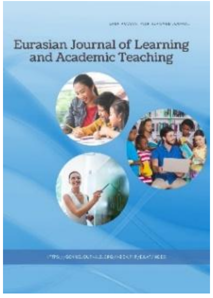

Innovative Technologies in Technology Classes for Students with Hearing Impairments

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ABSTRACT

This thesis examines how innovative technologies can enhance technology (hands-on vocational) lessons for students with hearing impairment. The aim is to justify an adapted instructional model based on visual-digital tools, simulations, and interactive step-by-step guidance to develop practical competencies. Methods include literature review, instructional design, classroom observation, and diagnostic assessment. Scientific novelty lies in proposing a multimodal visual instruction system with digital safety prompts and measurable performance criteria tailored to practice-oriented tasks

Keywords: Hearing impairment; hands-on learning; technology education; innovative pedagogy; visual didactics; digital instructional guide; simulation-based training; safety competence

Annotatsiya. Ushbu tezisda eshitishida nuqsoni bo‘lgan o‘quvchilarning texnologiya (predmetli amaliy ta’lim) darslarida innovatsion texnologiyalardan foydalanishning didaktik va metodik asoslari tahlil qilinadi. Maqsad moslashtirilgan o‘quv muhitida vizual, raqamli va simulyatsion vositalar orqali kompetensiyalarni rivojlantirish modelini asoslashdir. Metod sifatida adabiyotlar tahlili, pedagogik loyihalash va sinf amaliyotini diagnostik baholash yondashuvlari qo‘llanadi. Ilmiy yangilik texnologiya darslari uchun multimodal ko‘rsatmalilik va xavfsizlikka yo‘naltirilgan raqamli yo‘riqnomalar tizimini taklif etishdir.

Аннотация. В данном тезисе освещается вопрос применения инновационных технологий на уроках технологии (предметно-практического обучения) для учащихся с нарушениями слуха. Целью является разработка адаптированной модели формирования практических навыков на основе визуально-цифровых средств, симуляции и интерактивных инструкций. В качестве методов исследования используются подходы анализа источников, педагогического дизайна, наблюдения и диагностической оценки. В качестве новшества обоснованы дидактические решения, интегрирующие мултимодалное объяснение, контроль безопасности и оценку результата.

Kalit so‘zlar (o‘zbek): eshitish nuqsoni; predmetli amaliy ta’lim; texnologiya darsi; innovatsion pedagogika; vizual didaktika; raqamli yo‘riqnoma; simulyatsiya; xavfsizlik kompetensiyasi

Ключевые слова (rus): нарушение слуха; предметно-практическое обучение; урок технологии; инновационная педагогика; визуальная дидактика; цифровая инструкция; симуляция; компетенция безопасности

Organizing Technology (Subject-Based Practical Training) classes for students with hearing impairments is characterized by a high proportion of hands-on activity, strict requirements for occupational safety, the necessity of accurately following operational sequences, and the need to receive instructions quickly and comprehensively. In such conditions, reliance on traditional oral explanations leads to didactic losses: task requirements may be misunderstood, work pace decreases, errors increase, and risk factors intensify. Therefore, the introduction of innovative technologies in this field should not be viewed as "innovation for its own sake," but rather as a scientific and methodological necessity aimed at creating an equitable learning environment, reliably developing practical competencies, and ensuring occupational safety. Within the framework of special pedagogy, it is emphasized that the visual channel plays a leading role in information perception among students with hearing impairments. This necessitates a fundamental redesign of visual instruction in Technology classes, whereby "demonstration" evolves from simple showing into a "digital, structured, and measurable" instructional system. The content of Technology classes typically includes stages such as working with materials, using tools and equipment, reading drawings and technological maps, measuring and controlling accuracy, and final product finishing. For students with hearing impairments, it is essential to reinforce the logical connections between these stages through a structured "language of the work process," which includes pictograms, icons, color coding, concise written instructions, step-by-step photographs and videos, animated schemes, and demonstrative models of practical actions. Innovative technologies enable both the standardization and individualization of this "work process language." For example, a digital technological map should not remain a simple textual guideline but should transform into an interactive environment that incorporates images for each step, time norms, safety warnings, tool selection indicators, and quality control criteria. Such an approach regulates cognitive load: students are not required to retain large volumes of information simultaneously but instead rely on clear visual supports for each subsequent step. As a result, independence increases, dependence on the teacher decreases, and assessment becomes more transparent. When selecting innovative technologies, the key criterion should not be the mere availability of digital tools but their alignment with didactic objectives. The most effective solutions in Technology classes can be grouped into three categories: visual-communicative tools, simulation and training tools, and assessment-analytics tools. Visual-communicative tools include captioned and sign-supported video lessons, step-by-step photo instructions, QR code–based micro-demonstrations, and safety pictograms displayed at workstations. A critical methodological requirement is that visual materials must be not only aesthetically appealing but also technologically accurate: camera angles should correspond to the learner's practical viewpoint, and details must be presented with sufficient contrast and lighting. Otherwise, visual materials may increase errors rather than reduce them. Simulation and training tools enable students to practice complex or potentially hazardous operations in a safe environment before performing them with real equipment. For instance, connecting electrical tools, selecting cutting directions, or controlling measurement accuracy can be repeatedly practiced in virtual simulators. This strengthens motor planning and reduces risk factors in real tasks.

Assessment and analytics tools allow for monitoring processes, evaluating product quality based on criteria, classifying types of errors, and tracking individual progress. Importantly, these tools should not be understood as mechanisms of control alone but as systems of feedback for both teachers and students. Identifying the stages at which difficulties arise enables the provision of adapted instructions and differentiated tasks in subsequent lessons. The proposed approach is based on the principle of "multimodal instruction." This implies that information for a single operation is presented through multiple stable supports: visual sequences, concise written phrases, symbolic pictograms, and practical demonstrations. For students with hearing impairments, this approach ensures comprehension and facilitates retention, as different supports complement one another. In addition, the concept of "safety-oriented digital instructions" is introduced. Before each operation, potential hazards (e.g., cutting elements, heated surfaces, electrical voltage) are identified, corresponding protective equipment is indicated through pictograms, and students confirm compliance with safety requirements. This transforms verbal safety reminders into a stable system of visual control and personal responsibility. In practice, such systems can be implemented through tablets, classroom computers, printed cards, and QR-coded stands, provided that a unified set of icons and terminology forms a standardized "instructional language." To ensure the effective methodological application of innovative technologies, the structure of the lesson itself must also be reconsidered. The motivational stage becomes more effective when presented visually through product samples, real-life scenarios, or professional role models. During instruction, instead of delivering a single comprehensive explanation, the teacher adopts a step-by-step micro-instructional approach: brief guidance for each step, immediate execution, and immediate feedback. The consolidation stage should include not only completing the product but also reflecting on the process. Students analyze which steps were easy or difficult, how errors were corrected, and how safety requirements were followed. Reflection organized through pictogram-based checklists supports metacognitive development and strengthens individualization in subsequent lessons. Thus, innovation is not limited to devices but involves restructuring the entire didactic cycle. An important aspect of this approach is the adaptation of assessment criteria. For students with hearing impairments, it is advisable to evaluate not only the final product but also process indicators such as adherence to operational sequences, measurement accuracy, safe tool usage, workplace organization, and self-assessment. Digital checklists and rubrics enhance transparency, providing clear justification for grades and supporting differentiated instruction. Moreover, assessment fulfills an educational function by fostering professional values such as adherence to standards, quality assurance, and prioritization of safety. The principle of inclusivity must also be maintained: all students in the classroom can benefit from the same visual instructions, which improves overall discipline and organization without isolating students with special educational needs. The scientific novelty of the proposed approach lies in the substantiation of an integrated three-component model for Technology classes: (1) didactic design based on multimodal instruction, (2) safety-oriented digital instructions with pictogram-based control, and (3) criterion-based rubrics that assess both process and outcomes. This model enhances learning outcomes by aligning with the perceptual characteristics of students with hearing impairments, fragmenting complex tasks, standardizing visual supports, increasing independent work, and strengthening pedagogical feedback. From a methodological perspective, the model requires teachers to possess basic digital content creation skills, maintain consistency in pictographic design, and enrich technological maps with precise criteria. Once developed, such content can be easily adapted across topics, thereby optimizing teacher workload.

Conclusion. The application of innovative technologies in Technology (subject-based practical training) classes for students with hearing impairments improves the quality of practical skill formation, ensures clarity of learning tasks, and enables stable control of occupational safety. The integration of multimodal instruction, safety-oriented digital guidance, and criterion-based assessment enhances learner independence, systematizes early error detection and correction, and contributes to the development of an inclusive, competency-based model of Technology education. As a practical recommendation, it is advisable to develop a repository of visual standards, a pictogram glossary, and interactive step-by-step technological maps, and to implement them consistently across instructional topics.

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