



Significance And Advancement Of The Educational Technology: Holistic Development Of Learners In The Digital Age

Sonia Kaur Bansal^{1*}, Rajesh kumar Sharma², Rajnish Kumar Jain³, Veenu Chaturvedi⁴, Adamya Sharma⁵

¹Professor, Department of English language and Soft Skills, Poornima Institute of Engineering and Technology, Jaipur (soniakaurbansal@gmail.com)

²Director & Professor-Kamla PG College, Dholpur (Raj.-India) (drrajeshdlp66@gmail.com)

³Assistant Professor, Public Administration, Government Arts Girls College Kota (rajnishjain79@gmail.com)

⁴Assistant Professor, Dept. of Education, KamlaTT College, Dholpur (Raj.-India) (veenusharma2811@gmail.com)

⁵Scholar- BPT III Year, ITM University, Gwalior (drrajeshdlp66@gmail.com)

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ABSTRACT

In the contemporary educational landscape, the significance and advancement of educational technology are paramount. This abstract delineates the multifaceted dimensions of educational technology, elucidating its significance and the transformative advancements it brings to the present scenario of education. Educational technology, often abbreviated as EdTech, encompasses a wide array of tools, strategies, and methodologies aimed at enhancing teaching, learning, and assessment processes. Its significance lies in its ability to transcend traditional boundaries, making education more accessible, engaging, and personalized. With the integration of digital platforms, interactive multimedia, and adaptive learning systems, educational technology facilitates active learning experiences tailored to diverse learner needs and preferences. Moreover, educational technology encourages the collaboration and communication among students and educators, transcending geographical limitations and fostering a global learning community. Through online forums, video conferencing, and collaborative workspaces, learners can engage in meaningful interactions, exchange ideas, and participate in cooperative learning activities irrespective of their physical location. So, the significance and advancement of educational technology in the present scenario underscore its transformative potential in revolutionizing education. By leveraging cutting-edge technologies, educational institutions can create inclusive, engaging, and effective learning environments conducive to the holistic development of learners in the digital age. Embracing educational technology is not merely an option but a necessity in fostering lifelong learning and preparing learners for the challenges and opportunities of the 21st century. The research paper, as its title reveals, throws an ample light on the significance and advancement of the intellectual technology of the day. The major finding of the study is that the intellectual technology of the 21st century has given an entirely new shape to the world through its incredible inventions. With the introduction of advanced smartphones, the e-governance, digitalization, artificial intelligence, the world and all its countries seem to have been changed and transformed and are on the constant move towards higher and higher goals and horizons of achievement.

Keywords: Holistic, Intellectual, Technology, Education, ICT, IPR, skills, focus, exercise, smart classes etc.

Introduction:

In the contemporary era marked by rapid technological advancements, the integration of educational technology has become imperative in fostering the holistic development of learners. This paper explores the significance and advancement of educational technology in facilitating the comprehensive growth of learners in the digital age. Educational technology, commonly referred to as EdTech, encompasses a spectrum of

digital tools, platforms, and methodologies designed to enhance teaching, learning, and assessment processes. Its integration into educational practices has redefined traditional pedagogical approaches, offering innovative solutions to address the evolving needs of learners in a technologically driven society. The digital age has ushered in a paradigm shift in education, necessitating a departure from conventional teaching methods towards more dynamic and interactive learning experiences. Educational technology serves as a catalyst for this transformation, providing educators and learners with access to a diverse range of resources, multimedia content, and interactive learning environments. Through the utilization of digital platforms, simulations, and virtual reality applications, educational technology empowers learners to engage with content in immersive ways, fostering deeper understanding and retention of knowledge.

Moreover, the advancement of educational technology extends beyond enhancing academic performance to nurturing the holistic development of learners. By integrating social-emotional learning components, gamification elements, and personalized learning pathways, educational technology supports the development of essential skills such as critical thinking, creativity, collaboration, and adaptability. These skills are indispensable in preparing learners to navigate the complexities of the digital age and thrive in an increasingly interconnected and fast-paced world.

Furthermore, the holistic development of learners facilitated by educational technology transcends traditional classroom boundaries, extending learning opportunities beyond the confines of physical space and time. Through online platforms, remote learning modules, and digital collaboration tools, learners can access educational resources and engage in collaborative learning experiences irrespective of their geographical location. This democratization of education not only promotes inclusivity and equity but also fosters a global perspective and cultural awareness among learners.

In essence, the significance and advancement of intellectual educational technology underscore its pivotal role in shaping the holistic development of learners in the digital age. By leveraging the transformative potential of educational technology, educators can create dynamic and inclusive learning environments that empower learners to thrive academically, socially, and emotionally. Embracing educational technology is not merely a pedagogical choice but a necessity in equipping learners with the skills, competencies, and mindset required to succeed in an ever-evolving global landscape.

Advancement of Educational Technology: In the present scenario, the significance and advancement of educational technology are evident in their transformative impact on the field of education. Educational technology, often referred to as EdTech, encompasses a diverse range of digital tools, platforms, and methodologies aimed at enhancing teaching, learning, and assessment processes. Its significance lies in its ability to address the evolving needs and challenges of education in a technologically driven society, while its advancement continues to revolutionize pedagogical practices and reshape the educational landscape.

One of the primary significance of educational technology lies in its capacity to improve access to education. Through online learning platforms, digital libraries, and open educational resources (OERs), educational technology enables learners to access quality educational content regardless of their geographical location or socio-economic background. This democratization of education promotes inclusivity and equity by breaking down barriers to learning and providing opportunities for lifelong learning.

Furthermore, educational technology enhances engagement and personalized learning experiences for learners. Interactive multimedia resources, gamified learning applications, and adaptive learning systems cater to diverse learning styles and preferences, fostering active participation and motivation among learners. By tailoring content and pacing to individual learner needs, educational technology promotes deeper understanding and retention of knowledge, leading to improved learning outcomes.

Additionally, educational technology facilitates collaboration and communication among students and educators. Online discussion forums, video conferencing tools, and collaborative workspaces enable learners to engage in meaningful interactions, share ideas, and collaborate on projects irrespective of physical distance. This fosters a sense of community and collective learning, enriching the educational experience and preparing learners for collaboration in professional settings.

Moreover, the advancement of educational technology is driving innovation and efficiency in education. Artificial intelligence (AI), machine learning (ML), and data analytics empower educators with insights into student learning behaviors and preferences, enabling them to tailor instruction and interventions accordingly. Furthermore, the integration of immersive technologies such as virtual reality (VR) and augmented reality (AR) creates immersive learning experiences that simulate real-world environments, enhancing experiential learning and skill development.

In conclusion, the significance and advancement of educational technology in the present scenario underscore its transformative potential in revolutionizing education. By leveraging digital tools and innovative pedagogies, educational institutions can create dynamic, inclusive, and personalized learning environments that empower learners to succeed in the digital age. Embracing educational technology is essential in preparing learners for the challenges and opportunities of the 21st century, equipping them with the skills, knowledge, and competencies needed to thrive in an ever-changing world.

In the transformation and shaping of the various aspects several factors play their respective role and each of them remains effective. Technology is always supposed to add something new to the shaping of the world. Whenever a new technology is introduced, it brings new hopes to the people. Technology is effective not only

in the field of science, but in other fields as well. The intellectual technology of the 21st century has something more to give to man than the technologies introduced earlier.

The 21st century has already seen the rise of several transformative technologies, but it's difficult to predict which one will ultimately define the entire century. However, some of the leading contenders include artificial intelligence, biotechnology, and renewable energy technologies. These advancements have the potential to significantly reshape our societies and economies in the coming decades. The big techs of the 21st century - mobile computing, machine learning, practical solar and wind power, electric cars, satellite navigation - were all invented much earlier, and are just coming into their time of major impact. In 2005 with the launching of first modernized GPS satellite, it became commercially available for general use. Today we find GPS in mobile phones, tables, laptops and many other electronic devices. Speaking of ubiquity, social media is also so common to make some wonder what life was like before it. The Internet has transformed information sourcing, endangering and in many cases, replacing the 'mainstream media.' E-books and music streaming have had a huge impact on publishing and record companies.

The advancement of educational technology continues to reshape the educational landscape, driving innovation and efficiency. Artificial intelligence, machine learning, and data analytics play pivotal roles in personalized learning experiences, adaptive assessments, and predictive analytics, enabling educators to provide timely interventions and support to students based on their individual learning trajectories. Additionally, the proliferation of mobile devices and ubiquitous internet connectivity has led to the emergence of mobile learning, enabling learners to access educational resources anytime, anywhere. Mobile applications, podcasts, and micro learning modules offer learners flexibility and convenience, catering to their on-the-go lifestyles.

Major Inventions in Educational Technology: The intellectual technology of 21st century is a wide term which encompasses many inventions that are playing a vital role in the transformation of the world. Information technology has opened several unknown vistas to go for knowledge and information. The wonders caused by IT are immeasurable. 'Wearable computers, such as small wristwatch devices enable to check temperatures, news headlines, personal messages, and personal planners. Modern handheld devices, mobile phones, cameras, TVs, and personal computers are converging into single mobile and computational device. In the field of education, most of the colleges are implementing wireless campus enabling students to monitor their course content and working on collaborative projects' (Eduard Babulak, 2006)

The technologies associated with this century are revolutionary in nature as they aim at developing one or the other aspect of human life. '21st-Century General-Purpose Technologies are becoming more and more important. GPT has linked the world to the faster ways of working and living adopting computing. General-purpose technologies (GPTs), also known as platform technologies, are catalysts for major changes in economic activity. They are general purpose in the sense that they have multiple applications across a wide range of industries and support waves of innovative products and services. The discovery of different ways to use the new form of GPT can leave an industry profoundly different from how it was previously' (John Steen et.al, 2022).

The shaping inventions in this century are many in number. Each of these inventions contributes to the development and advancement. Some of the major inventions that have shaped the world and many of its fields and sectors as well as human behavior and human life are as under-

- **Artificial Intelligence (AI):** AI is already having a major impact on our lives, and its influence is only going to grow in the years to come. Artificial Intelligence (AI) in education revolutionizes learning by personalizing instruction, automating administrative tasks, and providing insights into student performance. AI-powered adaptive learning platforms tailor content to individual student needs, enhancing engagement and learning outcomes. AI algorithms analyze vast amounts of data to identify learning patterns, predict student behavior, and recommend interventions. Virtual tutors powered by AI offer personalized tutoring and support, supplementing traditional instruction. Additionally, AI streamlines administrative processes, such as grading and scheduling, freeing up educators' time for more impactful interactions with students. Overall, AI in education transforms teaching and learning, making education more accessible, efficient, and effective. AI will be used to automate tasks, improve decision-making, and create new products and services. 'As part of the human-computer interaction (HCI) that artificial intelligence has, it has a specific effect on developing critical thinking skills, which is what this study is looking at' (Muthmainnah et. al, 2022).
- **Virtual Reality (VR) and Augmented Reality (AR):** Virtual Reality (VR) and Augmented Reality (AR) are cutting-edge technologies that are transforming various industries, including education, gaming, healthcare, and manufacturing. While they share similarities, they also have distinct features and applications. VR and AR are two technologies that have the potential to revolutionize the way we interact with the world around us. VR can be used to create immersive experiences, while AR can be used to overlay digital information on the real world. Both VR and AR have the potential to revolutionize education by offering immersive, interactive, and personalized learning experiences. By leveraging these technologies, educators can create engaging simulations, interactive lessons, and immersive environments that cater to diverse learning styles and preferences. VR and AR enable students to visualize complex concepts, explore

virtual environments, and interact with digital content in ways that traditional methods cannot replicate. As these technologies continue to advance and become more accessible, they will play an increasingly integral role in shaping the future of education and empowering learners to succeed in the digital age.

- **Blockchain:** Blockchain is the technology behind Bitcoin and other cryptocurrencies. It is a decentralized ledger that can be used to record transactions and track assets. Blockchain has the potential to revolutionize many industries, including finance, healthcare, and supply chain management. Blockchain technology in education ensures secure, transparent, and tamper-proof record-keeping of academic credentials, certifications, and achievements. By decentralizing data storage and verification, blockchain eliminates the need for intermediaries, reducing administrative costs and enhancing data integrity. Smart contracts automate processes such as credential verification, ensuring efficiency and trust in credentialing systems. Additionally, blockchain enables learners to have ownership and control over their educational records, facilitating seamless transferability and recognition of qualifications globally. Through immutable and decentralized ledger systems, blockchain revolutionizes educational credentialing, authentication, and lifelong learning pathways, fostering a more transparent and trustworthy educational ecosystem.
- **Renewable Energy Sources:** Renewable energy sources, such as solar and wind power, are becoming more affordable and efficient. In the years to come, we will see a shift away from fossil fuels and towards renewable energy sources. Renewable energy education is crucial in preparing future generations for sustainable energy practices. It encompasses teaching about various renewable energy sources like solar, wind, hydro, and biomass, along with their applications, benefits, and challenges. This education instills a deep understanding of the importance of transitioning to renewable energy to mitigate climate change and reduce dependence on fossil fuels. Through hands-on experiences, students learn about renewable energy technologies, energy efficiency measures, and the societal impacts of energy choices. Renewable energy education empowers individuals to become advocates for clean energy solutions, fostering a more sustainable and resilient future for generations to come.
- **Space exploration:** We are entering a new era of space exploration. Private companies, such as SpaceX and Blue Origin, are leading the way in developing new technologies that will make space travel more affordable and accessible. Space exploration education plays a pivotal role in inspiring the next generation of scientists, engineers, and explorers. It involves teaching about space missions, celestial bodies, and the technologies used in space exploration. This education fosters curiosity, critical thinking, and problem-solving skills among students. Hands-on activities, simulations, and virtual reality experiences enhance understanding and engagement. Space exploration education also highlights the interdisciplinary nature of space science, incorporating elements of physics, astronomy, engineering, and biology. By igniting a passion for space exploration, education cultivates future innovators who will contribute to humanity's understanding of the cosmos and pave the way for groundbreaking discoveries in the evolving field of space exploration.
- **Genetic Engineering:** Genetic engineering is the technology of modifying an organism's genes. It has the potential to cure diseases, improve crops, and even create new life forms. Genetic engineering education is essential for understanding the principles, applications, and ethical implications of manipulating DNA. It covers techniques such as gene editing, cloning, and genetic modification, along with their potential benefits and risks. Through hands-on experiments and case studies, students learn how genetic engineering is used in agriculture, medicine, and biotechnology. This education fosters critical thinking, scientific literacy, and ethical reasoning, empowering individuals to make informed decisions about the use of genetic technologies. Genetic engineering education also prepares students for careers in biotechnology, genetics, and research, driving innovation and advancements in the field of life sciences.
- **Nanotechnology:** Nanotechnology is the science of manipulating matter at the atomic and molecular level. It has the potential to create new materials, devices, and even medicines 'Nanotechnology based human life comfort, High speed computation through optical computers, Embedded Intelligence, HIV Antivirus, Pseudo Senses - Sensation of existence through virtual reality and through artificial environment, Off Planet Production in micro-gravity, Protein Maps to know how many active genes are coding for proteins in living being, Customized Kids which are used for Customization of physical and mental ability of children, Development of Chameleon Chips which are reconfigurable photonic circuits using the idea of optical solitons, Flying cars through manipulation of gravitational force, Immortality through nano-biotechnology & stem cell research, Fractal Models for fragmented geometry shapes, and Space travel for everybody etc. affect the life of man in the twenty first century tremendously'. (P. S. Aithal & Shubhrajyotsna Aithal, 2015).

All the fields of life have been affected by the technology of the 21st century. The education sector that had long been in the grip of the traditional approach of teaching-learning is now a subject of the modern technology which focuses on the student-centric methods and scientific study of the various subjects in the varied disciplines. These days, leaving behind the traditional approach of learning, 'the personalized learning is at the nexus of 21st century education and includes three elements: (1) systems and approaches that accelerate and deepen student learning by tailoring instruction to each students' individual needs, skills and interests; (2) a variety of rich learning experiences that collectively prepare students for success in the college and career of their choice; and (3) teachers' integral role in student learning: designing and managing the

learning environment, leading instruction, and providing students with expert guidance and support to help them take ownership of their learning.(Andrew Topper, 2017).

In order to make the education effective, goal-oriented and student centric, the student centric methods that have a scope for the ICT are suggested. 'The adequate integration of information and communication technologies (ICT) in educational and training processes is one of the biggest current challenges in education. The classroom of the present is very different from just a few decades ago, new technological tools are completely transforming its characteristics and activities' (Ponce Omar, 2003). ICT is now unanimously approved as the bringer of revolution in the field of education and economic development. Most of the modern thinkers welcome ICT and want it to be adopted and exercised for the socio-economic development. 'Technological competencies for teachers and students cannot be developed and studied without considering an array of factors that impact the Teaching and Learning Processes (TLP) inside and outside of school' (Felipe OyarzoPineida, 2011).

The use of ICT in all the spheres of human life is apparent enough to make one believe that the ICT is going to do what hardly any other technique in the past could do. 'There is a remarkable advancement in the field of information and communication technologies (ICT) in the 21st century. The rapid advancement of technology, coupled with the increasing interconnectedness of the global society, has ushered in a new era characterized by unprecedented opportunities. At the same time, the dark sides of ICTs including threats to cybersecurity are also on the increase' (Dan J. Kim , et al. 2023).

With the introduction of ICT, the global teaching-learning approaches are going to change and bring about a speedy educational development. 'ICT Infrastructure and internet connectivity in educational institutions provides learners and teachers the opportunity of adopting 21st century teaching-learning methods that promotes the development of 21st century skills. The availability of internet connectivity in particular provides the platform for a shift from the use of teacher-centered pedagogy (content-based learning) to learner-centered pedagogy (inquiry and project-based learning) that is more interactive and activity oriented' (SaniAlhajiGarba, et. al. 2015).

Obviously, now it depends on us to adapt ourselves to the contemporary trends of working with various modern technologies and how we avail ourselves of all these technologies at present. 'The twenty-first century has seen significant expansion in the use and availability of technology, which has created a paradigm shift in how we can work' (Peter Holland & Anne Bardeel, 2016).

Objectives of the study:

- To discuss the significance and advancement of the intellectual educational technology for the holistic development of learners in the digital age of the intellectual technology
- To explore the fields where the intellectual educational technology are applicable
- To deal with the changes caused by the use of the intellectual educational technology.
- To argue the positive and the negative sides of the intellectual educational technology.

Hypotheses:

- The intellectual educational technology of 21st century is significant for fulfilling the demands of the present times
- This technology is being welcomed in several fields
- It has set several unexpected milestones
- The changes caused by it are revolutionary

Methodology:

The methodology adopted and exercised for this research paper is inductive. The use of secondary data collected and compiled from the previously made researches, studies and previously written books has been used in addition to the personal casual observation and casual interaction of the researchers with the associated people which serve as the primary data. Falling in the category of the qualitative research, it describes and interprets how these days the focus is being made on the adoption and use of the intellectual technology with new objectives and milestones. The authors relied chiefly on the sources of information available on the internet and accessible to the scholars.

Effects of Advancement of the Educational Technology: In the contemporary digital age, the advancement of educational technology has significantly impacted the holistic development of learners. This effect is evident across various dimensions of education, including academic achievement, socio-emotional development, and lifelong learning skills. A review of related literature highlights the transformative impact of educational technology on learner development.

The numerous studies have demonstrated the positive correlation between the use of educational technology and academic achievement. For example, a meta-analysis conducted by Hattie (2017) found that technology-enhanced learning strategies, such as computer-assisted instruction and multimedia simulations, significantly improved student outcomes across various subjects. Similarly, a study by Means et al. (2010)

reported that students exposed to technology-rich environments achieved higher test scores and demonstrated greater mastery of academic content compared to their peers in traditional classrooms. These findings underscore the role of educational technology in enhancing academic performance and promoting deeper learning.

Socio-Emotional Development: Educational technology also plays a crucial role in supporting the socio-emotional development of learners. Virtual reality (VR) simulations, for instance, provide immersive experiences that help students develop empathy, perspective-taking, and interpersonal skills (Freina & Ott, 2015). Furthermore, online collaboration tools and social learning platforms facilitate peer interaction, collaboration, and teamwork, fostering the development of communication and social skills (Veletsianos & Navarrete, 2020). By integrating socio-emotional learning (SEL) components into technology-enhanced learning environments, educators can promote the holistic development of learners by addressing their social, emotional, and cognitive needs (Durlak et al., 2011).

The advancement of educational technology also cultivates lifelong learning skills essential for success in the digital age. Adaptive learning systems, personalized learning pathways, and intelligent tutoring systems leverage artificial intelligence (AI) algorithms to tailor instruction to individual learner needs, promoting self-directed learning and metacognitive skills (Lajoie, 2017). Additionally, gamified learning platforms and microlearning modules engage learners in interactive and bite-sized learning experiences, fostering a culture of continuous learning and skill development (Hamari et al., 2016). By equipping learners with critical thinking, problem-solving, and digital literacy skills, educational technology prepares them to navigate the complexities of the digital age and thrive in an ever-changing world (Cuban, 1986).

Therefore, advancement of educational technology has a profound effect on the holistic development of learners in the digital age. Through its impact on academic achievement, socio-emotional development, and lifelong learning skills, educational technology empowers learners to reach their full potential and become active participants in the knowledge society. However, it is essential for educators and policymakers to address challenges such as digital equity, privacy concerns, and technological determinism to ensure that educational technology remains a force for positive change in education.

Conclusion:

In conclusion, the research paper has illuminated the profound significance and rapid advancement of educational technology in encouraging the holistic development of learners in the digital age. Through a comprehensive exploration of its multifaceted dimensions, from personalized learning experiences to global collaboration platforms, it is evident that educational technology is not merely a tool but a catalyst for transformative change in education. By leveraging innovative technologies and pedagogical approaches, educators can create dynamic, inclusive, and personalized learning environments that empower learners to thrive academically, socially, and emotionally. Embracing educational technology is essential in preparing learners for the challenges and opportunities of the 21st century, equipping them with the skills, competencies, and mindset needed to succeed in an ever-evolving global landscape. As we continue to advance in the digital age, the significance of educational technology in nurturing the holistic development of learners will only continue to grow, shaping the future of education and empowering learners to reach their full potential.

The educational technology facilitates the teaching-learning process in a systematic way that the students can get the maximum of knowledge of a subject in a given period of time, and the teachers can give most of what they have with them. 'Technology has become an educational necessity in global-digital era. Facing these phenomena, social studies (SS) should make innovations related to changes of 21st-century skills and learning paradigm, which is characterized by the principles of disclosure of information, computing, automation, and communication. Technology integration into SS learning is one of the learning innovations in the global-digital era, and powerfully supports the National Council for Social Studies (NCSS) as stated in their visions: meaningful, powerful, value-based, challenging, and active. It also strongly supports the development of three core skills of the 21st-century, including learning and innovation skills; information, media and technology skills; life and career skills that developed in partnership with the Partnership Forum for 21st-Century Skills (P21)' (Dr. Mohammad Imam FARISI, 2016).

The Role of Technology Integration in the Development of 21st Century Skills and Competencies in Life Sciences Teaching and Learning cannot be described in words as it has changed the entire scenario of teaching-learning. 'Development of 21st century skills and competencies in teaching and learning remains a key strategic imperative. Coherent development of skills and competencies requires adoption of innovative pedagogical strategies. Technology integration can be harnessed to foster effective teaching and learning. The study examined the role of technology integration in the development of 21st century skills and competencies in Life Sciences teaching and learning' (Sam Ramaila & Anwar Junior Molwele, 2022).

The Information Technology that has now got the form of a separate sector called the IT Sector is indeed revolutionary in its working and effects that has drawn the people of all the age groups and of all the backgrounds towards it and has forced them to adopt it for one or the other thing. 'Information technology has reached each and every sphere of life where it is setting new milestones day-by-day through its tools. The

computing power has left all the other things far behind. New trends are emerging in all the fields including the education at all levels due to the use of the information technology' (Sanjay K. Pal, 2008).

The worth of the twenty first century intellectual technology can be evaluated in terms of ICT which has made even the impossible looking things quite accessible. The twenty first century has witnessed emergence of some ground breaking revolutionary information technologies that have changed our ways of living. The study emphasizes the internet (arrived in 1995) which has given rise to methods, tools and gadgets having astonishing applications in all academic disciplines and business sectors. In addition, Internet of Things (IoT), Blockchain, Artificial Intelligence, Sensor Networks and Social Media are new intellectual educational technologies. The author observes that these days the latest intellectual technologies need to be given space in all the educational institutes and even business sectors in order to create a better and more fruitful scenario' (Mohammad Yamin, 2019).

Therefore, it can be mentioned that though we are enthusiastic to find ourselves working with the modern technologies, but we should rely in them in a balanced way. We should be careful while adopting and exercising them. We should use them only in those fields and only to such an extent that they do not slave us. We should adopt them only as helping agents. 'Although big data, big data analytics (BDA) and business intelligence have attracted growing attention of both academics and practitioners, a lack of clarity persists about how BDA has been applied in business and management domains. The advanced analytics techniques appear pivotal in bridging big data and business intelligence' (Jie Sheng, et. al, 2019).

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