

AI-Driven Lifelong Learning: Transforming Higher Education in Rural Bangladesh – A Review Article

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Abstract

The article describes the revolutionary change of artificial intelligence (AI) in lifelong learning (LLL) amidst a transnational higher education in rural Bangladesh context. The traditional education system is being replaced by evolving technologies, in this era of traditional systems. Lifelong learning is not a static destination but rather a dynamic journey, as the learning expertise can shape various demands in different geographical and cultural settings. The multiple uses of technologies in lifelong learning modify the routine of memorization and delve into some key features and approaches, including adaptive learning technologies, and AI-driven learning methods. This article discusses the scope of LLL, different approaches, and the assessment of the readiness

of educators and institutions, and how AI can contribute to lifelong learning in the rural Bangladesh context. Through this exploration, the article highlights the potential and emerging challenges in the use of AI. By reshaping the existing higher education system, AI will bridge the educational divide and promote personalized assistance in the rural Bangladeshi context.

Keywords: Lifelong Learning, Artificial Intelligence, Higher Education, Rural Bangladesh.

Introduction

In this fast-changing 21st century, the concept of lifelong learning has gained importance. Education is generally thought of as limited to a certain period of life, which is mainly the early years of life. At the end of this education, a man does something for his livelihood. It is assumed that this is the end of his or her educational life. However, with the rapid development of technology, there has been a need for lifelong learning in one's life. Lifelong learning is not just a matter of choice; it involves various activities such as career development, personal growth, and adapting to this changing world, which basically resolves around this complex global job market. Where skills are constantly changing, ongoing education and training are the only ways to create skilled workers (Abe et al., 2021). We know that each person likes to learn in a different way. With all the digital resources people are learning through, there are a variety of methods and techniques for learning, and these are available to everyone. This has made lifelong learning accessible to a large population.

Advances in technology, especially artificial intelligence, are one of the keys to such change. AI's data analysis capabilities, pattern recognition capabilities, and

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personalized learning recommendation systems are transforming how individuals learn across their lifespan (Harry & Sayudin, 2023). Currently, there are various types of AI-powered educational content-based applications, ranging from adaptive learning systems to intelligent tutoring systems which provides learning as well as instant feedback and support. The impact of AI on lifelong learning is far-reaching and profound. AI can create a personalized learning experience for everyone by identifying individual personalities that prioritizes the needs and abilities of learners. As a result, learners become more interested in such content, and their rate of mastery of skills or completion of a learning level increases (Jian, 2023). This is quite different from the traditional concept of professional development and continuous learning in the workplace.

In the context of Bangladesh, especially in rural areas, higher education faces many challenges. Such as the lack of good institutions, lack of resources, infrastructural constraints such as low-speed internet, insufficient digital devices, and lack of trained teachers, which is creating a digital divide between urban and rural populations (Saqr et al., 2023). Amidst all this, the integration of artificial intelligence in lifelong learning offers a transformative opportunity to overcome these barriers. AI can provide personalized, accessible, and flexible learning experiences, what can enable students in rural Bangladesh to access quality higher education and can develop essential skills. The ability of AI-driven platforms to offer adaptive learning, virtual tutors, and intelligent tutoring systems could bridge the educational gap and empower learners in these underserved areas to thrive in an increasingly digital and globalized world. Furthermore, this article will discuss the ethical issues that may arise when integrating AI into lifelong learning, how privacy should be maintained, and what challenges may arise.

Methodology

The transformative effect of artificial intelligence in Lifelong Learning in Transnational Higher Education is examined in this review article. This study aims to synthesize the current research on how AI is regenerating teaching-learning practices, institutional strategies, and international educational collaborations. By reviewing relevant literature, this review article highlights major key trends, challenges, and possible avenues for integrating AI into higher education sector in rural Bangladesh context.

A comprehensive data collection process was taken to collect relevant academic and industry-based information. Reputative database such as google scholar, IEEE Xplore, SpringerLink, ScienceDirect, and Web of Science were the source for literature review. The review article used some keywords to conduct the search, such as: Artificial Intelligence in Higher Education, AI in Transnational Education, Machine learning in University Teaching, and AI-driven Personalized Learning. To have a more comprehensive grasp of AI application in education, grey literature- such as institutional reports, policy briefs, and white papers were also reviewed to capture a broader understanding of AI applications in education.

With an emphasis on research released between 2015 and 2024, the study sought to address current advancements in AI-driven education. It included credible, peer-reviewed articles with an emphasis on AI-enabled pedagogy, adaptive learning, and assessment automation. Excluded were studies with no translation, that concentrated on elementary or secondary education, or that lacked empirical depth. However, studies that primarily focused on AI in primary or secondary education, lacked empirical or theoretical depth, or were published in languages other than English (without translation) were excluded from the analysis.

Although the review article adopted comprehensive approach, there are some certain limitations. First of all, as a secondary data-based study, the findings are limited, which may introduce publication bias. Second of all, some given insights may seem to be outdated over time. Moreover, this review does not include primary data collection or case studies from various institutions, that could have been provided deeper empirical validation.

AI and LLL: Transformative Potential

The Role of AI in Enhancing LLL Opportunities

In this rapid-changing world, the concept of LLL has become more important than ever before. LLL refers to the continuous and voluntary pursuit of knowledge that is useful for personal and professional development. As a result of industrialization and technological advancement, today a person has to constantly update himself in terms of skills to survive in this competitive job market (Jumaev, 2024).

Accessibility is one of the primary ways AI can enhance LLL. AI-driven platforms have ensured that all learners can learn from anywhere at any time in all walks of life. It is more beneficial for those who are not able to receive education in traditional educational institutions, such as working professionals, stay-at-home parents, or live in remote places where there are no educational institutions or a lack of suitable educational institutions (Zamecnik et al., 2022).

For example, Platforms like Coursera and edX offer a huge number of online courses from universities and institutions around the world. They help millions of students learn according to their own skills, knowledge, and pace of learning (Saqr et al., 2023). AI-powered tools can also provide real-time transcription and translation, helping non-native speakers and individuals with disabilities access learning materials.

AI also plays a critical role in continuous learning and skill development. The demand for skills and competencies is constantly changing in today's fast-paced job market. AI helps one get ahead by recommending a variety of courses based on the ongoing job market and the individual's career goals (Billiot, 2023).

A good example of this would be LinkedIn, where the AI algorithm suggests different courses based on the user's job role, career aspirations, and previous learning history (Bagai & Mane, 2023). It ensures that learners are constantly improving themselves with a variety of skills and knowledge relevant to their field of work and making themselves competitive in the job market.

Moreover, AI supports LLL by ensuring a collaborative and interactive learning environment. AI-powered chatbots and virtual assistants can facilitate group discussions, provide instant feedback, and even provide tutoring support if someone needs personalised assistance (Antony, 2022).

In conclusion, AI has a significant role in enhancing LLL opportunities by making education more accessible, personalized, and relevant to the modern world. As AI continues to refine itself day by day, there is no doubt that this role will grow further. It is going to offer learning methods in more innovative and effective ways for individuals to pursue continuous education in the days ahead.

Key Features and Approaches of AI in LLL

Artificial intelligence has revolutionized the field of education, especially in the field of LLL. AI's ability to deliver individualized learning experiences, automate administrative tasks, and provide personalized learning experiences has put it in the driver's seat of modern education. This section explores the core features and approaches of AI that are driving these transformative changes in lifelong learning.

Adaptive Learning Technologies

A very important feature of using AI in LLL is its capacity for adaptive learning. Adaptive learning systems use algorithms. Through which they can address the student's real-time performance, effort to adapt to the difficulty of the content, pace of learning, unique needs, etc. (Shelle et al., 2018). Which is essentially a dynamic approach against the conventional education system, where all students are treated the same.

For example, platforms like Smart Sparrow and Knewton create customized learning experiences for each student. These platforms record student progress through continuous monitoring, identify areas where students are struggling, modify content to meet student needs in those areas, and provide additional support as needed.

Natural Language Processing (NLP) in Education

Natural Language Processing (NLP) is another AI feature that is transforming lifelong learning. NLP allows AI systems to understand, interpret, and respond to human language, making the learning experience more interactive and intuitive (Ali & Shandilya, 2021). It is used extensively in language learning applications, automated grading systems, and virtual assistants.

For instance, Language learning platforms like Duolingo and Babbel use NLP to conduct real-time conversations with learners. These platforms can correct grammatical errors, suggest vocabulary, and give feedback on pronunciation, which is mainly based on the proficiency level of the learner. Since there is an interactive learning environment, the learner is helped to develop language skills through adequate practice, which he can use in real-life communication.

AI in Automating Administrative Tasks

Beyond personalized learning, AI contributes to LLL by automating a variety of administrative tasks so that they can save a lot of time and spend that time on teaching and mentoring. AI can handle tasks such as grading assignments, managing enrollment, and scheduling, which are typically time-consuming for educators (Parycek et al., 2023).

For example, Turnitin, a plagiarism-checking tool. The originality of various written works by the students can be checked through this. Turnitin is a good way to know whether they have done the work themselves or are carrying on the work of others as their own. As a result, quick feedback is possible. If it had to be done manually, it would have required a lot of time. Sometimes it would be difficult to address some plagiarism.

Personalized Learning and Skill Development through AI

It is repeatedly said that every person is different, the needs and interests of each of them are different, and their abilities are different. So, in their learning, the learning experiment should be different, which confirms personalized learning. With the improvement of the AI, the talent between the individual has been revealed. It has been possible to give them more target, effective, and engaging learning experience. The ability to analyze a large amount of data and adapt content in real-time has put AI in the driver's seat for personalized learning and skill development (Maghsudi et al., 2021).

AI-Driven Personalized Learning: An Overview

Machine learning algorithms and data analytics are used to create AI driven Personalize Learning. Which gives learners a customized education experiment. This AI

system analyzes the student's performance, learning style, preferences for curriculum adjustment, everything (Murtaza et al., 2022). It is not like traditional education, where only one curriculum is forced to be taught to all students, it takes an individualized approach, keeping in mind the needs of diverse students.

For example, Squirrel AI, an AI-powered tutoring system in China, its lessons are created based on students' understanding. Squirrel AI uses personalized instruction to provide mastering skills for subjective knowledge. Students can learn at their own pace. At this time, they decided on learning content and material based on the learning gaps identified by the quiz and student feedback.

Adaptive Learning Technologies

One of the foundations of AI-driven personalized learning is adaptive learning technology. This system continues to assess the progress of the learner, and in a realistic way, the learning content is adjusted. Osmosis is a platform that teaches health care (Güven et al., 2020). Let's give an example from there. They use the AI for medical students' personalized learning. They use learner's knowledge levels to identify the focus areas and strengths, and through the AI analysis of these data, they direct the learning material.

AI in Skill Development

AI has taken itself to a high level in the development of skills. Especially where complex skills are needed and hands-on learning is required. In the automotive industry, for instance, BMW uses AI to training their employees. The company's AI-operated system provides hands-on experience in various subjects, provides work instructions, and gives real-time feedback. This approach not only mobilizes the learning process but also reduces the

possibility of errors in critical manufacturing tasks (Plathottam et al., 2023).

In the arts, AI is being used to help create new skills in creative ways. Runway ML allows artists and designers to work even though there is no advanced coding skill. Their AI tool creates digital art based on the user's input only. As a result, an inexperienced person in coding can also gain a skill like digital art (Anantrasirichai & Bull, 2022).

AI is also being used to acquire linguistic skills. Such as Google's AI-powered application, Google Translator. Which makes real-time translations to enhance the user's linguistic skills, guide the pronunciation, and provide usage examples. This tool is very useful for those who want to practice the English language in real-world scenarios

AI brings a new paradigm in terms of personalized learning and skill development. With AI, teachers and various institutions can create different types of learning experiences by identifying the specific learning needs of learners, enhancing engagement, retention, and overall learning outcomes. Since AI technology will improve more in the future, more sophisticated and effective tools will be developed day by day, which means that personalized learning and skill development will be easier and more effective (Liang et al., 2020).

It is easy to say that the inclusion of AI in the academic, corporate, industrial, or creative fields will make Learner LLL more dynamic. It will motivate them to gain skills and knowledge throughout their lives.

Levels and Interfaces of Lifelong AI Learning

Advanced Level

Students in higher education deal with more complex data and theory; they conduct research during this time and acquire specialized knowledge in one or more specialized

areas of their choice. This stage requires a high level of critical thinking and independent learning, which can be significantly enhanced through the use of AI (Slimi & Carballido, 2023).

In this stage, AI can suggest courses, resources, research opportunities, etc. based on students' academic goals and career aspirations. Dealing with a lot of information at this stage can divert students' attention from the real thing, i.e., deep learning and critical analysis. AI helps students focus on the area by keeping the information to itself (Pratama et al., 2023).

AI can assist in academic research. His or her work may include organizing research material, identifying relevant articles, or even helping to summarize complex topics (Kondaveeti et al., 2024). For example, an AI-powered assistant can assist a zoological researcher. He may be researching the utility of reptiles in the environment. In this case, the AI assistant can bring together relevant recent research papers on reptiles so that the researcher can quickly conduct an adequate literature review. It will save him or her a lot of time (Chubb et al., 2022).

Professional Development Level

Today's world is competitive, and the job market is constantly changing. There is no alternative to acquiring skills through continuous learning to survive in this competitive market. Along with fulfilling one's responsibilities in professional life, skills also need to be updated regularly. So that he can adapt himself to new technologies, industry trends, and job requirements. But after entering professional life, it is difficult to continue the education program along with it.

AI can create flexible and on-demand learning opportunities for professional development that fit these busy times. AI-powered platforms can make

recommendations for personalized learning based on one's career history, current job role, and future goals (Kaswan et al., 2024). Virtual mentoring can be done through AI. Where a professional can seek solutions to any problem in his or her work life or personal life. These programs provide individualized advice and support to make their professional journey smoother (Khandelwal & Upadhyay, 2021).

Different AI Interfaces in Lifelong Learning

AI learning has evolved significantly, offering diverse interfaces that cater to various learning environments and needs. There are different types of AI-driven interfaces. There are virtual tutors as well as adaptive learning platforms. These are designed to keep in mind different types of learners. So that they can acquire educational experiences in a systematic manner, which will help them advance in knowledge and skills throughout life (Kabudi et al., 2021). Everyone should know about these interfaces, as they are going to rule the education field in the coming days. This section will discuss some key interfaces of AI learning. It will be explained through real-world examples.

Virtual Tutors and Chatbots

Virtual tutors and AI-powered chatbots are among the most popular interfaces in AI learning. These tools can provide one-on-one tutoring on any academic or skill-related problem. Which is very useful in providing instant feedback, answering questions, and guiding students through learning materials (Lin et al., 2023). They are designed to be available 24/7, as a result, students who need assistance outside of regular classroom hours can receive it.

One of the most well-known virtual tutors is IBM's Watson Tutor, used in various educational settings. Watson Tutor can analyze a student's learning style and adapt its

responses to suit individual needs, providing explanations that resonate with the student's understanding level. For instance, if a student is struggling with a math topic, Watson breaks the problem down into simple steps and offers alternative explanations until the student gets the right concept of it (Bo i , 2023).

On the other hand, chatbots can be incorporated into learning management systems to provide accurate answers to common learner questions. Let's say a university has a chatbot in the LMS. It can help the learner with class schedules, course selection, various technical issues, emotional support, etc. (Shilowaras & Jusoh, 2022).

Adaptive Learning Platforms

The Adaptive Learning Platform is another AI-driven interface. It basically adjusts the learning content based on the learner's performance and learning speed. These platforms continuously assess the learner's progress and modify the curriculum accordingly. So that the curriculum does not become boring in any way or becomes challenging by overloading with unnecessary content (Kasinathan et al., 2017).

Dream Box Learning is one such adaptive learning platform that addresses K–8 mathematics education. The platform assesses students' answers in real time and continuously increases the difficulty level accordingly. For instance, a student is doing well in geometry but struggling in algebra. Then Dream Box will give him more algebra-related problems, and of course it will determine the difficulty level considering the ability of the student. So that the student can improve in algebra (Grams, 2018).

Intelligent Tutoring Systems (ITS)

Intelligent Tutoring Systems (ITS) are advanced AI learning interfaces that offer personalized instruction and feedback, it is almost a system close to human tutoring

(Alkhatlan & Kalita, 2018). This AI system is very effective in solving complex problems, providing hints for solutions, analysing something, and providing constructive feedback. Which is mainly provided according to the understanding level of the learner.

The Cognitive Tutor, developed by Carnegie Learning, is built on replicating the way a human tutor makes decisions. It analyzes the cognitive processes of the student and provides instruction according to his strengths and weaknesses. If a student keeps doing the same math equation wrong again and again, the system will automatically give him a step-by-step idea about the math equation and figure out the solution process for it.

ITS can be used outside of mathematics. such as language learning. ITS can help a student learn grammar and vocabulary. Can show suitable practice for that. While they can analyze the student's progress level and language proficiency level and make decisions. At this time, the analysis and correction provided by the system are very helpful in improving the learner.

Virtual Reality (VR) and Augmented Reality (AR) Interfaces

VR and AR interfaces are immersive AI-driven tools. Through these, the learner gets an opportunity for experiential learning. This technology is mainly effective in practical fields where teaching is given in terms of real-life experience, such as medicine, engineering, and science.

Through VR simulation in medical education, students can practice surgical procedures in a risk-free environment. Companies like Osso VR have developed platforms for medical professionals. Where realistic and immersive training experiences are provided. For example, a medical

student might wear a VR headset while performing simulated surgery. With the help of it he can get real-time feedback on various techniques and decision-making (Cevallos et al., 2022).

In AR applications like Google Expeditions, a learner can explore a historical site, complex machinery, or biological process. Augmented visualization gives them an understanding of that subject that would never be possible in a traditional classroom.

AI-Driven Learning Management Systems (LMS)

Learning management systems are a very old concept, but the inclusion of AI in it is quite revolutionary. There is no alternative to LMS for organizing the entire learning process of the learner. The LMS is very effective for tracking each student's progress, recommended resources, and potential outcomes, which is basically an AI-driven interface (Firat, 2023).

Canvas LMS is one such AI-powered personalized learning system. This system provides additional resources for a student who is consistently doing poorly in a subject, such as tutoring sessions or supplementary reading. So that his or her problem can be solved (Burrack & Thompson, 2021).

In conclusion, AI is not just a tool; it is also an influencer, which has changed the concept of lifelong learning. Its ability to accommodate individual learning styles, provide real-time feedback, and provide excellent learning experiences has emerged as a key player in the future of education. All of these interfaces need to be analyzed, explored, and refined as we move forward (Guan et al., 2020). It must also ensure that they are used ethically and that their use enhances learning outcomes.

Readiness of Universities / Institutions

In today's AI-driven world, higher education is also shaping as its new shell, and it has become an essential component in a very short time. There remains no doubt about AI's capability, which has the power to modify one's efficiency and upgrade acquisition levels in lifelong learning through personalization (Maghsudi et al., 2021). Maintaining an ample amount of information and data and identifying it has been highly appreciated in the education sector, especially in higher education. As it has been known, AI has the capability to create more customized learning routes by analyzing the motives for future readiness.

These platforms allocate a wide range of courses with certificates to help the learners embrace new skills. Therefore, to empower educators, AI readiness can be a contextualized training approach that focuses on understanding data-driven AI by recognizing the potential impact on various professions and workplaces. Adopting this readiness, educators would be ready for AI-driven lifelong learning.

Assessing Institutional Readiness for AI Integration for Lifelong Learning

In the evaluation of institutional readiness for AI integration in the context of lifelong learning, various dimensions and important factors must be considered very carefully. The aim is to measure the availability of AI for successful application.

In Bangladesh, to accommodate AI-driven lifelong learning initiatives, the existing technological infrastructure needs to be evaluated soon. The evaluation tends to have cloud-based platforms, enough computer resources, specific hardware, some AI-related tools like machine learning algorithms, customized learning systems, and virtual learning atmosphere as well (Martins, 2023). Thus,

educational institutions should pay attention to rethinking and reworking their systems' growing number of learners and datasets. The scalability and flexibility of the current infrastructure need to be considered to accommodate lifelong learning. Another valuable concern of integrating AI, whether the faculty members have the skills and understanding to use AI tools effectively for the pedagogy. Faculty and the staff should be equipped with AI literacy (Salhab, 2024). Teaching practices and curriculum design must be developed from a practical perspective.

But, how well AI is integrated into the curriculum to support lifelong learning, is a matter of concern now. Assessment of AI-driven courses can measure the readiness of an institute, as existing programs or interdisciplinary courses ensure great advancement in the area of educational assessments and feedback mechanisms as well. But a study in this area mentioned that there is a lack of college instructors' perspectives on AI integration in curriculum design (Salhab, 2024). This hinders institutional readiness. If the evaluation of the readiness of the institution works for micro-credentials, micro-learning, and other forms of certification, lifelong learning would be uplifted (Kizito & Kayi, 2024). So, to build a personalized portfolio of skills over time, these credentials should be designed soon. Institutions' capability to form sustainable partnerships with different sectors like industry, government, and educational organizations to assist AI-driven lifelong learning is one of the major factors in their success. Institutions' readiness can be improved by collaborating with other educational institutions; resources, knowledge, and best practices can be shared for AI integration in lifelong learning. Such collaborations cannot but enhancing the institution's capacity to rapidly changing educational landscape. Additionally, there is a highlighting gap between global humanitarian needs and donor funding resources. It has been observed that there is a need to increase sufficient funding to support comprehensive AI adoption.

Nevertheless, it is the duty of any institutional body to manage the required funding.

In fine, by evaluating technological infrastructure, faculty expertise, curriculum design, institutional culture, learner-centered focus, strategic partnerships, and funding, institutions can identify areas for improvement and develop strategies to enhance their capacity to deliver AI-powered lifelong learning in Bangladeshi higher educational institutions.

Preparing Educators and Institutions for AI Integration for Lifelong Learning

For the smooth transition of AI into lifelong learning in Bangladeshi higher educational institutions, an effort to prepare the educators and the leaders is a prerequisite. In most of the country's education perspective, to successfully implement AI, the willingness and readiness of higher educators are preconditions. AI can potentially transform educational environments and create personalized and accessible learning. However, the readiness of both educators and institutions has become a must for adapting these new tools and methodologies (Christensen & Knezek, 2017).

A few key factors have been discussed below in the context of bringing readiness to educators and institutions:

AI literacy programs for educators build a fundamental understanding of AI, which includes machine learning, natural language processing, and data analytics. Increasing such programs would rapidly discover AI's application in lifelong learning. On the other hand, providing training to educators in AI can also bring success and encouragement in professional development and if the educators' take advantage of these opportunities, they can update themselves in AI technologies. Besides, it has been observed that collaborative environment has a great impact as it brings all the learners under one roof and ideas get

shared. The integration of human and AI systems, leveraging their complementary strengths, holds high expectations and potential for educational innovation (Kim, 2024). Yet, the support for this is limited. Implement incentive programs and make the path clear. Innovation in AI in teaching and adequate research must be recognized, and if enough opportunities can be provided for career enhancement based on AI expertise, more educators may be influenced to learn these technologies (Alam, 2021). Similarly, redesigning the ongoing curricula to assimilate AI related topics, assures that learners across various disciplines (science, medicine, digital literacy, etc.) are exposed to the basics and implementations of AI (Tolentino et al., 2024). Many educators are unfamiliar with AI technologies. They are unaware of the AI-designed curriculum. Besides, for the better result, micro-credential programs and certifications that mainly focus on 21st century AI skills can bring more success. But it should be accessible and flexible for all.

Summing up, the process of preparing educators and institutions for AI integration in lifelong learning is a complex and time-consuming task that requires technical training, curriculum redesign, cultural adaptation, and strategic planning. Educational institutions can effectively mobilize the strength of AI to intensify lifelong learning opportunities, whether funds are allocated for cultural advancement, technological infrastructure, or institutional growth.

AI in Lifelong Learning: The Context of Rural Bangladesh

The integration of Artificial Intelligence (AI) into lifelong learning (LLL) has the potential to revolutionize the higher education landscape in the rural areas of Bangladesh, offering meaningful opportunities to overcome existing barriers. Higher education in rural areas of Bangladesh often faces many challenges, including limited

access to quality institutions, insufficient resources, and a lack of well-trained teachers. AI-driven platforms can bridge these gaps by providing attainable and individual learning experiences. AI-powered technologies such as adaptive learning systems, virtual tutors, and intelligent tutoring systems have the capacity to deliver customized education to the students of rural areas, empowering them to learn at their own pace, irrespective of geographical and infrastructural constraints (Fidalgo & Thormann, 2024).

Access to digital device is one of the most crucial challenges in the area of rural Bangladesh. While AI is booming with efficiency and potentials, rural area in Bangladesh faces significant barrier ensuring the access to digital device and internet connection. Most rural households have scarcity of stable internet access, and most of the students cannot afford personal computers or smartphones. Utilizing AI effectively in rural higher education, institutions have to adapt AI tools in academic practice within these limitations. Mobile-based apps that use AI systems to develop content on less expensive smartphones, and make these platforms efficient for low-bandwidth internet, would be significant in overcoming the digital divide. Additionally, it is urgent to provide training sessions that increase the knowledge on digital literacy, empowering students and educators to make perfect use of these AI-driven tools (Saqr et al., 2023).

AI's potential to enhance higher education in rural Bangladesh is not only about to improving access; it can also foster skill development, which is significant for economic growth. With inclusion of AI can be developed a specialized learning program that provide required tools to develop their skills according to demand in the contemporary job market for the students of rural Bangladesh. For example, AI enriches platforms that develop student's essential skills, like coding, digital marketing, or agricultural technology—fields that are

highly impactful to the rural economy (Jumaev, 2024). In addition, AI can help to the students of rural area in improving their career pathway by offering in-depth knowledge in specialized fields, thereby preparing them for better job opportunities both within the country and abroad as well. These platforms can be a breakthrough bridging the gap between the rural workforce's existing skill set and the demands of the global job market.

Furthermore, AI can make higher education more inclusive and accessible by offering personalized and tailored learning experiences according to individuals learning styles. In traditional education systems, students often face challenges to keep up with standardized learning materials. AI-powered learning platforms can modify the level of difficulty according to the learners' progress, ensuring that students receive the right amount of challenge. This is especially blessing for students who may not have had access to quality education before, enabling them get connected with their peers in urban centers (Maghsudi et al., 2021). For example, adaptive learning technologies can continuously assess a student's learning outcome and tailor the learning pace, ensuring that every student in rural areas receives the tailored support they need to succeed (Shelle et al., 2018).

AI can also support rural higher education institutions by reducing the administrative burden on faculty and staff. Teachers in rural Bangladesh often face high student-to-teacher ratios, making it difficult to provide personalized attention. AI can automate administrative tasks such as grading assignments, managing schedules, and tracking student progress, which would free up time for faculty to focus on teaching and mentoring students. AI-powered platforms could also provide real-time feedback to students, which is vital for improving learning outcomes. This automation would not only streamline operations but also help improve the quality of education delivered to students in rural areas (Parycek et al., 2023).

AI has the potential to raise the standard of instruction in rural higher education institutions when it comes to teacher preparation. In the rural areas of Bangladesh, many teachers have lack familiarity with the newest educational technologies. Teachers can learn how to successfully incorporate AI tools into their classrooms by enrolling in professional development programs centered on AI. These programs could include training on how to use AI to personalize learning experiences, manage classrooms more efficiently, and engage students more effectively. As AI tools become more widely used in higher education, it will be essential for teachers to gain proficiency in these technologies in order to deliver high-quality education (Cope et al., 2021).

However, the integration of AI into higher education in rural areas of Bangladesh must also address significant ethical considerations. When dealing with sensitive information of students, data privacy and security are critical issues. The use of AI in education requires the collection of huge amounts of data, and ensuring that this data is protected. The government, educational institutions, and AI developers must collaborate to create policies that ensure the responsible use of AI, addressing concerns about data privacy, bias, and transparency. Moreover, AI must be implemented in a way that is inclusive and equitable, ensuring that all students, regardless of their socio-economic background, have access to the benefits of AI-driven education.

In conclusion, AI has the potential to transform higher education in rural Bangladesh by making learning more accessible, personalized, and relevant to the modern workforce. AI can play a key role in providing less privileged students with the education and skills they need to succeed by overcoming the challenges posed by digital literacy, limited infrastructure, and teacher readiness. However, efficient concern must be paid to ethical

considerations, assuring that AI is deployed responsibly and equitably to benefit all learners. With the right infrastructure, policies, and training programs in place, AI can empower rural communities in Bangladesh and contribute to the country's broader development goals (Homayouni et al., 2024).

Challenges and Considerations

The traditional education system has been transforming into an AI-integrated platform for lifelong learning. With the advantages of AI, the challenges to it require to be dismissed for human-AI collaboration in education and lifelong learning. To stimulate the benefits of AI in a more dynamic system of learning, it is high time to take in to consideration the challenges in to implementable actions. As AI literacy in lifelong learning at a crucial moment like any other technologies, there are both hopes and fears because of its significant challenges to reshape education, industries and job market (Romero, 2024).

Ethical Consideration

The future engine is AI, which is expected to bring revolution by altering teaching tools, learning approaches, and teacher training. On the other side of the coin, there are some ethical concerns surrounding, for example, profiling, intelligent tutoring, assessment, and personalization, as well as human rights concerns, data ownership, privacy, digital exclusion, and student and staff views (Ungerer & Slade, 2022). To understand the challenges of AI and AI in lifelong learning, people should consider its technological assumptions and aspirations. In most of the studies, limited researches are found regarding ethical consideration, but among them, respecting human rights, privacy, equity, fairness, trust, transparency, enhancing learning outcomes, providing equal access, and avoiding discrimination are mentioned using AI learning (Homayouni et al., 2024).

Data Privacy and Security Issues

As the AI system requires a large amount of data, there remains a main issue of keeping the data secured. Along with this, the challenge stays crucial with data transparency and trust-building as this may hinder the whole system in the long run of learning. One of the most and concerned obstacles of AI is data privacy. Privacy concerns in AI technologies are often found more interested in security rather than privacy, as the meaning of the concept remains unclear and ill-formed (Elliott & Soifer, 2022). Most of the time, the vast information and data are seen at the marginal point to maintain confidentiality and to give proper protection to the sensitive information. With that, security issues of AI are still matter of concern and if it remains as this, the general people will lose their faith in it and the future of AI helping in lifelong learning would come to at stake. Furthermore, the knowledge needs to be accessed to their own data and should have a clear concept and understanding how it works.

Digital Divide and Accessibility Challenge

Underprivileged people lack behind and facing barriers while using AI-enhanced opportunities, also not getting the benefits of technology, internet connection, and digital literacy. To prioritize digital inclusion initiatives, some policy makers have proposed some model to provide affordable accessibility. The four-dimensional model offers a framework for institutions to identify, create, and measure their efforts to reduce the digital gap (Noguez et al., 2024). Digital division is turning to be great threat to the users as a large portion of the young generation are not connected to it and in most of the under-developed countries have not even provided these technological advantages for their economic status. Therefore, the current situation suggests that digital division could potentially determine the success or failure of lifelong learning.

Resistance to Change and Adaptation

To continue the legacy of AI in the future, the scenario needs to be changed as the old people still are not familiar with the technological use in their daily life. The significance of AI in promoting lifelong learning needs to be effectively presented to adapt to this change. Besides, not only transparent communication and trust enhancement in AI systems are found as crucial challenges, but also resistance and specific challenges arise due to the lack of transparency in AI systems (Felzmann et al., 2019).

Conclusion

To recapitulate, the benefits of AI in the long run are indisputable. The transnational higher education framework is changing their patterns, including the technologies in learning, and adding various learning approaches to education all over the world, as learning is not confined to one corner of the world. This chapter began by presenting the concept of learning, how AI has been brought to deliver a better personalized education, and how new technologies could provide a dynamic learning atmosphere. Then, the article discussed the characteristics of some evolving technologies like ML, NLP, and ALS and how these would modify the current curriculum and make learning flexible. The discussion also emphasized the increase in accessibility, continuous learning, and inclusive education, as they would reach out to all. For the enhancement of AI in lifelong learning, included an assessment of the readiness of institutions and their educators in rural Bangladesh context. The article was concluded by highlighting and measuring the ongoing challenges and obstacles in AI-driven learning that had much emphasis. Eventually, successful integration depends on the solutions to the challenges mentioned in the article to bridge the global education.

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