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Research Article

CONCEPTUAL FOUNDATIONS OF THE SMART EDUCATION CONCEPT

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Usarova Umida
Jizzakh Polytechnic Institute, Uzbekistan

ABSTRACT

The paper discusses the concept of «smart», the concept of smart education, its basic elements such as smart learning, smart university smart course. The analysis of the factors affecting the formation and development of the concept of smart education. There are three aspects of Smart Education: organizational, technological, and pedagogical.

KEYWORDS

Smart-education, e-learning, smart-Learning, smart-society.

INTRODUCTION

The rapid development of modern information technologies is gradually replacing “classical” e-learning with smart learning. The concept of smart learning is currently associated with several notions, many of which lack a singular interpretation. Concepts related to smart learning emerged several years ago, shaping the main trends in educational development and creating future forecasts for subsequent changes in the education system. At present, the popular "smart" component has merged with many other terms, forming concepts like “smart home,” “smart city,” and others that have become trendy. Various electronic systems and technologies used in education are referred to as "smart," although only some aspects of them meet the fundamentally new demands of smart learning or do not meet them at all. This situation arises because these demands do not always take a clear form, as the concept of smart learning itself is not sufficiently systematized. To clarify these requirements, it is necessary to systematize various perspectives and formulate the conceptual foundations of the smart learning concept dedicated to this research. Thus, the relevance of the research based on this article lies in the conceptual systematization of smart learning, which has not yet been carried out.

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The relevance of the research is defined by its objectives and tasks, as well as its theoretical and practical significance. The main goal of the research is to formulate a number of concepts that should be based on the smart learning concept. Accordingly, the tasks of the research include analyzing and defining the core concepts of smart learning and demonstrating the relationships between these concepts. From a theoretical perspective, this research is of great importance in laying the foundations for the theoretical conceptualization of smart learning. The practical significance of the research lies in the fact that the conceptual clarity of smart learning allows for the analysis of various systems and solutions in the field of education in accordance with the principles of smart learning. In the future, this research can be used to develop a comprehensive concept of smart learning and a new system of specifications and standards in this field.

Considering the state of research in the field of smart learning, it can be noted that many aspects have not been comprehensively studied. The term "smart learning" is significantly less common in foreign and local literature compared to the concept of "e-learning." Many studies provide specific examples of systems and solutions related to the field of smart learning. Various implementations of systems in the educational field that realize the smart learning paradigm have been mentioned [5].

Research Methodology. The system of concepts in the field of smart learning is generally a freely structured set of several perspectives considered in this area. The creation of the conceptual foundation aims to systematize several such perspectives. This systematization is necessary to create a general theory of smart learning. The formation of concepts is itself a methodological approach to conducting research in the field of smart learning. Concepts related to smart learning are systematized, and classifications are created. It is evident that creating classifications and defining concepts always reduces the objects and phenomena of a specific subject area to a certain schematic structure. To minimize this reduction, it is necessary to demonstrate that certain resources and technologies are more compatible in order to allow the inclusion of some event, technology, solution, or electronic educational resource into the field of smart learning.

The concept of smart structure encompasses ideas such as smart materials. It is noted that "smart materials" can only demonstrate the "smart" property through their interaction with the external environment. Smart materials are characterized by the ability to automatically recognize changes in the external environment and respond to them with designated actions.

The term "smart" refers to the properties that manifest during the interaction of a system or process with the environment and provide the following capabilities to the system in the process:

- Immediate response to changes in the external environment;
- Adaptation to changing conditions;
- Independent development and self-management;
- Effective achievement of outcomes, among others.

The concept of "smart" signifies the ability to communicate with the environment. This property has an independent meaning and can be applied in many

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categories such as higher education, education, society, and others. When this property was identified 40 years ago, the level of technological development did not allow for the consideration of many systems or processes being discussed. However, modern achievements in ICT enable the construction of very complex systems like smart cities.

The use of ICT in the economy enables companies to adapt to a constantly changing business environment, create mobile offices, and achieve new economic efficiencies through continuous communication with partners and consumers. The development of the ICT sector has reached a very important stage, allowing us to view the information space not only as a workplace and educational environment but also as an integral part of modern human living conditions.

Information technologies are being replaced by smart technologies, which are a set of features that allow for adaptation to user needs during the operation of various devices, such as smartphones, televisions, and others. Smart technologies are transitioning to a category of priorities that can define the next stage of society's information-based development.

However, simply using new technologies with the "smart" prefix or referring to their "smart" applications does not adequately define the essence of a new type of education. If we analyze various technological solutions considered smart for the education sector, we can list the following: smart boards, smart textbooks, smart projectors, and software for creating and distributing educational content with interactive and communicative characteristics. Several other technologies, primarily various types of social media and data mining technologies, are also used in the smart education segment.

When we consider any technology as a smart technology, systems like smart homes and smart TVs have become everyday terms. The literal translation of "smart" means "smart." However, in English, there are at least two common words that signify intelligence – namely, "clever" and "intelligent."

Of the three words that denote intelligence, "intelligent" carries the deepest meaning, indicating the ability to draw deep conclusions, as well as the inherent ability for rational thinking and behavior.

Here, the concept of "smart" signifies not only the capacity for intellectual activities but also external aesthetics, which is why the term "smart" is very well applied to various gadgets, expressing the idea of the relationship between aesthetics, ergonomics, and intellectual functions.

Intelligent systems automate regular actions for data retrieval and systematization but do not perform "spontaneous" intellectual functions that require human intelligence. They speed up human work, but the actions of any intelligent system do not necessarily require correct organizational decisions or meaningful intelligent arrangements, while also contributing to the creation of specialized organizational structures that have become the foundation of smart education.

The Concept of "Smart Education." The concept of "smart" is becoming the most commonly used term in modern social development and education as a property that allows an object or process to instantly adapt to changes in the environment. The new concept of smart education is based on achievements in information and communication technologies,

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enabling new economic and social efficiencies within the education system and facilitating new levels of effectiveness. The formation of the smart education concept indicates the emergence of regular conferences on the topics of smart education and smart learning [8].

Table 1: Changes in Generations X, Y, and Z

Birth Year	Generations	Distinct Characteristics	Key Factors
1963–1981	Generation X	Fundamental education, technical literacy, individualism, self-sufficiency, pragmatism, aspiration for career growth, informal views, nonconformity	Access to education, creation of high-skilled jobs, development of globalization, urbanization
1982–1991	Generation Y (Digital Immigrants)	Education is not sufficiently fundamental, but there is rapid development of new technologies in various fields; focus is on self-actualization rather than career growth; hedonism, liberal views, communication, awareness, cosmopolitanism, conformity, self-confidence	Development of technologies, the internet, globalization, crisis of political systems
1992–2001	Generation Z (Digital Natives)	"Natural" attitude towards technology, idealism, lack of criticism, virtualization	ICT is viewed as a natural part of the environment, regarded as a natural means of communication

Before examining the Central Concept of Smart Education, it is essential to define education. "Education is a purposeful process of teaching and upbringing that holds social significance and is carried out in the interests of the individual, family, society, and state, as well as a collection of acquired knowledge, skills, values, and experiences (see Figure 1). The internet is viewed as a connecting element between the main stakeholders in the activities and competencies of a certain volume and complexity, aimed at meeting the educational needs and interests of an individual's intellectual, spiritual, moral, creative, physical, and professional development" [3].

It is important to note that education is a process carried out in the interests of the individual, family, society, and state. Recent research indicates that the widespread use of ICT alters the distinctiveness of individuals, families, and society. Thus, developing education that meets the demands and needs of individuals and society is deemed necessary, taking into account changes in the economy, production technologies, and science (see Table 1).

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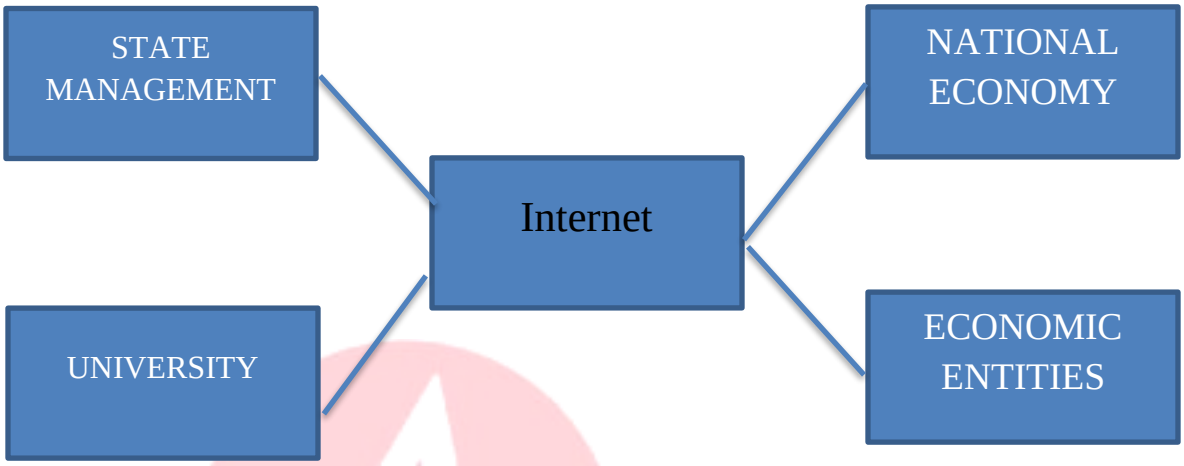

Figure 1. The Internet as a Connecting Element Among Key Stakeholders.

The necessary conditions for developing the smart education concept include:

1. Technological Factors: These involve providing new tools and technologies for teaching in an environment supported by modern information and telecommunications.

2. Social Factors: These encompass the society's need for new quality in educational services.

3. Economic Factors: It concludes that education has always contributed significantly to the development of the macroeconomy, and the relevant education system in the emerging information exchange defines the role of society in the development of an innovative economy.

The primary task facing smart education is to ensure the sustainable development of society and the economy in accordance with changing environments, providing programs that create new levels of efficiency in the economy and state management.

At the same time, smart education must meet the needs of individuals and families. The most valuable and in-demand aspect is the creative potential of individuals, which allows them to break free from professional stereotypes and find new solutions. Therefore, an intellectual economy is developing based on smart technologies.

E-learning addresses a number of issues related to adapting the education system and educational institutions to changes such as distance learning, individual education, and others [4].

Unlike e-learning, the smart education concept implies the existence of elements that ensure the entire system can quickly adapt to changing requirements,

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not only focusing on the learning process. Smart education encompasses teaching in a traditional sense while utilizing electronic technologies and developed approaches, without being limited to them. None of the previously applied approaches in education considered the immediate response of the learning process to changing conditions in the external environment.

The smart education concept encompasses the development of educational services, including personnel provision, administrative and legal management, material and technical resources, and pedagogical complex development.

To create a concept map, smart education is chosen as the central concept. The remaining concepts included in the concept are linked through a certain system of relationships with the central concept. The types of connections between the concepts may vary (see Figure 2).

Currently, smart education is becoming an integral part of modern society. When viewed as a special and new type of education, the main approaches can be divided into three categories:

- Technological: This presumes the primary difference lies in the technologies used.
- Organizational: This considers the organization of the educational process itself and determines which type of education we will choose in the future.
- Pedagogical: This focuses on the form of content presentation, the skills being developed, and the learning outcomes.

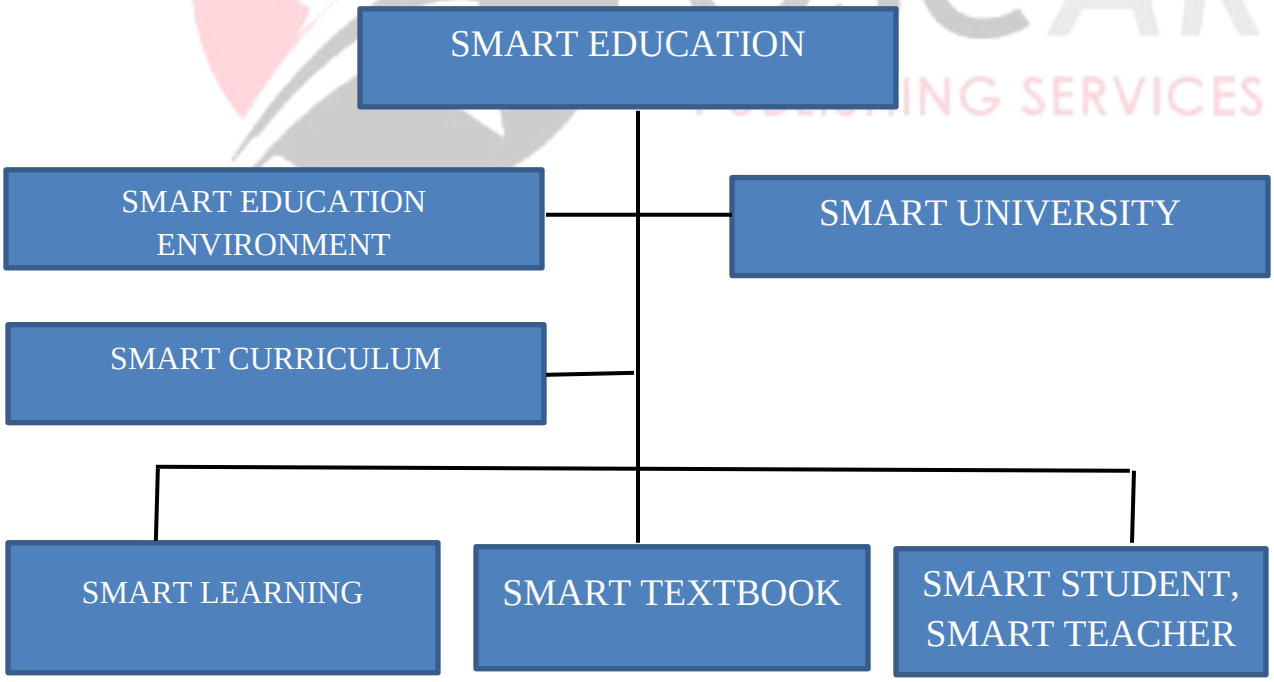

Figure 2. Elements of Smart Education.

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CONCLUSION

In conclusion, smart technologies have great potential to become a priority production technology that ensures the economic development of society. A distinctive feature of smart technologies is their ability to respond immediately to changes in the external environment. In a dynamically developing technological and information environment, the number of environmental factors and the speed of their changes are continuously increasing. Thus, "smart" education is becoming a demand that encompasses many processes and systems, including the management of education. The necessity to shape the smart education concept is evaluated alongside the development of ICT and changes in the educational process within society. The development of the smart education concept aligns with the emergence of a new technological paradigm worldwide. Many universities in various countries are placing significant emphasis on the opportunities arising in the educational process. It is evident that as the concept of smart education rapidly evolves, it is becoming increasingly urgent for specialists in this field to address numerous questions.

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