Journal of Research and Development
Peer Reviewed International, Open Access Journal
ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-17, Issue-1 | January - 2025

Original Article

The Future of Learning: How Ai Will Transform Industry 4.0 with Education 4.0

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Manuscript ID:
JRD -2025-170109
ISSN: 2230-9578
Volume 17
Issue 1|
Pp. 44-50
January 2025

Submitted: 02 Dec. 2024
Revised: 2 Jan. 2025
Accepted: 25 Jan. 2025
Published: 31 Jan. 2025

Abstract:

This paper provided a review of 4.0 educations as long as the India and international - education providers and the role and importance of digital personal assistant and learning online and lifelong world class learning and education 4.0. With the advent of Industry 4.0 and Work 4.0, modern education is undergoing a transformation in terms of educational practices, skill sets and competencies, teaching and learning methods (including flipped classroom, blended learning, self-regulated learning, project-based learning, inquiry-based learning, student-centered pedagogy), digital tools used at all levels of education, and barriers and challenges. This chain of changes is captured by the new buzzword "Education 4.0".It is not so far finally defined. There are various explanations of the concept. Most align with the Fourth Industrial Revolution and Industry 4.0.What can the industry learn from these pioneers? Are there opportunities yet to be explored? And how might this impact the way educators teach and deliver curriculum in the future?

Keywords: *AI, ToI, ML*

Introduction:

Industrial 4.0

Since the first Industrial Revolution, subsequent revolutions have resulted in manufacturing, from water and steam powered machines to electrical and digital automated production which makes manufacturing process more complicated, automatic and sustainable so that people can operate machines simply, efficiently and persistently. "The term Industry 4.0 stands for the fourth industrial revolution which is defines as a new level of organization and control over the entire value chain of the life cycle of products, it is geared towards increasingly individualized customer requirements. The central objective of Industry 4.0 is fulfilling individual customer needs which affects areas like order management, research and development, manufacturing commissioning, delivery up to the utilization and recycling of products. The main difference between industry 4.0 and Computer Integrated Manufacturing (CIM) is the concern of the human role in production environment. Industry 4.0 has an important role of human worker in performing the production whereas CIM considered workerless production. Paradigm Industry 4.0 promotes the connection of physical elements such as sensors, devices and enterprise assets. to each other and to the Internet. Design and drafting methods across disciplines need to be reviewed and their suitability tested for a modern, interdisciplinary model of product development approach and translated into general, integrated and interdisciplinary IT methods, processes and solutions. The production process is divided into small value-oriented units that's hare information only from consecutive process steps, which helps increase flexibility and likely results in reduced coordination complexity.

Different Concepts under Industry 4.0

There are several hundred terms and concepts related to Industrial 4.0. Of these, 12 foundational phrases and words are essential, irrespective of you want to invest in these solutions or not:

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How to cite this article:
R., R., S., P., & R., S. (2025). The Future of Learning: How Ai Will Transform Industry 4.0 with Education 4.0. Journal of Research and Development, 17(1), 44–50.
https://doi.org/10.5281/zenodo.14948703

Quick Response Code:
Website: https://jrdrvb.org/
DOI:10.5281/zenodo.14948703
Access this article online

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1	ERP	Enterprise resource planning is an essential tool for business process management. It is used for managing information across the organization.
2	IOT	Internet of Things refers to the connection between physical industrial objects like machines and sensors and the Internet
3	IIOT	Industrial Internet of Things is the link between manpower, data and manufacturing related machines/equipment.
4	Big Data	A vast collection of structured and unstructured data that is collected, stored, analysed, and organized to identify patterns, associations, trends, and opportunities.
5	AI	Artificial intelligence is another concept that refers to the ability of a computer to perform tasks and make decisions that historically required human intelligence
6	Digitization	It refers to the method of collecting information and converting it into digital form
7	M2M	Machine to Machine is the communication that takes place between two different machines over a wired or wireless network.
8	Smart Factory	This is an object that invests and uses technology, approach, and solution industry 4.0.
9	Cloud computing	How to use some interconnected remote servers on the Internet for storage, management and processing of information
10	Processing of real data	IT systems and machines can automatically and continuously process data to provide real -time or simply exit in the near future, more understanding
11	Ecosystem	in production, an ecosystem means a connection or a potential connection of all operations, including the planning of actions, financial indicators, management of supply chains, customer relations, production , etc.
12	Cyber-Physical System (CPS)	Also called cyber manufacturing, it is an Industry 4.0 enabled manufacturing environment that provides real-time data collection and analysis, with transparency into different aspects of manufacturing operations.

Education 4.0

In the 21st century, technology began to permeate the educational process, and both students and teachers began to use technology in education in fundamental ways that became known as Education 2.0. Technological advances, particularly the widespread adoption of a more user-friendly internet, led to the emergence of Education 3.0.

Now, Education 4.0, an approach to learning associated with the fourth industrial revolution, aims to transform education in the future through advanced technology and automation. This technological revolution includes robotics, artificial intelligence, and smart technologies.

Five important advantages in education 4.0- 5 landscape training

According to McKinsey Digital Studies indicates that 60 % of all occupations can have at least one -third of the activity automated from the fourth Industrial Revolution. Therefore, there is need for adoption of Education 4.0 and the use of technology in education.

Here are the key benefits of Education 4.0:

- **Preparing students for evolving industries:** The skills required by employees will undoubtedly evolve as more organizations integrate cyber-physical systems. The ability of technology to keep us connected at all times has led to increased flexibility and adaptability in job roles. Therefore, Education 4.0 aims to adapt to change, integrate the use of technology in education, and enable schools to determine the needs of their students in the future.
- **Automate basic administrative tasks:** Teachers spend a lot of time on administrative tasks. Automation of activity grading and assessment will become easier with the use of technology in education, benefitting the teachers. Automating administrative duties with cutting-edge technologies like artificial intelligence (AI) and machine learning (ML) enables teachers to spend more time with students, further enhancing the learning experience in classrooms.
- **Providing personalized teaching:** The goal of AI and ML in education is to help teachers better understand the potential and limitations of each student through the use of technology in education. Each student has a different learning method and pace, and teachers can now meet these needs with the help of AI and ML.
- **Providing constructive criticism:** AI can be used by teachers in the classroom to improve the guidance they give to their students and to make learning more interesting as students are engaged in active learning. It also allows teachers to provide students with instant feedback that helps students identify their weaknesses and understand how to improve them.

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- **Provide access to all students:** AI and automatic learning are used in class so that all students can use training. Even students suffering from visual violations and hearing impairment can access education using AI tools such as real -time subtitles. Using well-designed artificial intelligence in education allows teachers and students to benefit from technological advances that can improve teaching methods. AI-based tools will help teachers improve student performance and sharpen their critical thinking.

These four elements are key components of instructional design and learning theory.

1	Learning Tasks	Learning tasks are the central, whole-task experiences designed to achieve the learning objectives	Example: In a medical training program, a learning task might involve diagnosing a simulated patient based on symptoms and test results.
2	Supportive Information	Supportive information provides the knowledge and context needed to perform learning tasks	Example: Medical students can learn information about diseases, symptoms, and diagnostic methods before diagnosing patients.
3	Procedural inf ormation	Procedural information provides step-by-step guidance for performing routine, rule-based tasks.	Example: A control list for a physical inspection is an example of procedural information for medical students.
4	Practice Part-tasks	Part-task practice involves repeated practice to master a particular skill or subtask. It focuses on building automaticity and proficiency in essential components of the whole task.	Example: Practicing how to read X-rays to identify fractures is a part-task practice for doctors.

Education 4.0 and Industrial 4.0

Over the years, education has been transformed with the emergence of new pedagogies, advanced technology, and developments in the field of digitalization. If we look from where we started to where we are today, the role of technology in modernizing education is enormous. In the early stages of the transformation known as Education 2.0, technology began to permeate the Indian education system, equipping classrooms with computers, interactive whiteboards, and smart projectors, initiating new ways of teaching and learning that enhanced the quality of education in various ways.

Further technological advancements ushered in Education 3.0, which witnessed the mass penetration of the internet through gadgets such as laptops, tablets, and smartphones, elevating digital learning to the level of mainstream education. Now we are moving into a new phase of transformation: Education 4.0, where global connectivity, intelligent machines and new media are changing the was students imagine their futures.

Have we achieved this yet?

The Fourth Industrial Revolution, also known as Industry 4.0, has predicted “profound changes in the future of work” and highlighted the role of disruptive technologies in the future world of work. The true purpose of education is to prepare students for a bright and prosperous future. To prepare students for tomorrow's world of work, there is a critical need to change the approach to teaching and learning and align it with the global career landscape, which has necessitated the development of Education 4.0, which defines how industrial technologies can improve learning for Indian school children and reduce educational disparities.

Moving with the times, in today's digital age, cyber-physical systems are widely integrated across multiple industries. The intrusion of technology into almost every system and process of an organization is further impacting workforce skill expectations. According to one study, Industry 4.0 is expected to automate at least one-third of activities in 60% of all occupations.

According to the World Economic Forum, more than one-third of the skills required for most jobs will consist of cross-cutting skills, with an increasing emphasis on technical skills. However, not only will hard skills be the prerequisites for the jobs of tomorrow, soft skills are also going to be in high demand, including complex problem solving, social skills and process skills. The jobs of the future will be much more flexible and adaptable.

Industry 4.0 has technologies such as automatic learning, artificial intelligence, and robot engineering and is very strongly influenced by our daily lives.

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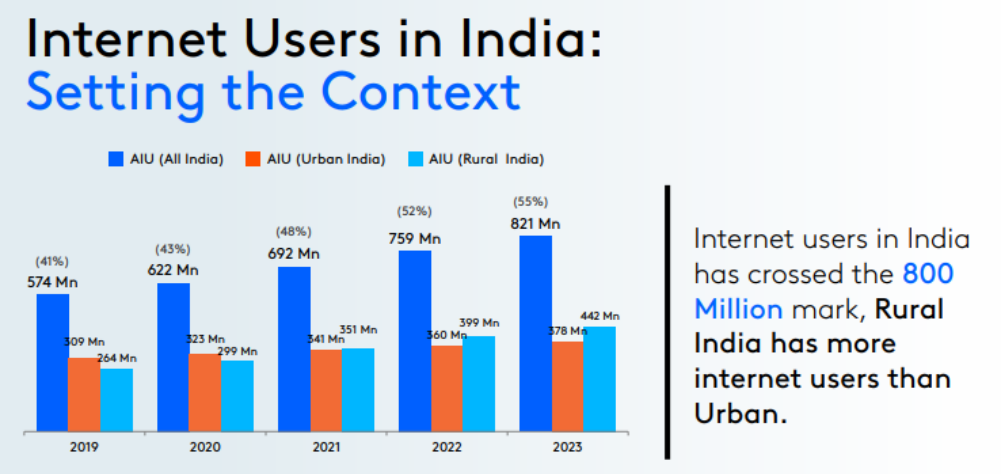
Education 4.0- Everything is not delayed in connection with development time, and the introduction of a young program at a young age. Improving learning in the classroom Education is undergoing many transformations around the world, with many educational institutions introducing immersive technologies into the classroom to enrich students' experience, increase retention, and improve understanding of concepts taught in traditional classes. Immersive technologies refer to a range of interactive technologies that can be used to create interactive learning experiences in the classroom. These technologies include virtual reality (VR), augmented reality (AR), and mixed reality (MR), which are used to create simulations, visualizations, and interactive learning environments. The technology allows educators and institutions to focus on promoting student and teacher engagement, fostering deeper learning, facilitating collaboration, and creating a learning environment that is accessible to students regardless of their location, revolutionizing the way education is delivered. A Transformative Approach to Learning For Education 4.0 to have a significant impact, it must permeate all levels of education, especially higher education. By integrating future skills development into their teaching and learning strategies, universities can better prepare students for the Fourth Industrial Revolution.

An effective way to achieve this is to promote accelerated digital learning in which students can study remote theoretical information using digital methods, while receiving personal training for practical skills.

To move on to a new working method, students will also have to develop their ability to adapt quickly to new developments. Project-based learning emphasizes the importance of learning a broad set of skills that can be applied in any scenario, rather than focusing on a set of skills directly related to a specific job. Additionally, the way we test and assess will need to evolve. This could mean moving away from traditional ways of retaining information and de-emphasizing the amount of learning.

Giving significant importance to practical and experiential learning projects is an excellent way forward. Putting students at the centre of the educational process and shifting the focus from teaching to learning are the ultimate goals of Education 4.0. The National Education Policy also reiterates the need for career guidance in schools to give students an early start in skills development with a focus on technical skills. It is difficult to migrate the school at work at work, and education 4.0 aims to work as a catalyst for browsing in the right direction.



Source: Secondary Data (IAMAI report 2023)

India is witnessing more internet user day by day, this boosting the education and industry becoming more powerful and that lead for the technological advancement and growth of industry in increasing the knowing of AI both rural and urban people.

How does the internet penetration vary across States?

Table showing Top Three States of India Using Internet

1	Goa	73%
2	Maharashtra	69%
3	Kerala	69%

Table showing Bottom Three States of India Using Internet

1	Jharkhand	46%
2	Uttar Pradesh	41%
3	Bihar	37%

Source: Secondary Data (IAMAI report 2023)

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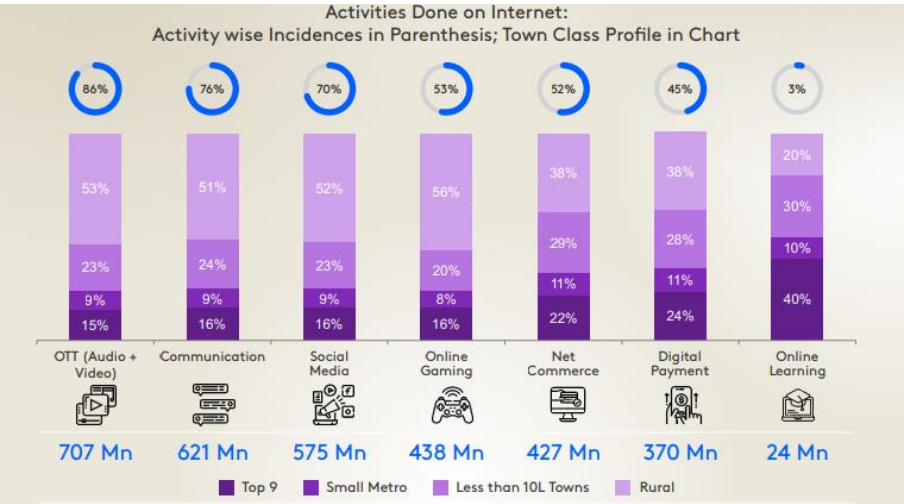
Top Activities Done on Internet

While Net Commerce, Digital Payment and Online Learning are more Urban centric activities, other activities like OTT, Communication, Social Media and Online Gaming are more democratized.



Source: Secondary data

Indian industry 4.0 market size

In 2023, the market size in India was estimated at 4,609.0 million US dollars and, according to forecasts, in 2024 to 21,862.0 million US dollars will reach 5,373.3 million US dollars, for the predicted one predicted period (2024-2032) an average age of 19.2% (2024-2032). The market should expand significantly, due to technological achievements and government initiatives, such as,“ Make in India ”. AI, IOT and Data analytics. Moreover, the rising emphasis on sustainability and operational efficiency fuels investment in advanced manufacturing technologies.

Industry 4.0 with educational 4.0 for the new fashionable word in production, and Indian companies can switch to production productivity.

In recent years, the Indian production department has become a monument to the monumental change caused by the beginning of the industry 4.0. This transformed revolution, which is characterized by the integration of advanced technology such as artificial intelligence (AI) and internet of things (IoT), redirects the normal production process, unprecedented levels, performance, competitiveness will improve. Industry 4.0 means important conversion in production. In this case, interconnected systems, automation, and data analysis agree to create intellectual, adaptation, and digital production media in real time. In India, this transition is not just theoretical but a tangible reality as manufacturers across various sectors are leveraging AI and IoT to improve their operations.

At the forefront of this revolution are visionary initiatives like ‘Make in India’, ‘Skill India’ and ‘National Manufacturing Policy’ under the Department of Industrial Policy and Promotion. These initiatives aim to increase the contribution of manufacturing to 25 per cent of the gross domestic product (GDP) by 2025, propelling India towards its aspiration of becoming a global manufacturing hub.

The momentum is palpable, with India ranking 30th in the World Economic Forum’s Global Manufacturing Index in 2018, and gross fixed capital formation (GFCF) in manufacturing reaching an impressive $405.88 billion in the first half of FY 2019-20. The use of artificial intelligence, the machine learns data, identifies the model, and makes a decision based on information. This algorithm analyzes a large amount of datasets generated by sensors and production devices to optimize processes, predict maintenance needs, and reduce stop time. AI-based predictive maintenance proactively identifies potential equipment failures, mitigating costly outages and improving asset utilization.

Additionally, the Internet of Things (IoT) plays a key role in Industry 4.0 by connecting devices, machines, and systems to enable seamless communication and data exchange. IoT sensors embedded in equipment collect real-time data on productivity, energy consumption, and product quality, allowing manufacturers to remotely monitor operations and make data-driven decisions. With IoT-enabled smart factories, manufacturers gain unrivaled visibility and control over their production processes, increasing efficiency and responsiveness.

Devjani Ghosh, Chairman, NASSCOM, said, "Indian manufacturing is at a tipping point with Industry 4.0 and we expect strong demand for increased investments over the next two years, which is likely to generate better customer

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experiences and long-term business models." Going forward, it will be interesting to see how ready Indian manufacturing is to adopt and scale Industry 4.0. This will primarily depend on the use cases selected, the scale of proof-of-concept deployment capacity, and alignment of IT and operational capabilities.

In India, the adoption of Industry 4.0 technologies is gaining momentum across sectors including automotive, electronics, pharmaceuticals, and consumer goods. Automobile manufacturers are using AI and IoT to optimize supply chain management and improve customer experience, while electronics companies are implementing AI-based quality control systems to ensure product quality. Pharmaceutical companies are using IoT-enabled sensors to monitor environmental conditions during drug production, ensuring product compliance and integrity.

According to a recent NASSCOM report, investments in Industry 4.0 solutions are on the rise, with the Indian manufacturing industry committing significant funds of US$ 5.5-6.5 billion during the financial year 2020-21. Backed by government regulations and private sector investments, this concerted effort aims to support India's digital transformation, increasing the country's contribution to GDP to 25% by FY2026.

Despite this promising trajectory, challenges remain, particularly for micro, small and medium enterprises (MSMEs) that face challenges related to scaling, financing and digital adoption. However, smart manufacturing technologies hold great potential to improve India's competitiveness and long-term sustainability as it seeks to lead the Fourth Industrial Revolution.

Conclusion:

Industry 4.0 offers a transformational opportunity for education 4.0, Indian manufacturing by enabling the creation of intelligent, digital and connected manufacturing systems. Integrating AI and IoT can help manufacturers achieve greater efficiency, agility, and innovation to drive sustainable growth in the Fourth Industrial Revolution. India is leading this digital manufacturing revolution with its AI/ML-powered Supply Network Control Tower (SNCT). SNCT not only provides complete visibility at every stage of the manufacturing pipeline, but also provides predictive alerts to customers regarding delays and potential solution scenarios. Our SNCT promotes transparency and trust by providing real-time updates, streamlining manufacturing processes. Aligned with Prime Minister Narendra Modi's 'Make in India' initiative, India serves as a trusted partner for global entities across diverse industries, driving progress and sustainability in India's manufacturing landscape.

Education 4.0 represents a huge opportunity for Indian manufacturers to embrace the digital revolution and improve their competitiveness. By leveraging IoT, AI, big data analytics and robotics, Indian manufacturers can transform their operations, drive innovation and achieve sustainable growth.

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