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Research Article

Data Driven Educational Planning Strategy: Examining Challenges and Opportunities in the Digital Era

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ABSTRACT

This study aims to examine and comprehend the implementation of a data-driven approach in educational strategic planning by identifying the challenges encountered and the opportunities that can be leveraged in the digital era. Educational institutions often struggle to maximize the use of data due to infrastructure limitations, low digital literacy, and minimal integration of technology in decision-making processes. This research employs a Research and Development (R&D) methodology to design a data-driven implementation model for educational planning. Data collection was conducted through in-depth interviews with various stakeholders, observations of daily data utilization practices, and document analysis of education policies and evaluation reports. The data analysis process utilized triangulation techniques to ensure accuracy and consistency in research findings. The results indicate that a data-driven approach enhances efficiency and precision in educational strategic planning; however, its implementation remains hindered by constraints such as limited human resources, technological infrastructure, and supporting policies. This study recommends capacity building for educators, investment in digital infrastructure, and the development of regulations to safeguard and optimize data utilization. While data-driven approaches hold significant potential to transform educational strategic planning, successful implementation requires comprehensive and well-integrated support.

Keywords: Educational Strategic Planning; Data Driven; Digital Era;

1. INTRODUCTION

Strategic planning in education is very important to ensure that the education system can adapt quickly to ever-evolving global dynamics (Akbar et al., 2024). In the midst of rapid technological, economic and social change, the education sector needs to have a flexible and proactive framework to prepare a generation capable of facing future challenges. Proper planning can help in allocating resources efficiently, identifying long-term educational needs, and formulating policies that are relevant to global market demands. A good strategy in education will ensure the achievement of educational goals that are more inclusive, sustainable and in line with current developments (González García et al., 2020).

Based on data from UNESCO, around 1.5 billion students worldwide are affected by school closures due to the COVID-19 pandemic, illustrating how vulnerable the education system is to external factors (Rambe, 2024). This gap is often caused by economic and geographic factors, where students in rural areas or developing countries have more difficulty getting internet access and the hardware needed for online learning (Triyanto, 2020). Therefore, careful and data-based planning is very necessary to ensure that educational investments can provide optimal results and are relevant to the needs of the times.

Information and communication technology (ICT) plays a key role in supporting this strategic planning by providing tools to collect and analyze the data necessary for better decision making (Fitriyani et al., 2024). Changes in student learning patterns. Generation Z, who grew up in the digital era, has a different way of learning compared to previous generations. They prefer interactive and visual learning over traditional methods. This requires the education system to adapt quickly to remain relevant (Fitri & Dilia, 2024). Data security and privacy issues are also a major concern. Many online learning platforms collect students' personal data, and without proper protection, this information can be misused or exposed to cyber threats (Bandara et al., 2014). Over-reliance on technology can also lead to digital fatigue and reduce social interaction between students, which is important for emotional development (Shanmugasundaram & Tamilarasu, 2023).

The potential for data-based approaches in the education sector is enormous, with limited use of these methods in daily practice. Many educational institutions have not fully integrated data-driven decision-making into the planning process. (Zou et al., 2019). A study shows that only 30% of schools in Indonesia use data analysis to formulate education policies (Soro et al., 2024). The main obstacles faced include limited access to technology, lack of training for educators in using data analysis tools, and an organizational culture that does not fully support data-based decision making. This creates a gap between the potential and reality of implementing data-driven approaches in education.

In the existing literature, there is a research void regarding the application of data-based approaches in the education sector, especially in developing countries like Indonesia. Most previous studies emphasized the theory and basic concepts of strategic planning without paying sufficient attention to practical applications in the field (Azis, 2019). A study by (Sinaga & Firmansyah, 2024) revealed that although technology can increase educational accessibility, the access gap is still a major problem that needs to be addressed so that all students can experience the benefits of digital-based learning. Other research also shows that the application of technology in education requires profound adjustments in the way educators deliver material and the way students understand it (Hu & Hui, 2012).

The urgency of this research lies in the urgent need for educational institutions to respond to the challenges of the digital era through data-based strategic planning. In the midst of dynamic job market needs and technological developments, a data-driven approach is a potential solution for improving the quality of education (Bibri, 2021). However, implementing this approach is faced with various challenges, such as limited access to technology, lack of competence in data analysis, and resistance to change. Identification of these obstacles is an important step for formulating effective strategies, so that the benefits of a data-based approach can be optimized in the context of educational planning.

Many educational institutions do not yet have an adequate evaluation system to measure the effectiveness of online learning platforms. This paper aims to address this gap by exploring the direct experience of educational institutions in implementing data-based approaches and their impact on educational outcomes, identifying challenges and opportunities in implementing data-based approaches in educational strategic planning in the digital era. By analyzing existing obstacles and exploring practical solutions through data analysis and experiences from educational institutions, this article seeks to provide recommendations that can support policy makers in designing more responsive and inclusive education policies. This article can contribute to creating a fairer and better quality education system for all students, regardless of economic or geographic background.

2. RESEARCH METHOD

This research uses a Research and Development (R&D) approach which aims to design and develop a product or model related to the application of a data-driven approach in educational strategic planning at MAN 4 Banyuwangi (Okpatrioka, 2023). Although R&D is not completely synonymous with a qualitative approach, in this research, the data collection process relies on descriptive qualitative methods to gain an in-depth understanding of the practices, challenges and opportunities faced by educational institutions in integrating data into planning and decision making. Data collection techniques used in this research include in-depth interviews, observation, and document analysis. In-depth interviews were conducted with school principals, educational technology operators, teachers, and school committees to explore their experiences and views regarding the application of data-driven in educational planning (Jailani, 2023). Observations were carried out in the school environment to understand how data is used in daily practice and how data-based education policies are implemented. Document analysis includes reviewing educational policies, evaluation reports, and other documents related to the use of data in planning and decision making.

The data reduction process is carried out by identifying and selecting relevant data from interviews, observations and collected documents. During the interview stage, researchers recorded the information most relevant to the research topic, then grouped the data based on main themes, such as challenges in using data, successful implementation of data-driven, and data-based education policies. Observations were carried out by recording daily interactions at school which were directly related to the use of data in planning and decision making. The collected document data was also selected based on its relevance and contribution to the understanding of data-driven applications in education policy. Reduction is carried out by eliminating less relevant or duplicate information, and focusing on in-depth aspects related to the research objectives. The data analysis technique used in this research is triangulation, which involves comparing and validating data from various sources, namely interviews, observations and documents. This triangulation aims to increase the credibility and accuracy of research results by ensuring that the findings obtained are consistent and supported by various

relevant data sources (Harahap, 2020).

Table 1. Informant Data

No.	Position	Code
1	Principal	IN1
2	School Operators	IN2
3	School Committee	IN3
4	Representatives for Curriculum	IN4
5	Representatives for Student Affairs	IN5
6	Teachers	IN6

3. RESULTS AND DISCUSSION

3.1 Lack of Technology Infrastructure

The lack of availability of technological devices in educational institutions, such as computers, tablets, or other supporting devices, is one of the main obstacles in implementing a data-driven approach (Ahmad et al., 2023). This shows that there is a significant digital gap between educational institutions in urban areas and remote areas. This imbalance not only affects institutions' ability to collect and analyze data, but also limits students' opportunities to learn using technology. As a result, educational institutions are unable to exploit the full potential of technology to increase the efficiency of their strategic planning. Limited or unstable internet access is a serious challenge for schools in remote areas. Poor internet connections hinder real-time data collection, use of online learning platforms, and integration of data management systems (Darwish et al., 2019). When schools cannot reliably access the internet, they not only miss the opportunity to implement a data-driven approach, but also lag behind in leveraging digital education innovations. This condition emphasizes the need for the government and related parties to contribute to providing adequate network infrastructure throughout the region. The minimal budget allocation for technological infrastructure development reflects the lack of priority on digital transformation in the education sector (Paramesti et al., n.d.). Limited budgets make it difficult for schools to provide sufficient technological devices and improve supporting infrastructure, such as internet networks or staff training. As a result, efforts to adopt a data-driven approach often stall midway due to a lack of financial resources. Therefore, strategic policies are needed that ensure education budgets include sustainable development of technology infrastructure, especially in less accessible areas, because without adequate infrastructure, a data-driven approach is difficult to implement effectively

3.2. Human Resource Capacity

The low percentage of educators who are able to use data analytical tools shows that technology and data literacy is not yet a competency that is widely mastered among educators (Baharun, 2024). This hampers the effectiveness of implementing a data-driven approach in educational strategic planning, because educators cannot process student learning outcome data to design appropriate interventions. In addition, these limited capabilities often result in the use of educational technology only at a basic level, such as administration, without exploiting the potential of deeper analytics to support decision making (Jauhariyah et al., 2023). The lack of formal data literacy training for educators reinforces the skills gap in utilizing data optimally. Educational institutions often assume that data analytical skills are not urgent to be taught, so they do not include this training in the teacher competency development agenda (Duryat, 2022). Without structured training, educators only rely on independent learning which tends to be unsystematic, making it difficult to understand and apply data analytical tools effectively in the learning process or strategic planning (Jauhariyah et al., 2023). Educational decision making that is still based on intuition or habit reflects the lack of a data-based culture in educational institutions. While these traditional methods may be effective in some situations, reliance on intuition often results in less objective and measurable decisions. Without valid data as a basis, educational institutions risk making policies that are not relevant to student needs or the current educational context (Hayati et al., 2021). Therefore, building a data-driven culture is an urgent need to increase the accountability and effectiveness of educational decisions.

3.3 Privacy and Data Security Issues

The absence of standard data security protocols in educational institutions reflects the weakness of the data protection system in the education sector. Many schools do not have standard guidelines for how student data should be collected,

stored, and used, increasing the risk of sensitive information being leaked (Neviyarni & Sukur, 2024). Without clear protocols, data access is often uncontrolled, allowing potential misuse by internal and external parties. This condition emphasizes the need for a national policy that regulates comprehensive education data management to ensure student privacy is maintained.

Heavy reliance on third-party learning platforms without security evaluation shows a lack of attention to the risks they may pose. Many educational institutions use these platforms because of the convenience and features they offer, but often without fully understanding how student data is managed by the platform provider (Al-Maroof et al., 2021). Vagueness in privacy agreements and a lack of security audits leave student data vulnerable to exploitation. This highlights the importance of building independently developed learning systems or ensuring third-party platforms meet stringent security standards.

Educators' low awareness of the importance of student data privacy is a serious challenge in creating a safe learning environment. Many educators do not realize that student data, such as names, addresses, or academic information, can be misused if not properly protected. This is often caused by a lack of training or outreach regarding the importance of data privacy in the context of digital education (Yindrizal & Susiana, 2024). As a result, educators tend to neglect data security practices, such as using weak passwords or sharing student information on public platforms. To overcome this, systematic efforts are needed to increase educators' digital literacy, especially in terms of data privacy and security. This risk requires special attention so that a data-driven approach can be implemented safely and sustainably. Technology-based education management needs further development. The lack of technological infrastructure and data literacy supports the view that data-driven implementation depends not only on the technology itself, but also on the readiness of the education ecosystem as a whole. Additionally, data privacy and security issues highlight the importance of integrating risk management theory into a data-driven strategic planning framework in the education sector. Implementing a data-driven approach on a large scale is often hampered by various interrelated factors. To provide a clearer picture of the complexity of this issue, take a look at the following diagram which highlights some of the key challenges that need to be addressed.

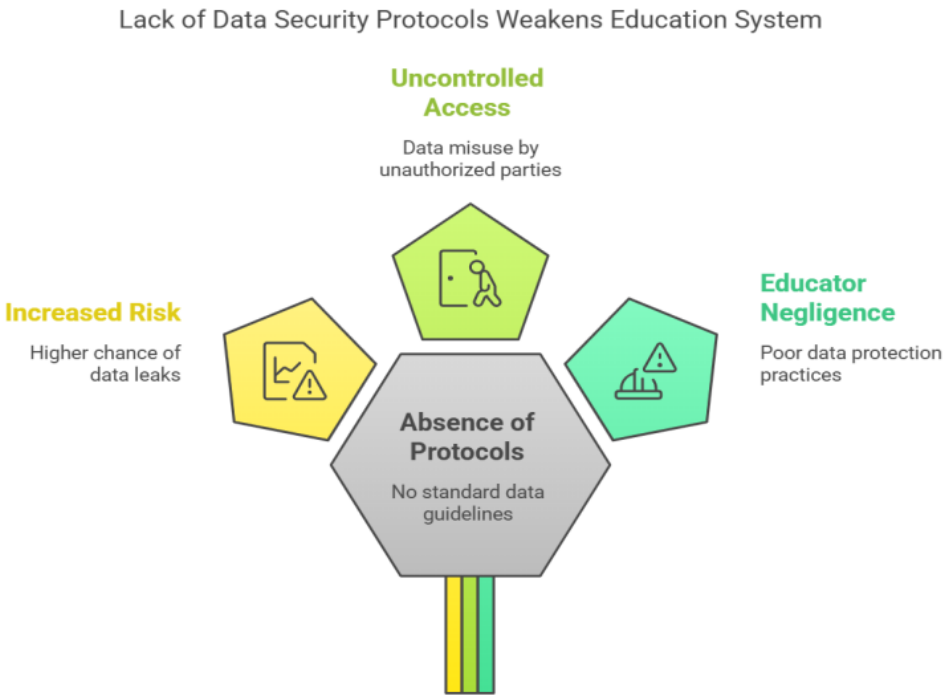

Figure 1. Challenges Data Driven Transformation

Practically, these findings can be the basis for designing data literacy training programs for educators and decision makers, aimed at improving their ability to use data for strategic planning. In addition, policy recommendations include a special budget allocation for developing technology infrastructure in remote schools and developing standard data security protocols. Thus, a data-driven approach can be applied more inclusively, safely and effectively.

3.4 Data-Driven Decision Efficiency

The use of student learning outcome data allows educational institutions to specifically identify learning areas that require special attention (Yindrizal & Susiana, 2024). By analyzing the pattern of students' grades or test results, educators can find the subjects or competencies where they experience the most difficulty. For example, if data shows that more than 50% of students in a class have low scores in a particular math topic, then the curriculum can be adjusted to devote more time to that topic. In addition, this data can be used to design interventions such as additional guidance or remedial learning in a more targeted manner, so that the teaching process becomes more efficient and has a direct impact on improving learning outcomes.

Curriculum decisions based on data analysis tend to be more accurate because they rely on measurable facts and patterns, not assumptions (Dimara et al., 2021). For example, by looking at student performance trends over several semesters, educators can determine which parts of the curriculum need to be improved, changed, or removed. This analysis also enables more contextual decision making, such as adapting curriculum content to local or individual student needs. Thus, a data-driven approach reduces the possibility of bias and ensures that the curriculum is more comprehensive. By using data analytical tools, the curriculum revision process can be carried out in a shorter time because the data needed for evaluation is already available and organized (Boudett et al., 2020). This tool allows educational institutions to quickly identify problem areas and propose improvements based on the analysis results. For example, a data management system that records student learning outcomes in real-time can immediately provide reports on student achievement, so that decision makers can immediately design and implement curriculum revisions (Mandinach & Schildkamp, 2021). These efficiencies not only save time, but also allow students to benefit from the updated curriculum without significant delays.

3.5 Increased Inclusivity

The use of demographic data is used to identify students from low economic backgrounds. This data includes information about the family's economic status, such as parents' income, number of dependents, and access to educational resources (Anggraini & Suaidah, 2022). By analyzing this data, schools can target students who may need extra support, whether in the form of scholarships, material assistance, or learning interventions. Utilizing this data allows educational policy makers to design more equitable and supportive policies, thereby ensuring that students from low economic backgrounds are not left behind in the educational process (Khaudli & Muna, 2022). The use of this kind of data increases equality of access and opportunity for students from disadvantaged families. Monitoring the learning outcomes of students from disadvantaged families through data analysis of exam results, daily assessments and learning progress, schools can identify gaps in academic achievement between students from low economic backgrounds and those who are better off (Pohan, 2020). This learning outcome data can be used to design more specific interventions, such as additional guidance, learning materials that are easier to understand, or recovery programs designed specifically for that student. With this data-based approach, decision making in determining appropriate steps to support students becomes more objective and evidence-based, increasing their chances of success in education.

Implementing data-based programs for students from disadvantaged families based on data analysis that has been carried out, schools can design intervention programs that are more targeted, for example by providing remedial programs or introducing technology-based learning for students who have difficulty following lesson material. This implementation is based on data that reflects specific student needs, such as the need for additional time to study or material tailored to the student's level of understanding. With a data-driven approach, each student receives support that is relevant to the challenges they face, thereby increasing the overall inclusiveness of education. Programs developed based on data analysis will be more effective in bridging academic gaps between students from various economic backgrounds (Joyce & Cartwright, 2020). The following figure depicts key elements that support efficiency and inclusivity in education through a data-driven approach. The importance of a data-based approach in improving the quality of education is because data-based decisions allow educators to understand specific student needs, such as identifying learning areas that require special attention (Mandinach & Schildkamp, 2021). With this approach, curriculum decisions can be adjusted based on measurable facts and patterns, so that they are more accurate and relevant to student needs. In addition, the use of modern analytical tools accelerates the curriculum revision process, allowing educational institutions to quickly respond to new needs without significant time lag.

3.6 Analysis of Challenges and Solutions

MAN 4 Banyuwangi is an educational institution that applies a data-driven approach in educational strategic planning. The main challenges faced are low data literacy among educators and limited access to analytical tools. Apart from that, this institution is also faced with budget limitations for procuring supporting technology. However, through staff training and collaboration with technology providers, this school was able to integrate a data-driven approach in various aspects of strategic planning, such as curriculum management, evaluating student learning outcomes, and designing intervention programs. One of the first steps taken by MAN 4 Banyuwangi was to hold data literacy training for staff, involving teachers, school principals and school operators. This training focuses on the use of simple analytical software such as Microsoft Excel and cloud-based educational management platforms. Additionally, the school collaborates with local educational technology providers to provide access to data analysis platforms at an affordable cost. This step ensures that all educators and administrative staff have a basic understanding of how data can be used to support better decision making.

In an interview with the Head of MAN 4 Banyuwangi, he explained, "We see data not just as numbers, but as a guide to understanding student needs and evaluating the effectiveness of our programs. With this data, we can prioritize budgets for areas of greatest need, such as teacher training and technology facilities." The school operator added, "The digital platform we use allows us to monitor student learning outcomes in real-time. For example, we can immediately see which subjects have low average scores, so we can provide early guidance to students." These interviews underscore the importance of data in creating responsive, needs-based education strategies.

1) A Practical Approach to Planning

The first step in implementing a data-driven approach at MAN 4 Banyuwangi is collecting comprehensive data regarding student learning outcomes, attendance, and other aspects relevant to academic performance. This data is not only limited to test scores, but also includes information from online learning platforms, student satisfaction surveys, as well as reports on interactions between students and teachers. The collected data is then grouped and analyzed using simple analytical software which allows staff to identify trends and patterns in student performance, for example subjects that require more attention or students who are experiencing learning difficulties.

The analyzed data is used to design focused improvement policies. In planning meetings, the results of data analysis are used to determine program priorities, such as allocating resources for teacher training in subjects with low performance or developing remedial programs for students who have grades below average. This data allows policy makers at MAN 4 Banyuwangi to make more appropriate evidence-based decisions, reducing reliance on intuition or assumptions alone. This process also involves school committees and parents in evaluating the impact of policies and ensuring transparency. Implementing a data-driven approach also includes continuous monitoring and evaluation. Every semester, student learning outcomes are re-evaluated to see whether the policies implemented are effective. If necessary, improvement strategies are adjusted based on the results of the latest data evaluation. For example, if remedial interventions in a particular subject do not show significant results, then new approaches, such as the use of more interactive learning methods or the integration of additional technology, will be considered. This approach provides flexibility and allows rapid adaptation to evolving needs, ensuring that education policies remain relevant and effective in improving the quality of education. The principal explained:

> *"Since we started adopting a data-driven approach, our decisions in educational planning have become more focused. Previously, the decisions we made were based more on experience and intuition. However, by using data on student learning outcomes and program evaluations, we can see more clearly the areas that require special attention. For example, after we analyzed the semester exam results, we saw that many students had difficulty in Mathematics, so we decided to provide additional tutoring and revise the teaching methods in that subject. All these decisions are based on concrete and accountable data" (IN1).*

One of the big implications of implementing this data-driven approach is increasing efficiency in policy making. For example, policies that were previously based only on subjective observations are now being replaced by more objective and measurable decisions. As a result, not only is budget allocation more efficient, but also education programs are more targeted. Available data allows decision makers to see clearly which parts of the curriculum require changes or additions, as well as the extent to which the intervention programs implemented are successful. As a statement from the school committee explains:

"We strongly support the use of data in planning school policies. Previously, we felt that existing policies sometimes did not accommodate the needs of students as a whole. With data, we can more clearly see how big the impact of each policy implemented is. For example, after data showed a decline in performance in several subjects, we supported allocating a budget for teacher training programs and additional courses for students. This ensures that every policy we make is not only based on assumptions, but can be accounted for" (IN2).

From the observations made, the implementation of a data-driven approach at MAN 4 Banyuwangi shows that good data management can be a very powerful tool for improving the quality of education. The use of data allows for more responsive and evidence-based decisions, which in turn reduces reliance on conventional methods that are often subjective. In addition, this approach introduces transparency in the planning and evaluation process, ensuring that the policies taken can be accounted for by all parties, including students, teachers and parents. However, to optimize this implementation, a long-term commitment to the development of technological infrastructure and continuous training for educators and decision makers is needed, as well as full support from all stakeholders. In line with what the principal said:

"If it is data-based, we can show the reasons behind each policy to teachers and parents. All decisions are more transparent because they are supported by real evidence, not assumptions. The main challenges are of course technological infrastructure and teacher training. Not all teachers are familiar with this system, so we regularly hold training and seek budget support for technological devices" (IN1).

This approach has produced significant results. One of them is an increase in the average student score in Mathematics by 15% after the data-based guidance program was implemented (IN4). Additionally, collaboration with technology providers provides benefits in the form of software solutions that are accessible even on a limited budget. Existing practice shows that by integrating data into decision-making processes, educational institutions can not only overcome internal challenges, but also create learning environments that are more inclusive and adaptive to student needs.

2) Recommendations for Data-Driven Evaluation Systems to Improve the Effectiveness of Educational Strategic Planning

One of the main recommendations for increasing the effectiveness of educational strategic planning is the implementation of an integrated data-based learning management system (LMS). This system allows the collection, analysis and visualization of student learning outcomes data in real-time, including monitoring attendance, test scores, and student interactions with learning materials (Kurniawan et al., 2022). By using an LMS equipped with analytical tools, educational institutions can identify student performance trends and patterns more accurately. The main advantages of using a data-based LMS are more objective assessment accuracy, more effective monitoring of student progress, as well as time and resource efficiency in data collection and analysis (González García et al., 2020). In the future, an LMS equipped with artificial intelligence (AI) can provide deeper predictive analysis, such as projecting student potential or providing automatic recommendations regarding learning material that needs improvement. This system can also develop features to detect students' level of emotional involvement, which is important to support their social and emotional aspects in the learning process (Mehra et al., 2024).

The second recommendation is the implementation of an integrated dashboard in the education management system to support data-based decision making. Dashboards enable decision makers, such as school principals and education administrators, to monitor key indicators in education, such as test results, attendance rates, and program effectiveness easily and quickly. The main advantage of using dashboards is the ease of access and interpretation of data which makes it easier for decision makers to identify areas that require attention or policy adjustments (Sedrakyan et al., 2019). With data that is more transparent and easy to understand, decisions taken can be more responsive and on target. In addition, this dashboard can support better collaboration between teachers, principals and school committees, because all parties can see the same data in real-time. Potential developments in dashboards in the future include the integration of artificial intelligence that can provide predictive insights and higher customization features, so that decision makers can better customize the appearance and type of data according to specific needs (Lu, 2019). To effectively implement a data-based approach in education, a structured and integrated learning management system is needed. The following figure shows the main elements of such a system, covering the steps from data collection to applying artificial intelligence technology to support better decision making.

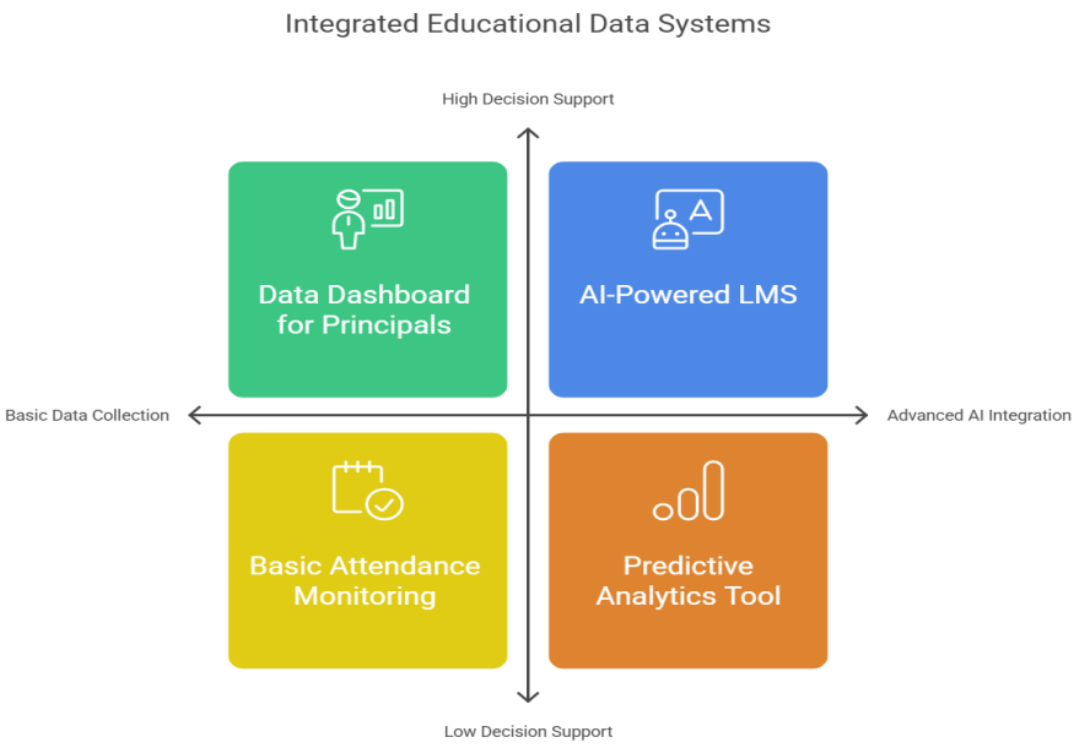

Figure 2. Components of a Data-Based Learning Management System

4. CONCLUSION

Implementing a data-driven approach in educational strategic planning faces a number of significant challenges, such as a lack of technological infrastructure, low data literacy capacity among educators, and problems related to data privacy and security. However, there is a huge opportunity to optimize the use of data to improve the quality of educational decisions. Through proper data analysis, educational institutions can identify student needs more accurately, design more targeted interventions, and improve existing policies to improve overall learning outcomes.

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