Implications of Data Science in Fostering Educational Process

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Abstract

This study has focused on discussing all the necessary elements that are associated with the implication of data science in fostering the educational process. There is a detailed discussion about data science and data analytics to establish a clear concept about it and helps to understand the effectiveness of data science in education systems. Data science and data analytics have effectively improved educational structures by changing them with advanced technologies that have provided a barter educational environment for the students and also helped in developing more efficient and effective strategies to improve the performance levels of the students. The data analytics and data science area has made different online learning applications with the help of advanced technologies in this digital era that has increased student engagement in the educational systems. However, this study has focused on discussing all the advantages and disadvantages of the implication of data science that are fostering educational changes. Apart from that, the secondary qualitative data collection method has been followed in this study to collect all the information from authentic and reliable sources. Besides that, thematic analysis has been done in this study to evaluate the depth of the study by analysing the gathered information in a systematic way throughout the study.

INTRODUCTION

Data science is a different field from the education sector that combines the information of domain expertise, programme skills, and knowledge of mathematics and statistics to develop a meaningful logical insight of study from the collected data of the study. This method helps to identify the patterns of the research and helps to analyse data using various statistical techniques. In this rapidly changing world, with advanced technologies and strategies, the education system is improving its effectiveness and efficiency [1]. It is projected that the total revenue of the education segment of the whole world has reached 7.08 billion US dollars in 2022 [2]. However, data science in the educational structure helps to empower the educators which improve their performance levels and by data prediction, description and reduction tasks it helps to perform data visualisation of the educators. Hence, there is a detailed discussion about the impacts of data science in fostering the educational system and its role in improving educational growth throughout the study.

AIM OF THE STUDY

The implication of data science in the education system has fostered different effective changes in the education structure. The main aim of this study is to find out how the implementation of data science can effectively foster the education sector of the whole world.

Objectives

- To understand the basic concept and benefits of data science and data analytics
- To find out the effectiveness of implementing data science in the education system
- To identify the best ways of implementing data science in the education system

RELEVANCE OF THE STUDY

In this digital era, the world is constantly evolving with new changes and data science has a massive impact on many aspects of the education system. Data science helps to customise the learning experiences and helps to develop more efficient administrative programmes for the educators of this system. Data science comes along with data analytics which helps to implement advanced technologies and artificial intelligence (AI) in this system which is increasing the learning process and experience of the students every day. In this generation, the learning process has become virtual and hence, data science has a huge role in the development of virtual learning platforms for students and its effective strategies that are constantly fostering the education system with innovative techniques. Apart from this, data science has helped in providing more personalised and interactive e-learning platforms for the students to shape the education market which positively increases the brain development of the people associated with the education system.

MATERIALS AND METHODS

Research philosophy

Research philosophy is an ideal way in which the information about the phenomenon of the study should be collected and analysed to conduct appropriate outcomes of the study. The research philosophy means a system of a researcher's thoughts, following which new knowledge about the study is developed with proper objects. There are different types of research philosophy among which the *interpretivism* method helps to gather proper information about the study by questioning and observing in order to generate a deep understanding of the phenomenon [3]. The interpretivism method has been adopted in this study which helps to collect data in a naturalistic way by observing reliable information about the phenomenon of the study.

Research design

The research design refers to an overall strategy to integrate different components of the study to conduct the outcomes of the study in a logical way which ensures that the investigation of the research problem will be conducted throughout the study. There are different types of research design methods among which the *exploratory* method helps to investigate the research problem in a detailed way to conduct defined results from it that have previously not been clearly defined [4]. This exploratory method has been taken for this study to investigate the problem in depth to conduct defined outcomes of the phenomenon of the study.

Research type

Research type refers to a systematic enquiry about the phenomenon of the study to predict the research problem and explain the problem in detail to control the phenomenon. However, the research type is an essential part of the research process of the study as it enhances the productivity of the researcher which affects the outcomes of the study in a positive way. Qualitative and quantitative are important research types that all researchers use vastly to conduct a proper analysis of the gathered data systematically [5]. The *qualitative* method that has been followed in this study positively improves the effectiveness of the study and also improves the outcomes of the study significantly.

Research approach

The research approach method refers to the enquiry about the social phenomenon of the study and also includes the different aspects of the phenomenon in the study to shape the functional ways of the study in an appropriate way. The *inductive* research approach method conducts the conclusion of the study by drawing a proper research analysis of the gathered information from the study by analysing the specific aspects of the general aspects of the study [6]. The inductive research method has been followed in this study that helps to conduct the conclusion of the study by analysing every aspect of the phenomenon of the study from specific to general information about it.

Inclusion and exclusion criteria

The *inclusion and exclusion criteria* method includes factors and objectives associated with the phenomenon of the study to conduct proper outcomes of the study and helps to make the research study more efficient by improving the overall authenticity of the phenomenon of the study [7]. Through the inclusion criteria method, all the gathered data has been taken from authentic and reliable sources such as journals, articles, newspapers and online websites. Besides that, for data collection, all the journals and articles published after 2018 have been taken in this study to improve the effectiveness of the study. Through the exclusion criteria method, those articles that are not in the English language have been excluded and also those articles that are published before 2018 have been excluded from this study to conduct proper outcomes of the study.

Data collection and data analysis

Data collection and data analysis methods in the study help to maximise the effectiveness of the study by gathering information in a legal and ethical way and also the analysis method helps to establish a better understanding of the research problem by analysing the gathered data about the study. The *secondary qualitative* data collection method helps to establish a better understanding of the study by gathering those data that are already available previously [8]. This method has been followed in this study which helps in collecting data from previously released articles and newspapers to conduct a better research paper. The *thematic analysis* method has been adopted in the study. It helps to analyse the qualitative data by examining the collected data closely and dividing them into different themes to establish the results in a descriptive way. Besides that, all the ethical considerations have been followed in the study that has guided the conduct of appropriate outcomes from the gathered information.

RESULTS

Theme 1: Evaluation of data science in education

Educational sectors and the learning process entails rich data and information about everything and data science in the education sector empowers the learning and teaching process of educators. The world is rapidly changing and the educational sectors are also emerging with new techniques to improve the educational growth of the whole world. Data science and data analytics process help to develop a better education system that can provide better education to the students of the whole world. This process helps to improve the management of the educational structure and also changes the institutional management of schools and colleges to provide a better educational environment to the students and improve the learning process of each student [9]. However, the richness of data science in the education streams helps to extend the higher education realm by increasing the e-learning process and by establishing new

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authentic online learning platforms for students around the whole world.

All these new platforms have new data resources that are replete with new technologies, information and communication relations which helps to acquire behavioural profiles of the students in their educational career. Data science and data analytics process in the educational sector helps to analyse the gathered data in an effort to understand the persistent educational problems and solve them. Implications of data science in the educational sector support training educators to improve their teaching skills and also improve their problem-solving powers to ensure they can solve any problem related to the educational system with potential solutions. Apart from that, educational data science helps to improve the performance of educators in data visualisation, data prediction and reduction tasks [10]. The data reduction task includes many complex records and fields of data on the educational growth of the student.

Besides these factors, with the help of advanced technologies, data science in the educational sector has developed different AI technologies to improve the performance level of students and teachers who are associated with the educational sector. AI technologies have established different data types from human interactions in these educational platforms to keep a track record of the educational growth of the whole country. The broad access and availability of data have increased the interest of educators and students in exploring new knowledge that is relevant to education by enhancing their learning skills [11]. Hence, data analytics and data science in the educational sectors have effectively increased the performance of the educational systems and have also improved the academic careers of the students and the teachers associated with the education system.

Theme 2: Impact of science and technologies in the education learning process

All the universities and schools of the whole world are following the digitisation process and all their necessary operations are becoming digitised with effective and efficient strategies. The digitisation process is increasingly changing the education structure with effective digital strategies to improve the performance of the students. In this digital era with the advancement of technologies many new online learning platforms have been established for students from all around the whole world [12]. Besides that, the educators of these sectors have partnered with different multinational companies which have helped in establishing Onliner Programme Management (OPM) and Massive Open Online Courses (MOOC) platforms for the students in higher education systems to deliver effective learning programmes for the students in online mode. In this digital era, technologies have increased diversification in the educational sector which impacts the improvement of the educational system. There are different technologies implemented in different educational sectors depending on the education

stages.

There are different technologies implemented in higher education and the middle school education system augmented reality or AR technology has been implemented to develop a better relationship between educators and students to improve their performance levels. However, the changes in data science and technologies have affected the educational structure of different social backgrounds and also established rapid changes in the human profile of students and educators [13]. Data science and advanced technologies have provided improvement in systematic research policies in the educational systems. These systematic researches have developed learning skills in students of secondary schools and especially empower their learning power in mathematics and science subjects [14]. Apart from that, the use of advanced digital tools in secondary schools has provided a better educational environment for the students and practical implementations have increased the interest of the students in their learning process. Hence, data science and advanced technologies are positively impacting the educational sectors and improving the performance levels of the students in their educational sectors.

Theme 3: Purpose, implications and importance of data science and data analytics in the education sector

Data science and data analytics have huge potential to improve the educational system by improving learning methods. Data science and data analytics helps to interpret the collected data effectively, which helps to understand the individual student needs and also establish different strategies according to the different needs of the students. Besides that, the data analytics process helps the teachers to understand the capabilities of learning skills of individual students and makes the understanding between students and teachers about their challenges which also helps to develop different facilities to overcome the challenges of the students to ensure the optimal outputs of the students [15]. There are different types of data and information about individual students such as attendance rates of every student, behaviours, classwork, grades in exams, the health of every student and many others that help in providing proper strategies to overcome the challenges for the students.

Data science and data analytics with advanced technologies helps to establish data-based decision making which encourages educators to provide innovative and different strategies to improve the outcomes of the students. The data science and data analytic process in the educational firm has different purposes such as it helps to collect accurate and timely based data to provide a better service for the students, ensuring the collected data that helps the teachers to improve their teaching skills and many others [16]. Apart from all these, data analytics ensures easy access to the data and improves the understanding of the gathered data to provide strategies according to the problems to improve the performance of the students and teachers associated with the educational system. Besides that, it provides different

efficient training for the teachers to improve their learning skills which also improves their data literacy skills.

Data science is a multidisciplinary field that requires the skills of maths, statistics, computer science, and knowledge of science and literature that helps to extract meaningful insights into educational problems to solve them with potential solutions. Besides that, data science helps to collect data from different sources about the problem to solve it with effective long-term solutions and helps to establish the solution in a very short period. The implication of data science in the educational system has effectively changed the structures of the educational systems than before and with effective availability of data in the educational sector has generated more opportunities for the students and also for the teachers [17]. Apart from this, modern data science tools invented with advanced technologies have increased the number of machine learning algorithms such as random forest, logistic registration, support vector machine and many others to use for different purposes to improve educational structures than before. In 2019, the global e-learning market has reached almost 200 billion U.S. dollars and it is estimated that by 2026 it will reach up to 400 billion U.S. dollars [18].
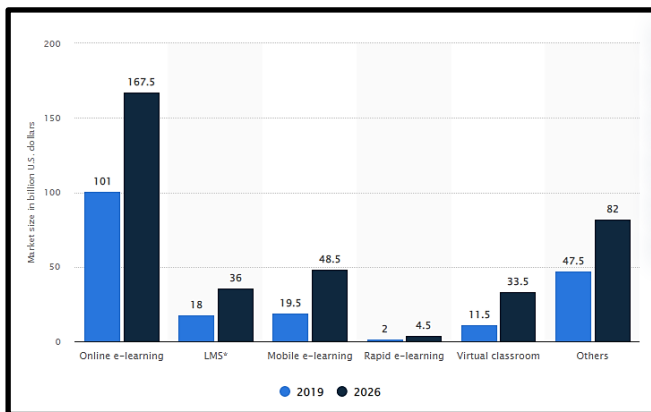
Figure 1: Segment of the global e-learning market between 2019 and 2026 [18]

Theme 4: Implication of different technologies in the education system to improve the learning process

The implication of different technologies in the education sector has many beneficial facilities as it changes the way of learning and makes more efficient administrative programmes for the students. Apart from this, it increases the interest of the students by making the educational sectors more colourful by implementing effective and efficient gadgets that help to improve their learning process and helps increase their acknowledgement power. There are many advantages of using advanced technologies in the education system such as it increases the productivity of teachers and effectively increases their efficiency level, helps to the reduced excessive cost of schooling, encourages and increases the communication between teachers and parents, encourages students in collaborating learning, technologies helps to improve the future lives of the students and many others [19]. With the help of advanced technology Artificial

Intelligence or AI has been developed and implemented in the educational sectors.

AI has increased the performance of students and helps educators to achieve institutional growth positively. AI has increased the accessibility of web sources and online learning platforms which has impacted the surveillance system of the students positively and has improved their performances of the students. Apart from that, the implementation of AI in the educational sectors has provided a more personalised educational environment for the students and also provided more personalised learning techniques which help to improve their performance [20]. However, there are many disadvantages of this technology such as it requires higher management and training which is expensive, makes students less enthusiastic in their physical activity, makes them cheat, and sometimes they acquire wrong information among many other factors that negatively impact the education systems. Hence, the implication of different technologies has impacted the educational system both the ways negatively and positively.

DISCUSSION

The implication of advanced technologies in the education sector is increasing which is tremendously developing revolutionary changes in the education system which is increasing the educational growth of the whole world. In the previous decades, the education structures were different and were not effective enough to create revolutionary changes in the education system. The time has changed over time and the world has become digitalised which has effectively changed the learning process. With the help of different advanced technologies and data science, it has developed many efficient and effective online learning platforms in this digital era which has effectively increased the interest of the student in their learning process and helped in learning new skills [21]. Data science plays an important role in the education system and the embracement of data science has effective advantages in the educational system.

Data science creates numerous opportunities for students in the educational field by establishing different effective strategies to increase their engagement in the educational sector. Data science collects important data for making innovative and beneficial strategies and applications in the educational system. These innovations help in gathering data on students of schools, colleges and universities to keep track record of their academic records such as their grades, performance levels, results, cultural activities and many others [22]. Analysing these gathered data helps them to establish an advanced approach to encourage the students in their learning process and also helps to advance the machine learning process by maintaining the purpose of data science with the help of advanced technologies.

Every institute has its ways, strategies and techniques to handle institutional growth to handle student requirements. Big data analytics have been implemented in schools to improve the teaching process of the teachers as teachers are

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the main pillars of the educational system and they help to establish a brighter future for the students. The implication of new data science and technologies helps to improve the social skills of the students as well as the teachers and positively impacts their performance growth in the education sectors. However, there are some disadvantages of the implications of data science and advanced technologies in the educational sector such as physically becoming less active, becoming a social media addict, influencing the young generation in the wrong direction and many others as it negatively impacts the performance levels of the students [23]. Hence, implementing data in advanced technologies impacts the education sectors and also impacts the performance levels of the students.

CONCLUSION

The implication of data science in educational systems with the help of advanced technologies has impacted educational structures. Data science is a complex process that ensures educational growth and in this digital era with the implication of new technologies, it helps to improve the performances of individual students of an organisation. besides that, it has different advantages such as it helps to improve organisational growth, improving the teaching skills of the teachers and also maintaining the rapid changes in the educational system in this rapidly changing world and many other factors that impact the education system positively. The data analytics and data science implements different effective and efficient strategies to increase the institutional growth of different insinuations of the education system. Apart from that, data science has helped in providing many efficient online learning platforms for students with the help of advanced technology and advanced internet usage. There are some disadvantages of this online learning as it makes the students physically less active, theory becomes social media addict which reduces their educational growth and many others that impacts the educational system negatively. Thus, all the necessary aspects of the education system to understand the depth of the educational functions and to provide more strategies to prevent them have been concluded throughout the study.

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