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PEDAGOGICAL AND EDUCATIONAL INNOVATION IN CROSS-MULTI-DIMENSIONAL EDUCATIONAL ENVIRONMENTS

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Abstract

This article presents a conceptual and organizational-methodological vision of the application of pedagogical and educational innovations in cross-multidimensional educational environments. The characteristics and content of the cross-multidimensional educational environment are considered as an integrative phenomenon, the result of interaction and intersection of several spaces and environments, as a new reality of innovative education. Using the example of the intersection and interaction of educational, innovative and digital environments, the corresponding effects are traced and analyzed, the vision of the features of pedagogical management and design in these conditions is presented. The features of the innovative process in the field of school education are highlighted, including the large-scale introduction of digital services and technologies, changes in the content, organizational forms of school education, approaches to the continuous professional development of teaching staff. A number of negative characteristics of the innovation process that reduce the effect of its implementation are considered: insufficient continuity and correlation of individual innovations, their scientific and methodological study and support. As part of the disclosure of the stated problems, examples are given of the use of pedagogical and educational innovations that are used in the framework of cross-multidimensional educational environments at the level of a secondary school as a key element of an innovative educational environment. The characteristic features of the pedagogical and educational innovations of recent years, actively developed and mastered by the teaching community and applied in the logic of the multimedia approach, are noted and revealed. Among them are science intensity, integrativity, variability, selectivity; qualitativeness.

Keywords: Cross-multidimensional educational environment, environment, innovation process, multi-media approach, pedagogical and educational innovation

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1. Introduction

The Russian economy, operating in conditions of global competition, is in dire need of innovation. A special role among the factors of competitiveness is played by education, which creates creativity, abilities and prepares for the challenges of the future (Atakhanov, 2018). According to Artykbaeva's (2017) education influences economic growth not directly (as a factor of production), but through the growth of the aggregate productivity of factors.

Modern education, being a key area for the reproduction of human capital, is being substantially rebuilt and modernized in accordance with innovative processes. The sources of innovation are not only foreign experience, technical and technological achievements, but also educational prognostics, best pedagogical practices, effective management decisions, including those related to the reorientation of the vectors of state educational policy.

The peculiarities of the innovation process in the field of school education are its short implementation cycle, its focus on obtaining the required effects relatively quickly. The analysis shows that, along with positive, the innovation process has a number of negative characteristics that reduce the effect of its implementation: insufficient continuity and correlation of individual innovations, their scientific and methodological study and support.

2. Problem Statement

A significant number of publications by representatives of pedagogical science and practice are devoted to the study of innovations in education, their importance for the qualitative renewal of educational activities and educational systems (Altrichter, 2017; Kurganskaya & Shaikemelev, 2020; Qi Yanming et al., 2009; Yang, 2018).

An important problem that reduces the sustainability and efficiency of the innovation process is the unwillingness of its initiators and participants to analyze and take into account the complexity of the educational environment (Guerra & Costa, 2018). It is no coincidence that Robskiy (2018) notes the multifactorial nature of the pedagogical process, the growth of its complexity, uncertainty.

Traditional approaches to the consideration of the structural and content characteristics of such an environment stop "working" when it acts as a cross-multidimensional phenomenon (Elistratova & Panasyuk, 2019). In order to accumulate innovative potential, the educational environment actively interacts, enters into numerous connections and relationships with cultural - historical, axiological, semantic, semiotic, event spaces; subject - spatial, digital, library - media and other media. Information and communication technologies make a special contribution to the intensification of innovation processes (DeWitt & Alias, 2020).

Numerous connections, interactions and intersections of the educational environment with other environments and spaces contribute to obtaining not only additional opportunities and effects, but also cause the complication of control mechanisms, the unpreparedness of participants in educational relations to function in new conditions. This provision is very clearly confirmed by the situation with blended learning, when teachers, students and parents had to act in new realities, master new technologies of educational interaction, and rebuild their individual educational and pedagogical strategies.

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The point is that the complete or partial translation of the educational process into a digital environment:

- made it impossible or difficult to use a number of pedagogical tools, forms, techniques and technologies related, based on the individual-typological, creative characteristics of the teacher;
- demanded greater independence in the educational process and responsibility for the achievement of educational results of students;
- provided a new package of services and tools for transmission, visualization of educational information (Lang, 1999);
- limited the possibilities of building emotional-value relationships between teachers and students, between students.

The situation with blended learning, in fact, the situation of a complicated binary environment, demonstrates the need to search for innovative answers to emerging challenges, research innovative modes of learning, including distance learning. There are opinions that the diversity of forms of education leads to a decrease in its quality (Juan Lu & Yang Shi, 2020), that excessive enthusiasm for innovative technologies in education can have its consequences as a fragmentation of the student's knowledge screen and a subjective feeling of emotional distress. If we consider more complex environments derived from the interaction and intersection of the educational environment with two, three, and sometimes a large number of spaces and environments, then they, in fact, generate a new reality in the form of an open ecosystem. Various applications of such ecosystems can be observed in higher education (Cai et al., 2020), including STEM-education ecosystems (Chavela Guerra & Smith, 2016).

In a cross-multidimensional educational environment (or, in other words, a multi-environment), along with poly-subjectness, there are:

- multivariate content, including of a supra-subject nature;
- virtual objects (including retro and prospective ones) and the possibilities of design and analytical work with them;
- multiple binary connections and relationships, including non-deterministic ones;
- fuzzy sets and situations of uncertainty.

3. Research Questions

While highly appreciating the scientific groundwork and achievements of practice in the study and interpretation of the application of innovations and the management of innovative processes in education, at the same time, we see unresolved issues in the methodological substantiation of an innovative strategy in cross-multidimensional educational environments, taking into account the factors of their complexity, uncertainty, and stochasticity. Scientific research and scientific and methodological substantiation are required by the design of innovative cross-multidimensional educational environments as open ecosystems, the search and application of tools and mechanisms to ensure the quality of their functioning and development.

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4. Purpose of the Study

In this article, we consider a cross-multidimensional educational environment as a complex socio-pedagogical system, as an open ecosystem and a multidimensional object of research.

Taking into account the methodological, general scientific positions of considering various aspects of pedagogical innovation and the concept of cross-multidimensional spaces and environments, the article provides a number of options for the elemental composition of a cross-multidimensional educational environment and the pedagogical and educational innovations used within them.

Due to the presence of a complicated educational environment in the management of the innovation process, tasks of a qualitative nature are solved, including the tasks of a qualimetric assessment of each of its stages. The development, design and use of appropriate qualimetric tools are required.

5. Research Methods

To achieve the goal of the study, we used research methods for the application of pedagogical and social innovations in the framework of cross-multidimensional educational environments. Methods of theoretical analysis and generalization, classification, as well as empirical methods (survey, observation) were chosen. Key attention in the article is paid to the conditions for the application of innovations, their characteristic features, quality assurance tools. In connection with these positions, the main methods used in the study are: system analysis, which makes it possible to determine the methodological foundations of the application of pedagogical and social innovations in cross-multidimensional educational environments; theoretical analysis of philosophical, psychological and pedagogical literature from the standpoint of the topic of the stated research; analysis and generalization of the pedagogical experience of innovative activity in school education; the use of questionnaires.

6. Findings

The cross-multidimensional educational environment presupposes and stimulates the selection and widespread use of pedagogical and educational innovations, which are designed to maintain its ecosystem balance and ensure the required level of efficiency. In principle, in any educational organization for its sustainable development, a high-quality innovative environment should be formed as a certain setting, supported by a set of organizational, methodological, psychological measures that ensure the introduction of innovations into wide professional practice (Schneider, 2014).

In innovation science, various models of innovation diffusion are presented, among which we note the innovation diffusion model, which combines the variables of cross-cultural diffusion (Warford, 2017).

In order to study the phenomenon of diffusion of pedagogical and educational innovations in school education, we conducted an Internet survey of representatives of the professional pedagogical community (teachers, school methodologists). Forty seven teachers took part in the survey. When answering, we used a three-level scale of the frequency of one or another source of diffusion of

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innovations (never - rarely - often) with the translation of answers into quantitative estimates (0-1-2 points). The survey data are presented in the table (see Table 1)

Table 1. Data from a survey of school teachers on the frequency of use of various sources and channels of dissemination of pedagogical and educational innovations

Survey questions	Weighted average value of the frequency of use of one or another channel of innovation dissemination (points)
Refresher courses	1.31
Social media groups, blogs	1.58
Professional periodicals and methodological publications	1.60
Informal professional communication	1.34
Webinars, online-conferences	1.74
Corporate training	0.78
Websites of educational organizations, regional educational development institutions, municipal information and methodological centers; personal sites of teachers	1.08
Professional skill contests, educational exhibitions	1.56
Activities according to the plan of the school methodological association, school methodological service (open lessons, master classes, etc.)	1.24
Print and electronic media, Internet publications	0.98
Educational platforms	0.89
Tutor support, mentoring	0.63
Other (internships; methodological trips)	0.41
Specialized mailings, announcements	0.32

As follows from Table 1, significant channels for the dissemination of pedagogical and educational innovations in school education, along with traditional ones (professional periodicals and methodological publications; refresher courses; informal professional communication; school methodological events; professional skill contests, educational exhibitions), are also a number of new channels based on the use of digital, information and communication technologies (webinars, online conferences; groups in social networks, blogs). According to the results of the study, it can also be stated that the potential of official and personal sites is far from being fully realized (in terms of diffusion of innovations); corporate training; tutor support and mentoring.

It can be concluded that it is necessary to improve the quality of management of innovative processes using new approaches to solving motivational, technological issues, taking into account the cross-multidimensional reality of the educational process.

The table below (see Table 2), based on the innovation diffusion model, survey data, analysis and systematization of cross-multidimensional educational environments used in school practice, presents examples of various innovations and defines the conditions for their effective application.

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Table 2. Examples of pedagogical and educational innovations used in cross-multidimensional educational environments at the school level

Composition of the components of a cross-multidimensional educational environment	Innovations in Use		Conditions for effective application of innovations
	Pedagogical	Educational	
Educational environment - cultural and historical space - digital environment	Time tape technology: virtual event practices	Implementation of integrated work programs of academic subjects and courses	Functioning of vertically oriented methodological associations of teachers; availability of sufficient cultural and educational resources
Educational environment - subject-spatial environment - digital environment	Workshop technology		A high level of independence and activity, the need for the development of students; a high level of professionalism of the teacher, willingness to act and manage the teamwork of students in conditions of uncertainty
Educational environment - cultural and historical space - axiological space	Project and research activities based on cultural and historical material	Implementation of the virtual school museum project	Availability of qualified personnel; The presence of appropriate value attitudes in the organizational culture of the school; effective educational system
Educational environment - subject-spatial environment - industrial and technological environment	Study trips; projects	Educational and production cluster;	High level of integration of educational and extracurricular activities; partnership with organizations of the real sector of production

The examples of the use of pedagogical and educational innovations presented in Table 2 above in the framework of cross-multidimensional educational environments show how much they expand, supplement and enrich the educational space, create a field for educational and creative interaction of participants in educational relations.

The characteristic features of such innovations are: science intensity; integrativity; variability; selectivity; qualitativeness.

Science intensity. This kind of innovation contains a significant component associated with scientific substantiation and prediction of the consequences, effects from their application.

Integrativity allows you to combine potentials and resources, effectively use them to solve innovative problems. In the spheres of production, business, there are numerous examples and effective

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models of coordinating activities of the subjects of innovative activities have been developed (Van de Meene et al., 2020).

Variability determines the variety of situations of application of this or that innovation. It is also associated with the possibility of their repeated use, subject to making adjustments adequate to the current educational and educational situation, as well as ensuring the sustainability of educational innovations (Guerra & Costa, 2018), including the situation of transformation of the digital environment of an educational organization (Aksyonov et al., 2021).

Selectivity. The selective nature of pedagogical and educational innovations is associated not only with the specificity of the conditions and tasks of their application, but also with educational-autonomous strategies for the professional behavior of teachers who select innovations that best meet their individual needs and preferences in a particular educational situation.

Qualitativeness implies that any innovation must first of all solve the problems of the quality of the educational process, the quality of educational results.

7. Conclusion

Thus, the above general vision of the application of pedagogical and educational innovations in cross-multidimensional educational environments allows us to draw a number of generalizing conclusions of a conceptual, methodological and applied methodological nature:

1. Integration of several spaces and environments within a cross-multidimensional educational environment significantly complicates the innovation process, makes additional requirements for its management.

2. Cross-multidimensional educational environment, as a situational ecosystem, creates conditions and stimulates the development, selection and implementation of a wide range of innovations.

3. Management of innovations in a cross-multidimensional educational environment involves:

- use of the achievements of pedagogical qualimetry, such special sections as expert, probabilistic-statistical, index, taxonomic qualimetry;

- development and application of a special managerial and methodological constructor, taking into account the specifics of multi-media education, allowing differentiated application of innovations and adapting them to solved didactic, educational and developmental tasks.

The issues stated in this article and the problems raised are of a debatable nature, suggest further elaboration. The expressed judgments, provisions, assessments are an invitation to a dialogue with the participation of scientists and practicing teachers.

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