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THE DUAL MODEL OF VOCATIONAL EDUCATION AS AN ENVIRONMENT FOR THE FORMATION OF ENTREPRENEURIAL COMPETENCES: A COMPARATIVE ANALYSIS OF THE EXPERIENCE OF GERMANY, AUSTRIA AND SWITZERLAND

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Abstract: the article considers the dual model of vocational education not as an organisational form of workforce training, but as a didactic environment possessing a specific potential for the formation of students' entrepreneurial competences. A comparative analysis of the vocational education systems of Germany, Austria and Switzerland is carried out; their common structural core and three different mechanisms of embedding the entrepreneurial component into dual training are identified. Criteria for adapting foreign experience to the conditions of the national system of vocational education are substantiated.

Keywords: dual education, entrepreneurial competences, vocational education and training, comparative pedagogy, educational transfer, practice firm, learning venues, social partnership, entrepreneurship competence framework, student enterprise, competence assessment, in-company mentoring, technical college, Germany, Austria, Switzerland

Introduction. Entrepreneurial competence has firmly established itself as a key competency, the development of which is a direct objective of the vocational education system. This approach has received its most comprehensive conceptual expression in the framework of entrepreneurial competence of the European Union EntreComp , where entrepreneurship is defined as the ability to transform opportunities and ideas into value for others, and the competence itself is described as cross-cutting, applicable at all levels of education [1]. Recommendations of the European Centre for the Development of Vocational Training directly indicate the need to develop entrepreneurial competence not in isolation, but in integration with professional competencies [8]. A similar position is taken by the International Labour Organization and UNESCO, which view entrepreneurial training as an element of vocational education, and not as a superstructure above it.

At the same time, empirical studies consistently document a gap between the declared goals of entrepreneurship education and its actual effectiveness. A systematic review by L. Pittaway and J. Cope demonstrated the limited impact of programs implemented exclusively in the classroom environment [15]. E. Rasmussen and R. Sørheim substantiated the advantage of education based on action, rather than on the study of descriptions of entrepreneurial activity [14]. M. Lakeus, in a study prepared for the Organization for Economic Cooperation and Development and the European Commission, empirically demonstrated that the intensity of the development of entrepreneurial competencies directly depends on whether the student creates real value for the external user [10]. In other words, the key condition for effectiveness is not the content of the educational material, but the nature of the environment in which this content is mastered.

It is here that the methodological connection with the dual model of vocational education is revealed. Dual learning, by its very nature, places the learner in an environment where actions have

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consequences, results have a recipient, and mistakes have a cost. From the perspective of J. Leive and E. Wenger's theory of situated learning [11] and S. Billett's concept of the didactic potential of the workplace [2], such an environment possesses a fundamentally different learning potential than the classroom. However, in pedagogical literature, dual learning and entrepreneurial education have traditionally been studied separately: the former as a means of improving the quality of vocational training, the latter as an independent area of economic education. The intersection of these two approaches has been understudied.

The purpose of this article is to reveal the didactic potential of the dual model as an environment for the development of entrepreneurial competencies based on a comparative analysis of the vocational education systems of Germany, Austria and Switzerland and to substantiate the criteria for transferring the identified solutions to national vocational education systems that are undergoing reform.

Materials and methods of research. The study was conducted using comparative pedagogical and documentary analysis methods. The source base included: regulatory and statistical-analytical materials of the Federal Institute for Vocational Education and Training of Germany [17], comparative reviews of apprenticeship systems of the European Centre for the Development of Vocational Training [7; 8], materials of the Austrian Federal Economic Chamber [20], documents of Swiss vocational education authorities [21], as well as scientific works by D. Euler [5], T. Deissinger [3], T. Deissinger and F. Gonon [4], W. Renold et al. [13], L. Lassnig [9] and F. Rauner et al. [12]. The conceptual framework for the analysis of the entrepreneurial component was the EntreComp framework [1] and the European Commission guide for educators [19].

The choice of three countries is motivated by three considerations. First, Germany, Austria, and Switzerland form the classic core of dual systems and are most fully represented in comparative studies. Second, despite their structural similarities, they demonstrate different ways of integrating the entrepreneurial component, making the comparison substantively productive. Third, the German entrepreneurial training methodology serves as the primary source of transfer for a number of vocational education systems in the post-Soviet space, including the system of the Republic of Uzbekistan, where the corresponding objective is enshrined in law [22].

The units of comparison were: the regulatory structure of the system; the distribution of content between training sites; the legal status of the student; the subject of educational outcome assessment; the form of the entrepreneurial component; and the method of confirming entrepreneurial competence. The results are systematized in comparative tables and interpreted from the perspective of educational transfer theory.

Results and discussions.

The common structural core of the three systems. Comparative analysis reveals four characteristics common to all three systems, forming their structural core.

The first characteristic is the distribution of the educational process between two institutionally independent training sites, each of which bears its own responsibility for the educational outcome. In Germany, the coordination of the two training sites is ensured by two regulatory documents: the content of training at the enterprise is determined by the training regulations (Ausbildungsordnung), approved at the federal level, and the content of training in a vocational school is determined by the framework curriculum (Rahmenlehrplan) [17]. Their mutual coordination constitutes the didactic integrity of the system.

The second characteristic is the trainee's legal agency. They enter into a training agreement with the company, receive remuneration, and are full members of the workforce. The pedagogical significance of this circumstance is difficult to overestimate: the trainee is not an observer at the company, but a

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participant with responsibility. The work they complete has a real result, and any mistakes they make have real consequences.

The third characteristic is the independence of the final assessment from the educational institution. In Germany and Austria, the competent authority is chambers that monitor the quality of training at companies, certify mentors, and organize the final exam. In Switzerland, this function is distributed among industry-specific labor organizations and the cantons. Thus, the assessment of results is carried out by the employer community, not by the institution that provided the training.

The fourth characteristic is the institution of social partnership, which ensures the regular updating of educational standards with the participation of employer associations and trade unions. This is what gives the system the ability to quickly respond to technological changes [7].

Significantly, in all three systems, the entrepreneurial component is not separated from dual training, but rather viewed as its natural extension: the student, working at the enterprise, observes entrepreneurial activity firsthand, from the inside. The differences lie not in the presence of this component, but in the mechanism for its institutionalization.

Germany: Didactic integration through a network of training companies. The conceptual core of the German model is the category " Beruf ," which is broader than the everyday concept of "profession" and encompasses an individual's professional identity, their attitude toward work, and their membership in a professional community. It is this category that distinguishes the content of dual training from narrow operational training: the student masters not only technological operations but also the ability to see a professional task holistically—planning, executing, and evaluating the results. F. Rauner operationalized this position in the COMET model, where professional competence is measured as the ability to independently design, implement and control the work process at three levels – functional, procedural and holistic-project [12].

The entrepreneurship component is implemented in the German system not as a separate academic discipline, but through a set of didactic forms, among which the training firm (Übungsfirma) occupies a central place. Its didactic essence lies in the fact that the enterprise is fictitious, while all the processes occurring within it—document flow, accounting, invoicing, payroll, and tax reporting—are real. Students successively occupy all the positions in such a firm, thereby experiencing entrepreneurship as a holistic system.

Essentially, the training companies are united in a national network, coordinated by a centralized structure in Essen; it comprises approximately five hundred training companies. The network forms a closed economic circuit: training companies trade with each other, their employees receive and spend conditional compensation, and the centralized structure assumes the functions of the state—bank, tax authority, and social security. Where the absence of a counterparty would prevent the full reproduction of economic transactions, correspondent firms are introduced into the system. Membership in the national network simultaneously signifies membership in an international association of training companies, encompassing over seven thousand firms in more than forty countries, which opens up the possibility of conditional foreign trade transactions [18].

The second form is student enterprises, which conduct real, albeit small-scale, commercial activities; the third is entrepreneurial competitions, which introduce the student's idea into a competitive environment with external expert evaluation. The theoretical justification for the effectiveness of these forms is provided by S. Billett's concept of the didactic potential of the workplace : the learning outcome is determined by the interaction of the opportunities provided by the environment and the student's own activity [2]. A training company is precisely such a purposefully enriched environment.

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Austria: Certification-Based Embedding of Entrepreneurial Competence. L. Lassnigg attributes the sustainability of the Austrian apprenticeship system to the presence of mechanisms for dynamic adaptation to labor market demands: programs for new professions are developed promptly, current standards are regularly updated, and continuous information exchange is established between educational organizations and companies [9]. The training firm is as widespread in Austrian vocational educational organizations with a commercial focus as in German ones, and also has its own coordination center.

However, Austria's most original solution lies in a different direction. Since 2004, the Austrian Federal Economic Chamber has been implementing the "Entrepreneur's Certificate" (Unternehmerführerschein , Entrepreneur's Skills The Certificate is a modular additional qualification designed for students aged fourteen and older, including those attending vocational schools and one- to two-year vocational colleges. The program consists of four sequential modules: Module A covers the basic concepts of economy and society, Module B covers macroeconomic content, Module C covers the fundamentals of enterprise economics, and Module UP is the entrepreneurial exam itself. Exams for Modules A, B, and C are administered in a standardized online format directly at the educational institution, while Module UP is taken before a committee at the Chamber's examination structure. According to the Chamber of Economy, students have successfully completed approximately one hundred twenty thousand modules of the program [20].

The pedagogical significance of this decision is as follows. The principle of independent assessment, which applies to professional qualifications in the dual system, is extended here to entrepreneurial competence as well: it receives an independent, externally validated qualification status and ceases to be an "invisible" learning outcome. This eliminates the problem, characteristic of many systems, in which entrepreneurial training is conducted, but its results are not recorded anywhere and therefore have no value for either the student or the employer. Additionally, the basic module of the program is linked to the apprenticeship mini-enterprise program, allowing the student to obtain a Common European Certificate in Entrepreneurial Skills.

Switzerland: Structural Integration through a Third Place of Study. The Swiss system is structurally similar to the German one, but differs from it in two significant ways. The first is the scale and status of vocational education: approximately two-thirds of young people after compulsory schooling choose vocational basic education, which is conducted in approximately two hundred and thirty professions and culminates in a federal certificate of vocational suitability or a federal vocational certificate [21]. The second is the high permeability of educational trajectories, as indicated by the research of W. Renold et al.: graduates of a vocational program can continue their education through a vocational bachelor's degree and universities of applied sciences, which is facilitated by the modular structure of programs, credit recognition, and a national qualifications framework [13]. Vocational education is thus no longer a dead end and becomes part of the lifelong education system.

Of particular interest to this study is the Swiss third-place training institution. Along with training companies and vocational schools, inter-company courses, organized by industry organizations and subsidized by the confederation and cantons, are a mandatory element of vocational basic education. Their purpose is to ensure the acquisition of those basic professional skills and general topics that neither a single company nor a school can provide. In other words, the third-place training institution is a structural response to the objective limitation of the dual model: a single company is always specialized and therefore does not cover the full range of required competencies.

Entrepreneurial programs in Switzerland are implemented primarily in an extracurricular , partnership-based format. The most well-known of these involves students aged sixteen to twenty establishing a mini-enterprise and running it throughout the school year, developing a business plan,

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raising funds, organizing sales, and compiling an annual report. The program is also offered in vocational schools and culminates in a national competition [23].

A comparative study by T. Deissinger and F. Gonon shows that the difference between the German and Swiss systems is not technical, but cultural: the German model is based on the concept of professional identity, while the Swiss model is based on the idea of flexibility in relation to the labor market [4]. This difference has a direct methodological consequence for transfer: not only the structure of the system is transferable, but also its cultural foundation, which, as a rule, is impossible to reproduce.

The summary results of the comparison are presented in Table 1.

Table 1. Comparative characteristics of the dual systems of Germany, Austria and Switzerland

Comparison parameter	Germany	Austria	Switzerland
System name	Dual system (Ausbildung)	Dual learning (Lehre)	Professional basic education
Places of study	Enterprise and vocational school	Enterprise and vocational school	Enterprise, vocational school and inter-industrial courses
Methodological center	Federal Institute of Vocational Education	Structures of the Chamber of Economy	State Secretariat for Education, Research and Innovation
Documents defining the content	Regulations on training and framework curriculum	Professional standards and framework programs	Modular educational plans
Student status	Training agreement; remuneration is paid	Apprenticeship contract; remuneration is paid	Training agreement; remuneration is paid
Subject of final assessment	Chambers of Commerce, Industry and Crafts	Chamber of Economy	Sectoral labour organizations and cantons
The strength of the system	Standardization and professional identity	Rapid adaptation to the labor market	Trajectory permeability and modularity
Entrepreneurial component	Training companies, student enterprises, competitions	Modular entrepreneur's certificate, training companies, mini-enterprises	Mini-enterprises, modular program elements, startup support
Confirmation of the result	Mainly internal, within the framework of the program	External Certification Exam of the Chamber	Program Certificates and Competitive Achievements

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The systematization of the identified differences allows us to formulate the main result of the comparison: with a common structural core, the three systems implement three different mechanisms for integrating the entrepreneurial component into dual training (Table 2).

Table 2. Mechanisms for integrating the entrepreneurial component into dual training

Characteristic	Germany: Didactic Mechanism	Austria: Certification Mechanism	Switzerland: Structural Mechanism
The essence of the mechanism	Creating an enriched learning environment that replicates economic activity	Granting entrepreneurial competence an independent qualification status	Identifying a separate learning space and ensuring the permeability of trajectories
Carrier Institute	The network of training companies and its centralized structure	The Chamber of Economy and its examination structures	Industry organizations of the world of labor
Student activities	Work in all positions of a hypothetical company	Mastering the modules and passing the external exam	Running a mini-enterprise during the school year
Confirmation of the result	Product of activities within the training company	A certificate recognized by the business community	Certificate of the program and the competition result
What is subject to transfer	Didactic design of the intermediate environment	The idea of external confirmation of entrepreneurial competence	The idea of a third place of study as a component carrier

Hierarchy of didactic forms by the level of realistic outcome. An analysis of the practices of three countries shows that the forms of entrepreneurial training used are not equivalent or interchangeable: they form a hierarchy that ensures a gradual transition of the student from a simulated environment to a real one. Business simulation occupies the lowest level: the process is simulated, the outcome is simulated, there is no risk, and errors have no consequences. A training company represents an intermediate level: the processes are real, the outcome is simulated, and the risk is didactic in nature. The highest level is formed by a student enterprise and servicing a real client at a partner enterprise: both the process and the outcome are real, and therefore, so is the risk.

The theoretical justification for this hierarchy is provided by J. Leiva and E. Wenger's concept of legitimate peripheral participation: the learner enters the community of practice from the periphery and gradually becomes its full member [11]. It receives empirical confirmation in the study of M. Lakeus , who established a direct relationship between the intensity of the development of entrepreneurial competencies and whether the learner creates real value for the external user [10]. The practical consequence for the design of methods is obvious: stopping the learner at the bottom of the hierarchy devalues all previous training, since competence formed in an environment without consequences is not tested in an environment with consequences.

The obtained results must be correlated with the problem of educational transfer, which has been studied quite thoroughly in comparative pedagogy. A fundamental study by D. Euler, commissioned by the Bertelsmann Foundation , directly raises the question of whether the German dual system can

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serve as a model for other countries, and gives a reserved answer: the system is not transferable in its entirety, since it is inextricably linked with the structure of the national economy, legal tradition, and the culture of social partnership; transfer is possible only with respect to individual elements and only with their adaptation to the conditions of the receiving country [5]. T. Deissinger , critically reconsidering the status of the German model as "best practice", shows that its success is largely explained by the structure of the German economy - strong medium-sized businesses and a craft tradition - and these factors cannot be reproduced [3]. O.N. Oleynikova and A.A. Muravyova, comparing the experiences of Russia and Germany, identify the weakness of the institution of social partnership as the main obstacle to transfer [24]. E.V. Tkachenko emphasizes that a necessary condition for dual education is an equal partnership between the educational organization and the enterprise [25].

The methodological aspect of the problem is also significant. N.E. Erganova demonstrates that professional training methodology represents a holistic system of unity of content, forms, methods, and means [26]. It follows that the transfer of a single element of a foreign methodology—for example, only a game simulation—will certainly not produce the expected effect, since the removed element is deprived of the connections that ensured its effectiveness in the original system.

A summary of the above allows us to substantiate six criteria for adapting foreign experience to the conditions of the national system of vocational education.

The first criterion is the professional specificity of the content. The general content of the foreign methodology should be related to the professional product of the profession the student is mastering. This criterion is based on M. Mulder's position on the contextual determinacy of competence: competence acquires meaning only in a specific professional context [6].

The second criterion is synchronization with the dual environment. The content learned in the classroom must be didactically aligned in timing and meaning with the student's practical activities at the enterprise. This criterion is based on the experiential learning cycle and the concept of didactic capabilities of the workplace [2].

The third criterion is the level of implementation. The methodology should not end with simulation; it must expose the student to a real customer, a real service, and a real result [10; 14].

The fourth criterion is alignment with the competency framework. The results of the methodology must be anchored in the competency framework of the educational program; otherwise, the training module becomes normatively "homeless": it is implemented but does not produce a single recorded outcome [1; 8].

The fifth criterion is the correspondence between the method of development and the method of assessment. Competence developed through activity should also be assessed through activity; a written test is methodologically inadequate here [12].

The sixth criterion is legal feasibility. The proposed solution must be implementable within the current regulatory framework of the host system, without changing legislation.

Applying these criteria to the national context reveals the following. In the vocational education system of the Republic of Uzbekistan, the regulatory framework for dual education has been established, and the goal of introducing entrepreneurial skills development programs based on German best practices into the educational process of technical schools has been enshrined in a decree of the head of state [22]. The corresponding methodology has been implemented, teaching hours have been allocated for it, and a corps of certified teachers has been trained. However, analysis shows that the transfer has occurred primarily in the organizational rather than didactic dimension: the methodology is not specified in relation to the profession being mastered, is not synchronized with industrial practice, is not linked to the competency framework of the educational program, and is not assessed

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through activities. It is this discrepancy, rather than the quality of the methodology itself, that limits its effectiveness.

A comparison with the experiences of three countries suggests a way to resolve this contradiction. The Swiss Institute of Third Place Training demonstrates that it makes sense to consolidate the entrepreneurial component within a dedicated learning environment, without overburdening either the school or the company. The German experience of a training company provides a didactic framework for such a space—an environment in which processes are realistic with a hypothetical outcome. The Austrian solution points to the need for external confirmation of entrepreneurial competence as an independent educational outcome. Combining these three ideas allows for a sequence of "simulation – training and entrepreneurship company – serving a real client at a partner company," in which the learner's responsibility increases gradually and in a pedagogically sound manner.

The limitations of this study stem from its nature: it utilizes comparative pedagogical and documentary analysis methods, and therefore substantiates the feasibility but does not prove the effectiveness of the proposed solutions. Experimental testing of the methodology, based on the criteria outlined, is the subject of the next stage of the research.

Conclusions. The conducted comparative analysis allows us to formulate the following conclusions.

Firstly, the structural core of the dual systems in Germany, Austria, and Switzerland is formed by four principles: the distribution of the educational process between two or more institutions, the legal agency of the student, the independence of the final grade from the educational institution, and the institution of social partnership. The degree of transferability of these principles varies and is objectively limited by the conditions of the host system.

Secondly, the entrepreneurial component in all three systems is not separated from dual training, but rather serves as its natural extension; differences concern the mechanisms for its institutionalization – didactic in Germany, certification in Austria, and structural in Switzerland.

Thirdly, the didactic forms used form a hierarchy according to the degree of reality of the result and the level of risk accepted by the learner; the pedagogical value of the form increases as it approaches the actual value created for the external user.

Fourth, the dual model has a specific potential for developing entrepreneurial competencies precisely because it places the learner in an environment where the result has a recipient, and the error has a cost; the classroom environment does not possess this property and therefore cannot serve as a full-fledged substitute.

Fifth, the transfer of foreign experience is effective only if six substantiated adaptation criteria are met: professional specificity of content, synchronization with the dual environment, level of implementation, alignment with the competency framework, alignment of the development method with the assessment method, and legal feasibility. It is not the organizational and legal core of foreign systems that is transferable, but their didactic principle—training in a real production environment with a gradual increase in the learner's responsibility.

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