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Application of Data Science to Access Classroom Management Information

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ABSTRACT

This study explores emerging trends in educational data science with a focus on smart learning and research areas. Information fusion, soft computing, machine learning, and the Internet of things are just a few of the cutting-edge frameworks and techniques in data science that are applied to education in the finest manuscripts reviewed. Here it is discussed about searching the data using data science and analyzing the necessary paper from it. This study focuses on data analysts and emphasizes the importance of evaluating technical areas of data science based on their ability to learn from data. The benefits of a field can be direct or indirect, where the tools used by data analysts provide direct benefits and the theories serve as the basis for developing the tools, the review studies provide indirect benefits. Despite getting accurate results, data science (DS) methods often produce complex models. Despite this, the multiple opportunities presented in research through DS have increased the demand for research today.

Key Words: Big Data, Classroom Management, Data Analytics, Data Mining, Data Science

INTRODUCTION

In the 21st century, every developing country is moving towards the developed country with the help of technology, the foundation of this developed country is being built in the classrooms of every school in the country. Therefore new information related to technology should be applied to teachers and students at every level from primary to higher education. After first being seen as a continuation of the statistical sciences, data science is now firmly recognized as a separate field of study (Cleveland, 2001; Dhar, 2013). The interdisciplinary field of data science (DS) employs a number of techniques, procedures, and systems with the aim of gaining knowledge from data (Aljawarneh & Lara, 2021). Data science consists of two main parts at its core. The first component is referred to as data management (DM), and the second component is data science, which emphasizes data analytics (DA) (Kalidindi & Graef, 2015).

A first step in this direction can be found in Tukey's "The Future of Data Analysis" where the author discusses exploratory and confirmatory data analyses this inspired the arguments for "data science," which were made by Wu (1986) and Naur (1974) as a cover for computer science and statistics, etc. (Donoho, 2017). When the International Association for Statistical Computing (IASC) was founded in 1977, it had a "mission to link traditional statistical methodology, modern computer technology, and the knowledge of domain experts in order to convert data into information and knowledge" (McFarland et al., 2021). The University of Montpellier's statistics symposium in 1992 was among the first to recognize data science as an emerging field that uses data in various structural forms (Escoufier et al., 1995). Data science has become a distinct discipline because it (a) is focused more on finding information and applications on issues relevant to the real world (Donoho, 2017),

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(b) combining multidisciplinary quantitative and qualitative research (Dhar, 2013), and (c) generally focused on digitally retained, both structured and unstructured data (Silver, 2020).

The discipline of DS, which is strongly related to computing, has proved to be very useful in a variety of fields, especially education (Klasnja-Milicevic et al., 2017). The application of the DS approach appears to be helpful and required in order to extract knowledge from those data for a better understanding or learning-related processes (Mitrofanova et al., 2019). Educational institutions can now use this newly accessible data to inform their administrative and pedagogical decision-making processes (Daniel, 2015). Education Data Science (EDS) encompasses a variety of disciplines, including Learning Analytics and Educational Data Mining (Romero & Ventura, 2020). Discovering information in data is not a new concept, but applying these techniques in educational contexts has just recently begun (Baker & Yacef, 2009; Kabakchieva, 2013). A subsection of machine learning places particular emphasis on natural language processing (NLP), which is applied in educational contexts, as text data from media recordings or direct observation has been widely utilized (McFarland et al., 2021).

Data analysts, assessing technical areas of data science based on their ability to learn from data, which has direct benefits, include tools, while indirect benefits include theories and broad success theories (Cleveland, 2001). For example, collecting classroom management information by using data science. Classroom management encompasses a broad range of actions and tasks to create a friendly and conducive learning environment, guarantee the smooth operation of the lesson, and reduce disruptions and misbehaviors (Soleimani & Razmjoo, 2016). These behaviors gave rise to the idea that teachers are skilled classroom facilitators who can engage their students to the fullest extent possible, which in turn reduces or eliminates student disobedience (Sueb, 2013). Recent studies of Moltudal et al. (2019) found a significant correlation between teachers' classroom management abilities and their digital competence. In a real-world educational setting, however, the teacher's role as a classroom manager means that academic and socio-emotional learning are facilitated by the teacher as part of a larger learning ecology, with the human-machine interaction playing only an advisory function (Evertson & Weinstein, 2006; Emmer & Sabornie, 2015).

The study was conducted as, there is a dearth of report regarding scenario of data science and classroom management application of data science to access classroom management information globally with reference to India.

OBJECTIVES

The study's objectives are as follows:

- To describe the present scenario of data science;
- To highlight all the work done on classroom management in different areas of the world;
- To bring up how much information there is about classroom management in different browsers;
- To demonstrate the volume of work pertaining to classroom management across Indian states.

METHODOLOGY

Researchers used qualitative methodology in the present study and Documentary analysis was used as a methodology (Samaddar & Sikdar, 2023). Documents used for systematic evolution in studies include advertisements, agendas, minutes, manuals, books, brochures, diaries, journals, letters, maps, charts, newspapers, press releases, program proposals, application forms, summaries, televisions, reports, survey data, and public records (Bowen, 2009).

A documentary study is a process that uses an official or private document as its information source, in this research method various documents, journals, newspapers, proposals, etc. were used (Samaddar et al., 2023). "Documentary research is one of the three major types of social research and arguably has been the most widely used of the three, throughout the history of sociology and other social sciences" (Ahmed, 2010).

FINDINGS AND DISCUSSION

Present Scenario of Data Science

Theory: The protocols for archiving, retrieving, sharing, and aggregating data are all part of data management and Data fusion, noise or background filtering, statistical analysis, dimensionality reduction, pattern recognition, regression analysis, machine learning, and statistical learning are a few of the methods used in data analytics to extract the embedded high-value information (Kalidindi & Graef, 2015).

We discussed an article on Classroom Management from the particular area of data science in education that most accurately reflects work in EDS. From micro-interactions to macro trends, the collection of works presents theoretical, descriptive, predictive, and causal explanations (McFarland et al., 2021). Previous reviews highlight the value of education data mining and learning analytics from computer science, data science, or learning science perspectives (Fischer et al., 2020; Piety et al., 2014). Many articles published in various journals on topics like classroom management have text data mining as a major focus in order to better understand the variable success of experiments. Classroom Management related data science in various journals generally presents a line of heterogeneous research that leans more towards individual learning and social issues than learning science and learning science seen in other journals; emphasizes description and explanation over prediction; and emphasizes the achievement of ethical goals over the development of new algorithms and tools that can predict behavior in certain directions. Shayan Doroudi (2020) in his article, "The Bias–Variance Tradeoff: How Data Science Can Inform Educational Debates", contributes a theoretical argument on how data science thinking can inform some of education's central debates and dualisms.

Big Data: Big data can be refined as "the datasets whose volume, velocity, variety and veracity are so big that is beyond the ability of typical ICT tools to capture, store, manage, and analyze" (Manyika, Chui, & Bughin, 2011). According to McAfee and Brynjolfsson (2012), big data is different because of its velocity, volume, and variety of data, which is now widely accessible and considerably less expensive to access and store. These data are generated through science data, sensors, emails, click streams, logs, posts, images, videos, audios, health records, social networking interactions, and mobile phones and their applications (Eaton et al., 2012). Big data is categorized into structured, semi-structured, and unstructured types, with 80% of the world's data being unstructured, primarily stored in relational database systems like Oracle (Sathi, 2013).

Big data analytics: Data analytics involves data mining or data science, involving data processing and analysis to gain insights for business problem solutions, building and evaluating predictive models from processed datasets (Fayyad el al., 1996; Shearer, 2000; NIST, 2015). Big data analytics is a science and technology that organizes, analyzes, and discovers knowledge, patterns, and intelligence from large amounts of data, aiding in decision-making (Sun et al., 2018). Big data descriptive analytics, predictive analytics, and prescriptive analytics are the three primary components of big analytics (Sun el al., 2018).

Data Mining Education: A substantial amount of work and research is being done in the area of data mining within analytics work in education (Daniel, 2015). Any technique that involves "digging into" or searching a data file for knowledge to better understand a specific

phenomenon is commonly referred to as "data mining" (Picciano, 2012). A second theme involves using natural language processing to discover "hidden" patterns of language use in sizable education databases. In the case of Oliver (2007) “Effective Classroom Management: Teacher Preparation and Professional Development”, the author study different textbooks and journals for developed this article. Such, the author present a variety of means by which future education researchers can reveal hidden patterns of word embeddings, Innovation Configuration for Classroom Organization and Importance of Effective Classroom Management so that more awareness can be introduce among classroom management. A sample of approximately 79,20,00,000 articles that are accessible in various digital archives and represent research on classroom management are exposed to natural language processing (NLP). Topic models are used to identify the main topics of this subfield and those that appear in grants before publications. By doing this, they may be able identify the ways in which federal funding stimulates and drives scholarly output and probably has a significant impact on the careers of scholars. Berland, Baker, and Blikstein (2014) further explain the benefits of data mining, particularly educational data mining (EDM), include assisting with research and providing information to decision-makers. Although extracting information from data is not a new idea, applying these techniques to educational contexts is an exciting new area of research (Baker & Yacef, 2009; Kabakchieva, 2013).

New Data and Critique of Machine Learning Predictions: Machine learning is the study of how computers can recognize and infer patterns, as well as adapt to changing conditions (Russell & Norvig, 2010). A fourth theme is the gathering of new data types through the use of cutting-edge devices like smart phones and Web platforms. From the data that has been recorded on these platforms and the phone logs, observations about user behavior might become accessible that were previously concealed because there weren't enough relevant data. If researchers searched through popular computer science journals for articles on data science, they would discover that machine learning models and attempts to forecast different behavioral or attitudinal outcomes were commonplace. A learning machine's automatic process of recognizing patterns is the core of machine learning (ML) (Wu et al., 2016). The primary goal of machine learning is to create systems that are as competent as humans in handling a wide range of challenging tasks and issues (Sun & Huo, 2021).

The rate at which (at least) five important keywords are adopted within the corpus indicates the growth of data science in education: Natural language processing, learning analytics, machine learning, artificial intelligence, and data science a qualitative shift in the amount of data-intensive studies being hosted by education research, motivated by methodological innovations from computer science and statistics, is seen in Figure 1. First, although the Education Resources Information Centre corpus contains articles with the five keywords as early as 2000, they are hardly ever used until 2010. Published articles using these keywords have increased significantly since 2010. This increase may have been caused by the explosive growth in e-learning and MOOCs' recourse (Massive Open Online Courses) between 2008 and 2012 (Clow, 2013; Yuan & Powell, 2013).

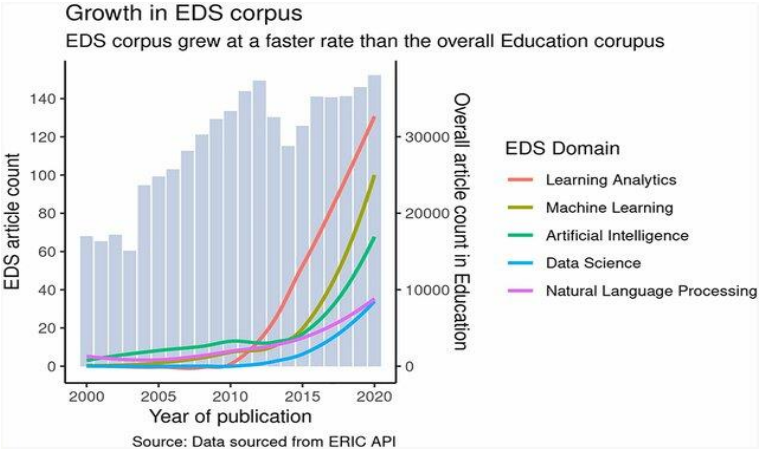

Figure 1: Over the past decade, the education data science (EDS) corpus has experienced a 30-fold growth rate, as evidenced by concave curves

Insight into Interventions: A different theme centers on the experiments and interventions used in research related to education. This theme centers on using data science to uncover the reasons behind a treatment's uneven effectiveness and reception or the degree to which a reform was carried out. The study by Dowell et al., 2021; "It's Not That You Said It, It's How You Said It: Exploring the Linguistic Mechanisms Underlying Values Affirmation Interventions at Scale" uses NLP to identify the elements of essay interventions that work for specific disadvantaged groups and under specific circumstances (Jiang & Pardos, 2021).

E-collaboration science: This part covers the web-based resources created especially to initiate and support interdisciplinary research partnerships between data scientists and application domain experts (Kalidindi & Graef, 2015). We conclude with recommendations for the future that the emerging field of EDS should take advantage of in order to further improve education. The first such chance is that education research should benefit from the many traditions that inform the field, especially the humanistic and social science traditions (McFarland et al., 2015). One potential approach for integration of data science and education is through "adversarial collaboration" (Martschenko et al., 2019) and utilizing predictive models, create new intervention avenues (Bird et al., 2021). However, EDS approaches are starting to offer new, complementary perspectives on institutional and student-level data in higher education (Chaturapruek et al., 2021).

Psychometric approaches can serve as useful benchmarks for new data science methods as well as informative for future methodological advancement (in terms of features that may merit attention) (McFarland et al., 2021). The amount of data in education has increased relative to other domains, but it is still far less than data rich with multiple fields, which may limit the application of the most advanced algorithmic approaches (Bird et al., 2021). The most prevalent use of data-driven decision making in higher education is in the area of student retention (Picciano, 2012). It can also be applied to assist students learn (Martin & Ndoye, 2016; Roberts et al., 2016).

Information on Classroom Management Related Work across the World

At present, there are many works related to classroom management that are constantly being done on one or the other, currently there have been works related to classroom management in various developed countries which have improved their education system. It is illustrated with the help of Figure 2. Not all data must be gathered due to the importance of the information in order to make decisions, seek regulations, or draw statistical conclusions (National Research Council, 2013, p. 128).

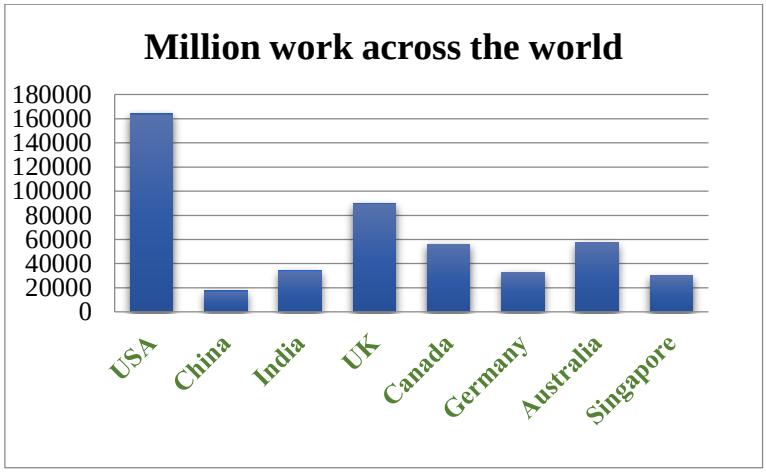

Figure 2: Classroom Management related work across the world

Information on Classroom Management Related Work in Different Browser

Currently, there is a lot of classroom management information available in web browsers. The amount of information available in different web browsers varies. For example, a scholar at Google Scholar has 4 research areas: Classroom Management, Class control, classroom Instruction Method, and effective management information retrieval. This research uses a method to collect 150 x 5 data items from top 150 classroom management scholars, derived from Google Scholar's big data, resulting in a small data collection for the proposed research, serving as a big data reduction (Sun & Huo, 2021). By using them this process, a researcher can easily complete his research work through related reviews, and since the data are related to each other, multiple data are presented in a data search. In the 25th century, a large number of classroom management information can be accessed using various Google browsers and one of them is browsers Google Scholar, Semantic Scholar, SodhGanga etc.

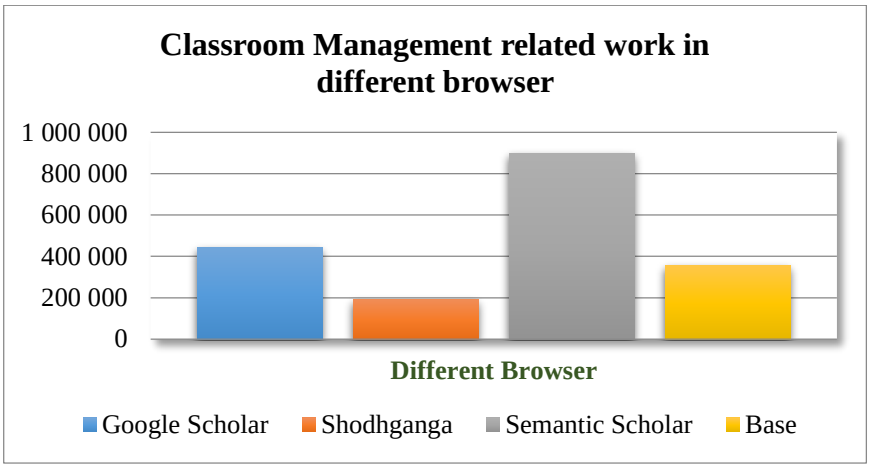

Figure 3: Classroom Management related work in different browser

Information on Classroom Management Related Work in Different State in India

At present, in developed countries as well as in India, various works related to class room management are constantly being done. Data analysis involves collecting specific types of data and determining their importance for the research, with the latter directly related to data analysis (Sun & Huo, 2021). In a large country like India, various works related to classroom management have been done in different states. To collect all this data, big data and data analytics help by showing multiple pieces of information related to that, which is part of data science.

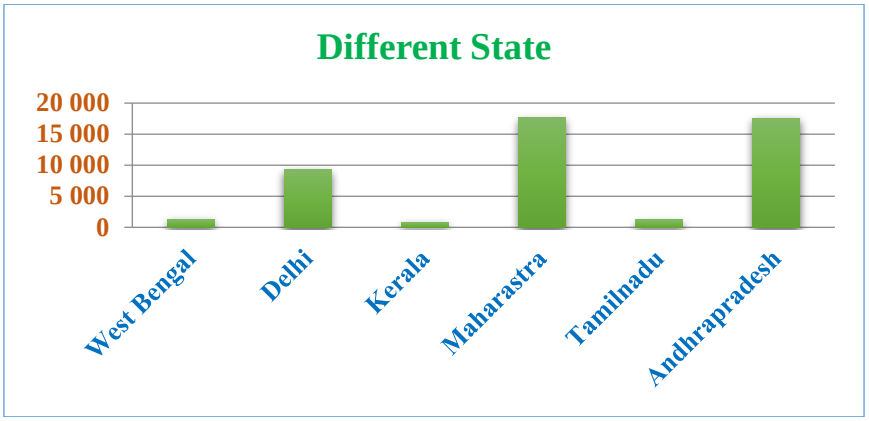

Figure 4: Classroom Management related work in different State in India

CONCLUSIONS

Since the average research publication contains only 30 references and up to 30 MB of data in terms of data volume, all research, including special research publications, is fundamentally based on big data derived small data analysis (Wu el al., 2016). Within the context of big data, 30 MB of data considered relatively small (Strang & Sun, 2015). As such, determining which data set is necessary to achieve the research's goals is a major problem (Sun & Huo, 2021). This research uses data from Google Scholar and Semantic scholar to examine Classroom Management. Google Scholar provides big data of first 100-200 scholars' publications, while Semantic scholar offers key words from the first 200 latest classroom management papers. Analyzing these data can help understand the relationship between Classroom Management and related disciplines or research fields. Learning analytics involves gathering and analyzing data from various sources to enhance teaching and learning quality in educational institutions (Fiadhi, 2014). The study found that the incorporation of advanced modeling techniques and rich data did not significantly enhance the predictability of various life course outcomes that are pertinent to the young adult population. Recent inadequacies of the computational techniques demonstrate their limitations “Fragile Families Challenge” (Salganik et al., 2020). In their study, Samrat Singh and Dr. Vikesh Kumar in 2012, formed to the conclusion that historical and operational data could be found in educational institutions' databases (Singh & Kumar, 2012).

Analytics have the ability to address a number of institutional issues, including understanding student demographics and behavior, assisting students in learning more efficiently, recruiting students, enhancing administrative services, bringing down the cost of education, enhancing faculty performance, cutting administrative expenses, etc. (Bichsel, 2012). Data scientists create intelligence-driven technologies to represent, learn, simulate, and transfer human intuition, imagination, curiosity, and creative thinking through human-data interaction so, Artificial intelligence and data science are "intelligence science" transforming data into knowledge and wisdom (Cao, 2017). To review classroom management and classify it based on research, researchers can use a big data reduction method to collect articles, and then reduce them by analyzing the abstracts, headings, and development, implementation, and discussion of these articles. In the second step researcher can analyze those small numbers of publications, and finally researcher can analyze the classroom management in different ways based on the aims and objectives of the research.

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