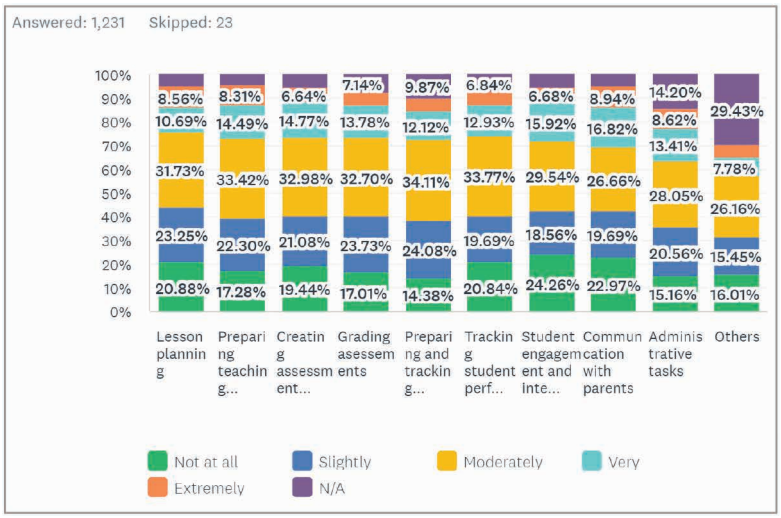
The provision of internet connectivity in every school is imperative to address. It is one of the key issues raised by the participants surveyed and is echoed in the *National Strategy for Artificial Intelligence Bangladesh*. Ensuring good connectivity will provide educators and learners with access to AI tools. When asked to prioritize support needed, the participants called for connectivity, training, and devices.

Annex 4: Detailed Survey Results: Insights on Time-Consuming, Tiresome, and Challenging Tasks During the Teaching

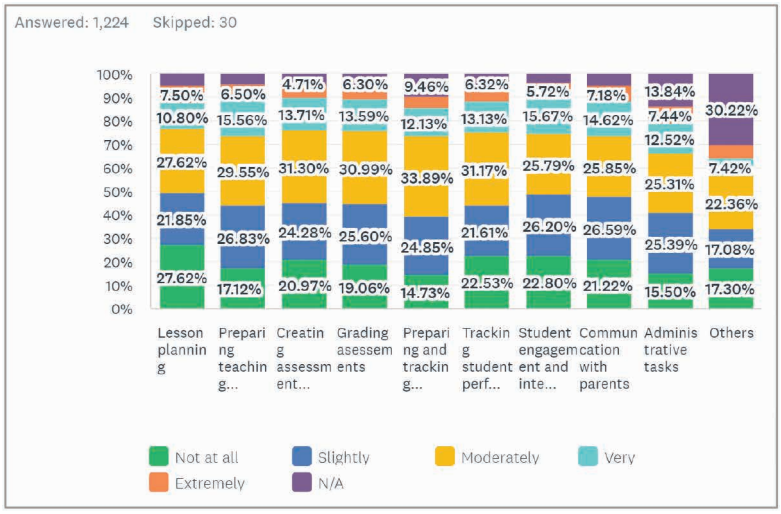
Q13. On average over the teaching term, please indicate which tasks/processes you consider time-consuming. Please check N/A, if you are not involved in the tasks/processes:



Q15. On average over the teaching term, please indicate which tasks/processes you consider tedious/tiresome. Please check N/A, if you are not involved in the tasks/processes:



Q16. On average over the teaching term, please indicate which tasks/processes you consider difficult/challenging to perform. Please check N/A, if you are not involved in the tasks/processes:



Artificial Intelligence for Education in Bangladesh

Insights from the First Small-Scale Artificial Intelligence Needs Assessment and Training for Primary Education Teachers

Bangladesh, with one of the largest education systems in the world, has started to lay the foundation for reskilling its youth in preparation for an automated world of work. The country has thus looked to using artificial intelligence (AI) in the education sector, recognizing its promise to transform the teaching–learning landscape while acknowledging the challenges inherent in its adoption. This paper presents results of an AI needs assessment survey and training workshop conducted among primary education teachers from 2023 to 2024, to gather opinions on pedagogies that could benefit from AI-enabled automation, as well as understand respondents' perceptions of integrating AI and automation into their teaching tasks.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 69 members —49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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