Chapter 15
Data Science in Education: Transforming Decision Making, Learning Processes, and Policy Making

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ABSTRACT

This chapter discusses how data science changes the education sector and how it can be used to improve management, decision-making, and learners' interactions. Since it focuses on extensive information, educational institutions can enhance the decision-making, control, and planning processes, ultimately resulting in optimized operations and addressing students' needs. The application of data science is evident in the learning process through the incorporation of adaptive technologies in an effort to offer unique learning experiences that enhance creativity and learner's performance. However, this integration of data science has some challenges in aspects of data protection, data transparency, and data consent. In the future, data science will continue to foster advances in adaptive learning, artificial intelligence, and policy, providing further chances to achieve fair and efficient educational structures. The presented chapter supports the call for the combination of ethical factors with the positive effects of data science for education to better impact learners and instructors.

1. INTRODUCTION

Data science has become widespread in practically every industry, and education is one of them (Sarker, 2021). In the modern world, where business decisions are increasingly based on data, the use of data science in education is changing the way decisions are made, learning processes are enhanced, and policies are set. This chapter focuses on how data science influences education these days, including the possibilities for improving decision-making, personalizing learning experiences, and the development of policies. Educational institutions increasingly leverage data science to gain insights into student performance, predict outcomes, and improve administrative efficiency (Namoun & Alshanqiti, 2020). By analyzing vast amounts of data, educators can make informed decisions that enhance teaching strategies,

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identify at-risk students, and tailor interventions to individual needs. This data-driven approach improves academic outcomes and fosters a more equitable and inclusive learning environment.

In addition, data science is also the centre of the current revolution in learning processes. Applying these concepts can also involve adopting machine learning algorithms to tailor the content and learning path to particular needs and learning styles (Bajaj & Sharma, 2018). The transition towards personalized learning is reshaping education systems' teaching and learning process structure from the traditional approach to a more student-centred one. Besides the impact on decision-making and learning, data science is also becoming relevant in policymaking in the education sector. Policymakers use data-driven insights to design and implement policies that address systemic challenges, improve educational equity, and effectively allocate resources. When there is efficient and effective utilization of data, decisions made concerning policy will be relevant to students' and educators' needs.

This chapter expounds on these themes in detail to explain how data science revolutionizes education. In this discussion, we will demonstrate how it is being applied to improve the education system to be more effective and fair through examples, case studies, and evaluation of the current software available for data science in education.

2. BACKGROUND

Incorporating data science into learning systems is one of the significant emerging innovations that can improve decision-making, learning, and policy development (Sarker, 2021). It is essential to trace the process of its occurrence and consider the context that has led to the present situation, where data is gradually taking the central spot. Traditionally, decision-making in education has been strongly based on observation, intuition, and experience; data available is meagre – most often limited to test results and, perhaps, the most fundamental, demographic data.

The arrival of big data and analytics helped to change the world entirely. With the increased use of ICT in teaching and learning, Learning Management Systems (LMS), online assessments, and e-learning platforms, a wealth of data is being produced daily (Villegas-Ch et al., 2020). This data includes student activity and interaction and their interaction patterns, learning progress, and even social-emotional indicators. The challenge, however, is finding meaning in all this information being produced. From the context of education, data science supplies the approaches and means that would empower the analysis and interpretation of educational data. From predicting student performance using analytics to natural language processing, it can give the student's sentiment or the content of learning resources.

The following are some of the factors which have contributed to the emergence of data science in education: