# Chapter 8
# Trusted Credentialing Systems Using Blockchain Technology for Learning Analytics Dashboards

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## ABSTRACT

*This chapter introduces a new framework for issuing and analyzing educational credentials using blockchain technology and learning analytics. The goal is to create a system where credentials are issued dynamically, transparently, and data-driven, and that guides the learning path in real time through self-adaptive dashboards. This model not only increases the validity of credentials, but also elevates the role of the learner from a passive recipient to an active owner of the learning path. The nexus of blockchain, smart contracts, and analytics opens up new horizons for assessment, digital trust, and personalized learning.*

## 1. INTRODUCTION

In this era where digital learning has become a key pillar of education on a global scale, the issue of trust in issued certificates and analytical data related to the learning path of learners has become one of the fundamental challenges for educational institutions, assessment organizations, and end users. In environments where education is provided virtually, blended, or based on open learning platforms (such as massive online courses), the validity and authenticity of certificates is no longer limited to the seal of an institution, but depends on technological infra-

DOI: 10.4018/979-8-3373-5117-9.ch008

structures and transparent systems that can guarantee validity in a data-driven and forgery-resistant manner. In such a context, the concept of "learning analytics" as a tool for understanding, predicting, and optimizing the learning process becomes doubly important, but at the same time, without a reliable infrastructure, its data-driven nature can lead to skepticism, manipulation, or doubt in the results (Movahed, Movahed, & Nozari, 2024).

Learning analytics refers to the process of collecting, processing, and interpreting educational data to improve teaching and learning processes. These include data such as learner engagement, course progress, content engagement, tests, feedback, and learning paths. However, one of the most important challenges for learning analytics in the digital age is the issue of data trust, the authenticity of learning records, and the lack of a transparent and immutable infrastructure for recording educational credentials (Nozari & Aliahmadi, 2023). Certificates issued manually or even digitally without traceable systems can be easily forged, creating severe vulnerabilities in the learning analytics ecosystem, especially when this data is involved in macro-decision making, recruitment, or organizational analytics.

In response to this growing need, blockchain technology has emerged as a new solution to create trust, transparency, and immutability in data-driven educational systems. By creating a distributed, untampered chain of data, blockchain enables certificates to be recorded in an encrypted, verified, and traceable form on a secure network (Rahmaty & Nozari, 2023). In addition, through smart contracts, the process of issuing, evaluating, expiring, or updating educational certificates can be managed automatically and without the need for human intervention. This transformation can upgrade the structure of issuing certificates from a centralized and static model to a dynamic and distributed model in which each certificate is a unique and verifiable digital asset (Nozari, Szmelter-Jarosz, & Ghahremani-Nahr, 2022).

One of the most important consequences of this transformation is the possibility of directly connecting these blockchain certificates to learning analytics dashboards. Such dashboards, which typically provide data on learning progress, successes, weaknesses, and behavioral patterns, can become a valid decision-making reference for users, educational institutions, employers, and assessment organizations when connected to valid and immutable certificates (Movahed, Movahed, & Nozari, 2024). In this structure, not only is the accuracy of the analyzed data guaranteed, but it also allows for a more comprehensive and personalized assessment of the learner's capabilities, as the certificates issued will be based on real-time and accurate analysis of his/her performance.

In addition, the ability to combine blockchain with other emerging technologies such as decentralized digital identity, educational NFTs, tokenized economy, and AI-based learning analytics, outlines new perspectives for the future of education and learning (Nozari, Fallah, Kazemipoor, & Najafi, 2021). In such a system, the