Visualising The Role Of Disruptive Technologies In Multidisciplinary And Holistic Education

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Abstract: Disruptive technologies encompass active learning methodologies and digital tools that promote student engagement and participation. Various technologies are considered disruptive, including Online Learning, Competency-Based Education, Virtual reality, Collaboration platforms, and Artificial Intelligence, enhancing the educational process's convenience for students and challenging traditional practices. Disruption in education, or disruptive technologies in education, is distinguished by improved service models focusing on enhanced educational program quality, personalized real-life educational processes, and the creation of high-value, specialized programs targeting specific user groups. The National Education Policy (NEP) 2020 underlines the significance of Multidisciplinary education through disciplinary and professional programs to cultivate critical thinking, adaptability, and self-management skills among learners. The policy aims for a substantial overhaul in higher education through the implementation of innovative and ambitious initiatives, acknowledging the intricacies and hurdles within higher education. The anticipation is that both formal and open and distance education modes in higher education will collaborate to actualize the recommendations outlined in NEP 2020. This article will analyse the impact of disruptive technologies on multidisciplinary and Holistic education, drawing insights from existing research journals and secondary sources. The research abstract underscores the varied roles of disruptive technology in delivering quality education within the realm of multidisciplinary and Holistic education.

Keywords: Disruptive technologies, multidisciplinary education and holistic education, digital tools, artificial intelligence, online learning.

1. Introduction

Prior to the invention of computers and other digital communication tools, students received their education in traditional classroom settings where there was a strong reliance on the tutor's skills. Time and space were also restricted in the transformation of knowledge by the resources made available to students, such as libraries, etc. However, the situation has changed. Numerous digital technologies exist that significantly influence the school system. Globalisation has also put pressure on countries around the world to adopt new technologies in the classroom (Suman, 2020).

One of the most important components in creating a sustainable enterprise is disruptive technology. Disruptive technology is mostly about changing current business models and practices. If such a dramatic shift goes unrecognised, it has the potential to endanger current institution in every sphere of the economy

and society at large. The term "disruptive technology" was first used by Bower and Christensen in a comparison between disruptive and sustaining technology. In sustaining technology, incremental improvements are made to current products, whereas in disruptive technology, new markets are created or alternative concepts of value are introduced. Any technology that challenges established markets with better products and services at cheaper prices and offers a different value proposition is considered disruptive (Zovko, V, & Gudlin, M, n.d.).

The National Education Policy (NEP)-2020 underscores the significance of holistic and multidisciplinary education to equip learners with competencies pertinent to the 21st century. NEP-2020 articulates that "education would be aimed at developing all capacities of human beings- Intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner" (NEP, 2020). This policy highlights the critical role of multidisciplinary education through both disciplinary and professional programs in fostering skills related to critical thinking, adaptability, and self-management among learners. The policy aspires to initiate a fundamental transformation in higher education by executing innovative and ambitious strategies while acknowledging the inherent complexities and challenges associated with higher education. It is anticipated that both formal, open and distance education modalities within higher education will endeavour to translate these recommendations of the NEP-2020 into practical applications (Priyadarshini, A, & Dave, D, 2021).

1.1 Disruptive Technology

Technological advancements continue to influence various aspects of our existence subtly. Disruptive innovations significantly alter the operational frameworks of consumers, enterprises, and sectors. Innovations in technology- including artificial intelligence, robotics, nanomaterials, biotechnology, bioinformatics, quantum computing, and the Internet of Things (IoT) are effecting transformative changes globally. Individuals increasingly embrace novel and accessible modalities, such as social media platforms like Facebook and Instagram, alongside numerous indigenous technologies, to engage with the digital landscape. Digital technologies encompassing mobile devices, social media, smartphones, big data analytics, predictive analytics, and cloud computing represent a fundamental departure from earlier IT-centric technologies.

Disruptive innovations allow start-up enterprises to establish a substantial presence within pre-existing industries. Recent technological advancements continue to disrupt our lives, often yielding positive outcomes. It is noteworthy that certain technologies are already operational, however, they persist in their evolution and transformation at an accelerated rate, suggesting that the ramifications of these advancements will only intensify. A disruptive technology possesses the capacity to supplant current systems or practices through attributes that are quantifiable and superior. Disruptive technologies are not exclusively novel or revolutionary in nature. Instead, they represent technologies that harbour the potential to disrupt established markets or industries (A Khan et.al,2023).

The continuous development of technology has a subtle and gradual impact on society. However, disruptive technologies affect, positively and suddenly, this requires a shift in mentality so that human capital can adjust to these new opportunities and swiftly take advantage quickly of all its benefits. The following traits will define disruption in education:

- Better service models that are built around improved educational program quality
- More personalized and real-life educational process
- Development of high-value, niche programs aimed at specific groups of users
- Student data automated management
- Systematic and organized analytics and reporting
- Effective recording and sharing of educational materials
- More keen progress evaluation

1.2 Disruptive Technology in Higher Education

With the swift advancement of data and communication technologies at the onset of the 21st century, an accelerated evolution in technological paradigms has emerged, leading to the incorporation of terminologies such as Cloud learning, mobile learning, e-learning, and MOOCs into the extensive catalogue of disruptive technologies. Several of the prominent disruptive technologies are:

1.2.1 Online Learning

Online education, which experienced substantial growth during the COVID-19 pandemic, has emerged as an essential element of global education systems. This mode of learning presents numerous advantages compared to traditional classroom instruction. Well-structured online educational platforms recognize the diverse learning styles of students. They are capable of integrating multimedia presentations and gamified instructional content.

Platforms such as Zoom and Google Classroom have witnessed extensive adoption, facilitating virtual classrooms, interactive discussions, and self-directed learning opportunities. These online educational platforms empower students with the capability to access and engage with learning materials from any location, including the convenience of their own homes, along with access to a plethora of resources and courses. Furthermore, access to such platforms has catalysed the emergence of innovative pedagogical methodologies, including flipped, hybrid, blended, and offline classroom experiences. The online learning format also acknowledges the variability in students' learning paces. Students have the ability to pause and replay instructional videos to enhance their understanding. Additionally, educators receive detailed reports regarding students' progress, enabling timely interventions when a student encounters difficulties.

While online learning has broadened access and opportunities for a significant number of individuals, it has also posed challenges in various instances, particularly for students lacking reliable internet connectivity or devices, who face obstacles in engaging with and keeping pace in their coursework. Moreover, there are pressing concerns regarding the efficacy of online learning, particularly concerning student engagement and social interaction.

1.2.2 AI-guided learning

The application of artificial intelligence (AI) serves as a mechanism to safeguard organizational or general knowledge from obsolescence when particular knowledge sources become unavailable. Such preserved knowledge possesses the potential for further development, thereby extending its functional lifespan. The immediate benefit of AI integration is manifested in cost efficiencies achieved through the automation of various processes. Learners exhibit diverse modalities of acquisition and varying rates of progress. The integration of artificial intelligence into e-learning platforms enables the systematic monitoring of students' advancement.

The incorporation of AI within the educational domain is fundamentally transforming the dynamics of teaching and learning, as well as the modalities through which education is delivered and experienced. AI-enhanced instruments facilitate personalized learning experiences by addressing the unique requirements of individual students. Furthermore, AI is optimizing administrative functions, such as grading, enabling educators to dedicate more attention to interactive pedagogical practices and student involvement. Despite the increasing integration of AI in educational settings, it is not devoid of challenges, which encompass significant issues about data privacy, inherent biases within AI algorithms, and the imperative for comprehensive training for educators.

1.2.3 MOOCs

The designation MOOCs was originally introduced by Dave Cornier in the year 2008 at the University of Manitoba. A distinctive characteristic of MOOCs is their provision of educational opportunities to the public at a nominal cost on a global scale, coupled with the issuance of certificates of completion to participants who successfully engage in their studies (Saikia, J & Padmavathy R.D., 2022). Massive Open Online Courses (MOOCs) have emerged as one of the most significant phenomena in the realm of higher education in recent times. MOOCs embody open access, worldwide, complimentary, video-based educational content, including instructional videos, problem sets, and discussion forums disseminated via a web platform to a substantial number of participants aspiring to enrol in a course or acquire knowledge. The incorporation of MOOCs within the higher education framework is congruent with the aims of the National Education Policy (NEP) 2020 in a multitude of ways:

- MOOCs furnish learners with the autonomy to engage in learning at their own rhythm and convenience, which is in direct correspondence with NEP 2020's emphasis on flexible and modular educational structures.
- MOOCs afford learners with avenues for continuous education and skill enhancement, which constitutes a principal objective of NEP 2020.

- MOOCs present a diverse array of courses facilitated by esteemed universities and experts, thereby granting learners access to an expanded spectrum of educational opportunities, as envisioned in NEP 2020.
- MOOCs possess the potential to broaden educational access for learners encountering geographical, financial, or other impediments to conventional higher education, which resonates with NEP 2020's commitment to equity and inclusivity in education.
- MOOC's can serve to impart knowledge to students who lack access to the formal education system.
- MOOC courses exhibit considerable flexibility for the learners.

1.2.4 Open and Distance Learning

Open and Distance Learning (ODL) emerged to address the exigencies precipitated by the inadequacies and inflexibilities inherent in the conventional face-to-face educational system. ODL assumes a pivotal role in delivering a multidisciplinary and integrative educational experience, thus dismantling traditional barriers to learning by providing flexible, accessible, and varied educational opportunities. In the Indian context, the imperative to extend equitable educational opportunities to diverse segments of society, alongside the demonstration of the necessity for higher education, catalysed the establishment of the ODL framework, commencing with the Dr. BR Ambedkar University in 1982 and subsequently the establishment of the Indira Gandhi National Open University in 1985. Institutions of higher learning operating under the ODL paradigm have significantly contributed to the dissemination of education to various societal strata through their diverse array of programs.

Through ODL, learners are allowed to engage with a broad spectrum of subjects and disciplines, thereby facilitating the construction of a comprehensive knowledge repository that encompasses multiple fields. This pedagogical approach not only nurtures interdisciplinary learning but also stimulates students to engage in critical thinking and to establish connections among disparate ideas across various domains. Furthermore, the inherent flexibility of ODL permits students to assimilate learning into their lives in a manner that aligns with their personal and professional aspirations, thereby fostering a culture of lifelong learning. By harnessing digital platforms, ODL avails a plethora of rich and varied resources along with interactive experiences that bolster a well-rounded educational framework, ultimately equipping learners with the requisite skills to navigate intricate, real-world challenges.

2. Review of Related Literature

Micheal Flavin (2012) The paper presents several key findings regarding the use of disruptive technologies in higher education, highlighting the contrast between technologies provided by Higher Education Institutions (HEIs) and those preferred by students and lecturers. The paper also highlighted several critical insights regarding the impact of disruptive technologies in higher education like Limited Adoption of Technologies, Preference for Simplicity, Role of Disruption, Changing Educational Dynamics, Need for Further Research and Activity Theory Insights. These conclusions emphasize the need for HEIs to adapt to the changing technological landscape and reconsider their roles in facilitating learning in an increasingly digital world.

Flavin (2012) study showed that there was no evidence arising from surveys and interviews that a wide range of technologies is being used to support their learning however people preferred using easy and free resources. Arnett (2014) explains how disruptive innovations potentially unlock ideas to improve student outcomes and has supplemented the impact of disruptive technologies to great mentors and instructors to expertise their work that can be made available to every student, not just a few additionally, computer-based technologies are making personalized learning a reality that access the mentors and tutors to make use of an accessible and affordable technologies for more students. Yadev (2018) study adopted activity theory and expansive learning to analyse data regarding the impact of disruptive technologies. This study identifies a contradiction between learning technologies made available by Higher Education Institutions (HEIs), and technologies used in practice. There is no evidence to suggest that a wide range of technologies is being used to support learning and teaching. Instead, a small range of technologies is being used for a wide range of tasks. Students and lecturers are not dependent on their HEIs to support learning and teaching. Instead, they self-select technologies and be innovative in their own manner.

Disruptive Technology in education is still resisting to adopt Artificial Intelligence (AI) in most of educational institutions. It shows that AI builds meaningful learning activities that enhance the nature of learning and help boost enthusiasm instead of traditional assessments that rely on small samples. The core of disruptive technology is not sustainability but the transformation of existing business practices and models. Such radical transformation, if unnoticed, can threaten existing organizations in all aspects of the economy and society in general Vatroslav Zovko & Monika Gudlin (2019). Suman (2020) in his review paper suggested to develop student's interpersonal skills and also found that Hilmi M. F. 2016 has discussed the advantages of Massive Open Online Courses (MOOCs) in higher education and recommended that it is important to recognized the nature of disruptive technology in education according to individual needs.

Together with the Internet of Things (IoT), blockchain and several others, Artificial Intelligence (AI) is considered to be the most disruptive technology. Multidisciplinary technological approaches in higher education are important because they foster interdisciplinary collaboration, develop critical thinking and problem-solving skills, align with the demands of the digital era, and promote innovation and creativity. The paper adopted systematic reviews retrieved from Scopus and Web of Science and found that multidisciplinary technological approaches in higher education offer benefits such as improving education quality, fostering interdisciplinary skills, integrating theory with technology, facilitating collaboration, and preparing students for future careers. These approaches explore areas like sustainability, student employability, complex thinking, pre-service teacher training, and innovation in teaching and learning Cai Chi et.al. (2024). Carlos Maya (2024) in his series of article embarked on a multidimensional exploration of the importance of conscious awareness on the implementation of disruptive technologies in educational management. The article delves into different themes highlighting the understanding of contextual factors shaping the modern educational environment and driving the imperative for technological innovation, navigating the Risks and Benefits of disruptive technology, addressing disparities in accessing technology and fostering digital inclusion within educational communities and examination of the ethical dilemmas inherent in the integration of disruptive technologies in education and the imperative of ethical leadership in guiding responsible technological innovation. Wendy Barber et.al (2024) showed that it is imperative for young individuals to engage in lifelong learning in order to adequately prepare for professions that may not yet be established at the commencement of their formal higher education. Indeed, these sociocultural transformations, particularly the swift and continual advancements in technology, signify that the emergence of novel jobs, occupational roles, and environments previously non-existent will exert pressure on educators and employers to innovate and refine learning and training paradigms.

Keerthana S et.al (2024) The research indicates that students are generally receptive to technology, demonstrating a readiness to improve their digital literacy. A significant finding is that 81.8% of students agree that technology offers the best opportunity for personalized instruction, which can enhance their performance and support their personal development. Despite the positive outlook, 61% of students feel that integrating technology into higher education takes considerable time. This highlights a challenge in the adoption process, suggesting that while students see the benefits, they also recognize the hurdles involved in fully implementing technological solutions.

3. Objectives of the Study
   1) To study the impact of disruptive technology in multidisciplinary and holistic education.
   2) To determine the strengths, weaknesses, opportunities and threats with regard to holistic development in education.

4. Need and Significance of the Study

Disruptive technology is an innovation that significantly alters the way and process of encompassing negative consequences and direct large-scale changes in the operating system. Small, medium and large-scale education technology companies have started proliferating in the future and are offering various new digital solutions to academic institutions. By incorporating artificial intelligence into e-learning software, now the program can track student advancement which gives a major advantage to teachers in keeping their progression in check. Arnett (2014) explains why disruptive innovations matter in education. First, disruptive technology is acting as a catalyst for bringing about more equitable access to high-quality education. Second, disruptive innovations bring a mechanism for personalized education system. Third, disruptive innovation circumvents the political battles that have historically been at the middle stage of education reform.

Education involves acquiring knowledge through study or instruction and aims to bring out a student's potential and lead them to a new understanding of disruptive technologies or updated innovations that help the students to be creative in different fields and think of new ways to use them. The use of immersive

technologies like Virtual Reality (VR), Augmented Reality (AR), mixed reality are salient disruptive technology examples that have just begin in educational field and gradually making their way and provide the students with new experiences that enhances student engagement and understanding. Digital learning has foster creativity and give students a sense of success, encouraging additional learning by thinking outside traditional technique. Disruptive technology can change the face of the tutorial structure to assist students thrive in the age of smart machines and globalized world as these technologies expand the boundaries of the classroom and provide interactive learning experiences.

The COVID-19 pandemic has exerted a significant influence on countless scientific and technical institutions worldwide, culminating in diminished productivity across various fields and programs. Nevertheless, the repercussions of the pandemic have also facilitated the emergence of novel and enhanced modalities of scientific communication. The pandemic has expedited the digital transformation across diverse sectors, with remote employment, telemedicine, and online education becoming ubiquitous. Advancements in artificial intelligence and automation have streamlined operations and improved decision-making processes, whereas fintech innovations and e-commerce platforms have transformed financial transactions and consumer habits. Moreover, the proliferation of 5G networks and the integration of blockchain and IoT technologies have further interlinked our global ecosystem, fostering the development of smarter, more resilient systems. As these technologies continue to progress, they are redefining the global landscape, promoting a future that is increasingly agile, efficient, and interconnected.

5. Methodology

For the present paper the researcher has under -taken review - based study in a qualitative nature which includes secondary sources, journals and articles and existing resources from internet. The researcher examined the findings keeping in mind the objectives of the study and has analysed in a Strengths, weaknesses, opportunities and Threats (SWOT) analysis format.

6. Findings and discussions of the study

Impact of disruptive technologies with regard to multidisciplinary and holistic education.

1. Disruptive technologies/innovations have unlocked ideas to improve students' outcome and has influenced a great number of mentors and instructors to expertise their work that can be made available to every student and not just a few, to make a holistic learning environment.
2. Students and teachers prefer using easy self-select technologies to accomplish their work successfully and be innovative in their work.
3. After Covid-19 pandemic many educational institutions opt for technologies support system in their teaching and learning process. Flipped classrooms and blended learning was one of the major advantages of utilizing ICT in educational field.
4. Massive Open Online Courses (MOOCs) have emerged as one of the most significant phenomena in the realm of higher education in recent times.
5. Disruptive technologies brought a transformative outcome after the COVID-19 incidents. Many institutions could identify the differences between traditional and modern education systems.
6. Disruptive technologies like AI, VR, AR etc can expand the learning environment into a practical learning environment, bring out student's interactive and collaborative learning experiences.
7. Through ODL, learners are allowed to engage with a broad spectrum of subjects and disciplines, thereby facilitating the construction of a comprehensive knowledge repository that encompasses multiple fields.

To determine the strengths, weaknesses, opportunities and threats with regard to holistic development in education.

SWOT analysis.

Strength	Weaknesses
- Disruptive technologies/innovations have unlocked ideas to improve students' outcome. - It has influenced a great number of mentors and instructors to expertise their work in holistic development of ideas and gaining information. - Disruptive technologies brought a transformative outcome after the COVID-19 incidents. Many institutions could identify the differences between traditional and modern education systems	- The dependency rate of utilizing the technologies in education hinders the confidence of students and teachers. - Poor internet connectivity distracts the learning environment of the learners. - Technology can reduce social interactions and the development of other skills.
Opportunities	**Threats**
81.8% of students agree that technology offers the best opportunity for personalized instruction, which can enhance their performance and support their personal development. - Bring out a student's potential and lead them to a new understanding of disruptive technologies or updated innovations that help the students to be creative in different fields and think of new ways to use them. - AI enhances engagement, personalized learning and provides valuable insights to open holistic opportunities in the field of education.	- Disruptive technologies can raise ethical threat or issue in ways like discrimination, privacy and copyright infringement. - An amount of screentime can impact social and emotional development of a learner reducing the face-to-face interaction process. - Disruptive technologies can create biased or false content.

7. Way forward

The National Curriculum Framework (NCF) 2023 recognizes that educational technology is not just about using devices, it's about leveraging technology to create meaningful learning experiences, foster critical thinking, and prepare students for the digital age. A number of disruptive technologies like online learning, AI-guided learning, Virtual and Augmented Reality, Machine learning, Cloud computing and MOOCs have set a way in shaping the educational environment. The extent of using these tools and platforms in education may vary but increase exponentially. Disruptive technologies have opened incredible possibilities in various fields, especially within the education sector and education-related fields.

The result of the Covid-19 on education is both unprecedented and widespread in education history impacting almost all students in the world. However, with the rapid development of data and communication technologies at the 21st century there is advanced development in technology that provides new opportunities and benefits in the learning process such as Augmented Reality, to enhance collaborative tasks, AI- Guided learning that develop education systems with some level of intelligence and the ability to perform and access different functions like assisting teachers to enhance their teaching strategies and complete their assign task and also giving support to learners in developing their knowledge and flexible skills for a constantly changing world. . As a result, it seems likely that future learning environments will be highly individualized and capable of enabling students to reach their full potential in the most gratifying manner.

8. Conclusion

By leveraging the power of technologies in educational field, incorporating disruptive technologies gives a positive impact in providing a holistic development that empowers the students to direct their learning journey, striking a balance between academics and commitments. Pioneering technologies pave the way for custom learning experiences tailored to individual needs, and advanced algorithms that decode students' learning preferences, strengths and growth areas. In an era defined by rapid technological progress, this data-driven technique ensures educational content that resonates with diverse learning styles, enhancing understanding and retention.

As technology and devices improve, integrating ICT in higher education marked a significant importance in implementing various technological tasks. Likewise, disruptive technologies are often implemented in education through various means such as artificial intelligence, machine learning, cloud computing, augmented reality, computer games etc. Every educational institution must adapt to all these latest and advanced technologies to plan, implement and go forward as the world is in its dynamic scenario and an institution by now should take into account as it will have an impact in the near future.

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