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Integrating Industry 4.0 technologies with Education 4.0 for teaching non-technical subjects

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Abstract: *Industry 4.0 is the integration of intelligent digital technologies into industrial processes. Education 4.0 integrates technology, personalized learning, and innovative teaching methods, preparing students for the future. This study explores the potential benefits of integrating Industry 4.0 technologies with Education 4.0 for teaching non-technical subjects, subjects that do not use or require technical or specialized knowledge or skills*. In addition, this study reviews the evaluation methods for teaching non-technical subjects such as English.
Keywords: Industrial Revolution

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Research Paper

I. Introduction:

Developing country like Bangladesh is focusing on Fourth Industrial Revolution in Education sector.Islam et.al (2018) have revealed that the elements of Industry 4.0 have beenestablished for the manufacturing settings which is not only indispensable to increase the productionof units, but also to reduce the production costs. It has also been found that investment of technologiesthat is integrated to humans for the development of the production level. Still lack of empiricalresearch reveals the prospects of Industry 4.0 in Bangladesh, which is projected to be the twenty-eighthlargest economy in the world by 2030. In Bangladesh few researches have been conducted but stillthere are some challenges including poor infrastructure, availability of cheaper labor, and expensiveinstallation of technologies, lack of government supports and lack of knowledge Islam and et.al,(2018). But in Bangladesh our education experts and practitioners are trying to promote I4.0 in theupcoming days as it is believed that the fourth industrial revolution will revolutionize industries sosubstantially, especially in education sector that much of the work that exists today will not exists innext 50 years (Marwala et al., 2006).

Fourth Industrial Revolution:

The history of Industry 4.0 can be traced back to the First Industrial Revolution of the late 18th and early 19th centuries, which involved the use of steam power and mechanization to automate manufacturing processes. This was followed by the Second Industrial Revolution, which involved the use of electricity and the development of mass production techniques, and the Third Industrial Revolution, which involved the use of computers and automation to optimize manufacturing processes.

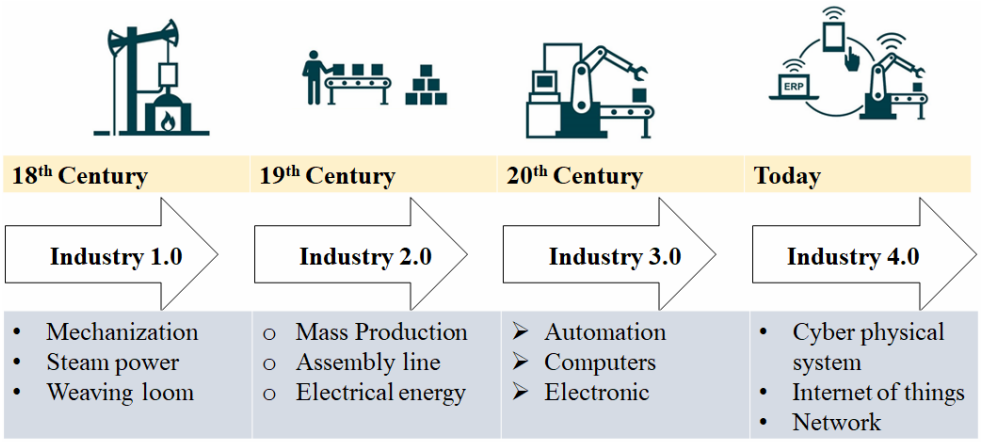

Figure 1: Emergence of the Industrial Revolution

Industry 4.0, also known as the Fourth Industrial Revolution, refers to the integration of advanced technologies such as artificial intelligence, the Internet of Things, and robotics into manufacturing and other industries. This integration is expected to bring significant changes and improvements to the way that businesses operate and the products and services they offer.

Some of the key characteristics of Industry 4.0 include:

1. The use of data and analytics: Industry 4.0 relies on the use of data and analytics to drive decision-making and optimize processes. This involves the collection, analysis, and interpretation of large amounts of data from a variety of sources.
2. The integration of physical and digital systems: Industry 4.0 involves the integration of physical and digital systems, with the goal of creating a more seamless and efficient workflow. This may involve the use of sensors, connected devices, and other technologies to gather data and automate processes.

Impact of industry 4.0 on economy and lifestyle of people

Industry revolution 4.0 is transforming the living and working standards of the planet; many conventionaleducational styles and learning methods are outdated. Digital education penetrates andhelps educate from distance to door [2]. The industrial revolution in other sectors isalso dependent on the educational structure to improve the industry's skills. According to Roodt& Koen, (2020) fourth Industrial Revolution and Industry 4.0technologies will present the enormous wealth creation opportunity in our planet'shistory. The technology leaders and digital entrepreneurs will be grabbing the opportunity by advancement in technology.

As the disruptive technologies of the fourth Industrial revolution continue changing every sphere of our life i.e. production, economy, business, governments and countries, society and cultural interactions in the world around us, so the new challenges arise. As an emerging developing nation, Bangladesh is adopting revolutionary technologies gradually in every sector for socioeconomic development despite having lots of challenges such as lack of awareness, insufficient funding, and availability of cheaper labor, lack of digital infrastructure, skill laggings, and socioeconomic challenges. But in recent years, public and private authorities taking endeavors in the development of infrastructure and human, technical, and financial capacity to upgrade the education and training systems to reap the benefits from 4IR.

Industry 4.0 is expected to have a significant impact on the economy and the lifestyle of people, with both positive and potentially negative consequences. Some of the potential impacts of Industry 4.0 include:

1. Increased efficiency and productivity: Industry 4.0 technologies are expected to improve the efficiency and productivity of businesses by automating and optimizing various processes, such as data analysis, decision-making, and production. This could lead to increased competitiveness and growth for businesses, as well as increased efficiency and effectiveness in the use of resources.
2. Changes in the nature of work: Industry 4.0 technologies are expected to lead to significant changes in the nature of work, including the automation of many tasks that are currently performed by humans. This could lead to the creation of new types of jobs that require different skills and knowledge, as well as the displacement of some jobs.
5. Changes in lifestyle: Industry 4.0 technologies are expected to have an impact on people's lifestyle in a variety of ways, including changes in the way that people work and interact with each other, as well as changes in the way that people access products and services.

Education 4.0

Education 4.0 refers to the integration of technology, particularly digital technologies, into the education system to improve the learning experience and outcomes.
Eight critical characteristics in learning content and experiences have been identified to define high-quality learning in the Fourth Industrial Revolution — "Education 4.0":

1. Global citizenship skills: Include content that focuses on building awareness about the wider world, sustainability and playing an active role in the global community.
2. Innovation and creativity skills: Include content that fosters skills required for innovation, including complex problem-solving, analytical thinking, creativity and systems analysis.
3. Technology skills: Include content that is based on developing digital skills, including programming, digital responsibility and the use of technology.
4. Interpersonal skills: Include content that focuses on interpersonal emotional intelligence, including empathy, cooperation, negotiation, leadership and social awareness.
5. Personalized and self-paced learning: Move from a system where learning is standardized, to one based on the diverse individual needs of each learner, and flexible enough to enable each learner to progress at their own pace.
6. Accessible and inclusive learning: Move from a system where learning is confined to those with access to school buildings to one in which everyone has access to learning and is therefore inclusive.
7. Problem-based and collaborative learning: Move from process-based to project- and problem-based content delivery, requiring peer collaboration and more closely mirroring the future of work.
8. Lifelong and student-driven learning: Move from a system where learning and skilling decrease over one's lifespan to one where everyone continuously improves on existing skills and acquires new ones based on their individual needs.

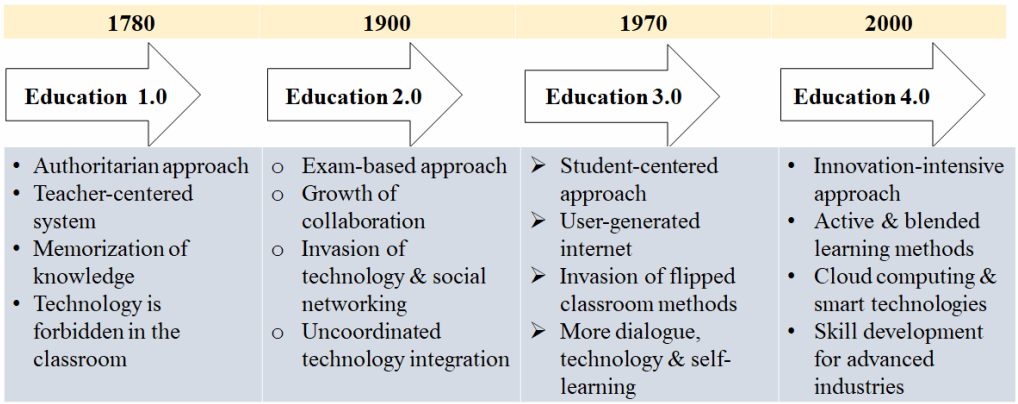

Figure 2: Evolution of the education industry

Relation between education 4.0 and industry 4.0

Education 4.0 and Industry 4.0 are closely related in their use of advanced technologies to enhance collaboration, communication, and the learning experience. Both are focused on leveraging the power of technology to improve efficiency, productivity, and innovation in their respective fields.

Education 4.0 and Industry 4.0 are related is through the use of technology to facilitate collaboration and communication. Digital tools such as video conferencing, online learning platforms, and collaboration software can be used to connect students, faculty, and staff with each other and with industry partners in real-time, regardless of their location. Another way that Education 4.0 and Industry 4.0 are related is through the use of advanced technologies to enhance the learning experience. Virtual reality, augmented reality, and simulation tools can be used to provide students with immersive and interactive learning experiences that can help them to better understand and apply course concepts. These technologies are also used in Industry 4.0 to train workers and enhance productivity.

Association of non-technical subjects with industry 4.0

Non-technical subjects, such as the humanities, social sciences, and arts, may not be directly related to Industry 4.0 in the same way that technical subjects, such as engineering or computer science, are. However, there are still ways in which non-technical subjects can be associated with Industry 4.0.

Non-technical subjects, such as business administration or management, can help workers gain the skills and knowledge they need to work effectively in an Industry 4.0 environment. Additionally, Industry 4.0 technologies are transforming the way we live and work, and this is likely to have significant social and cultural impacts. Non-technical subjects, such as sociology, psychology, and political science, can help individuals understand and navigate these changes. While non-technical subjects may not be directly related to Industry 4.0, they can still be associated with it in the sense that they can help individuals develop the skills and knowledge they need to work effectively in an Industry 4.0 environment and understand the social and cultural impacts of these technologies.

Role of digital tools in education 4.0

According to Hrtoňová et al. (2015), in the era of IR 4.0, digital technologies are becoming an integral part of society; educational development and learning are the vision of the current
world with digitalization.

Digital tools can be used in a variety of ways to enhance teaching and learning in Education 4.0, and can provide students with new and innovative ways to engage with course material and apply their knowledge and skills. It plays a significant role in Education 4.0, as they provide a range of opportunities for enhancing teaching and learning. Some specific ways in which digital tools can be used in Education 4.0 include:

1. Online learning platforms: These platforms, such as Blackboard or Moodle, allow students and instructors to access course materials, participate in discussions, and complete assignments online.
2. Collaboration tools: Tools such as Google Docs or Slack allow students to collaborate on projects and assignments in real-time, regardless of their location.
3. Virtual reality and augmented reality: These technologies can be used to create immersive learning experiences that allow students to explore and engage with real or virtual environments in a way that is not possible in a traditional classroom setting.

Role of university teachers in education 4.0

Education 4.0 is a brilliant, virtual and computerized unrest for the advantage of numerous partners, including instructors and teachers. Instructors might believe that the Education 4.0 customized learning theory will give more work. Education 4.0 grants instructors and teachers by giving best strategies and procedures to work with work.

University teachers play a critical role in Education 4.0 as they are responsible for delivering high-quality education to students and preparing them for the future.

There are several ways in which university teachers can contribute to Education 4.0:

1. Incorporating technology into teaching: University teachers can use technology, such as online learning platforms and educational software, to enhance the learning experience and engage students.
2. Promoting digital literacy: University teachers can help students develop the necessary skills to navigate and succeed in the digital world, such as critical thinking and problem-solving skills.

Role of university administration in education 4.0

According to an administration perspective, Education 4.0 makes the framework efficient and obviously creates unrivaled monetary outcomes. By lessening wasteful administration costs, getting the investment
funds that all schools still will be as yet conceivable need. The executives can move to a more productive working environment and execute a more compelling plan of action in Schooling 4.0.

In Education 4.0, the role of university administration is to provide leadership and support for the integration of advanced technologies, such as artificial intelligence and the internet of things, into the education system. Some specific ways in which university administration can support Education 4.0 include:

1. Developing a vision and strategy for Education 4.0: University administration can work with faculty and staff to develop a vision and strategy for Education 4.0 that aligns with the mission and goals of the institution. This may involve identifying areas where advanced technologies can be used to enhance teaching and learning, as well as developing a plan for implementing and evaluating these technologies.
2. Providing resources and support: University administration can provide resources and support to faculty and staff to help them integrate Education 4.0 technologies into their courses and programs. This may involve providing training and professional development opportunities, as well as funding for technology infrastructure and resources.

Education 4.0 ideas for teaching

Education 4.0 is a response to the needs of IR4.0 where human and technology are aligned to enable new possibilities. Fisk (2017) explains that the new vision of learning promotes learners to learn not only skills

and knowledge that are needed but also to identify the source to learn these skills and knowledge. Learning is built around them as to where and how to learn and tracking of their performance is done through data-based customization. Peers become very significant in their learning. They learn together and from each other, while the teachers assume the role of facilitators in their learning.

Principle educational methods in different subjects in universities of Bangladesh

There are a variety of educational methods that are used in universities in Bangladesh to teach different subjects. Some of the most common methods include:

1. Lectures: Lectures involve a teacher delivering a presentation to a group of students on a specific topic. This method is commonly used in universities to introduce new material and provide an overview of a subject.
2. Seminars: Seminars involve small groups of students discussing and analyzing a specific topic or text. This method is often used to encourage critical thinking and facilitate the exchange of ideas.
3. Tutorials: Tutorials involve a teacher working with a small group of students to discuss specific concepts and address any questions or issues. This method is often used to provide individualized support and guidance to students.

Importance of education 4.0 in non-technical subjects

Some specific reasons why education 4.0 is important in non-technical subjects include:

1. Interactive and immersive learning experiences: Education 4.0 technologies, such as virtual reality and augmented reality, can be used to create interactive and immersive learning experiences for non-technical subjects. For example, students studying history can take virtual field trips to historical sites or participate in simulations that bring historical events to life.
2. Personalized learning: Education 4.0 technologies can be used to provide personalized learning experiences, where students can learn at their own pace and receive tailored content based on their interests and needs. This can be particularly beneficial for students who struggle with traditional classroom-based learning.

Existing teaching methods at universities in Bangladesh

Teaching methods at universities in Bangladesh may vary depending on the institution and the specific subject being taught. However, some common teaching methods used at universities in Bangladesh include:

1. Lecture-based instruction: This is a traditional teaching method where the instructor delivers a presentation to the class, and students take notes and ask questions.
2. Discussion-based instruction: This method involves students actively participating in class discussions, where they share their ideas and perspectives on the material being covered.
3. Group work: This method involves students working in small groups to complete a task or project related to the course material.

Limitations of existing teaching methods at universities in Bangladesh

Teachers are less attracted to adapt and learn new educational methods; simultaneously, students are positive towardlearning new technologies. Individuals and organizations are unwilling to learn new educational technologies and digitization

There are also many technologies that, despite early promise, are no longer being used in university teaching and have been abandoned by institutions or individuals. The data also demonstrated that even relatively up-to-date or innovative technologies or practices (e.g. the use of Facebook) may be abandoned. The article discusses the participants' experiences of ceasing to use technology and demonstrates the importance of context in decisions about using technology and social media in teaching. The article argues that studies of technology adoption should be accompanied by research that revisits the sites of these studies to consider how the implementation of technology continues over time and how it comes to an end.

There may be several limitations to the existing teaching methods at universities in Bangladesh, including:

1. Limited use of technology: Some teaching methods at universities in Bangladesh may not incorporate the use of technology as effectively as they could, which may limit students' opportunities to learn and engage with the material in new and innovative ways.
2. Lack of flexibility: Traditional teaching methods such as lectures and discussions may not allow for a lot of flexibility in terms of student learning styles and preferences, which may not be effective for all students.

Hypothesis on education 4.0 in Bangladeshi universities for teaching different subjects

Teachers should use and focus on more technological applications with their proper training and

development in this. Student's curriculum must be based accordingly so that the teacher student interaction seems more engaging and interesting. A smart approach should be followed. This will provide greater flexibility to the students in choosing their choice of mode of engagement. Not only teacher and curriculum, but the entire education administration needs to shape in this manner. If not done, studentswill lose their shine in the future job market. As per the current scenario, a student's attitude and ability toperform is also seen with skills. That's why; Universities and institutions should acknowledge anddevelop the right strategy to achieve this. They should build a comprehensive and friendly framework.

It is difficult to make specific hypotheses about Education 4.0 in Bangladeshi universities for teaching different subjects, as it will depend on the specific goals and objectives of the institutions, the resources and support available, and the level of adoption and integration of advanced technologies. However, some potential hypotheses that could be explored for teaching different subjects include:

2. For non-technical subjects: Education 4.0 technologies will enhance the personalization of the learning experience and allow students to engage with course material in ways that are most meaningful and effective for them.
3. For creative subjects: Education 4.0 technologies will enhance the creative process by providing students with access to a wide range of digital tools and resources.

Methods of teaching different subject

Most of the schools, colleges and universities in India still follow the same traditional way to illustrate ondifferent subjects with the same old content. The purpose of bringing change is irrelevant if this systemprevails. The future of work should go hand in hand with a discussion on the future of curriculum and those whoeventually deliver i.e Teachers or faculty. There is a requirement of skills to be generated in students from basic problem solving, creativity thinking, and teamwork to some more specialized skills. But no attention is given to them in our persisting education system. All care about how high credit they can score which will help them in getting a good placement in future. Students need to be introduced to some professional courses in order to
explore and develop such skills.

According to Qureshi, Khan, Muhammad, et al., (2020) the extent to which teachers accept digital technology education in their teaching practice has long been in the focus of education and learning. Future teaching is wholly based on digital mediums and devices; avoiding digitalization is not possible at this point.

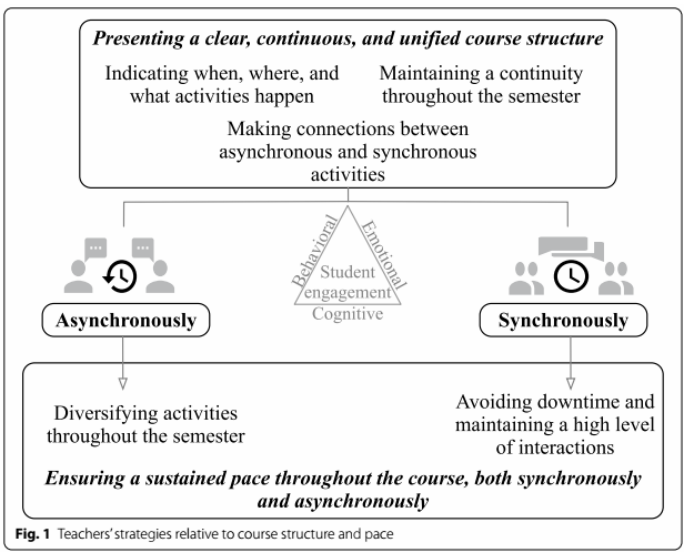

Fig. 1 Teachers' strategies relative to course structure and pace

Implementation education 4.0 in non-technical subjects

There are several ways in which Education 4.0 can be implemented in non-technical subjects:

1. Online education platforms: Online education platforms, such as MOOCs (massive open online courses) or LMSs (learning management systems), can be used to deliver non-technical subjects entirely online or as part of a blended learning program. These platforms can provide students with access to a wide range of educational materials and resources, and allow for collaboration and communication with classmates and educators.
2. Virtual reality and augmented reality: Virtual reality (VR) and augmented reality (AR) technologies can be used to create interactive and immersive learning experiences for non-technical subjects. For example,

students studying history can take virtual field trips to historical sites or participate in simulations that bring historical events to life.

3. Personalized learning: Education 4.0 technologies can be used to provide personalized learning experiences, where students can learn at their own pace and receive tailored content based on their interests and needs. This can be particularly beneficial for students who struggle with traditional classroom-based learning.
4. Collaborative learning: Education 4.0 technologies can facilitate collaboration and communication between students, educators, and experts in the field. For example, students can participate in online discussions and group projects, and connect with subject matter experts through video conferencing or other digital tools.

Activities of university administration to promote education 4.0

There are several things that university administration can do to promote Education 4.0:

1. Develop a vision and strategy for Education 4.0: University administration can work with faculty and staff to develop a vision and strategy for Education 4.0 that aligns with the mission and goals of the institution. This may involve identifying areas where advanced technologies can be used to enhance teaching and learning, as well as developing a plan for implementing and evaluating these technologies.
2. Provide resources and support: University administration can provide resources and support to faculty and staff to help them integrate Education 4.0 technologies into their courses and programs. This may involve providing training and professional development opportunities, as well as funding for technology infrastructure and resources.

Evaluating students in non-technical subjects in education 4.0

Some examples of evaluation methods that may be used in Education 4.0 for non-technical subjects include:

1. Online quizzes and exams: Online quizzes and exams can be administered through an online learning platform or other digital tools. These can be used to assess students' knowledge and understanding of course materials and can be graded automatically.
2. Project-based assessments: In Education 4.0, students in non-technical subjects may be asked to complete projects or assignments that involve applying their knowledge and skills to real-world problems or challenges. These projects can be assessed through a variety of methods, including written reports, presentations, or demonstrations.
3. Virtual reality and augmented reality activities: Students in non-technical subjects may be asked to complete virtual reality or augmented reality activities as part of their coursework. These activities can be used to assess students' understanding of concepts and their ability to apply what they have learned.
4. Peer assessment: In Education 4.0, students may be asked to evaluate the work of their peers as part of a collaborative learning environment. This can involve providing feedback on written work, participating in peer review sessions, or completing peer assessment forms.
5. Self-assessment: Students may be asked to reflect on their own learning and progress through self-assessment activities, such as keeping a learning diary or completing a self-assessment form.

Evaluating students in English literature in education 4.0

In Education 4.0, students in English literature can be evaluated through a combination of traditional and technology-based assessment techniques. Some examples of evaluation methods that may be used in Education 4.0 for English literature include:

1. Online quizzes and exams: Online quizzes and exams can be administered through an online learning platform or other digital tools. These can be used to assess students' knowledge and understanding of course materials and can be graded automatically.
2. Essay writing: Students in English literature may be asked to write essays or papers as part of their coursework. These can be assessed based on the quality of the writing, the depth of analysis, and the use of evidence from the texts being studied.
3. Group discussions and presentations: Students in English literature may be asked to participate in group discussions or give presentations as part of their coursework. These activities can be used to assess students' critical thinking skills, their ability to communicate effectively, and their engagement with the material.
4. Peer assessment: In Education 4.0, students may be asked to evaluate the work of their peers as part of a collaborative learning environment. This can involve providing feedback on written work, participating in peer review sessions, or completing peer assessment forms.
5. Self-assessment: Students may be asked to reflect on their own learning and progress through self-assessment activities, such as keeping a learning diary or completing a self-assessment form.

Evaluating students in English grammar in education 4.0

In Education 4.0, students in English grammar can be evaluated through a combination of traditional and technology-based assessment techniques. Some examples of evaluation methods that may be used in Education 4.0 for English grammar include:

1. Online quizzes and exams: Online quizzes and exams can be administered through an online learning platform or other digital tools. These can be used to assess students' knowledge and understanding of course materials and can be graded automatically.
2. Grammar exercises and activities: Students in English grammar may be asked to complete grammar exercises or activities as part of their coursework. These can be used to assess students' understanding of grammar rules and their ability to apply them.
3. Writing tasks: Students in English grammar may be asked to complete writing tasks, such as writing essays or papers, as part of their coursework. These can be assessed based on the quality of the writing and the accuracy of the grammar used.
4. Peer assessment: In Education 4.0, students may be asked to evaluate the work of their peers as part of a collaborative learning environment. This can involve providing feedback on written work, participating in peer review sessions, or completing peer assessment forms.
5. Writing assignments: Students in English grammar may be asked to complete writing assignments as part of their coursework. These assignments can be assessed based on the quality of the writing, the use of proper grammar and syntax, and the overall coherence and clarity of the writing.
6. Grammar and spelling tests: Students in English grammar may be asked to complete tests or quizzes to assess their knowledge of grammar and spelling rules. These tests can be administered online or in a traditional classroom setting.
7. Peer assessment: In Education 4.0, students may be asked to evaluate the work of their peers as part of a collaborative learning environment. This can involve providing feedback on written work, participating in peer review sessions, or completing peer assessment forms.
8. Self-assessment: Students may be asked to reflect on their own learning

F**uture opportunities of education 4.0 in Bangladeshi universities**

There are many potential opportunities for Education 4.0 in Bangladeshi universities, including:

1. Increased access to education: Education 4.0 technologies can be used to provide greater access to education for students in remote or underserved areas, as well as for students who may not be able to attend traditional in-person classes due to health or other constraints.
2. Personalized learning: Education 4.0 technologies can be used to provide personalized learning experiences that are tailored to the needs and preferences of each student, which can be more effective at promoting learning and engagement.
3. Enhanced collaboration and communication: Digital tools can be used to facilitate collaboration and communication among students, faculty, and staff, which can foster a more collaborative and connected learning environment.

II. Conclusion:

The education system is completely changed and shaped due to the transformation of traditional industry by digital technologies [32]. Teaching is challenging for teachers due to the rapid development of digital technologies like robots and artificial intelligence in education. IR4.0 technologies have formed new jobs in meeting the requirements of the current marketplace, as such new customer services and distinctive goods will be announced [34]

The understanding of required skills for teachers of 21PstP century and the pedagogy toned-up to the standards of industry4.0 is an urgent requirement. The flipped classroom approach would facilitate the classroom instructor to plan the learning activities to support the social emotional learning of the students. Systematic education policy and proper monitoring drive by AICTE/ UGC for higher education institutions would propagate quality industry relevant outcome. Students should be more exposed to project-based learning and hands-on-learning through field experience such as collaborative projects, mentoring and internships. The theoretical knowledge has to be amalgamated with usage of data interpretation and reasoning skills. The education system should induce Massive Open Online Courses (MOOCs) and other online learning platforms in the teaching and learning. To serve the 4.0 scenario, the physical-virtual dimensions should be intertwined for providing smart services.

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