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Benefits of Big Data in Supporting Better Educational Decision Making

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ABSTRACT

Big data plays an increasingly important role in education, offering great potential to improve educational decision making. Big Data collects, stores, and analyzes large amounts of and diverse data at very high speeds. In the educational context, big data collects data from various sources, including school management systems, student academic records, student satisfaction surveys, and online data. Analysis of this data can provide valuable information to decision makers in the education sector to identify relevant trends, patterns and opportunities. This research discusses the great benefits that can be gained from using Big Data in an educational context to support better decision making. Through research on the educational benefits of big data in supporting better decision making, it is hoped that this will provide an excellent opportunity to improve decision making in education. Through careful data analysis, education can become more effective, efficient and relevant to better meet the needs of students and society. The method used in this research is a quantitative method. Researchers conducted a survey using a Google form consisting of 15 statements related to the title of the research. Researchers found that using big data in education provides great opportunities to improve better educational decision making. And supported by careful selection as material for consideration. The limitation of this research is that the researcher only conducted research in schools and the researcher did not conduct research directly in schools but shared a survey link on a Google form containing a statement about the benefits of big data in supporting better educational decision making.

Keywords: *Big Data, Decision Making, Management Systems*

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INTRODUCTION

Education is the foundation for the economic, cultural and social development of a society (Zoph et al., 2018). Therefore, making informed decisions in an educational context is key to creating a better learning environment, which in turn will influence the future of future generations (Reichstein et al., 2019). However, the educational decision-making process often faces great complexity and various challenges (Butler et al., 2018). In an era of ever-changing information, Big Data has become a key driver of innovation in many fields, including education. As a tool that has the potential to change the way data is understood and managed, Big Data has opened the door to more accurate, faster and accurate educational decision making based on evidence. This is why technological innovation, especially the use of Big Data, has emerged as a highly effective tool to support better decision making in the field of education.

Big Data refers to large, complex amounts of data that can be collected, stored, and analyzed at incredible speeds (Zhao et al., 2019). In the educational context, Big Data includes various sources of information, such as student academic data, survey results, attendance records, academic interests, and even students' online footprints (Chen & Liu, 2018). These data sets continue to grow, creating the potential for unprecedented educational insights. Apart from that, Big Data also contributes to the development of more personalized and adaptive learning models (Frank et al., 2019). By analyzing students' interests and learning progress in real time, teachers can provide more relevant material and create a more engaging learning experience. This increases knowledge retention and learning motivation (Zhang et al., 2019). Not only at the individual level, Big Data also helps in strategic planning and resource management at the level of educational institutions and government. Data on enrollment numbers, enrollment trends, and graduation rates can be used to design more effective and efficient education policies.

The benefits of big data in supporting better decision making in education are so important that they cannot be ignored (Ting et al., 2020). In an effort to optimize the teaching and learning process, educational institutions, teachers, administrators and policy makers are increasingly relying on Big Data as an invaluable resource (Vinayakumar et al., 2019). In this article, we explore how the use of Big Data in education has opened the door to positive change in improving the quality of education, creating personalized learning experiences, and achieving more ambitious educational goals (Y. Lu et al., 2020). In addition, we will examine the important role of Big Data in identifying educational issues that may be overlooked, providing the information needed to improve policy, and providing a more comprehensive and sustainable perspective on education (Yuan et al., 2020). Through this discovery it can also be understood that Big Data is not just a technological trend but is also a tool that has the potential to fundamentally change the educational paradigm (Tian et al., 2020). By harnessing the power of big data, we can also create a smarter, more responsive and

more relevant education system which will ultimately provide positive benefits for all students, teachers, educational institutions and society.

Review of Literature

1. **Big Data**

Big data is a rapidly growing field and has the potential to revolutionize many aspects of business, science, healthcare, government, and education (Rasheed et al., 2020). This document highlights the four Vs of Big Data: Volume, Velocity, Variety, and Veracity (Tao et al., 2019). Big data refers to large amounts of data, generated at high speed in various formats. Ensuring the accuracy and reliability of this data (authenticity) is a major challenge (Alon et al., 2019). Many studies examine the technologies and tools used in big data management, including Hadoop, Spark, NoSQL databases, and machine learning algorithms (Ngiam & Khor, 2019). These tools are essential for processing, analyzing, and gathering insights from large data sets. In science, big data plays an important role in scientific research, especially in the fields of genomics, climate modeling and particle physics (Dash et al., 2019). In the educational context, Big Data is increasingly used for personalized learning, tracking student learning outcomes, optimizing teaching resources, and evaluating the effectiveness of teaching methods (J. Lu et al., 2018). Big data represents a dynamic and multifaceted field with far-reaching impacts across several sectors. While Big Data offers many opportunities and benefits, addressing the challenges of privacy, security and data quality remains critical for sustainable and responsible use. Future research will likely focus on improving methods, expanding applications, and exploring the ethical and legal aspects of this transformative technology.

2. **Decision Making in Education**

Educational decision making refers to the process of identifying, evaluating, and selecting the most appropriate actions to achieve specific educational goals (Aceto et al., 2020). It involves many different stakeholders in the education system, including teachers, students, parents, school administrators, and educational policy makers (Xu & Duan, 2019). Decision making in education can cover various aspects, such as curriculum development, classroom management, selection of teaching methods, planning educational programs, and educational policies(Dubey et al., 2019). Educational decisions should always focus on achieving clear educational goals (Fozouni et al., 2021). These goals can range from improving student achievement to developing social skills, creativity, and understanding of concepts. Good educational decisions must be based on relevant data and empirical evidence (Romero & Ventura, 2020). This may involve assessing student test scores, attendance data, research results, and program evaluations(Butun et al., 2020). Educational decision making is a complex and ongoing process that requires the involvement of many different parties and a thorough understanding of the goals of education and the impact of these decisions on students and the entire education system. The right educational decisions can influence the quality of learning, student

development and the future of education in society. Therefore, it is important to carry out this decision-making process carefully, transparently and based on accurate data.

There are several previous research opinions regarding research on the benefits of big data in supporting better educational decision making. First (Saiz-Rubio & Rovira-Más, 2020), with the title research on the use of big data in educational technology research and obtaining research results. The development of Big Data-based technology research applications will help researchers easily recognize the potential and problems that each student has. Based on this data, researchers will be able to monitor and evaluate students, teachers, teaching materials and learning implementers. This data can be used to prepare future research activities. Second (Moon et al., 2019), with the research title Implementation of Big Data Technology in the Digital Era and obtaining research results on what great benefits Big Data technology brings, which is interesting for use in Indonesia, especially in government and private organizations, as well as what are the challenges in its implementation. Third (Shatte et al., 2019), with the title research on the implementation of big data technology in Indonesian government institutions and obtaining research results that can provide information and inspiration so that the application of Big Data technology in Indonesia can be more widespread, especially in government agencies.

Research conducted by previous researchers is different from current research. Meanwhile, the study conducted by researchers was entitled The Benefits of Big Data in Supporting Better Educational Decision Making. Researchers found that using big data in the education process will offer opportunities to significantly improve the quality of education and provide benefits for students and other stakeholders. However, it is important to consider ethical, privacy, and data security challenges when applying big data in educational settings. In addition, educational decision making can be based on data so that better educational decisions can be made based on evidence and data, not just based on assumptions or intuition. This leads to more informed and informed decision making. Big data can also be used to involve parents more effectively in their children's education. Parents can access information about their child's progress and participate in educational decision making.

RESEARCH METHOD

Research on the benefits of big data to support better educational decision making requires careful and structured research methods to understand its impact in depth (Tao et al., 2019). A research method is a series of steps or approaches used by researchers to design, collect data, analyze data, and draw conclusions in order to answer research questions or achieve research results, specific research objectives (Zou et al., 2020). The appropriate research method is chosen based on the type of research, research objectives, required data and available resources. In this research, researchers used quantitative research methods to collect, analyze and interpret data (Yang et al., 2020). Quantitative research is a scientific method for measuring, determining cause-

and-effect relationships, and testing hypotheses using numerical or measurable data (Fang et al., 2019). The first step in quantitative research is to clearly formulate the research problem. The researcher must determine what will be studied, why it is important, and formulate the research question or hypothesis that will be tested. Quantitative research must pay attention to validity (whether the measurement tools and methods actually measure what is desired) and reliability (whether the results are reliable or traceable), the output if repeated or not).

By using quantitative research methods, researchers can gain a strong understanding of the relationships between variables, make broader generalizations (depending on the research design), and provide data feeds that can be used to convince data-based decisions (Fanelli & Piazza, 2020). The advantages of quantitative research methods include: first, the ability to measure and determine relationships between variables objectively. Second, the generalization of research results is due to the use of a representative sample. Third, the ability to perform powerful statistical analyzes to test hypotheses. And fourth, collect data easily from large samples (Yu et al., 2020). However, this method also has limitations such as the inability to explain phenomena in depth, especially those related to the socio-cultural context. Therefore, when studying more complex phenomena, quantitative methods are often used in conjunction with qualitative research methods to provide a more comprehensive understanding (Liang et al., 2019). Quantitative research methods use statistical techniques to analyze data. This includes the use of descriptive statistics to describe the characteristics of data, as well as inferential statistics to test hypotheses and make generalizations about larger populations (Baugh, 2001). Quantitative methods often use samples that are representative of a larger population. This allows researchers to make generalizations about a population based on data from a smaller sample. Good sample selection is very important in quantitative methods. Quantitative methods are often used to determine cause-and-effect relationships between variables.

RESULTS AND DISCUSSION

Big data plays an increasingly important role in education, opening up new opportunities and presenting significant challenges and changes in the way education is delivered. Big data is a collection of data that is large, fast, and/or very diverse. With the help of digital agencies, data is analyzed to discover patterns, trends and relationships regarding human behavior and interactions to provide better insights, decision making and process automation. Because the data continues to increase, the analysis cannot be carried out using conventional data processing techniques. The benefits of big data in supporting better decision making in the education sector highlight various important aspects that influence the education sector. Big data enables a more personalized approach to education. By analyzing individual student data, teachers can develop curricula and teaching methods that better suit each student's needs and abilities. This helps to improve student understanding and overall achievement. Big data also allows predictive data analysis to be used to predict student progress. By tracking data such as

test scores, attendance or homework results, schools can identify low- or high-risk students and take action to provide them with better support.

By using Big Data, educational institutions can measure the effectiveness of teaching methods and learning programs. Data can be used to measure the impact of certain teaching strategies on student achievement and identify the most effective methods. The use of big data can help schools and educational institutions manage their resources more efficiently. This includes budget planning, optimal course planning, and appropriate human resource placement. Big data is used by education policymakers to assess the impact of certain policies. This could include changes to the school curriculum, improving teacher quality, or budget allocations. Thanks to Big Data, educational institutions can identify students who need additional intervention. This data can help schools design support programs or additional assistance for students who are experiencing difficulties. Big data can be used to design research programs that better meet actual needs and labor market requirements. This helps students better prepare themselves to face future challenges. Big data can also be used to involve parents in their children's education. They can access data about their child's progress and work with schools to improve learning outcomes.

Better educational decision making through big data refers to the process of using big data and analyzing it to support more informed decision making, more accurate information, and more effective strategies. By using big data, student data such as test scores, grades, and attendance rates can be used to predict future student growth. By using predictive algorithms, educational institutions can identify low- or high-risk students and tailor interventions to help them reach their full potential. Let Big Data enable a deeper assessment of the effectiveness of teaching and education programs. By analyzing student performance data, teacher feedback, and test results, schools can identify effective teaching strategies and areas for improvement.

Big data can help develop and evaluate education policies. Data on student outcomes and educational trends can help policymakers make better decisions when changing curricula, improving teacher quality, or allocating budgets. Data is collected continuously to help track student progress and learning throughout the program. This allows teachers and educational institutions to quickly identify problems and take appropriate corrective action. Data can also help schools manage their resources more efficiently. By analyzing data on budget allocations, classroom utilization, and staff allocation, educational institutions can optimize resource utilization and reduce costs. When schools implement new technology or innovative learning methods, Big Data can be used to objectively measure their impact. This helps schools assess whether the innovation is beneficial and whether adjustments need to be made.

By integrating big data into educational decision making, educational institutions can increase learning efficiency, improve the quality of education, and provide better outcomes for students. However, it is important to handle student data with care, comply with privacy regulations, and ensure ethical use of data as part of efforts to improve these education systems. Thanks to Big Data, educational institutions

also have access to more accurate and relevant information to support decision making. This helps improve the quality of education, efficiency of resource use, and the overall student experience. However, it is important to pay attention to confidentiality, ethics and data privacy when using Big Data in an educational context. With several concrete examples of how Big Data has been used to support better educational decision making for example online learning platforms such as Khan Academy use Big Data to understand student learning behavior. Data collected includes student responses to questions, time spent on various topics, and the level of difficulty students encountered. Using this data analysis, the platform can personalize learning content for each student, providing additional practice on the topics they need, and accelerating their progress.

Figure 1 forms of using Big Data in education

Based on the picture above, it can be concluded that big data is bringing education to the peak of transformation. By analyzing data about student learning behavior, teachers and educational institutions can identify individual needs and provide a more personalized learning experience. Big data can also be used to predict student performance based on past data, thereby helping teachers identify students who may need additional help. Additionally, Big Data can help identify effective teaching methods and lead to the development of better teacher training. Most importantly, institutional leaders can use Big Data to make better strategic decisions, such as planning expansion, developing new programs, or investing in educational technology. However, the use of Big Data in education also raises challenges related to data privacy and security as well as the need for adequate technological infrastructure.

The use of big data in education offers great potential to improve the efficiency, quality and effectiveness of the education system. However, there are several challenges that must be overcome to maximize its benefits. First, regarding the security of student data. Protecting the personal data of students and educational users is a top priority. Data collection and storage must comply with applicable data privacy regulations. Because data security threats such as hacking and security breaches can threaten data integrity and individual privacy. second, data quality. Educational data can vary from grade records, attendance records to behavioral data. It is important to ensure the

accuracy and reliability of the data used. Incomplete or incorrect data can lead to faulty analyzes and incorrect recommendations. Third, data accessibility. Available data is often not easily accessed or understood by stakeholders, such as teachers, students and parents. Educators must develop ways to make data more accessible and understandable. While there are many challenges to using Big Data in education, its potential benefits make it an exciting area to continue to explore. Therefore, education needs to pay attention to appropriate policies and practices in the use of Big Data to support the positive transformation of education. By paying attention to data privacy, ethics and security, and investing appropriately in training and technology, education can leverage big data to improve student experiences and learning outcomes.

Researchers collected data about students' perspectives and responses to the benefits of big data in supporting better educational decision making, namely through distributing questionnaire links to students. The aim of distributing this questionnaire is to obtain results and to find out whether the use of big data is able to support better decision making than before. The questionnaire given by researchers to students contains 15 statements covering the benefits of big data in supporting better educational decision making. The questionnaire was created using Google Form. Apart from that, researchers also need to pay attention to aspects of the relevance of the statements given, also related to the accuracy of the statements with the title of the research. The response of students who filled out the questionnaire was very positive regarding the benefits of big data in supporting better educational decision making. The data that the researcher obtained then summarized it in one table, as below:

NO	Statement	SS	S	RR	T.S	STS
1	I feel Big data in education refers to the collection, storage, analysis, and utilization of big data in an educational context	60%	40%			
2	I feel Big data can be used to identify patterns and trends in student behavior, test results, and other factors that influence learning	33.3%	50%	16.7%		
3	I feel that with big data, educational institutions can make more personalized and targeted recommendations to improve student learning experiences	40%	60%			
4	I feel big data analysis can help teachers identify students who need additional help or special interventions to improve their academic performance	66.7%	33.3%			
5	I feel that the use of big data in education can help institutions to	55%	45%			

	plan resources and educational programs more efficiently					
6	I feel Big data can be used to measure the effectiveness of educational programs and identify areas that need improvement	50%	50%			
7	I think big data can provide insight into online learning behavior, including how often students participate and the level of interaction in the virtual environment	60%	40%			
8	I feel Big data can also be used to improve educational administration, including budget planning and resource allocation	50%	50%			
9	I feel that big data analysis can help in developing a curriculum that is more relevant and in line with student needs	50%	50%			
10	I feel Big data based predictive systems can help in forecasting student graduation and dropout rates, enabling early intervention	30%	50%%	20%		
11	I feel Big data can help in understanding student preferences, enabling personalization of learning and teaching content	55%	45 %			
12	I feel that the use of big data in education can increase transparency and accountability in the education system	60%	40%			
13	I feel the use of big data can help identify and overcome bias in educational decision making	55%	45%			
14	I feel that with big data, educational institutions can gain deep insight into the impact of changes in educational policies	50%	50%			
15	I feel that successful implementation of big data in education requires collaboration between	33.3%	50%	16.7%		

	administrators, teachers, data analysts, and technology developers					

Table 1. Table of filling out questionnaires by students

Information :

SS = Strongly Agree
S = Agree
RR = Undecided
TS = Disagree
STS = Strongly Disagree

The table above is a table of assessment results from the questionnaire given to students. Feedback or responses given by students are really needed to provide an assessment of the benefits of big data in supporting better educational decision making, whether it is optimal or not. In this statement there are 5 assessment categories, namelyStrongly Agree (SS), Agree (S), Undecided (RR), Disagree (TS), Strongly Disagree (STS). Based on this table, the first highest assessment result was 66.7% with the assessment category strongly agree. The second assessment was 60% with the assessment category strongly agree. The use of big data to support decision making greatly facilitates teachers and students in the ongoing learning process. Although there are still some negative effects in its implementation. With big data, educational decisions can be made based on concrete evidence and data rather than intuition or assumptions. This can improve the quality of decisions and help achieve better results. The use of big data in education enables a more scientific and targeted approach to decision making, which in turn can improve student learning experiences and outcomes.

Next, the researcher will describe the results of filling out the questionnaire. For the first statement, I feel that big data in education refers to the collection, storage, analysis and use of big data in the educational context, obtaining responses in the strongly agree category of 60% and the agree category of 40%. For the second statement, I feel Big data can be used to identify patterns and trends in student behavior, test results, and other factors that influence learning. Obtaining responses in the strongly agree category was 33.3% and the agree category was 50% and the category was unsure. 16.7%. For the third statement, I feel that with big data, educational institutions can make more personalized and targeted recommendations to improve students' learning experiences, receiving responses in the strongly agree category of 40% and the agree category of 60%. For the fourth statement, I feel that big data analysis can help teachers identify students who need additional help or special intervention to improve their academic achievement. Obtaining responses in the strongly agree category was 66.7% and the agree category was 33.3%. For the fifth statement, I feel that the use of big data in education can help institutions to plan resources and educational programs more efficiently, obtaining a response in the strongly agree category of 55% and the agree category of 45%.

Furthermore, for the sixth statement, I feel that Big Data can be used to measure the effectiveness of educational programs and identify areas that need improvement,

obtaining responses in the strongly agree category of 50% and the agree category of 50%. For the seventh statement, I think data with big data can provide insight into online learning behavior, including how often students participate and the level of interaction in the virtual environment, obtaining responses in the strongly agree category of 60% and the agree category of 40%. For the eighth statement, I feel that Big Data can also be used to improve educational administration management, including budget planning and resource allocation, obtaining responses in the strongly agree category of 50% and the agree category of 50%. For the ninth statement, I feel that big data analysis can help in developing a curriculum that is more relevant and in line with students' needs, obtaining responses in the strongly agree category of 50% and the agree category of 50%. For the tenth statement, I feel that a big data-based predictive system can help in predicting student graduation and dropout rates, enabling early intervention to obtain responses in the strongly agree category of 30% and the agree category of 50% and the doubtful category of 20%.

Furthermore, for the eleventh statement, I feel that Big Data can help in understanding student preferences, enabling personalization of learning and teaching content. Obtaining responses in the strongly agree category was 55% and the agree category was 45%. For the twelfth statement, I feel that the use of big data in education can increase transparency and accountability in the education system, receiving responses in the strongly agree category of 60% and the agree category of 40%. For the thirteenth statement, I feel the use of big data can help identify and overcome bias in educational decision making, obtaining responses in the strongly agree category of 55% and the agree category of 45%. For the fourteenth statement, I feel that with big data, educational institutions can gain in-depth insight into the impact of changes in educational policy, receiving responses in the strongly agree category of 50% and the agree category of 50%. For the fifteenth statement, I feel that the successful implementation of big data in education requires collaboration between administrators, teachers, data analysts and technology developers, obtaining responses in the strongly agree category of 33.3% and the agree category of 50% and the unsure category of 16.7%.

CONCLUSION

The conclusion regarding the benefits of Big Data in supporting better decision making in the field of education is that the use of Big Data in the educational context has great potential to produce significant improvements in performance, efficiency and effectiveness of outcomes and quality of education. Through careful data analysis, educational institutions can predict future problems. Big data can also predict future outcomes, such as graduation or dropout rates, making early intervention possible. It is also possible to customize the learning experience for each student according to their interests and needs. And measure the effectiveness of teaching methods and educational programs, thereby enabling timely improvements. Manage resources better for better educational outcomes and make education policy decisions based on solid data. By using

Big Data, education can better meet the needs of students, teachers and administrators, and produce better learning outcomes. However, it is important to pay attention to the privacy and ethical issues associated with the use of big data in education, and ensure that the data is used appropriately and responsibly.

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