

RESEARCH ARTICLE

Assessing Students' Design Competencies in Technology Lessons Based on The Tpack Model

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Abstract

This article analyzes the didactic possibilities of the TPACK model in the process of developing students' design competencies in technology lessons. It discusses issues related to organizing the educational process based on the integration of technological, pedagogical, and content knowledge. In particular, the article substantiates the effectiveness of using the project method, problem-based tasks, and digital design tools in studying the construction and modeling of sewing products within the service-oriented branch of the technology subject. The article also reveals the possibilities of developing students' design thinking, spatial imagination, and design competencies through the use of the Gemini CAD software. In addition, assessment criteria for evaluating students' design competencies based on the TPACK model are developed, and the possibilities of comprehensively assessing their knowledge and skills through the components of technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) are explained.

KEYWORDS

TPACK model, technology subject, design competence, technological knowledge, pedagogical knowledge, content knowledge, digital design.

INTRODUCTION

At present, modernizing the education system, developing students' creative activity, and forming and improving their core competencies are among the priority directions of state policy in the field of education. In the "Concept for the Development of the Public Education System of the Republic of Uzbekistan until 2030," approved by Presidential Decree No. PF-5712 of April 29, 2019, one of the important tasks identified is the improvement of the general secondary education system and the introduction of modern educational technologies aimed at developing students' independent thinking, creative approach, and ability to apply theoretical knowledge in practice [1]. This concept particularly emphasizes the need to develop students' competencies

through the application of innovative pedagogical approaches and digital technologies in the educational process.

In modern pedagogical theory, the TPACK (Technological Pedagogical Content Knowledge) model, based on the integration of technological, pedagogical, and content knowledge, is considered an important theoretical approach to the effective organization of the educational process. This model was developed in 2006 by American researchers P. Mishra and M. Koehler [3] and represents an expanded form of the Pedagogical Content Knowledge concept originally proposed by L. S. Shulman [2]. The TPACK model scientifically substantiates the possibilities of organizing the educational process on the basis of the interaction and harmony of the

components of technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) [5].

In technology lessons, teaching students how to construct product patterns, carry out technical modeling, and produce an item through a technological sequence contributes to the development of their design competencies. In this process, the use of digital design tools and modern pedagogical technologies makes it possible to integrate students' theoretical knowledge with practical activity, develop their spatial thinking, and organize independent project-based work.

From this perspective, organizing the process of assessing students' knowledge and skills in technology lessons on the basis of modern pedagogical approaches is an important scientific and pedagogical task. This article analyzes the theoretical and methodological foundations of assessing students' knowledge in technology lessons on the basis of the TPACK model and highlights the possibilities of comprehensively evaluating students' content knowledge (CK), pedagogical activity-related skills (PK), and technological knowledge (TK).

Within the framework of this study, such methods as pedagogical observation, analysis, experimental testing, and pedagogical modeling were used to investigate the process of developing students' design competencies in technology lessons. The methodological foundation of the study is the TPACK model, which is based on the integration of technological, pedagogical, and content knowledge.

This model is regarded as a theoretical approach that represents the integration of technology, pedagogy, and content knowledge. The TPACK model substantiates the possibilities of effectively organizing the educational process on the basis of technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), and their interrelation [4].

The TPACK framework emphasizes the complex relationships among these domains. At the same time, this framework serves as a theoretical basis for identifying the need for teachers to integrate technology effectively into their professional practice [2]. The structural components of this model and their interrelationship are reflected in the following diagram (Figure 1).

LITERATURE REVIEW AND METHOD

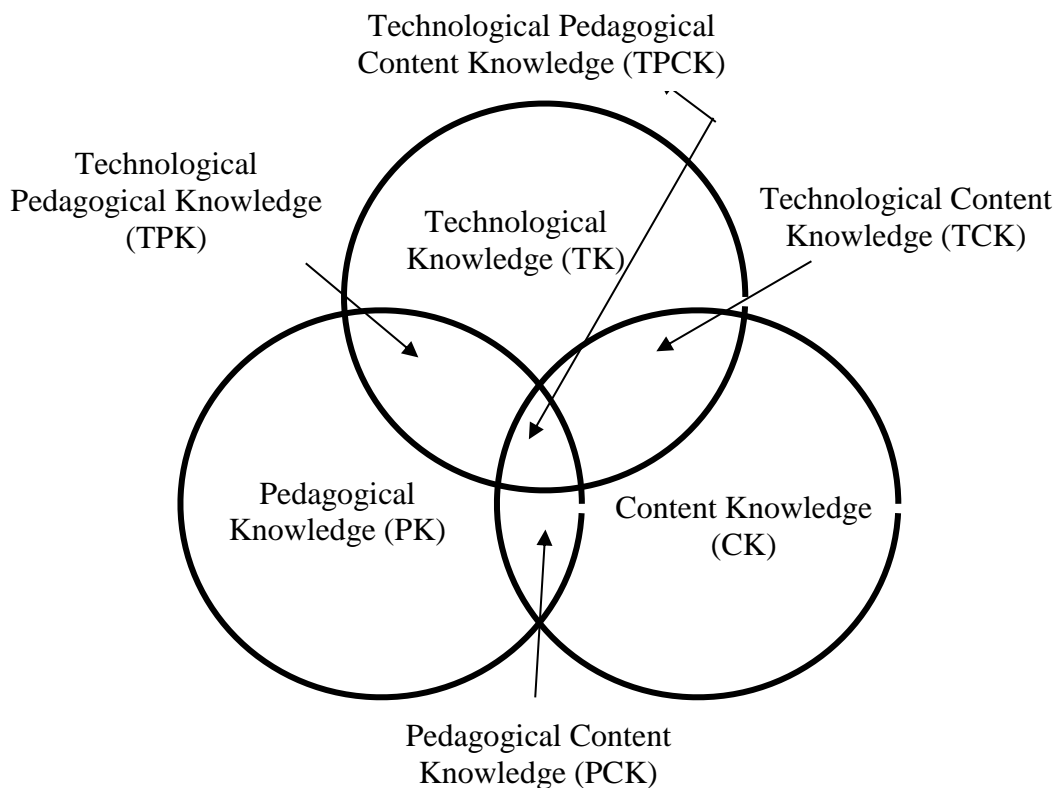


Figure 1. The model of interintegration of TPACK (technological, pedagogical, and content) knowledge (source: Koehler & Mishra, 2008).

This figure presents the main structural components of the TPACK model and their interintegration. The model expresses the interrelationship among the three main domains of knowledge: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK).

As a result of the integration of these domains, the following areas of knowledge are formed:

- technological pedagogical knowledge (TPK);
- technological content knowledge (TCK);
- pedagogical content knowledge (PCK).

At the center of the model, technological pedagogical content knowledge (TPACK) represents the teacher's competence in applying subject content in harmony with pedagogical

approaches and modern technologies [6]. This approach requires the teacher not only to have a deep understanding of the subject matter, but also to possess the skills to deliver it effectively to students through efficient pedagogical methods and digital technologies.

RESULTS

In the process of developing students' design competencies in technology lessons on the basis of a transformation system, the TPACK model makes it possible to connect students' theoretical knowledge with practical activity. Figure 2 reflects the interintegration of the technological, pedagogical, and content components applied in the educational process on the basis of the TPACK model.

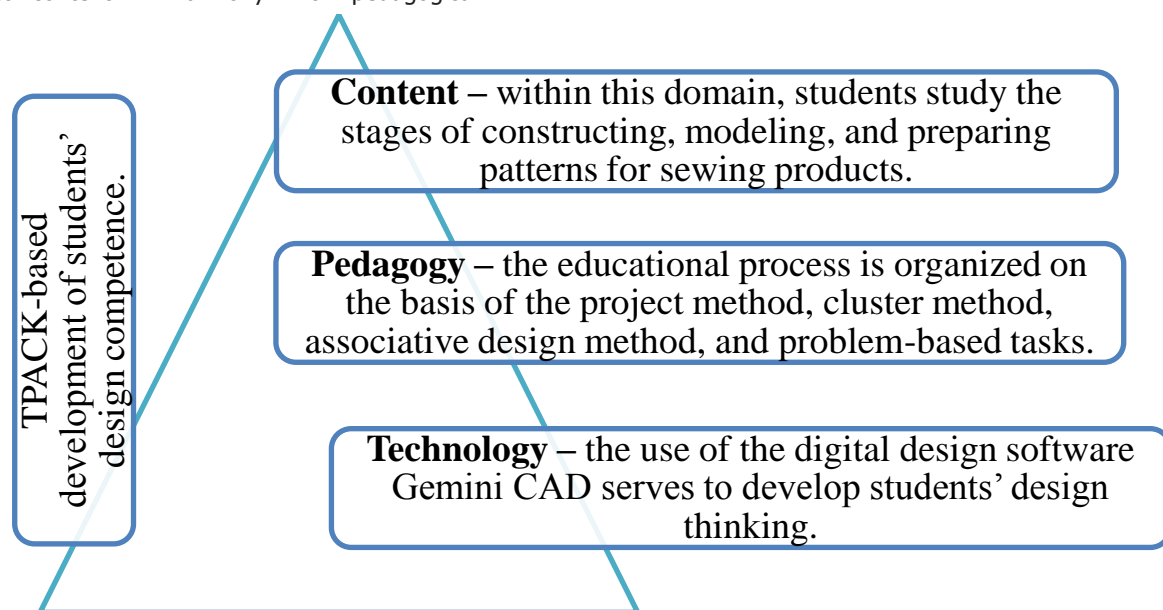


Figure 2. Technological, pedagogical, and content components applied in the educational process based on the TPACK model

This figure reflects the interrelationship of the technological, pedagogical, and content components. The technological component involves the use of digital design tools, including the Gemini CAD software and mobile applications, while the pedagogical component represents the educational process organized on the basis of the project method, the atelier method, the associative design method, and problem-based tasks. The content component, in turn, covers such instructional content within the technology subject as garment construction, modeling, and pattern making. The harmony among these components contributes to the effective organization of students' design activity.

The pedagogical component includes methods and approaches that ensure the effective organization of the educational process. In particular, students' creative and project-based activities are organized through the project method, the atelier method, associative design, and problem-based tasks.

The technological component includes the digital tools and software used in the educational process. In particular, the Gemini CAD software, mobile applications, and digital design tools serve to organize students' design activity effectively.

The content component encompasses the body of knowledge related to the subject matter of technology education. Within

this component, students are provided with theoretical and practical knowledge such as constructing garment patterns, technical modeling, developing clothing templates, and adapting them to different sizes. This knowledge helps students understand design activity, develop design thinking, and build the skills necessary to apply their knowledge in practice.

Thus, the TPACK model makes it possible to organize effective instruction in the educational process through the integrated application of subject content knowledge (CK), pedagogical approaches (PK), and digital technologies (TK). At the same time, this model also serves as an important methodological basis for the systematic assessment of students' knowledge and skills.

In the process of developing students' design competencies in technology lessons on the basis of the transformation system, assessing their knowledge and skills is an important didactic stage. For this purpose, the TPACK model was used in the course of the research as an assessment criterion. This model makes it possible to analyze students' knowledge on the basis of three main components: content knowledge (CK), pedagogical knowledge and skills related to learning activity (PK), and technological knowledge (TK).

Through content knowledge, the students' theoretical understanding of the technology subject was assessed,

including their level of mastery of concepts related to drawing product constructions, modeling, and the design process. Pedagogical knowledge served to identify students' ability to work independently in project activity, solve problem situations, and participate in group work. Through the technological knowledge component, students' skills in using digital tools, particularly the Gemini CAD software, as well as their ability to create and edit construction drawings with the help of a computer, were assessed.

In the process of evaluating students' knowledge and skills, it is important to take into account the interintegration of technological, pedagogical, and content knowledge. From this perspective, the TPACK model was selected as the theoretical basis for developing assessment criteria. This model reflects the interrelationship among the components of technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK), and makes it possible to carry out a comprehensive assessment of students' knowledge level. On the basis of this approach, students' theoretical knowledge related to the technology subject, their participation in learning activity, and their skills in using digital tools are identified through assessment criteria.

Table 1. Criteria and levels for assessing students' design competencies based on the TPACK model

Table 1.

Criterion	Level	Assessment indicators	CK – Content Knowledge	PK – Pedagogical Knowledge	TK – Technological Knowledge
Motivation and creativity	High	Carries out design activity independently, creates a new model and design, and works creatively	Independently applies deep knowledge of garment construction and pattern making	Works independently and demonstrates responsibility in teamwork	Effectively uses Gemini CAD and digital tools, and works productively
	Medium	Carries out design activity, but is not always creative and independence is not consistent	Applies knowledge partially in some cases	Works with the teacher's guidance; activity in collaboration is moderate	Uses the CAD software, but the opportunities are not fully exploited

	Low	Participation in design activity is passive; initiative is weak; performance in tasks is low	Has theoretical knowledge, but cannot apply it in practice	Does not participate actively; cannot work independently	Has difficulty using technological tools
Creativity	High	Creates an innovative idea, develops a new design independently, and approaches the process creatively	Applies knowledge in new situations	Solves problems independently and thinks creatively	Makes full use of graphic modeling and design capabilities
	Medium	Improves ready-made examples and proposes original ideas	Applies knowledge partially	Works with the teacher's support and can only perform partially	Uses CAD tools at a standard level
	Low	Weak aspiration to create novelty	Cannot apply knowledge in practice	Cannot make independent decisions	Cannot use technological capabilities
Operational independence	High	Independently organizes and optimizes the design process	Fully understands the technological stages	Independently organizes work activity and can evaluate it	In the CAD environment, independently creates a design model, makes technical modifications, and works productively
	Medium	Performs technological operations, but has difficulties with optimization	Knows the main processes	Carries out the work partially independently	Understands the software, uses simple operations
	Low	Cannot organize the work process	Has insufficient understanding of the technology	Skills of planning are not formed	Has difficulty using the software

Thus, assessing students' design competencies on the basis of the TPACK model made it possible to identify, in a comprehensive manner, students' theoretical knowledge, their activity in producing items and products, and their technological skills.

This model serves as an important theoretical foundation for

integrating digital technologies with pedagogical activity in the modern educational process. In particular, in teaching the technology subject, understanding the interrelationship among technological, pedagogical, and content knowledge is of great importance for increasing the effectiveness of instruction. From this perspective, the TPACK model makes it

possible to determine assessment criteria for evaluating students' knowledge and skills on the basis of the components of technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). In the process of assessing students' levels of knowledge, the technological, pedagogical, and content knowledge components of the TPACK model were adopted as the methodological basis.

The analysis of the TPACK model shows that, in the modern educational process, the integration of technological, pedagogical, and content knowledge is an important factor in enhancing teaching effectiveness. However, in many studies, the use of technological tools has mainly been discussed from a technical perspective, while their integration into the pedagogical process has not been sufficiently substantiated. In this regard, the TPACK model serves as an important theoretical foundation for determining not only teachers' command of subject content, but also their ability to teach it effectively through pedagogical approaches and modern digital technologies. On the basis of the theoretical possibilities of this model, the use of digital design tools, particularly the Gemini CAD software, in teaching the technology subject was organized in integration with pedagogical methods. As a result, the harmony of technological, pedagogical, and content knowledge emerged as an important didactic factor contributing to the development of students' design activity.

CONCLUSION

The analysis of the TPACK model shows that, in modern pedagogical theory, the integration of technological, pedagogical, and content knowledge is an important factor in improving teaching effectiveness. In technology lessons, combining digital design tools with modern pedagogical methods makes it possible to organize students' practical activities effectively.

The results of the study show that project activity organized on the basis of the Gemini CAD software is an important didactic tool in developing students' design thinking, spatial imagination, and design competencies. At the same time, the assessment criteria developed on the basis of the TPACK model make it possible to comprehensively evaluate students' content knowledge (CK), skills related to pedagogical activity (PK), and technological knowledge (TK).

REFERENCES

1. O'zbekiston Respublikasi Prezidentining «O'zbekiston Respublikasi xalq ta'limi tizimini 2030-yilgacha rivojlantirish konsepsiyasini tasdiqlash to'g'risida»gi 2019-yil 29-apreldagi PF-5712-sonli farmoni.
2. Shulman, L.S. Those Who Understand: Knowledge Growth in Teaching // Educational Researcher. — 1986. — Vol. 15, № 2. — P. 4–14.
3. Koehler, M. J., & Mishra, P. (2008). Introducing TPACK. In AACTE Committee on Innovation & Technology (Eds.), Handbook of technological pedagogical content knowledge for educators (pp. 3–29). New York, NY: Routledge.
4. Koehler M.J., Mishra P. What Is Technological Pedagogical Content Knowledge (TPACK)? // Contemporary Issues in Technology and Teacher Education. — 2009. — Vol. 9. — №1. — P. 60–70.
5. Mishra P., Koehler M.J. Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge // Teachers College Record. — 2006. — Vol.108, №6. — P.1017–1054.
6. Koehler M.J., Mishra P., Cain W. What Is Technological Pedagogical Content Knowledge (TPACK)? // Journal of Education. — 2013. — Vol. 193. — №3. — P. 13–19.