

Use of Modern Pedagogical Design in the Training of Future Mathematics Teachers

Gulzhamal USSAINOVA

Korkyt Ata Kyzylorda University

Angyssyn SEITMURATOV

Korkyt Ata Kyzylorda University

Introduction

The use of digital technologies and interactive tools is an important aspect of modern pedagogical design. For example, online platforms, electronic textbooks, multimedia tools and virtual simulations allow future teachers to organize the learning process in a new way. These methods increase visualization and interactivity in teaching, and create conditions for easy acceptance of educational material by students.

In addition, modern pedagogical design not only provides subject knowledge to future teachers, but also allows them to learn innovative teaching methods. This increases their professional competence and raises the quality of education to a new level. As a result, future mathematics teachers can make the teaching process interesting, modern and effective. David Merrill, one of the famous ideologues of the use of information technologies in education, emphasized that “information is still not self-teaching” (“Information is not instruction”). This issue has been deeply discussed among pedagogical teams in the last ten years. According to Merrill, too often there is too much interest in the technological side of learning without focusing on the actual learning outcomes.

The effectiveness, efficiency, and usability of any e-learning resource depends on proper planning or design, known in professional parlance as “pedagogical design.”

Pedagogical design is a relatively young discipline. If we look at the meaning of the term Instructional Design, it consists of two words: Instruction and Design. The word “Instruction” in a general sense refers to a set of activities that are the basis for teaching. Design is a generic term meaning any “creative pattern”. The goal of instructional design is to plan and create opportunities for individual learners in a wide range of learning situations. This means that you need to plan an effective and systematic training project.

There are several phrases associated with the word “Instruction”. The most common are Instructional Science, Instructional Technology, Instructional Design. Pedagogical science provides theoretical implementation of teaching. Teaching technologies are an applied aspect of pedagogical science, based on pedagogical design.

The meaning of the phrase Instructional Design/pedagogical design is defined by the word Design itself. Design itself is considered a science and means a plan of action based on a specific goal. Pedagogical design is a teaching discipline that has entered science in the last forty years. It is a new profession based on the theory and content of psychology and the theory of multimedia environment. Many scientists have given their own definition of pedagogical design. Let's look at some of them:

- Pedagogical design means the use of systematic processes to define a learning problem, to feel what needs to be done to find a solution to this problem, and to implement these solutions (McArdle, 1991).

-pedagogical design is a science that fully describes the conditions for embedding, evaluating and distributing situations based on education (Richey, 1986).

-pedagogical design is an integrated process of examination of demand and learning goals and educational methods that satisfy this demand (Briggs, 1992).

Simply put, pedagogical design is a pedagogical tool that makes teaching and learning materials attractive, effective, and efficient. “A doctor designs human health, an architect designs space, and a pedagogic designer designs human knowledge” (van Patten, 1989) highlights the importance of pedagogical design.

Table 1. Definitions of the concept of “pedagogical design”

R. Gagne	Pedagogical design-learning is strictly based on pedagogical guidelines. The researcher assigns an important role to inform the learning process [Gagne, 1985].
R.Richey	Pedagogical design is the development of situations based on education, evaluation The science of law and conditions of implementation are fully described [Richey, 1986].
G. Reinmann	Pedagogical design is a system of procedures that includes the analysis of learning needs and goals, as well as the development of didactic tools to meet these needs [Reinmann et al., 2009].
McArdle	Pedagogical design - systematic processes for defining the teaching problem application means realizing what needs to be done to find a solution to this problem and implementing these solutions [McArdle, 2010].
W. Dick, L. Carey, J. O. Carey	Pedagogical design as a systematic form of teaching (not the implementation of instructions). Interrelation of learning context and content: learning environment, methods of delivering materials to students, learning activities and teaching instructions. [Dick et al., 2005].
A.Yu. Uvarov	Pedagogical design as a systematic (systematized) use of knowledge (principles) about effective educational work (learning and teaching) in the process of designing, developing, evaluating and using educational materials [Uvarov, 2003].
E.V. Tikhomirova	Pedagogical design is defined as a systematic way of creating a course of study based on content, style and order of narration, as well as on the way it is presented. [Tikhomirova, 2017].
M.V. Moiseeva, V.N. Podkovyrova, I.M. Radchenko	Researchers consider pedagogical design as a pedagogical technology, a targeted process of creating pedagogical systems, a tool that makes educational materials attractive and effective [Moiseeva, Podkovyrova, Radchenko, www].
S.A. Kurnosova	Pedagogical design is an information and educational space where students can fully reveal their capabilities and abilities and show the necessary personal qualities [Kurnosova, 2011].
A.G. Klepikova	Pedagogical design is a psychological-the entire process of developing electronic learning and methodological materials based on pedagogical, technological, ergonomic and methodological requirements, including analysis, design, development, application, evaluation of the effectiveness of these developments [Klepikova, 2009].

K.G. Krechetnikov	The main goal of pedagogical design is to provide the most rational video to the student. shows that it is the creation and maintenance of an environment in which psychologically favorable and pedagogically correct development of subjects is ensured based on communication, communication and coordination of various types of educational resources [Krechetnikov, 2019]
-------------------	---

The canonical definition of pedagogical design in foreign theory and practice is given by Merrill, Drake, Lacey and Pratt suggested: “pedagogical design is a scientific discipline that deals with the development of the most effective, rational and convenient teaching methods and systems that can be used in the field of professional pedagogical practice” (Merrill, Drake, Lacy, & Pratt, 1996). Depending on the positions of the researcher, the pedagogical design can be explained as follows:

a) process - a complex process of analyzing educational goals and characteristics of learners, designing the educational process, developing optimal pedagogical solutions that contribute to increasing the quality of education, and their subsequent application and evaluation; assessment of teaching materials, types of activities, information resources and their effectiveness of teaching and learning principles; Dick and Carey (2000), Gerlach and Ely (2000) presented in the form of such models.

b) the field of knowledge about effective strategies of training programs, i.e. psychology, ideas of late behaviorism, B. Bloom’s taxonomy, cybernetics, ergonomics, behavioral psychology, cognitive science, etc. b. a certain body of knowledge that includes (Johari, Chen, & Toh, 2005).

c) reality is a continuous and non-linear process, where planning and development takes place, taking into account the context and feedback, until the desired result is obtained as a result of a series of successive approximations (iterative or recursive approach) [8; 9]. As Willis points out, all stages are interwoven like walls in an impossible triangle (see Figure 1.) (Willis, 1995).



Figure 1. Penrose triangle

In Russian science, researchers interpret pedagogical design differently. A. Yu. Uvarov presents it as “systematic application of knowledge” in addition to the set of procedures for creating effective educational materials (Uvarov, & Yu, 2003). Klepikova considers pedagogical design as “a whole process of developing electronic learning and methodical materials based on psychological-pedagogical, technological, ergonomic and methodological requirements” (Klepikova, 2009).

Krasnyansky and Radchenko considers it a “pedagogical tool that makes teaching and learning materials attractive, effective, and efficient.” (Krasnyansky & Radchenko, 2006). Melnikov, within the framework of the fractal-resonance approach, Sinitsyn defines pedagogical design as “a multi-level information system in which each object affects a person and generates various information signals that form several connections that cause a certain response, that is, resonance.” The vast majority of Russian researchers tend to associate pedagogical design with electronic resources and distance learning and consider it as follows:

- a) field of pedagogical knowledge on designing a quality new educational environment;
- b) the process of creating an environment that corresponds to the didactic principles and logic of the educational process; c) the process of developing highly effective educational materials;
- d) study subject.

We visualize the principles of pedagogical design, the system of teaching theory of one of the founders of this direction of pedagogy, Robert Gagnier, in the form of the following diagram:

1. Determines what the audience needs. This is in the sense of informational needs and perception characteristics. All this should be related to the expected result.
2. Sets educational goals (or an individual course), reveals them through individual tasks.
3. Selects / compiles educational materials suitable for the audience and set goals, formalizes them for more effective presentation.
4. Develops a results evaluation system.

Learning conditions, on the one hand, should stimulate the development of the learner's cognitive, motivational and activity spheres, and on the other hand, should be pedagogically sound, attractive and ergonomic. According to modern Russian and foreign experts (Abyzova, et al.) pedagogical design can help.

Based on the research of the above-mentioned authors, pedagogical design can be accepted and defined as a new direction of theoretical and practical knowledge, and research within the framework of the requirements for pedagogical activities leads to the achievement of the necessary learning results. This process includes the analysis of learning needs and the development of learning environments and learning tools that are distinguished by their pedagogical effectiveness, methodological relevance and appropriateness.

Materials and Basic Methods

Pedagogical design cannot be accepted unilaterally. On the one hand, it is a process, on the other - a subject, and on the third - a reality or teaching model. Its capabilities are not sufficiently studied and mastered by teachers, so it cannot allow full use of its educational potential. Pedagogical design is aimed at the development of integrative, project, interdisciplinary thinking of the future teacher and creates an opportunity to adapt to the social and professional sphere.

According to Lowyck, "pedagogical design is the most rational presentation of the interrelationship and combination of various types of educational resources that ensure the psychologically comfortable and pedagogically sound development of educational subjects, by choosing the best tools, taking into account the content of the educational material and the target audience. creative idea, planning and design of specific activities of the teacher to achieve results" (Lowyck, 2023).

With its help, it is possible to form the readiness of future teachers to carry out educational activities, to expand the personal capabilities of participants in educational relations, to create attractive conditions for achieving educational results, and to create an effective individual direction of education.

Analyzing and researching the works of foreign and Russian scientists, considering the issues of pedagogical design, creating and further supporting learning events with the help of

information and communication, digital technologies, content and content of pedagogical design made it possible to determine the theoretical rules that determine its features. However, in these works, insufficient attention is paid to pedagogical design tools, and there is insufficient research on the effectiveness of their use. Gretsova understands pedagogical design tools as “pedagogical tools created based on the principles of pedagogical design, ethically verified and aesthetically designed” and distinguishes visual, audiovisual and subject-spatial tools (Gretsova, Nedogreeva, Yu. Pribylova., 2022). The author believes that “pedagogical tools are transformed by design tools in order to improve the reception, memory and assimilation of learning information, and as a result, pedagogical design tools appear.”

Based on this logic, we defined pedagogical design tools as pedagogical tools created using information and digital technologies based on the principles of pedagogical design. Pedagogical design tools include video, audio, multimedia - animation, games and other digital resources. As for the basic principles of pedagogical design, the concept of pedagogical design has only recently emerged. And it is coming to the region of Kazakhstan only now, but the main principles have already been formed. Based on them, the teacher can create a quality course plan:

Table 2. *Steps to create a plan*

Stimulate attention	It is known that attention always precedes the communication of meanings
Taking into account the socio-cultural environment	The learner cannot be considered as a closed system
Ability to set goals and objectives	Students should be shown in advance and periodically reminded why they are participating in this course.
Contextualization of theory	Dry academic facts on the Internet fade from memory faster than in a typical classroom. Therefore, the proposed new material should be based on existing knowledge and be related to life
Variety of content forms	If it was enough for everyone to read a textbook, there would be no need for pedagogical designers. A modern course should include not only text, but also infographics, interactive tasks, videos, and podcasts
Keeping active	Knowledge is well absorbed if it is acquired during active service. Even if the student is sitting in front of the monitor screen
Feedback	It should be constant and constant. It is more difficult to assess how the material is perceived by the audience from a distance. Therefore, it is necessary to provide conditions for current analysis of the effectiveness of the course

Another important principle that is invisible to the audience is the final assessment of effectiveness. Its criteria should be clear and transparent both to you and to your colleagues. [Lebow D., 2022]. Consider the theory and model of pedagogical design. First, let's define the difference between a theory and a model. A theory provides a common definition for observation and explanation, while a model is a mental representation (mental picture) that cannot be seen or directly experienced.

Instructional design theory provides clear and precise guidance on how to support people's learning and development. Learning is divided into the following types: cognitive/understanding, emotional, social, physical and spiritual. There are several theories and models of pedagogical design developed by different authors. Reigeluth identified three main characteristics that correspond to all the principles of pedagogical design theory:

- orientation/direction of design,
- definition of teaching method and learning situation,
- Pedagogical methods that can be classified into separate methods.

The design of the learning environment allows choosing the tools and methods that can make it accessible, friendly and understandable for every student. In this case, the peculiarity of the pedagogical design is that not only the structure of the future educational object is being developed, but also the direction of its research, including the individual direction, is being thought out and created. The design is intended to consider what kind of experience the learner will have when working with the interface of the created course, resource, content, how easily he can achieve his goal and implement it. So, what color the learning object will have, whether it will be convenient for the student with the proposed navigation, whether the text will be read, etc. these features allow you to consider the basic laws of UX/UI design. UX-design (User Experience) - user experience design, UI-design (User Interface) - interface design. The result is a ready-made electronic information and educational environment. As a pedagogical designer, a teacher should not only provide a methodological basis for the process of designing learning materials, but also implement a well-thought-out strategy to deal with the creation and creation of a real electronic educational environment.

It may be necessary to use elements of different models of pedagogical design. In this case, the teacher is required to develop a balanced approach to the development of educational materials and to be able to choose a model for the situation and not vice versa. Mastering pedagogical design tools demonstrated by the ability to electronically create quality learning objects, video objects of learning content, control-measurement materials allows the future teacher to choose suitable strategies for successful and attractive teaching, immersing the student in a more effective learning environment. Methodological support of pedagogical design strengthens professional motivation; ensures the solution of cognitive, professional-oriented and communicative-developmental tasks; equips with specific methods and work skills.

Design theories are important because they affect the preparation of observation and observation of the pedagogical process at the initial stages of design. It is about looking at outcomes (how learners change) and means (how to effect those changes). These theories are important because they provide guidance on three levels, namely:

- methods of teaching in different situations.
- teaching tools that provide many accessible teaching methods
- systems that ensure the possibility of creating quality teaching tools.

All models of pedagogical design have some common characteristics:

- definition and examination of the purpose of training,
- planning and design of methods to achieve educational goals,
- implementation of the planned action,
- review and evaluation of goals and strategies, etc.

When creating more complex programs, using traditional methods leads to loss of time and resources. As a result, the concept of pedagogical design emerged - a discipline used by development teams in the design, creation and evaluation of learning materials. It is based on

systematic application of knowledge about effective work, creation of learning process with “open architecture” and creation of this learning environment.

Pedagogical design technology is relatively simple. Learners’ needs must be understood, learning objectives must be determined, and knowledge and information must be delivered as quickly, accurately, and efficiently as possible. But this requires an understanding of all the prerequisites and a clear indication of the final properties of the product. This, in turn, requires planned and well-structured work, not just one person, but a well-chosen team of developers. In addition, the tasks of a pedagogical designer are wide and very difficult: Analysis of the needs of the target audience, its competencies and expected learning outcomes.

Determining the goals and objectives of the educational material.

Analysis and structuring of materials according to the purpose.

Selection of tools and methods of educational work.

Create course elements, style and visual design.

Development of tests and assignments, monitoring and information gathering tools.

Create a course using appropriate tools or assign tasks to team members to develop specific elements.

Uploading the course to the learning management system (Learning Management System, LMS).

Development of methods for evaluating the results and effectiveness of materials.

Development of solutions for further improvement of educational content.

Such a clear sequence ensures the qualitative growth of the educational material during the work and specifies the forms of its delivery.

The main task of the quality and planned development of the educational course is to provide the necessary information to the student as fully as possible. It’s not just the fact of giving it that matters - simple methods will do it well. The main task is to clearly accept the acquired knowledge and then apply it in practice. To achieve this, pedagogical design is based on 8 principles of the American psychologist Robert Gagne (Robert Mills Gagne), one of the founders of pedagogical design and the author of books on learning theory.

Attract students’ attention, encourage learning, arouse interest in topics and methods. Explain the goals and objectives of education. Here, “why?” and also a certain level of expectation from the process itself is formed.

Presentation of new material. The most difficult part of the process, because the selection of accepting any new material is characteristic of the human psyche. This means that it is necessary to provide in advance certain elements that will keep the student’s attention at important moments and allow him to convey the main idea of the project as accessible as possible. You can assemble the material using the iSpring Suite online course designer.

Accompanying teaching. It is mainly a guide for students and a semantic formation of the attitude to store the acquired material in long-term memory.

Experience. When new knowledge is still new, it needs to be tested in a real situation or confirmed by an appropriate experiment, which links theory and knowledge application in a clear and very effective way.

Feedback. It is impossible to evaluate the chosen teaching method and its effectiveness without a quick analysis. Therefore, even at the stage of course development, a flexible feedback system should be built as much as possible (here the results of the analysis of the target audience and its capabilities will be useful).

Assessment of learning progress and overall evaluation of the effectiveness of the training course. Moving to the practical plane, helping students to retain knowledge and use it correctly. Unlike the fifth principle, it is important to transfer practical skills to new situations that are not defined by the initial framework of the course. This allows to assess the depth of knowledge acquisition.

5 stages of development of educational materials

The process of designing instructional materials is similar in many parameters to disciplines such as programming, logistics, design, and applied psychology. It is a series of well-defined procedures, grouped into several stages and with specific tasks and methods of solving them. The well-established ADDIE (Analysis, Design, Development, Implementation, Evaluation) model, which divides the entire process into 5 stages, is often used during the development of the pedagogical design of the lesson.

Analysis

The most important stage of development: the main elements are distinguished, the needs of students and the tasks of the teacher are studied, measurable and understandable learning goals are formulated, the target audience and forms of working with it are evaluated, and a list of expected results is drawn up. To increase efficiency, this stage is divided into several stages, which allows for a clear formulation of tasks by gradually defining key points. Carefully thought-out objectives help determine the tools of the training course, the extent to which it will be filled with interactive elements, and the use of already existing materials and methods.

Here you can clearly determine the methods of evaluating the effectiveness of the learning process. Clear and accurate expected results allow for a clear formulation of the content and form of exercises, control questions, final tasks and forms of their delivery. Also, it allows you to compare the materials and methods of different authors with each other, choosing only the most suitable. This helps the student in the learning process, focuses on the meaning of the presented material and directs efforts to achieve the goals. After the analysis, the learning objectives can be clarified, which allows to start the development of learning materials.

Projecting

The most extensive and unpredictable phase of the project. At this time, it is necessary to take into account all the conclusions of the analysis stage, to develop a general plan and structure of the material, to design an exercise and evaluation scheme, a visual series, an interface and a general design, and sometimes to connect different components with each other. In fact, in the first stage, a certain prototype, a scenario of the entire project, is created, which defines the effect of each element on the defined tasks. It should also be divided into several steps, because trying to solve all the tasks without a planned approach will often fail.

Selection of educational tools. Here, it all starts with the analysis and research of the target audience, the expected conditions and forms of learning, the content of the materials and the

application of certain TEACHING methods to them. Then you can begin to specify the learning tasks in detail and the tools, as well as to determine the necessary knowledge and skills that will allow you to complete all the tasks of the course.

Create a script or outline of future training materials, design and approve the appearance of typical screens, develop working layouts of various fragments and expert evaluation of each element. The most important thing at this stage is to clarify the technical requirements for the future course. Preparing trial version of educational materials, selecting or creating illustrations, animation effects and interactive elements, audio or video sequences. At this stage, it is possible to identify personal shortcomings, quickly correct them and make prompt changes to the work scenario.

Evaluation and processing of materials in terms of full compliance with tasks. Here, third-party expertise and all kinds of modeling are most effective: from a pedagogical experiment with the training of a test group to brainstorming to identify the strengths and weaknesses of a developed product. Support and development of educational materials. In this step, you can focus on solving small technical problems that already arise during the development and testing process, supplementing and expanding successful modules, defining logical connections, preparing the release of new versions or creating new training courses using existing developments.

Development

The main “technical” stage of any project, all created materials take their place in the general structure, are supplemented with new elements and logical connections, are corrected and “rubbed” with each other. Here, based on the goals of the entire project and the characteristics of the audience, you can very precisely adjust the choice of methods of presentation of material, tone of presentation, style, form of presentation of individual elements.

At this stage, general content elements are finalized, the most effective exercises are selected, feedback forms and material mastery checks (tasks and control methods) are created, connections between the interface and individual topics or questions (transition rules) are improved. Particular attention should be paid to clearly defining the means for summarizing the examination or practical work, which will allow the evaluation of the effectiveness of the entire course. The development stage is a very careful, but creative work, which requires maximum flexibility from the creators while fulfilling the strict initial settings.

Implementation

At this stage, the course is uploaded to the appropriate Learning Management System (LMS) or resource where students can access the materials. Despite the fact that the importance of this period seems to be small, it allows to evaluate the practical application of educational materials. It is here that you can check whether a lesson or course is suitable for your chosen audience, get first-hand information about its implementation and effectiveness, connect with the community of learners, find guides, accompanying documents and more. provides additional material for preparation.

Assessment

After collecting the first information about the implementation of the training course, it is necessary to evaluate its effectiveness. It is necessary to connect the tasks set at the analysis stage with the results obtained in practice. The learning materials themselves, the achievement of learning goals, the appropriateness of certain types of tasks and their relevance to the overall task are evaluated. Based on this, the course as a whole or individual lessons are developed, the results of the study work are evaluated, and ways of correcting the study materials are determined. This phase should end with a review of the requirements for individual units and an updated version

of the entire course. Now let's explain the typical model "ADDIE" of this pedagogical design (according to Figure 2).

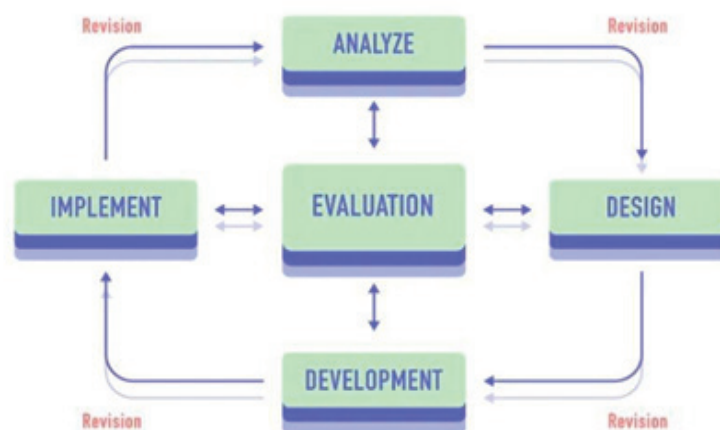


Figure 2. “ADDIE” models

- Analysis– learners and the learning environment of learning issues;
- Design- drawing up a plan for the creation of pedagogical activities;
- Development - creation of pedagogical activities;
- Implementation - embedding design;
- Evaluation– evaluation of students and the effectiveness of the given project (Uvarov, 2003).

“ADDIE” phases work according to the principle of a closed chain and they must always be repeated to improve the performance of the process. It is possible to reduce the phase of pedagogical design purposefully, but it is implemented only after the examination of the needs of learners. The “ADDIE” process is especially important in distance learning technology, where there is little, if any, personal interaction between the teacher and the student.

Preparation of modern educational materials, i.e. electronic textbooks, is a collective work. Specialists of various fields, for example, planners, artists, technicians, programmers, etc., work hand in hand. If one person prepares the educational material, he will be responsible for planning, drawing, and programming. However, there is almost no such comprehensive specialist. Currently, e-textbooks are prepared by specialists of each field as a team. The artist creates illustrations and decorates the program, screenwriters (professionals) write the script text and prepare tasks for model creation, cameraman shoots video clips, programmers create computer models and assemble the final product. All of these are combined by a pedagogical designer (or technician) who is responsible for the meaning and pedagogical effectiveness of the work.

In general, it can be concluded that only a methodologically competent teacher is capable of performing the function of a pedagogical designer, because the software teaching tool pedagogical design includes psychological and pedagogical principles of teaching.

Table 3. *Important characteristics of pedagogical design*

Scientific foundations of pedagogical design	based on pedagogical and cognitive-psychological point of view; based on the concept of education and training of a competent specialist for the future profession; focused not on description, but on form (gestalt) and the goal of perception, which is important and necessary for practical work
Purpose of pedagogical design	aimed at empirically substantiating theoretical rules and proving the effectiveness of selected teaching strategies and methods
Pedagogical design methods	pedagogical design methods are probabilistic rather than deterministic, that is, they do not require causality; represents more or less possible relationships between “if” and “then” - components in design based on empirical data
Use of pedagogical design	interrelated with the use of information and communication technologies for educational and methodological purposes; can be considered as didactic principles and thus used in planning pedagogical situations

Pedagogical conditions for the formation of pedagogical design in the professional training system of future mathematics teachers in the context of digital education are determined, methodology is developed, experimental results, conclusions and recommendations are made.

Conclusion

The use of modern pedagogical design in the training of future mathematics teachers is one of the most important aspects of the modern education system. Pedagogical design is a comprehensive approach aimed at developing the skills necessary for teachers, allowing for effective organization and management of the educational process. It aims to adapt curricula, teaching methods and technologies to the individual needs and abilities of students. This is especially important when teaching a complex and abstract subject like mathematics.

The use of modern pedagogical design provides several advantages. First, it helps teachers structure the subject and effectively convey the material to students. The use of interactive tools, visualization and multimedia elements during teaching increases students' interest in the subject and contributes to deepening their knowledge. Secondly, pedagogical design takes into account the individual characteristics of students and creates conditions for organizing the learning process in a way that is convenient and accessible for each student.

In addition, modern pedagogical design is aimed at developing the professional competence of teachers. It is important for teachers to learn new technologies, innovative teaching methods. This will help future teachers show creativity and flexibility in explaining the subject and meet the requirements of modern education. Another important aspect of pedagogical design is the possibility of improving the quality of teaching through continuous evaluation and feedback.

In conclusion, the use of modern pedagogical design in the training of future mathematics teachers not only organizes the educational process qualitatively, but also creates conditions for the professional development of teachers, students' deep learning of the subject, and the increase of educational efficiency. This approach opens the way for future teachers to bring innovation and creativity to the field of education.

References

- Azuma, R., Bailiot, Y., Behringer, R., Feiner, S., Julier, S., & MacIntyre, B. (2001). Recent advances in augmented reality. *Computer Graphics and Applications, IEEE*, 21(6), 34–47. <https://doi.org/10.1109/38.963459>
- Caudell, T. P., & Mizell, D. W. (1992). Augmented reality: An application of heads-up display technology to manual manufacturing processes. *System Sciences, Proceedings of the Twenty-Fifth Hawaii International Conference on*, 2, 659–669. IEEE. <https://doi.org/10.1109/HICSS.1992.183632>
- Dick, W., Carey, L., & Carey, J. O. (2005). *The Systematic Design of Instruction*. 5th ed. Boston, MA: 448 p.
- Gagne, R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of Instructional Design* (4th ed.). Orlando: Harcourt Brace Jovanovich.
- Gerlach, V. S., & Ely, D. P. (1980). *Teaching and Media: A Systematic Approach* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall, Inc. 420 p.
- Gretsova, A. P., Nedogreeva, N. G., & Pribilova, Y. V. (n.d.). Understanding the concept of “instructional design” through the history of its development. *Pandia.ru*. <https://pandia.ru/text/77/283/90820.php> (Accessed: August 21, 2022)
- Janin, A. L., Mizell, D. W., & Caudell, T. P. (1993). Calibration of head-mounted displays for augmented reality applications. *Virtual Reality Annual International Symposium, IEEE*, 246–255. <https://doi.org/10.1109/VR.1993.380804>
- Johari, A., Chen, C., & Toh, S. (2005). A feasible constructivist instructional development model for virtual reality (VR)-based learning environments: Its efficacy in the novice car driver instruction of Malaysia. *Educational Technology Research and Development*, 53(1), 111-123.
- Klepikova, A. G. (2009). *Preparing a future teacher for the use of pedagogical design in professional activities: Abstract* (Doctoral dissertation, Belgorod). 24 p.
- Lebow, D. G. (1993). Constructivist values for instructional systems design: Five principles toward a new mindset. *Educational Technology Research & Development*, 41(3), 4-16.
- Lowyck, J. (2014). Handbook of research on educational communications and technology: Fourth edition (pp. 3–20). <https://www.scopus.com/authid/detail.uri?authorId=6507081786> (Accessed: December 1, 2023).
- McArdle, J. J., & Cohen, S. A. (1991). Quantitative topics in research on aging. *Experimental aging research*, 17(1), 3–5.
- Merrill, M.D., Drake, L., Lacy, M.J. and Pratt, J. (1996). Reclaiming Instructional Design. *Educational Technology*, 36, 5-7.
- Reigeluth, C. M. (Ed.). (1999). *Instructional-design Theories and Models: A New Paradigm of Instructional Theory* (Vol. II). Routledge. 728 p.
- Richey, R. (1986). *Theoretical and conceptual bases of instructional design*. New York: Nichols

Publishing. 227 p.

- Sin, A. K., & Zaman, H. B. (2010). Live Solar System (LSS): Evaluation of an augmented reality book-based educational tool. In *Information Technology (ITSim), IEEE International Symposium* (Vol. 1, pp. 1–6). IEEE. <https://doi.org/10.1109/ITSIM.2010.5560493>
- Smith, P. L., & Ragan, T. J. (1999). *Instructional Design*. New York: John Wiley & Sons Inc.
- Sutherland, I. (1968). A head-mounted three-dimensional display. *Proceedings of Fall Joint Computer Conference*, 757–764.
- Uvarov, A. Y. (2003). Pedagogical design. *Informatics*, 3, 1–32.
- Willis, J.W. (1995). A Recursive, Reflective Instructional Design Model Based on Constructivist-Interpretivist Theory. *Educational Technology archive*, 35, 5-23.

About the Authors

Gulzhamal Ussainova is studying at Korkyt Ata Kyzylorda University.

E-mail: gulzhamal.u@mail.ru, **ORCID:** 0000-0003-2620-9745

Angyssyn Seitmuratov is studying at Korkyt Ata Kyzylorda University.

Associate professor of the Department of “Physics and Mathematics”, Korkyt Ata Kyzylorda University, Kyzylorda, Kazakhstan

E-mail: angisin_@mail.ru, **ORCID:** 0000-0002-9622-9584

Similarity Index

The similarity index obtained from the plagiarism software for this book chapter is 2%

To Cite This Chapter:

Ussainova, G. & Seitmuratov, A.(2024). Use of modern pedagogical design in the training of future mathematics teachers. In S.A. Kiray & O. Cardak (Eds.), *Current Studies in Social Sciences 2024* (pp.114-126). ISRES Publishing.