TEXNIK IJODKORLIK FAOLIYATI ORQALI BO‘LAJAK O‘QITUVCHILARNING TEXNIK FIKRLASH KOMPETENSIYASINI RIVOJLANTIRISH

РАЗВИТИЕ КОМПЕТЕНЦИИ ТЕХНИЧЕСКОГО МЫШЛЕНИЯ У БУДУЩИХ УЧИТЕЛЕЙ ПОСРЕДСТВОМ ТЕХНИЧЕСКОГО ТВОРЧЕСТВА

DEVELOPMENT OF TECHNICAL THINKING COMPETENCE OF FUTURE TEACHERS THROUGH TECHNICAL CREATIVITY ACTIVITIES

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Annotatsiya. Ushbu maqolada texnik ijodkorlik faoliyati orqali bo‘lajak o‘qituvchilarning texnik fikrlash kompetensiyasini rivojlantirish masalasi tahlil qilinadi. Tadqiqot texnik g‘oya yaratish, konstruktorlik, prototiplash, modellashtirish, sinovdan o‘tkazish va takomillashtirish bosqichlarining pedagogik imkoniyatlarini asoslaydi.

Kalit so‘zlar: technical creativity, future teachers, technical thinking, prototyping, design activity, modelling, constructive tasks, competence development, creativity, engineering education

Аннотация. В статье анализируется развитие компетенции технического мышления у будущих учителей посредством технического творчества. Обосновываются педагогические возможности генерации технической идеи, конструирования, прототипирования, моделирования, испытания и совершенствования продукта.

Ключевые слова: technical creativity, future teachers, technical thinking, prototyping, design activity, modelling, constructive tasks, competence development, creativity, engineering education

Abstract. This article analyzes the development of technical thinking competence of future teachers through technical creativity activities. The study substantiates the pedagogical potential of idea generation, constructive design, prototyping, modelling, testing, and improvement as stages that develop analytical, creative, and practical dimensions of technical reasoning.

Key words: technical creativity, future teachers, technical thinking, prototyping, design activity, modelling, constructive tasks, competence development, creativity, engineering education

INTRODUCTION

Technical creativity is one of the most productive means of developing technical thinking competence because it connects knowledge with invention, design, experimentation, and improvement. For future teachers, technical creativity has additional pedagogical significance: it prepares them to organise creative technological activities for learners and to cultivate an innovation-oriented mindset.

Technical thinking becomes mature when a student can move beyond reproducing an existing model and can independently propose, justify, construct, test, and improve a technical solution. Such activity requires understanding of materials, functions, constraints, safety requirements, and educational aims. Therefore, technical creativity should be considered an essential component of professional pedagogical training.

In practice, however, technical creativity is often reduced to making a product according to a sample. This limits the development of independent reasoning. A more effective approach is to organise tasks

in which students identify a need, formulate a design problem, generate alternative ideas, build prototypes, evaluate performance, and reflect on the pedagogical value of the result.

The purpose of this article is to substantiate the development of technical thinking competence through technical creativity activities. The objectives are to define the didactic essence of technical creativity, describe the stages of creative technical activity, identify competence components, and offer a methodological model for teacher education.

LITERATURE REVIEW AND METHODS

Research on creativity and education emphasises that creative competence emerges through meaningful activity, problem finding, experimentation, and reflection. Guilford's classic work on divergent thinking explains the importance of generating multiple solutions rather than following a single predetermined path [1, 444-446]. This idea is directly applicable to technical creativity.

Design thinking literature highlights empathy, problem definition, ideation, prototyping, and testing as stages of creative solution development [2, 39-42]. In teacher education, these stages can be adapted to technological tasks and pedagogical projects. Future teachers learn not only to produce an artefact but also to explain its educational purpose.

Project-based learning supports technical creativity because it requires students to plan, implement, and present a product. Blumenfeld and colleagues note that projects become meaningful when they involve driving questions and sustained inquiry [3, 371-373]. For technical thinking, a driving question may concern efficiency, usability, durability, or instructional value.

Engineering design education also stresses the iterative nature of technical solutions. Honey, Pearson, and Schweingruber argue that integrated STEM education should include design, application, and problem solving [4, 54-56]. These principles make technical creativity a powerful didactic context for future teachers.

The article was prepared within a theoretical and methodological research design. The study applied system analysis, comparative pedagogical analysis, conceptual modelling, synthesis of international literature, and pedagogical generalisation. System analysis made it possible to consider technical thinking competence as an integral formation that includes cognitive, operational, creative, communicative, and reflective components. Comparative analysis was used to examine the didactic potential of innovative methods in contrast with predominantly reproductive teaching formats. Conceptual modelling enabled the development of a methodological sequence that can be implemented in teacher education programmes.

RESULTS AND DISCUSSION

The study shows that technical creativity develops technical thinking competence through a sequence of interrelated stages. The first stage is problem discovery. Students should not receive only ready-made tasks; they should learn to identify a technical need or educational problem. This stage activates observation, questioning, and analytical reasoning.

The second stage is idea generation. At this point students propose several possible solutions. Divergent thinking is important because it prevents the dominance of one stereotypical answer. The teacher's role is to encourage variety and to postpone premature criticism until alternatives are developed.

The third stage is constructive design. Students choose a solution and transform it into a scheme, drawing, digital model, or prototype plan. They determine materials, dimensions, functions, and constraints. This stage connects abstract reasoning with concrete technical action.

Component	Didactic focus	Expected outcome
Problem discovery	Identification of technical or educational need	Analytical and diagnostic thinking
Idea generation	Creation of several possible solutions	Divergent and creative thinking
Prototyping	Construction and testing of physical or digital models	Practical engineering action
Improvement	Revision based on results and feedback	Reflective and iterative competence

The fourth stage is prototyping and testing. A prototype may be physical or digital. Testing reveals whether the solution works, what limitations exist, and which parameters need adjustment. Through testing, students understand that technical thinking is iterative rather than linear.

The fifth stage is improvement and pedagogical interpretation. Future teachers evaluate not only the technical quality of the product but also its value for teaching. They consider how the model can be used in a lesson, what concepts it demonstrates, and how learners may interact with it.

CONCLUSION

Technical creativity activities are an effective didactic mechanism for developing technical thinking competence in future teachers. They unite analysis, imagination, construction, experimentation, and reflection in one pedagogical process.

Higher pedagogical institutions should include creative technical projects, prototype development, digital modelling, and reflective presentations in teacher training programmes. Assessment should focus not only on the final product but also on the originality of the idea, justification of design decisions, testing process, improvement strategy, and pedagogical applicability.

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