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# Theoretical, Conceptual, and Technological Model for Shaping Professional Competencies in The Dual Education System

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**Abstract:**

This article scientifically and theoretically illuminates the theoretical, conceptual, and technological aspects of shaping professional competencies within the framework of the dual education system. Based on general scientific principles of modeling and the classification of pedagogical models, a systemic model of dual education was developed, consisting of methodological, activity-technological, and results-based levels. The research results propose a technological model comprised of functional-structural, technological-process, criterion, and outcome components, which ensures the integration of educational institutions and production enterprises. This model serves to progressively develop professional competencies, enhance students' practical training, research potential, and technological culture. The proposed approach is assessed as a scientific and practical solution aimed at improving the dual education system, enhancing the quality of education, and increasing the adaptability of graduates to the labor market.

**Keywords:** Dual Education, Professional Competence, Pedagogical Modeling, Technological Model, Systemic Approach, Conceptual Model, Research Competency, Technological Culture, Educational-Practical Integration, Educational Technologies

## Introduction

Modern economic development, digitalization, industrial automation, and the increasing complexity of technological processes place new demands on the personnel training system. Today, educational institutions must not only limit themselves to theoretical training but also involve students directly in the production environment, shape real professional skills in them, and develop

their abilities for independent thinking and creating innovative solutions [1]. Therefore, the dual education system is recognized globally as the most modern professional education model, whose effectiveness has been proven worldwide.

The essence of dual education is that a certain part of the learning process takes place at an educational institution, and another part is conducted at production enterprises. This model not only imparts knowledge to students but also adapts them to operate within a real professional environment [2]. Developing professional competencies, evolving thinking operations, fostering a technological culture, enabling independent decision-making, and preparing for research activity in the specialist are the main objectives of the dual system. Accordingly, the relevance of this research lies in identifying the theoretical foundations of the dual education system, developing its conceptual model, substantiating its structural-component composition, and creating a technological model that facilitates the shaping of professional competencies [3].

## Literature Review

The foundations of dual education model, systemic analysis, professional competencies and modeling integration of education and production developed mainly in pedagogical and psychological literature. Insights into complex processes can be gained by modeling them with simpler systems that remain representative of the real system. Core principles of modeling were formulated by Shtoff, Bespalko, Tunnikov and Afanasyev; Klaus called it a simplified view of facts and relationships. Modeling is a scientific method of reflection of reality, Arkhangelsky [4]. This systematic process operates on principles regarding abstraction, isomorphism, structural correspondence, and systematicity. There are different models in pedagogy like Structural models which depict elements of the educational process, Functional models that depict functions of the educational process, Mixed Structural Functional models, and Process-models tracking the stages of the educational process. With regard to dual education, mixed models are best, since they reflect both structure and process [5]. The experiences of dual education in Germany, Austria and Switzerland, Korea and Japan, show that dual education works when education and production are closely linked, training is aligned with labor market needs, practical skills are deepened, and such a system leads to a high level of immediate graduate employment. These examples are a good addition to the system of Uzbekistan. Methods: The research employed systemic research approaches in recognizing dual education as a multi component, multi stage structure and utilized modeling to develop its theoretical framework [6]. Also, the process consisted in: the definition of the object, differential analysis, identification of structural parts, and graphic representation. Abstraction identified essential pedagogical characteristics, and component analysis articulated the instantiation of motivation, cognition, activity, and reflexivity in professionalism. It is comparative analysis that helped to adapt foreign experience to local conditions.

## Methodology

This research methodology was based on a systemic scientific approach that gave an opportunity to explore dual education as a complex system consisting of interconnected components, which can serve to study theoretical foundations and practical mechanisms in an integrated process. Initially, we analyzed pedagogical and psychological literature to reveal all available ideas on modeling, competency formation, and integration of education with production. This data was used to analytically inform the theoretical and conceptual model [7]. This modeling method was subsequently used to characterize the subject of study, to identify its basic properties, separate its structural parts, and build a model reproducing the internal logic of dual education. This involved applying abstraction to separate out the key features of the professional training (its function) and component analysis to identify intrinsic to competency formation motivational, cognitive, practical, and reflexive parts and their interrelation. In comparison with adaptation, analysis of the international practices of dual education was also applied, as it is important that the model is designed taking into account realistic production requirements and conditions of the

Republic of Uzbekistan [8]. The technological model, which describes the functional structural, process, criterion and outcome components of the system, were constructed synthesizing data from normative documents, methodological guides and scientific sources. This triangulation of theory and practice has yielded a model of dual education firm in science, which can, and should prove useful to practitioners in programme design and improvement in the real world of institutions and industry.

**Results**

A pragmatic model that strengthens the professional competencies within the dual education system has been generated by the research findings in three folds of conceptual, technological, and theoretical dimensions [9]. The findings suggest a model of parity, interdependence, methodological unity, variability, and individuals that forms a stable basis for linking learning settings to actual production environments. The three-level structure defines shift from broader scientific heuristics to activity based technologies to assessment based learning outcomes. This model consists of functional structural, technological process, criterion, and outcome components, and it establishes an unbroken link between theory and practice, which enables a step-by-step progress in the quality of a developing professional, his/her research capacity, and a technological culture.

The results confirm that students of dual education integrate into production processes more quickly and continuously deepen their theoretical knowledge through practice. They naturally and efficiently nurture discipline, responsibility, and professional identity, compared to what we might see in a traditional programs. This backs up the worldwide finding that closer interaction between education and production results in more powerful practical skills and better employment outcomes [10]. However, shortly after, the study highlights several challenges that undermine the system. Such as limited opportunities for enterprises to accommodate all students, gaps in educators' mastery of modern technologies, discrepancy between curricula and current production tasks, lack of modern digital educational content. Such issues expose a distinct divide between academic training and industrial needs.

So more theoretical and empirical studies are needed to expose the potential of the model. The interplay of motivational, cognitive, practical and reflexive aspects of competence development is yet to be explored in theory. It is still not known what combinations of these components produce the greatest impact on student learning. Practically speaking, there should be more research into the effects of the various forms of training: modular instruction; lab-based training; project based, and experiential learning; etc., on professional development/ career progress over time [11]. There is also a critical knowledge gap with regard to the evaluation of research ability and technological culture, since both of these were recognised as important outcomes, but there are still no specific assessment tools available.

Many important research directions remain to be addressed in the future. What we need now are long term studies that track graduates to find out to what degree the various competencies learned stick or fade back into real work. Identifying the production environments that best facilitate dual education is a comparative research field, which spans across different industries [12]. Also, as digital transformation advanced, there is a need to investigate virtual and hybrid dual-learning especially for regions or organizations with limited resources. As technology changes quickly, one way to achieve flexible programs is to ensure good collaboration between educators, production specialists and policy makers.

In general, the model suggested provides a scientific and practical basis for advancing dual education [13]. Nevertheless, it will only realise its full potential through continued research, closer collaboration with production enterprises, and a focused effort on the knowledge gaps highlighted in this analysis.

## Discussion

Studies have shown that: the dual education system quickly adapts students to production processes and shapes effective work skills in them. Students reinforce their theoretical knowledge through practice, and acquire professional responsibility, discipline, and work culture [14].

However, the following problems are observed in the implementation of the system: the inability of enterprises to accept all students for practice; insufficient knowledge of technologies by educators; misalignment of curricula with production; shortage of educational materials on digital technologies.

The proposed model overcomes these problems through: systemic approach, renewal of didactic foundations, strengthening cooperation between education and production, and integration of curricula [15].

## Conclusion

We show by example that the implementation of a scientifically organized theoretical, conceptual and technological model enhances the professional competencies formation process in the dual education system, by linking methodological grounding with activity-based technologies and outputs − with their acceptance as corresponding outcomes − that proposes capabilities for meaningful coexistence of education and production environments. The results indicate that students who are undergoing dual learning showed higher propensity towards adapting to real work situations, as well as better practical skills and foster greater sense of responsibility, discipline and ability to research is a great read as the findings prove the importance of aligning educational programs with skills required by industry. These results have serious implications for national education policy: the quality and relevance of professional training can only be raised through deeper cooperation between institutions and enterprises, renewal of instructional technologies, and improvement of digital learning resources. Simultaneously, the study found gaps, including weak enterprise capabilities, low levels of technological preparedness among teachers, and misalignment of curricula with production processes that solutions must overcome. Future research should follow the long term stability of acquired competencies from dual learning, highlight the best technologies for production based education with the potential of evidence based practices, provide tools for sustainably assessing research capacity and technology culture in a broad range of institutions, and document digital or blended formats enabling greater access to dual education whilst retaining practical utility.

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