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CONTENT AND TECHNOLOGY OF PREPARING STUDENTS FOR PEDAGOGICAL ACTIVITY BASED ON THE PRINCIPLE OF VISUAL AIDS

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Scientific supervisor: P.f.f.d **Ochilova Hursanoy Mahmudovna**
Researcher: Master student of CSPU, **Shahrizoda Mirtoshboyeva**

Abstract: *This article investigates the content and technology of preparing students for pedagogical activity based on the principle of visual aids. The principle of visibility has been recognized as a foundational element of didactics since the work of Jan Amos Comenius in the seventeenth century, yet its application in modern teacher education requires substantial reconceptualization in light of digital technologies, cognitive science, and contemporary pedagogical theory. The study addresses the gap between the theoretical acknowledgement of visibility as an important didactic principle and the practical preparation of future teachers to apply it effectively in their professional work. The purpose of the article is to define the content of professional preparation related to the principle of visual aids and to propose a technology for its practical application in teacher training programmes. The research draws on both international scholarly literature in educational psychology, multimedia learning, and instructional design and the works of Uzbek scholars who have studied didactic principles in the context of national pedagogical practice. The article distinguishes between three generations of the visibility principle - object-based, image-based, and interactive-digital - and argues that modern teacher preparation must address all three. The main result is a four-stage pedagogical technology that guides students from theoretical understanding of the visibility principle through observation and analysis of visual teaching practices to independent design and reflective evaluation of visually supported lessons. The study concludes that the effective application of the visibility principle in contemporary education requires not only technical skills in using visual tools but also a deep understanding of the cognitive mechanisms through which visual information supports learning, and that teacher education programmes must develop both dimensions systematically.*

Keywords*: principle of visual aids, visibility in education, teacher preparation, pedagogical technology, multimedia learning, instructional design, didactic principles, visual literacy, cognitive load theory*

СОДЕРЖАНИЕ И ТЕХНОЛОГИЯ ПОДГОТОВКИ СТУДЕНТОВ К ПЕДАГОГИЧЕСКОЙ ДЕЯТЕЛЬНОСТИ НА ОСНОВЕ ПРИНЦИПА НАГЛЯДНОСТИ

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Аннотация: *В статье исследуются содержание и технология подготовки студентов к педагогической деятельности на основе принципа наглядности. Принцип наглядности признаётся фундаментальным элементом дидактики со времён Яна Амоса Коменского, однако его применение в современном педагогическом образовании требует существенного переосмысления в свете цифровых технологий, когнитивной науки и современной педагогической теории. Исследование обращается к разрыву между теоретическим признанием наглядности как важного дидактического принципа и практической подготовкой будущих учителей к его эффективному применению в профессиональной деятельности. Цель статьи - определить содержание профессиональной подготовки, связанной с принципом наглядности, и предложить технологию его практического применения в программах педагогического образования. Исследование опирается как на международную научную литературу по педагогической психологии, мультимедийному обучению и инструкционному дизайну, так и на труды узбекских учёных, изучавших дидактические принципы в контексте национальной педагогической практики. В статье выделяются три поколения принципа наглядности - предметная, образная и интерактивно-цифровая - и обосновывается, что современная подготовка учителей должна охватывать все три. Основным результатом является четырёхэтапная педагогическая технология, направляющая студентов от теоретического понимания принципа наглядности через наблюдение и анализ практик визуального обучения к самостоятельному проектированию и рефлексивной оценке уроков с использованием наглядности. Исследование заключает, что эффективное применение принципа наглядности в современном образовании требует не только технических навыков использования визуальных средств, но и глубокого понимания когнитивных механизмов, посредством которых визуальная информация поддерживает обучение, и что программы педагогического образования должны систематически развивать оба этих измерения.*

Ключевые слова: *принцип наглядности, наглядность в образовании, подготовка учителей, педагогическая технология, мультимедийное обучение, инструкционный дизайн, дидактические принципы, визуальная грамотность, теория когнитивной нагрузки*

KO'RGAZMALILIK TAMOYILLARI ASOSIDA TALABALARNI PEDAGOGIK FAOLIYATGA TAYYORLASH MAZMUNI VA UNI AMALIYOTDA QO'LLASH TEXNOLOGIYASI

Annotatsiya: *Ushbu maqolada ko'rgazmalilik tamoyillari asosida talabalarni pedagogik faoliyatga tayyorlash mazmuni va uni amaliyotda qo'llash texnologiyasi*

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o'rganiladi. Ko'rgazmalilik tamoyili XVII asrda Yan Amos Komenskiy asarlaridan boshlab didaktikaning asosiy elementi sifatida tan olingan, biroq uni zamonaviy pedagogika ta'limida qo'llash raqamli texnologiyalar, kognitiv fan va zamonaviy pedagogik nazariya nuqtai nazaridan jiddiy qayta kontseptsiyalashtirishni talab qiladi. Tadqiqot ko'rgazmalilikni muhim didaktik tamoyil sifatida nazariy tan olish va bo'lajak o'qituvchilarni uni kasbiy faoliyatlarida samarali qo'llashga amaliy tayyorlash o'rtasidagi tafovutga murojaat qiladi. Maqolaning maqsadi ko'rgazmalilik tamoyiliga oid kasbiy tayyorgarlik mazmunini belgilash va uni pedagogika ta'limi dasturlarida amaliy qo'llash texnologiyasini taklif qilishdan iborat. Tadqiqot pedagogik psixologiya, multimedia ta'lim va instruktsion dizayn bo'yicha xalqaro ilmiy adabiyotlarga, shuningdek milliy pedagogik amaliyot kontekstida didaktik tamoyillarni o'rgangan o'zbek olimlarining asarlariga tayanadi. Maqolada ko'rgazmalilik tamoyilining uchta avlodi - predmetli, tasviriy va interaktiv-raqamli - farqlanadi hamda zamonaviy o'qituvchilarni tayyorlash uchalasini ham qamrab olishi kerakligi asoslanadi. Asosiy natija to'rt bosqichli pedagogik texnologiya bo'lib, u talabalarni ko'rgazmalilik tamoyilini nazariy tushunishdan vizual o'qitish amaliyotlarini kuzatish va tahlil qilish orqali ko'rgazmalilikdan foydalangan darslarni mustaqil loyihalash va refleksiv baholashga yo'naltiradi.

Kalit so'zlar: *ko'rgazmalilik tamoyili, ta'limda ko'rgazmalilik, o'qituvchilarni tayyorlash, pedagogik texnologiya, multimedia ta'lim, instruktsion dizayn, didaktik tamoyillar, vizual savodxonlik, kognitiv yuk nazariyasi*

INTRODUCTION

The principle of visual aids - known in classical didactics as the principle of visibility or the principle of intuition - holds that learning is more effective when abstract concepts are supported by concrete sensory experience. This principle has been central to pedagogical thought for nearly four centuries. Comenius, in his Didactica Magna (1657), argued that the foundation of all learning is sensory perception: nothing should be taught by verbal means alone if it can be presented to the senses. He insisted that the teacher should always begin with objects, images, and demonstrations before moving to verbal explanations and abstract generalizations. Pestalozzi developed this idea further in the late eighteenth century, proposing that education should move from concrete observation to abstract thought through a carefully structured sequence. Ushinskiy, whose work deeply influenced pedagogical traditions in Central Asia, argued that visibility is not merely a teaching aid but a fundamental condition of understanding, because the human mind develops from sensory impressions to conceptual knowledge.

Despite this long historical tradition, the practical application of the visibility principle in modern education faces significant challenges. The first challenge is technological: the range of visual tools available to teachers has expanded

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dramatically, from physical objects and printed materials to projected images, video, interactive simulations, virtual reality, and augmented reality. A future teacher who is prepared only for traditional visual aids - posters, models, diagrams on the blackboard - is not ready for the full range of contemporary visual pedagogy. The second challenge is cognitive: research in educational psychology has shown that visual information does not automatically improve learning. It can also cause cognitive overload, distraction, and misconceptions if used without understanding the principles of visual perception and information processing. The third challenge is pedagogical: the effective use of visual aids requires not only technical skill but also the ability to select, sequence, and integrate visual materials into a coherent lesson design that serves specific learning objectives.

Uzbek pedagogical scholarship has addressed the role of visual aids in education from several angles. Ziyomuhammadov (2006) provided a comprehensive treatment of pedagogical technologies in the context of Uzbek higher education, including the use of visual methods and means. Yo'ldoshev (2004) examined the modernization of teaching methods and emphasized the need for systematic integration of visual tools into the methodological preparation of future teachers. Mavlonova, Tursunov, and Holiqberdiyev (2001) discussed the didactic principles of the educational process in Uzbekistan, including a detailed analysis of the visibility principle and its relationship with other didactic principles. Ishmuhamedov, Abduqodirov, and Pardayev (2008) developed innovative pedagogical technologies for Uzbek educational contexts, with significant attention to interactive methods that rely on visual and multimedia support. These works provide an important foundation, but the specific question of how to prepare future teachers to apply the visibility principle as a professional competence - not merely as a general methodological recommendation - requires further theoretical development.

International research on multimedia learning provides critical insights for this topic. Mayer (2009) formulated the cognitive theory of multimedia learning, which proposes that people learn more deeply from words and pictures together than from words alone, provided that the multimedia materials are designed according to specific principles. These principles include the coherence principle (excluding extraneous material), the signalling principle (highlighting essential information), the spatial contiguity principle (placing corresponding words and pictures near each other), and the temporal contiguity principle (presenting corresponding words and pictures simultaneously). Sweller (2011) developed cognitive load theory, which explains why poorly designed visual materials can impair rather than enhance learning: when the visual information

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exceeds the processing capacity of working memory, or when the relationship between visual and verbal information is unclear, cognitive overload occurs and learning efficiency decreases.

Clark and Lyons (2010) provided a comprehensive framework for visual design in instructional settings, distinguishing between decorative visuals (which add aesthetic appeal but no instructional value), representational visuals (which depict objects or processes), organizational visuals (which show relationships among ideas), and transformational visuals (which illustrate changes over time). This classification is directly relevant for teacher preparation, because it helps future teachers understand that not all visual materials serve the same function and that the selection of visual aids should be guided by the learning objective rather than by visual attractiveness alone.

The research problem of this article can be formulated as follows: what should be the content and technological structure of the preparation of future teachers for effective application of the visibility principle in their professional pedagogical activity? The purpose of the study is to define the content components of this preparation and to propose a pedagogical technology that organizes the process of preparation into a coherent, stage-based system. The object of the study is the process of preparing students of pedagogical universities for professional pedagogical activity. The subject is the content and technology of preparing students to apply the visibility principle effectively in teaching.

The hypothesis of the article is that the preparation of future teachers for applying the visibility principle becomes effective when it includes four interconnected components: theoretical knowledge of the cognitive and didactic foundations of visual learning, analytical skills for evaluating existing visual teaching practices, design skills for creating and integrating visual materials into lesson plans, and reflective competence for assessing the effectiveness of visual support in one's own pedagogical practice. If any of these components is absent, the future teacher may use visual aids mechanically - selecting them by habit or availability rather than by pedagogical purpose - and the potential of the visibility principle will not be fully realized.

Methods

The article employs a theoretical and analytical research design. The method includes systematic literature review, comparative analysis of didactic approaches, and pedagogical technology modelling. The literature base covers four categories of sources: classical didactic works on the principle of visibility; international research on multimedia learning, visual literacy, and cognitive load theory; Uzbek pedagogical scholarship on didactic principles and educational technologies; and curriculum documents from pedagogical universities.

The analytical procedure was organized in four stages. At the first

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stage, the historical development of the visibility principle was traced from Comenius through contemporary cognitive science, identifying the key shifts in understanding that have occurred over four centuries. At the second stage, the content of professional preparation related to the visibility principle was defined by integrating classical didactic knowledge with contemporary research findings. At the third stage, practical applications of the visibility principle in teacher education were reviewed, including methods used in Uzbek and international pedagogical programmes. At the fourth stage, a four-stage pedagogical technology for preparing students to apply the visibility principle was developed and theoretically substantiated.

The article does not present original experimental data. Its contribution is theoretical and design-oriented: it proposes a structured approach to professional preparation that can be implemented in pedagogical university curricula and subsequently tested through empirical research. This choice is justified because the effective design of any pedagogical technology requires a clear theoretical foundation before experimental implementation begins. Without such a foundation, practical training risks becoming a collection of disconnected exercises rather than a coherent developmental programme.

Results

1. Three generations of the visibility principle

The first result of the analysis is the identification of three historically successive but currently coexisting generations of the visibility principle. Understanding these generations is essential for defining the content of teacher preparation, because each generation requires different knowledge, skills, and pedagogical approaches.

The first generation is object-based visibility. This is the classical understanding that goes back to Comenius and Pestalozzi. It emphasizes direct sensory contact with real objects, specimens, models, and natural phenomena. In this approach, the teacher brings physical objects into the classroom, organizes observations, conducts demonstrations, and uses material models to represent abstract concepts. Object-based visibility remains important in contemporary education, particularly in natural sciences, geography, and early childhood education. Its limitation is that not all concepts can be represented through physical objects, and not all objects are available in every classroom.

The second generation is image-based visibility. This generation emerged with the development of printing, photography, and projection technologies. It includes printed illustrations, maps, charts, diagrams, photographs, slides, overhead transparencies, and educational films. Image-based visibility allows the teacher to present phenomena that cannot be observed directly - microscopic structures, historical events, distant

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geographical locations, internal processes of organisms or machines. Ushinskiy's emphasis on the role of visual representations in forming clear concepts is most closely associated with this generation. The limitation of image-based visibility is that it presents static or linear information, often in a one-directional mode from teacher to student.

The third generation is interactive-digital visibility. This generation has emerged with the development of computer technology, the internet, and mobile devices. It includes interactive simulations, virtual laboratories, augmented reality applications, dynamic infographics, educational animations, interactive whiteboards, and multimedia presentations with embedded activities. Interactive-digital visibility allows students not only to observe visual information but to manipulate it, explore it at their own pace, and receive immediate feedback. Mayer's (2009) cognitive theory of multimedia learning and Sweller's (2011) cognitive load theory provide the scientific basis for understanding how this generation of visibility works and under what conditions it supports or hinders learning.

Generation	Primary media	Cognitive function	Teacher competence required
Object-based	Real objects, specimens, models, demonstrations	Direct sensory perception, concrete experience formation	Selection and organization of objects, demonstration technique, safety management
Image-based	Illustrations, maps, charts, photographs, video	Visual representation of inaccessible phenomena, spatial organization of knowledge	Selection criteria for images, visual design literacy, integration with verbal explanation
Interactive-digital	Simulations, virtual labs, AR/VR, interactive presentations	Active exploration, manipulation of variables, immediate feedback, multimodal processing	Digital tool proficiency, multimedia design principles, cognitive load management

These three generations are not mutually exclusive. In a well-designed lesson, a teacher may use a physical model to introduce a concept, a diagram

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to organize the information visually, and an interactive simulation to allow students to explore variables independently. The key pedagogical insight is that each generation of visual aid serves a different cognitive function, and the effective teacher knows when and why to use each type. Mavlonova, Tursunov, and Holiqberdiyev (2001) emphasized that the principle of visibility should be applied in coordination with other didactic principles - scientific character, systematic progression, accessibility, and connection between theory and practice. This coordination requires professional judgement that goes beyond simple technical skill.

2. Content components of professional preparation

The second result is the definition of four content components that should constitute the professional preparation of future teachers for applying the visibility principle.

The first component is theoretical-cognitive knowledge. This includes the history and evolution of the visibility principle in didactic thought, the cognitive science of visual perception and information processing, the principles of multimedia learning formulated by Mayer and colleagues, the theory of cognitive load and its implications for visual design, and the classification of visual aids by function. A future teacher who lacks this theoretical foundation will make decisions about visual aids based on intuition or imitation rather than on understanding. Ziyomuhammadov (2006) argued that modern pedagogical technologies require teachers who understand not only how to use technical tools but also the theoretical principles that determine their effectiveness.

The second component is analytical-evaluative skill. This includes the ability to observe and analyse the use of visual aids in real lessons, to evaluate the quality of visual materials according to established criteria, to identify cases where visual aids support learning and cases where they cause confusion or overload, and to compare different visual approaches to the same content. This component is developed through structured observation of lessons, analysis of video recordings, and critical evaluation of textbook illustrations, digital resources, and presentation materials.

The third component is design-creative skill. This includes the ability to select appropriate visual aids for specific learning objectives, to create original visual materials using both traditional and digital tools, to integrate visual elements into a coherent lesson design, and to adapt visual materials for different age groups and learning contexts. Clark and Lyons (2010) demonstrated that the design of visual materials requires understanding the distinction between decorative, representational, organizational, and transformational functions. A future teacher who can create visually attractive materials but does not understand their instructional

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function has not yet developed full professional competence in this area.

The fourth component is reflective-evaluative competence. This includes the ability to assess the effectiveness of visual support in one's own lessons, to gather feedback from students about the clarity and usefulness of visual materials, to identify areas for improvement, and to adjust visual strategies based on reflective analysis. This component connects the visibility principle with the broader competence of professional reflection. Ishmuhamedov, Abduqodirov, and Pardayev (2008) emphasized that innovative pedagogical technologies are effective only when teachers continuously reflect on their application and adjust their methods accordingly.

Component	Content	Learning activities
Theoretical-cognitive	History of visibility principle, cognitive science of visual learning, multimedia learning theory, cognitive load theory	Lectures, seminars, reading assignments, comparative analysis of theoretical models
Analytical-evaluative	Observation criteria for visual teaching, quality evaluation of visual materials, identification of effective and ineffective visual practices	Lesson observation protocols, video analysis, textbook evaluation, peer review of visual resources
Design-creative	Selection and creation of visual aids, integration into lesson design, adaptation for different contexts, digital tool proficiency	Workshop on visual material creation, lesson plan design, microteaching with visual focus, digital tool practicum
Reflective-evaluative	Self-assessment of visual teaching effectiveness, student feedback analysis, continuous improvement of visual strategies	Reflective journals, post-lesson analysis, peer feedback sessions, portfolio of visual teaching experiences

3. Four-stage pedagogical technology

The third result is a four-stage pedagogical technology for preparing students to apply the visibility principle in professional pedagogical activity. The technology is structured as a progressive sequence in which each stage builds on the competencies developed in the previous stage.

Stage One: Theoretical Foundation. At this stage, students study the

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theoretical and scientific bases of the visibility principle. The content includes the historical development of the principle from Comenius to contemporary cognitive science, the cognitive theory of multimedia learning, cognitive load theory, and the classification of visual aids by type and function. The primary methods are lectures, seminars, guided reading, and comparative analysis of theoretical models. The expected outcome is that students develop a clear theoretical understanding of why visual aids support learning, under what conditions they are effective, and what risks they carry when used improperly. This stage typically occupies the first phase of the relevant university course and provides the conceptual framework for all subsequent stages.

Stage Two: Observation and Analysis. At this stage, students observe the use of visual aids in real and recorded lessons and analyse them using structured criteria. The content includes lesson observation protocols focused on visual teaching, video analysis of lessons with effective and ineffective use of visual aids, evaluation of textbook illustrations and digital learning resources, and comparison of visual approaches across different subject areas. The primary methods are structured observation, protocol-based analysis, group discussion of observed lessons, and written analytical reports. The expected outcome is that students develop the ability to recognize effective and ineffective visual practices, to explain why specific visual choices support or hinder learning, and to formulate evidence-based recommendations for improvement. Yo'ldoshev (2004) emphasized that the analytical study of teaching methods in real conditions is an essential step in the formation of professional methodological competence.

Stage Three: Design and Practice. At this stage, students design and deliver lesson fragments that demonstrate purposeful application of the visibility principle. The content includes the creation of visual materials for specific lesson topics, integration of visual elements into complete lesson plans, microteaching sessions with peer and supervisor feedback, and adaptation of visual strategies for different age groups and learning contexts. The primary methods are design workshops, microteaching, peer review, and supervisor consultation. The expected outcome is that students can independently select, create, and integrate visual materials into lesson designs that serve clear learning objectives, and that they can adapt their visual strategies to the needs of specific learning situations. This stage connects theoretical knowledge with practical application and is the core of the preparation technology.

Stage Four: Reflection and Evaluation. At this stage, students evaluate the effectiveness of their own visual teaching practices and develop plans for continued improvement. The content includes self-assessment of microteaching sessions, analysis of

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student feedback on visual materials, identification of strengths and areas for improvement, and development of personal professional development plans related to visual pedagogy. The primary methods are reflective journaling, post-lesson analysis protocols, peer feedback sessions, and portfolio compilation. The expected outcome is that students develop a stable habit of reflecting on their visual teaching practices and continuously improving them based on evidence. This stage ensures that the competence developed during the preparation programme does not remain static but becomes a foundation for lifelong professional development.

4. Conditions for effective implementation of the technology

The fourth result is the identification of conditions necessary for the effective implementation of the proposed pedagogical technology. The first condition is the qualification of university teachers. Faculty members who teach courses related to didactics and methodology must themselves be competent in the application of the visibility principle across all three generations. This means that university teachers should model effective visual teaching in their own lectures and seminars, demonstrating the same principles that they expect students to master. If university instruction relies predominantly on verbal presentation while requiring students to teach visually, a significant gap between theory and practice is created.

The second condition is the availability of material and technical resources. Students need access to a range of visual tools and technologies: physical models and specimens for object-based visibility, quality printing and projection equipment for image-based visibility, and computers, software, and internet access for interactive-digital visibility. Resource limitations are a reality in many educational institutions, but the technology should be designed to work with available resources while gradually expanding the range of tools as circumstances permit. Ishmuhamedov, Abduqodirov, and Pardayev (2008) noted that innovative technologies in Uzbek education must be adaptable to varying levels of material provision.

The third condition is the integration of the technology across the curriculum. The preparation for applying the visibility principle should not be confined to a single course on general didactics. It should be reinforced in subject methodology courses, in pedagogical practice, and in the final qualifying work. When students encounter the visibility principle in multiple contexts - in a general pedagogy course, in a physics methodology course, in a supervised lesson during school practice - they develop a more integrated and flexible understanding than when the topic is covered only once.

The fourth condition is systematic assessment. The effectiveness of the preparation technology should be evaluated through diagnostic tools that

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measure each of the four content components. Theoretical knowledge can be assessed through written examinations and concept mapping. Analytical skills can be assessed through structured observation reports. Design skills can be assessed through lesson plan evaluation and microteaching rubrics. Reflective competence can be assessed through portfolio analysis and reflective essay quality. Without systematic assessment, the technology cannot be improved over time and its actual effects on student preparation remain unknown.

Discussion

The results of the theoretical analysis demonstrate that the preparation of future teachers for applying the visibility principle requires a comprehensive approach that goes beyond traditional didactic instruction. The identification of three generations of visibility - object-based, image-based, and interactive-digital - provides a historical and technological framework that helps future teachers understand the full range of visual possibilities available to them. The four content components - theoretical, analytical, design, and reflective - ensure that preparation addresses not only technical skills but also the cognitive understanding and professional judgement needed for effective visual teaching.

The proposed four-stage technology is consistent with international research on teacher education. The sequence from theoretical study through observation to practice and reflection corresponds to the general logic of professional competence formation described in studies on teacher learning. Mayer's (2009) principles of multimedia learning provide scientifically grounded guidelines that future teachers can apply when designing visual materials. Sweller's (2011) cognitive load theory offers a critical perspective that prevents the naive assumption that more visual information automatically means better learning. Together, these theoretical frameworks give future teachers a rational basis for making decisions about visual aids rather than relying on intuition or convention.

The Uzbek scholarly tradition contributes important contextual perspectives. Mavlonova, Tursunov, and Holiqberdiyev (2001) correctly emphasized that the visibility principle does not operate in isolation but in coordination with other didactic principles. A visually rich lesson that lacks scientific accuracy, logical structure, or connection to students' prior knowledge may be entertaining but pedagogically ineffective. The integration of the visibility principle with other principles - particularly the principle of scientific character, the principle of systematic progression, and the principle of accessibility - is therefore an essential part of teacher preparation. Ziyomuhammadov (2006) further noted that pedagogical technologies must be understood as systems, not as isolated techniques, and this systemic understanding should be developed during university study.

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Several risks should be acknowledged. The first risk is visual overload. Contemporary digital tools make it easy to create visually saturated presentations with animations, colours, images, and text competing for attention on every slide. Students who are trained to use digital tools without understanding cognitive load principles may produce materials that distract rather than support learning. The second risk is decorative use of visuals. Clark and Lyons (2010) documented that decorative images - those that are visually attractive but carry no instructional content - can reduce learning efficiency by consuming cognitive resources without contributing to understanding. Future teachers must learn to distinguish between visual materials that serve a pedagogical function and those that merely decorate. The third risk is technology dependence. A teacher who can teach effectively only when all digital equipment is functioning is vulnerable to the everyday realities of schools where technology sometimes fails. The preparation technology should therefore develop competence across all three generations of visibility, ensuring that the future teacher can adapt to different resource conditions.

For curriculum design in pedagogical universities, the discussion suggests that courses on didactics and methodology should include explicit modules on the cognitive science of visual learning, practical workshops on visual material design, structured observation experiences focused on visual teaching, and reflective assessment of students' own visual teaching practices. These elements should be coordinated across the curriculum rather than confined to a single course. Subject methodology courses should address the specific visual tools and strategies relevant to each discipline: molecular models and laboratory demonstrations in chemistry, maps and statistical graphics in geography, timeline visualizations and documentary images in history, geometric constructions and graphical representations in mathematics.

The proposed technology can be adapted to different institutional conditions. In universities with advanced digital infrastructure, greater emphasis can be placed on interactive-digital visibility. In institutions with limited technology resources, the focus can begin with object-based and image-based visibility while gradually introducing digital tools. The key point is that the pedagogical logic of the technology - moving from theoretical understanding through analytical observation to practical design and reflective evaluation - remains constant regardless of the technological level. This adaptability makes the technology relevant across the diverse landscape of pedagogical education in Uzbekistan.

Conclusion

The content of preparing students for pedagogical activity based on the principle of visual aids can be defined as a system of four interconnected components: theoretical-cognitive

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knowledge of the foundations of visual learning, analytical-evaluative skills for assessing visual teaching practices, design-creative skills for developing and integrating visual materials, and reflective-evaluative competence for continuous professional improvement. The proposed four-stage pedagogical technology - theoretical foundation, observation and analysis, design and practice, and reflection and evaluation - provides a structured pathway through which these components are developed progressively during university study.

The main conclusion of the study is that the effective application of the visibility principle in contemporary education requires a new level of professional preparation that integrates classical didactic wisdom with contemporary cognitive science and digital technology competence. A teacher who understands why visual aids work, who can analyse their use critically, who can design them purposefully, and who can reflect on their effectiveness possesses a professional competence that goes far beyond the mechanical use of available visual tools. Pedagogical universities have the responsibility to develop this competence systematically through coherent curricula, qualified instruction, adequate resources, and sustained practice opportunities.

Further research should focus on the empirical testing of the proposed technology in pedagogical university conditions, the development of diagnostic instruments for assessing visual teaching competence at each stage, comparative studies of visual teaching preparation across different subject specializations, and longitudinal investigation of how visual teaching competence develops during the transition from university study to professional work in schools.

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