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INNOVATIVE TECHNOLOGIES IN ONLINE EDUCATION

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Abstract

The demand for online education is widespread in today's society. Educational institutions and governments actively promote the growth of the educational services market. Ensuring access to education for all individuals at any time is a key priority. In the digital economy's transformation of education, modern digital technologies play a crucial role in its development. The current standard for online learning is noteworthy as it enables the creation of personalized and adaptable training experiences through individualized and adaptive online courses. This article discusses the contemporary standards used in online learning. To meet adaptability requirements and tailor learning paths, it's essential to centralize all educational materials within an online library. The system determines the selection and sequence of educational components based on students' activities. Adopting an object-oriented approach to knowledge structuring allows for efficient organization of the education process, including the creation of individualized learning systems and adjustments to pedagogical methods. Utilizing modern information technology in online education enables timely responses to the demand for skilled professionals in the context of digitalization, breakthrough innovations, and their impact on businesses.

Keywords: Educational standard, electronic portfolio, individual trajectory, online course, repository of educational objects

1. Introduction

The potential for achieving sustainable development in modern human society through the widespread adoption of digital technology is evident in various economic processes and the evolving landscape of contemporary life. The rapid advancement of digital technology presents a primary challenge for education systems, urging them to create a modern digital environment and make active use of online courses hosted on various platforms (Larionov et al., 2021). This growth is closely linked to the increasing prevalence of digital devices, particularly since 2020.

Innovative methodological approaches in online education have been made feasible by the progress in information technology and a deeper understanding of the pedagogical principles that underpin successful distance learning. One such innovation involves the development of instructional courses centered around learning objects. These are small segments of e-learning materials designed for educational purposes (Komleva & Dneprovskaya, 2018). Simultaneously, platforms for creating electronic courses should facilitate the exchange and sharing of information about various education systems over the Internet (Vaganova et al., 2020). To meet this requirement, the establishment of educational institutions should incorporate open protocols and standards. While some of these standards have been updated, and new ones have emerged, they continue to be relevant and in demand (Idrisova et al., 2021).

In today's world, it is challenging to envision the realm of online education without international standards that ensure accessibility and mobility. For instance, the growth of the IT sector in online education has introduced new technologies and diverse methods for presenting information, leading to changes in standards. This evolution is driven by the need to adapt to the dynamic landscape of digital education.

2. Problem Statement

The rapid development of digital technologies and the growing demand for education have stimulated the widespread use of online learning courses. However, the lack of personalization and adaptability in existing online courses often results in a one-size-fits-all approach that does not meet the needs of individual learners. According to modern standards of online learning, it is recommended to create individualized adaptive online courses. According to modern standards of online learning, it is recommended to create individualized adaptive online courses. To address this issue, modern standards of online learning support the creation of personal adaptive online courses. A course for the development of such courses has to be prepared in an online library, which can be used to support the creation and design of customized learning trajectories that are ideal for each student.

3. Research Questions

The author's team in this study seeks answers to the main research questions: What are the current standards for developing personalized adaptive online courses? How can an online library of educational

resources contribute to the development of personalized adaptive online courses? What are the advantages of an object-oriented approach to knowledge structuring in creating personalized adaptive courses?

4. Purpose of the Study

A study aimed to explore the modern standards for creating personally adaptable online training and the role of an online library in supporting such programs. The purpose of this study is to investigate the modern standards for developing personalized adaptive online education, as well as the role of an online library of educational resources in supporting these activities. An object-oriented approach to knowledge structuring is used in creating personalized courses that meet the unique requirements of every learner. Moreover, the research aims to investigate how the integration of modern information technology will help improve the effectiveness of online education in meeting the requirements for qualified personnel in terms of digital economy. Based on the results of this study, it will be possible to develop effective, personalized approaches to online education that can better prepare individuals for success in the constantly changing digital landscape. The result of this study will provide insights into the development ofeffective and personal approaches to online education that can better prepare individuals for success in the constantly evolving digital world.

5. Research Methods

Most learning management systems (LMS) incorporate online education standards to some extent. However, many of these courses lack adaptability, meaning they do not adjust the training to individual levels of knowledge. To address this issue, modern online education standards like XAPI and cmi5, along with electronic databases of educational materials and Learning Record Stores (LRS), have been implemented (Nazarov et al., 2021).

The development of online learning standards has led to the emergence of XAPI and cmi5, which enable the creation of dynamic courses capable of collecting information about students' actions during training.

The SCORM standard, introduced in 1999 by the Advanced Distributed Learning initiative, has been a widely recognized standard for online education. It allows you to upload online courses to any LMS that supports the SCORM standard. However, one of its significant drawbacks is its limited capacity for in-depth analysis of student activity.

XAPI, also known as Tin Can, has improved upon the SCORM standard by significantly expanding its capabilities, allowing for more comprehensive tracking and recording of student learning activities. However, one challenge is that support for XAPI is primarily available in modern LMS systems.

CMI 5, released to the public in 2016, aims to address the shortcomings of both SCORM and XAPI. It not only solves compatibility issues with older LMS systems but also enables students to access courses even without an internet connection (Kasavina, 2019).

These online education standards simplify the process of using and transferring courses between different LMSs, achieving universality in course accessibility (Starichenko, 2020; Uvarov, 2018; Uvarov et al., 2019).

6. Findings

Modern online learning standards allow for the adaptation of course content to a student's level of preparedness by using materials that are relevant to their needs. However, this approach does have its drawbacks. Over time, training materials can become outdated, and there may be incomplete coverage of certain topics or activities, leading to insufficient information.

Each learning object can consist of one or more components, such as text, presentations, video files, or other types of documents with images or data sheets. These learning objects should be designed in a way that seamlessly integrates into electronic courses, following the principles of object-oriented programming where the user doesn't encounter issues due to the object's internal structure.

One of the primary advantages of working with learning objects is their reusability in developing training materials tailored to individual learning goals. An example of a course is a collection of learning items organized in a specific order. To be included in an online course, a learning object must align with the course's content and help students acquire the necessary competencies upon completion. These educational objects are stored in an online library for resource management and sharing.

Access to repository components is regulated by specialized security services, distinguishing between public and private access. This separation allows for the automation of content processing. Each material within an information environment should have its own set of data and parameters that guide decisions on how to handle it, whether it's deletion, relocation to other sections, or copying to a disconnected part of the portal. Depending on the information and educational environment of an educational institution, categorization, databases, change date, popularity, or moderator ratings can be used for organizing and managing these resources (Idrisova et al., 2020; Komleva et al., 2018). To identify and search for content, metadata is crucial. Once a training object is published in the open part of a repository, it should be associated with a set of requirements that guide decisions regarding its handling, whether it should be deleted, moved between sections, or copied to other parts of the portal. Based on this data, the object is automatically described with metadata, which is used for classifying, organizing, and facilitating the search for training objects. This metadata helps in categorizing, organizing, and searching for training objects and can also determine whether a learning object should move to the private part of the repository based on its accuracy, relevance, usefulness, and alignment with specific standards (Komleva et al., 2018). Metadata plays a critical role in enabling the reuse of learning objects. Precisely defining interfaces and formats facilitates effective interaction with these objects. Cataloging educational items using a data system allows for individual or combined distribution of metadata to enhance its volume. It also aids in organizing and storing information about educational products used in education. Moreover, the level of content granularity impacts the reuse of learning materials. This level, determined by component specifications, can range from simple images or pictures to complete courses or curricula. In general, the more detailed a training object, the more likely it is to be reused (Afanasev et al., 2018).

Learning Record Store (LRS) systems in online learning serve as repositories of capabilities and are essential for monitoring a student's learning activities. To gather information about an individual student's skills and learning outcomes, adaptability within the system is necessary. By responding promptly to the student's actions, the system can offer educational objects that best align with the student's learning goals. XAPI and cmi5 standards support the collection of student learning materials in the Learning Record Store (LRS), which can either be integrated into the Learning Management System (LMS) or exist as a standalone service. This database contains information about educational activities and is accessed by various systems that accept requests from the LMS to store, retrieve, and update information. The development of an LRS is a complex process that involves meeting specific operational requirements, and numerous companies are developing such systems using different technologies (Komleva & Dneprovskaya, 2018).

Blockchain technology has indeed brought significant changes to various sectors, not only in finance but also in business, healthcare, energy, and education. Blockchain is essentially a continuous chain of blocks, and it uses encryption algorithms to secure data from tampering by other network users.

One promising application of blockchain technology is the development of a new type of Learning Record Store (LRS) system known as Learning Record Blockchain (LRB) systems. These systems offer several advantages over standard implementations:

1) Security of Personal Information: LRB systems ensure the confidentiality and security of personal information through cryptography.

2) Decentralized Storage: Data in LRB systems is stored in a decentralized manner, reducing the risk of centralized data breaches.

3) Immutability: Added blocks in the blockchain are immutable, meaning once data is added, it cannot be altered or deleted.

In an online learning system, the XAPI standard can send data about each student's academic performance to the LRB system, where it is stored in an unencrypted format. However, the information is transmitted securely through digital communication using cryptographic algorithms. Encryption can also be applied to all student results, requiring verification to access information about a specific student.

The verification process is essential for students to create an account in the LRB system, where their training and education results will be stored. LRB systems can not only store information about student actions but also certificates, diplomas, and details about the educational organizations where the student was trained. This enables the creation of an electronic portfolio that showcases a student's educational achievements.

Access to a student's data is strictly controlled and requires their consent to ensure that confidential information remains protected. Blockchain is renowned for its high level of trust in stored data, achieved through cryptography, decentralization, and consensus algorithms. However, it's important to note that while blockchain ensures data integrity and trust, it doesn't provide protection against the issuance of fake certificates or other fraudulent methods, which can still be a concern in the education sector.

By implementing a single, cryptographically secure system, educational institutions can not only collect and store information about student activities, certificates, diplomas, and other educational

achievements securely but also provide recommendations on the content and sequence of educational objects to enhance individual students' competence monitoring. This data is stored in an unencrypted format, making it useful for monitoring and assessing students' competence levels.

7. Conclusion

An individualized personalization trajectory is a unique educational route tailored to an individual's specific features and requirements. The development of such a personalized trajectory involves several components:

1) Learning Record Blockchain (LRB): This database contains student information, including their learning history and achievements.

2) Closed Repository: This module investigates material hierarchies in the closed part of the repository, likely containing more sensitive or confidential data.

3) Export Analysis: There is a module for exporting analysis results to create a course based on the individual's learning history.

4) Quality Assessment: The system includes a module for assessing the quality of the constructed learning trajectory.

From the private part of the repository, learning objects are collected from an individual's records for later use in creating an online course. The inclusion of metadata within learning objects simplifies the process of finding the right objects.

When removing learning outcomes from the LRB system for similar courses, it becomes easier to select relevant learning materials from the repository. This helps optimize the course creation process by leveraging existing knowledge.

The development of an individual learning trajectory has received considerable attention, but its successful implementation requires a substantial and diverse database of educational materials. The ability to create a truly adaptable online course that caters to the needs of each individual hinges on the richness and variability of materials available in the database.

In today's information-driven society and education system, knowledge has become the primary driver of socio-economic success and competitive advantage. The management of knowledge and intellectual capital plays a crucial role in this context. Online education is in high demand and is actively promoted by educational institutions and governments. Personalizing the curriculum is a significant step in education, as it considers individual requirements and aspirations, fosters self-confidence, independence, and helps individuals achieve their goals.

One of the most important challenges in modern education is the development and implementation of software that can create personalized learning trajectories. In an era marked by the growing popularity of online courses, the development of programs for crafting individual learning paths to achieve specific goals is paramount. Modern online learning standards, which enable the creation of personally adaptable online training, play a crucial role in transforming education in the digital economy.

A well-organized repository of educational materials, compliant with modern standards for storage, management, and sharing, serves as an ideal platform for training highly qualified personnel for the digital economy (Petrova & Bondareva, 2019).

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