

Utilization of Disruptive Technologies in Promotion of Education 5.0: An Overview

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Abstract: Education 5.0 is a technology-driven digital education system. Various types of disruptive information technologies are used in Education 5.0 to serve better performance. Various disruptive information technologies are playing a crucial role in implementing Education 5.0 in a real scenario. Education 5.0 is a futuristic technology-based education system. It not only provides technology-based education but also considers different human values, ethical concerns, critical thinking development, creativity development, and all-round development of the learners. Education 5.0 is also an environment-concerned education system. It tries to achieve the Sustainable Development Goals. This paper tries to provide an overview of Education 5.0. It tries to discuss various disruptive information technologies and the role of various disruptive information technologies in Education 5.0. The study tries to make a comparison between Education 4.0 and Education 5.0. Some challenges in Disruptive Technology-Based Education 5.0 are also discussed in this paper.

Keywords: Disruptive Technology; Education 4.0; Education 5.0; Digital Education; Emerging Information Technology.

Introduction

Education 5.0 is a human-centric model that uses various types of disruptive technologies, which create artificial intelligence-based digital education. It maintains human values with ethical concerns, and it provides education for mankind. Where Education 4.0 is based only on skill development, Education 5.0 tries to maintain the balance of human moral values with a technology-based education system. Education 5.0 is a modern-smart-technology-based digital education system. It makes bridges between human values, technology, and the environment. In the modern era, Education 5.0 has a great impact on the education system. It is the collaboration between automation, ethics, human psychology, technology, and the environment. It creates interest-based learning with an advanced curriculum and research-based learning. Instead of the traditional classroom-based face-to-face mode of learning, Education 5.0 promotes digital learning with technology. It does not promote rote learning, but it encourages hands-on project-based learning. Education 5.0 promotes building critical thinking and creative thinking that help in survival in the future workplace. Education 5.0 tries to build an efficient generation that has great ethical values with environmental concern.

Related work

To get the knowledge about the utilization of various disruptive technologies in Education 5.0, it is necessary to study some previous work in this context. Some of the previous study are - **Alharbi (2023)** [1] made a comparative study on Implementation of Education 5.0 in developed and developing countries.

It followed PRISMA method and used six years data. It has selected Zimbabwe and Sri Lanka for the study purpose. It has used quantitative and qualitative methodologies for the study. **Chinchorkar and Jadhav (2024)** [2] made a theoretical study on Sustainable education perspective with the Transformation of education 4.0 to education 5.0. It performed some literature study and tried to made correlation between industry, society and education. **Coman et. al., (2024)** [3] performed a conceptual study on the Influence of Emerging and Disruptive Technologies on the Development of Industry 5.0. It showed the conceptual framework with Trends of interest over time. It also perform keyword analysis and bibliometric study. **Gowda (2023)** [4] performed a comprehensive review based study on Education 5.0. It classified different generation of Education. It performed detail discussion on the role of role, need, benefits and others features of ICT in Education. It also discussed some intelligent tutoring system and other AI based education system. **Pratyusha and Varghese (2025)** [5] made a review based study on Education 5.0 and various use of Disruptive Technologies in education. It discussed the role of Technology in Education 5.0. It also discussed the implementation potentiality of Education 5.0. Table 1 compares this work with the related work or previous research by other researchers.

Table 1. Compares this work with the related work or previous research by other researchers

	Education 4.0	Education 5.0	Disrupted Technology
[1]	Yes	Yes	No
[2]	Yes	Yes	No
[3]	No	Yes	Yes
[4]	Yes	Yes	No
[5]	Yes	Yes	Yes
This work	Yes	Yes	Yes

Method

The paper title-“Utilization of Disruptive Technologies in Promotion of Education 5.0: An overview” is tries to provide a fundamental concept about Education 5.0. It tries to show the utilization of different Disruptive information technologies to enhancement of the Education 5.0. It is a theoretical study to find the role of Disruptive information technologies in digital transformation of education system. The study involves different interdisciplinary fields.

Finding and Result

Education 5.0: Fundamental concept

Education 5.0 is a technology-driven, human-centric, environment-friendly education system. Education 5.0 mainly concentrates on the social development and all-round development of the learner, as well as tries to protect the environment. One of the focuses of Education 5.0 is education for society. With the help of different types of emerging Information and Communication Technologies, it spreads education in all parts of society. It is more than Education 4.0. Where Education 4.0 considers technology-based learning, Education 5.0 combines the technology-based education with societal values by ensuring sustainable development. It is the digital transformation of the traditional education system into a smart education system with a human-centric approach. Education 5.0 aims to make a collaboration between humans, technology, and the environment. Education 5.0 offers an artificial intelligence-based education system with advanced learning analysis procedures. It is an interdisciplinary education system with research-oriented learning. It creates a digital educational ecosystem with future skill development potential [6]. Education 5.0 is a combination of Education 4.0, technology, ethics, human collaboration,

human values, cyber-physical systems, human-artificial intelligence collaboration, social responsibility, creativity and sustainable development.

Disruptive Technology: An Overview

Disruptive technologies are emerging information technologies that are used in transforming different sectors from traditional-based procedures to digital procedures. Disruptive information technology is useful in upgrading the existing system into a smart system. It incorporates new procedures of information management that offer more advanced data analysis with more accurate predicted results. It tries to convert the whole system into a digital format. It utilizes different technologies like Cloud Computing, Edge Computing, Fog Computing, Green Computing, Internet of Things, Big Data Analytics, Blockchain technology, Artificial Intelligence, Machine learning, Deep learning, Virtual Reality, Augmented Reality, Extended Reality and other emerging information technologies. It tries to use real-time data and create an autonomous information system. It utilizes various types of adaptive technologies to offer personalized content. It uses various educational technologies (EdTech) to create a smart digital education system [7].

Utilization of Different disruptive information technologies in Education 5.0

The education system has been changed with the utilization of different types of disruptive information technology. The advent of information technology transforms the existing education system into a technology-based digital education system [8]. Artificial intelligence is one of the important disruptive technologies that is used in Education 5.0. Artificial intelligence-based education systems offer personalized education, customized study material, intelligent content recommendation, automatic decision-making, and so on. Generative AI is another disruptive technology. It helps in topic-based content creation with intelligent content recommendation. It also provides an AI tutor 24 X 7 personal learning support with adaptive explanations [9]. Machine learning offers advanced predictive analysis of student performance with learning pattern identification. The deep learning helps in complex pattern identification and is able to process different types of images, speeches, and languages. Natural language processing systems help to learn in any language. Cloud computing decreases the dependency on local resources. It provides data virtualization with minimum overhead. Cloud storage is helpful for data storing and can be accessed at any time with the use of the internet. Internet of Things is one of the important disruptive technologies. IoT devices are useful in campus-based education systems. Different sensors and actuators perform their desired work and offer an automated smart classroom. It helps in minimizing resource utilization and ensuring energy efficiency. It helps to create a technology-based green campus. Edge computing, fog computing, and green computing are some important disruptive technologies used in Education 5.0. Blockchain technologies are used to enhance data security. If any alteration or modification happens with any data, then it generates a new block. Smart contracts automatically execute the predefined statements and reduce transactional risk. Big Data Analytics is another disruptive information technology [10]. It is able to process different types of heterogeneous data. It also processes real-time data and generates more accurate results. Virtual reality, augmented reality and extended reality are part of disruptive information technology. With the use of 3D printing technology, it also helps in the innovation of 3D models and 3D teaching-learning materials (TLM) that help the learner to learn more easily. Cyber-physical systems, metaverse technology, and digital twin concepts also enrich the potential of Education 5.0. For the perfect implementation of Education 5.0, it needs stable, high-speed internet connectivity. It also tries to incorporate 5G technology, 6G technology, and even LiFi technology

for the transmission of data. One of the important aspects of Education 5.0 is to ensure sustainable development. With the utilization of different types of disruptive information technologies.

Discussions

Comparison between Education 4.0 with Education 5.0

Education 5.0 is a completely technology-driven digital education system. It considers human values as well as environmental perspectives in digital education. Education 4.0 is only a technology-based education system. The main objective of education 4.0 is to prepare the learner for industry 4.0, whereas Education 5.0 prepares the students for society 5.0 and a sustainable education system. The main approach of education 4.0 is the digital transformation of the education system, whereas Education 5.0 considers human, technology, and environmental collaboration. Artificial intelligence integration, the use of generative AI, authentic AI are used for strategic perspectives only in education 4.0, whereas in Education 5.0, AI technologies are used for generating personalized content with more advanced data analysis that helps in intelligent autonomous learning. In the case of curriculum designing, the main focus of education 4.0 is to prepare the skill development needed for Industry 4.0; on the other hand, Education 5.0 focuses on the all-round development of the learner, considering human values and preparing the learner to be a responsible future citizen. So, it is found that Education 5.0 is a disruptive technology-driven digital education system that considers human values as well as tries to achieve the Sustainable Development Goals. Table 2 illustrates Comparison between Education 4.0 with Education 5.0.

Challenges in Disruptive Technology-Based Education 5.0

It is very challenging to implement disruptive technology in Education 5.0. The main challenge is technological feasibility challenge. It is very difficult to establish digital infrastructure to provide the benefits of Education 5.0. It is necessary to ensure strong and stable internet connectivity to access the facilities in Education 5.0. It is necessary to establish internet connectivity in all parts of the country. It is very tough to ensure equal access to digital devices and digital infrastructure in both urban areas and rural areas. It is necessary to reduce the digital divide among the people in different parts. To establish the digital infrastructure, it needs to invest a huge amount of funds. It is also necessary to update hardware, software, and different useful technologies on a regular basis. It is also challenging to incorporate disruptive information technologies into the existing education system. It is necessary to consider that artificial intelligence-based systems can make mistakes. The result of an AI-based system is probability-dependent. In the case of an AI-based assessment system, AI may give different marks for different executions. AI-based systems also have biases. Cybersecurity challenges are also a big threat to the system. It is very difficult to ensure the safety of the data. It is also challenging to train a huge number of teachers about the system, and it is associated with the digital competency of the teacher. It is very difficult to ensure teacher-technology bonding. There is also a chance that the AI teacher may reduce the job opportunities of human teachers. Students are also facing different types of challenges. The main problem is screen time problem. To access the system, the student needs to expose their eyes for a long time, which creates different types of eye problems. There is also a digital literacy gap among the students if they access the whole learning through technology. It also creates different types of psychological and social boundaries for the students. Another big challenge is to maintain the ethical concerns of the system. The use of technology must consider human values. Maintaining algorithmic auditing on a regular basis and checking the output for accurate results. The institution must provide clear guidance on the ethical use of Artificial Intelligence and technology-based systems. The system should consider cultural diversity,

language diversity, psychological diversity, sociological diversity, and so on. It is also necessary to maintain environmental concerns. It is very difficult in the management of digital e-waste, reducing energy consumption, enhancing renewable energy sources, and creating energy-efficient green campuses. It is very difficult to minimize environmental threats and achieve sustainable development.

Conclusions

Education 5.0 has a great potentiality in education system.

1. Problem Statement: Conceptual overview of Education 5.0 and Different disruptive information technologies.
2. Method used: The study is theoretical in Nature.
3. Key findings: The role of disruptive information technologies in Education 5.0.
4. Education 5.0 offers many benefits to learners and teachers but faces challenges in initial setup and minimizing the digital divide between urban and rural areas.

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