

RESEARCH ON THE FORMATION OF MARKETING COMPETENCE OF EMPLOYEES OF ENGINEERING COMPANIES SPECIALISING IN WATER TREATMENT AND WASTEWATER TREATMENT: PRINCIPLES AND METHODOLOGICAL APPROACHES

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Annotation. The study explores the formation of marketing competence among employees of engineering companies specialising in water treatment and wastewater purification within corporate training contexts. It presents principles and methodological approaches essential for structuring research in this field. The study establishes key principles: objectivity ensures verifiable and replicable competence formation through validated pedagogical conditions; unity between theory and practice integrates interdisciplinary insights from philosophy, psychology, management, marketing, engineering, and pedagogy, confirming the validity of existing research; systematisation connects empirical findings with broader pedagogical theories and human capital development; determinism examines causal relationships in competence formation, allowing for predictive modelling and adaptation to industry dynamics; cognitive processing defines scientific inquiry as a structured intellectual operation, incorporating analysis, synthesis, and hypothesis testing; decomposition and abstraction facilitate an in-depth study of motivational, cognitive, and praxeological components, supporting modelling and forecasting. To enhance understanding, the study employs multiple methodological approaches: systemic approach conceptualises competence as a network of interconnected components within corporate training; holistic approach ensures balanced development by integrating structural elements; synergetic approach views competence formation as an emergent phenomenon within a self-organising system; personality-oriented approach allows adaptive modifications based on employee characteristics; activity-based approach frames competence formation as an interactive process between employees and their work environment; contextual approach aligns training with real-world professional demands. The study underscores the strategic role of corporate training in fostering marketing competence, offering a structured foundation for further research in professional development within engineering industries.

Keywords: research, research principles, methodological approaches, employee of engineering company, an engineering company specialising in water treatment and wastewater purification, corporate training, corporate training program.

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Дослідження формування маркетингової компетентності працівників інжинірингових компаній, що спеціалізуються на водопідготовці й очищенні стічних вод: принципи та методологічні підходи

Анотація. Дослідження присвячене вивченню формування маркетингової компетентності працівників інжинірингових компаній, що спеціалізуються на водопідготовці та очищенні стічних вод, у контексті корпоративного навчання. У ньому представлено принципи та методологічні підходи, які є необхідними для структурування дослідження у цій галузі. Дослідження визначає ключові принципи: об'єктивності, що забезпечує верифіковане та відтворюване формування компетентності через валідні педагогічні умови; єдності теорії і практики, що інтегрує міждисциплінарні знання з філософії, психології, менеджменту, маркетингу, інженерії та педагогіки, підтверджуючи валідність існуючих досліджень; систематизації, що пов'язує емпіричні результати з ширшими педагогічними теоріями та розвитком людського капіталу; детермінізму, що досліджує причинно-наслідкові зв'язки у формуванні компетентності, дозволяючи прогнозувати та моделювати адаптацію до галузевих змін; когнітивної обробки, що визначає наукове дослідження як структуровану інтелектуальну операцію, яка охоплює аналіз, синтез і перевірку гіпотез; декомпозиції та абстрагування, що забезпечують глибоке дослідження мотиваційного, когнітивного і праксеологічного компонентів, сприяючи моделюванню та прогнозуванню. Обґрунтовано використання низки методологічних підходів: системний підхід трактує компетентність як систему взаємопов'язаних компонентів у корпоративному навчанні; цілісний підхід забезпечує збалансований розвиток шляхом інтеграції структурних елементів; синергетичний підхід розглядає формування компетентності як емерджентний феномен у самоорганізованій системі; особистісно орієнтований підхід дозволяє адаптувати навчальну програму відповідно до особливостей працівників; діяльнісний підхід визначає формування компетентності як інтерактивний процес між працівниками та їхнім професійним середовищем; контекстний підхід узгоджує навчання з реальними вимогами професійної діяльності. Дослідження підкреслює стратегічну роль корпоративного навчання у формуванні маркетингової компетентності, пропонуючи структуровану основу для подальших наукових розвідок у сфері професійного розвитку в інжинірингових галузях.

Ключові слова: дослідження, принципи дослідження, методологічні підходи, працівник інжинірингової компанії, інжинірингова компанія, що спеціалізується на водопідготовці та очищенні стічних вод, корпоративне навчання, програма корпоративного навчання.

Introduction

Scientific inquiry involves the discovery, processing, and accumulation of information, with its systematisation, analysis, and generalisation serving as the foundation for the continued advancement of knowledge. It is important to note that individual facts, while undoubtedly valuable to researchers, do not inherently possess scientific significance. Their scholarly relevance emerges only when they are organised and interpreted within a coherent logical framework.

Each scientific study – from its initial conception through analysis to the synthesis of conclusions – is conducted as an individualised endeavour. “Science, as an activity, constitutes a process of reality generalisation, whereas science as a system of knowledge represents an accumulation of judgments subjected to conceptual refinement. The definition of any phenomenon is ultimately rooted in identifying its enduring elements – those aspects that persist throughout its existence regardless of transformations. Thus, in defining science, primary attention must be directed toward its fundamental stability, not merely the historically contingent assertions that characterise its evolutionary stages, but rather the “timeless” attributes of the cognitive process” [3, p. 5]. Researchers emphasise that “science is distinguished by alternating extensive and revolutionary phases of development, a dialectical interplay between differentiation and integration of scientific knowledge, and the progression of fundamental and applied research. Science fulfils several essential functions, including cognitive (addressing human needs for understanding the laws of nature, society, and thought), practical (enhancing societal systems and interactions), and cultural-educational (advancing cultural development and fostering individual and collective intellectual growth)” [5, p. 387].

The organisation of research necessitates the identification of its theoretical and methodological foundations, serving as the starting point for its implementation. Accordingly, it is logical to delineate the principles and methodological approaches that underpin the study, which aims to examine the specifics of marketing competence formation among employees of engineering companies specialising in water treatment and wastewater purification.

The analysis of recent research and publications. The review of the source base for this study indicates that the theoretical and methodological foundations of scientific and pedagogical research, as well as the specifics of its organisation and implementation, have been the subject of extensive investigation by domestic scholars. Notable contributions have been made by V. Abrakitov [1], I. Astrelin, I. Kosogina, and S. Kirii [2], H. Birta and Yu. Burgu [3], S. Vazhynskyi and T. Shcherbak [4], O. Vlasenko [5], O. Hutorov [6], O. Dubaseniuk [7], A. Konverskyi [8], and S. Sysoieva and T. Krystopchuk [9]. This body of work provides a valuable foundation for understanding the conceptual and methodological parameters guiding research in scientific and pedagogical contexts.

The formulation of article purpose. The article aims to present the principles and methodological approaches used in the research on the formation of marketing competence of employees of engineering companies specialising in water treatment and wastewater treatment.

Results

According to O. Dubaseniuk, "scientific inquiry represents a distinct form of the cognitive process – an organised and purposeful investigation of phenomena that employs scientific methodologies and instruments, ultimately culminating in the theoretical systematisation of knowledge regarding the studied phenomena" [7, p. 18]. By employing both general and specialised research methodologies, scholars delineate the key stages of inquiry – determining the starting point, structuring acquired data, and formulating precise conclusions. The successful implementation of scientific research requires adherence to established principles, the validity and logical coherence of which have been substantiated in prior academic studies. This includes reliance on knowledge verified for accuracy and grounded in logical reasoning; the systematic examination and analysis of complex problems through the identification of their constituent elements; progression from simple and evident aspects of a problem to its multidimensional complexity; and the consideration of diverse perspectives, which facilitates the identification of critical details that may significantly contribute to further scholarly investigation [1].

Undoubtedly, scientific research is directed toward the discovery of new scientific facts, phenomena, and processes. However, equally significant is their justification within the broader context of science, considering their theoretical and applied relevance, potential for further utilisation, and prospects for refinement and advancement. Therefore, the successful execution of a research study necessitates the development of a structured program and a well-defined plan that systematically organises all stages of the investigation.

The development of a research program, the formulation of a study plan, the selection of appropriate scientific inquiry methods, and the understanding of the logic of its progression enable researchers not only to document scientific facts, describe phenomena and processes, and characterise their attributes but also to apply critical analysis tools to examine their essence. This approach facilitates the comparison of newly acquired data with pre-existing knowledge systems related to the given fact, phenomenon, or process, allowing for the assessment of their significance in advancing theoretical understanding or refining practical applications.

Scholars argue that "a research program is a document that regulates all stages, phases of preparation, organisation, and execution of a specific study. It encompasses theoretical justifications for methodological approaches and techniques used in examining a particular phenomenon or process. The program defines the research problem, objectives, and tasks, outlines the methods for their solution, and identifies the primary pathways and forms of practical implementation for anticipated results. It serves as the foundational framework of the study, determining its conceptual and substantive value, as well as the quality and reliability of the obtained information" [4, p. 17]. The key requirements for structuring a research program include theoretical and methodological soundness, structural completeness, logical coherence of all program elements, and flexibility [4, p. 17].

Regarding the logic of scientific inquiry, it is interpreted as "a set of components such as cognitive tasks, information structure (a list of its types and interconnections), necessary data for decision-making, tools for data collection and processing, procedures for task formulation, strategies

for problem-solving, and result generation. The logic is developed within the methodology of scientific research, and its description represents the outcome of the study. It serves as a prerequisite for designing research methodologies" [6, p. 50]. This systematic framework ensures that research is conducted with methodological rigour and intellectual precision.

It is well established that the research process represents a fundamental form of scientific advancement, built upon the application of scientific methods for cognition and the analysis of facts, phenomena, and processes. These methods ensure the objectivity of scientific inquiry, the validity of findings, and the possibility of reproducing results for verification. "The goal of scientific research is a comprehensive, objective, and thorough examination of phenomena, processes, their characteristics, and interrelations, based on scientifically developed principles and methods of cognition. Additionally, research aims to yield findings beneficial to human activity, implementing them in production to enhance efficiency. In conducting scientific research, it is essential to consider all relevant aspects while concentrating on the core, key issues of the subject" [1, p. 31]. It is widely recognised that scientific inquiry is not merely a process of observation but also an exercise in deep comprehension, the identification of intricate details, and the revelation of the essence of phenomena in their most subtle manifestations, without losing sight of the broader research direction. The higher the quality of generalisations and conclusions, the more persuasive and effective the research outcomes become.

According to S. Sysoieva and T. Krystopchuk, who classify scientific and pedagogical research into fundamental, applied, and practical categories, applied research is grounded in the findings of fundamental studies, which are characterised by "the theoretical significance of the obtained results, influencing the development of theory, transforming and reshaping perspectives on key issues in education, upbringing, history, and the methodology of pedagogy" [9, p. 17]. I. Astrelin, I. Kosogina, and S. Kyrii define applied research as investigations "aimed at identifying ways to apply the laws of nature to improve existing methods and create new tools and approaches in human activity. The goal of this type of research is to establish the feasibility of using scientific knowledge, acquired as a result of fundamental scientific studies, in practice" [2, p. 8]. A. Konverskyi argues that applied research constitutes "scientific and scientific-technical activity focused on acquiring and utilising knowledge for practical purposes. The direct aim of applied sciences is to implement the findings of fundamental sciences in solving cognitive and socio-practical problems" [8, p. 19]. The primary characteristics of applied research, as outlined by the authors, include "its alignment with current practical demands, the relatively limited scope of its sample selection, and the efficiency of conducting studies and implementing results" [9, p. 20]. This framework underscores the essential role of applied research in bridging theoretical advancements with real-world applications.

The applied research conducted is dedicated to a persistent issue in continuous professional education, namely, the formation of marketing competence among employees within the corporate training framework of an engineering company specialising in water treatment and wastewater purification.

The relevance of this scientific problem and the justification for undertaking the study are substantiated by the contradictions it seeks to address, between the growing demand for marketing competence among employees of engineering companies specialising in water treatment and wastewater purification and the insufficient level of research on this issue within theoretical and applied scientific-pedagogical studies; the requirements of the modern labour market in the field of water engineering and water technologies, the expectations of employers, and the sporadic nature of competence formation within initial professional education, which underscores the necessity of leveraging corporate training's compensatory function; the capacity of engineering companies to organise corporate training aimed at fostering marketing competence among their employees and the need to develop a specialised corporate training program that could enhance existing practices. The study aims to bridge these gaps and contribute to the systematic formation and improvement of marketing competence within professional and corporate educational settings.

According to the principles of the methodology of scientific and pedagogical research, it is necessary to distinguish between the object and the subject of the study. The object of this scientific inquiry is corporate training for employees of engineering companies specialising in water treatment and wastewater purification. Accordingly, the subject of the scientific-pedagogical study is defined as the pedagogical conditions for the formation of marketing competence among employees within the corporate training framework of engineering companies.

The relevance of the research problem, the identified contradictions, and the delineation of the object and subject of the study provided the foundation for formulating the research goal and objectives. Considering the findings of domestic scholars in the field of research methodology, the study's goal is formulated as follows: the determination, justification, and experimental verification of pedagogical conditions for the formation of marketing competence among employees within the corporate training system of an engineering company.

In this study, the following research objectives should be outlined:

- to analyse the formation of marketing competence among employees of an engineering company within the corporate training framework, examining its conceptual foundations and structural components within scientific-pedagogical discourse;
- to define the criteria, justify the indicators, and establish the levels of marketing competence formation among employees in corporate training settings;
- to substantiate the pedagogical conditions that facilitate positive dynamics in the development of marketing competence among employees of an engineering company;
- to develop and implement a corporate training program aimed at fostering marketing competence among employees of an engineering company specialising in water treatment and wastewater purification;
- to organise and conduct a pedagogical experiment to assess the effectiveness of the proposed pedagogical conditions for marketing competence formation among engineering company employees.

Notably, when examining various aspects of scientific methodology, particularly in the domain of scientific and pedagogical inquiry, researchers highlight the underlying principles and the methodological approaches employed in conducting such studies. A principle is understood as "the fundamental premise of a scientific theory, serving as the initial and most abstract formulation of an idea and the foundational framework for the systematisation of knowledge" [6, p. 27].

Based on an analysis of literature in the methodology of science, it is concluded that scientific inquiry, specifically the study of marketing competence formation among employees within corporate training in an engineering company, specialising in water engineering and water technologies, should be structured around several key principles.

Among these is the principle of objectivity, which serves as a cornerstone of scientific inquiry, substantiating the objective nature of marketing competence formation in corporate training contexts through the implementation of well-founded pedagogical conditions. This entails the verifiability and reproducibility of research findings, their empirical validation through pedagogical experimentation, logical justification, evidential rigour, and the systematic nature of the obtained results.

We emphasise the relevance of applying the principle of unity between theory and practice, which underpins this study by integrating the findings of previous scientific-pedagogical research. It also accounts for contributions from various fields of scientific knowledge, including philosophy, psychology, management, marketing, engineering, and pedagogy. Following this principle, the research has empirically validated the hypothesis, examined scientific theories, and tested methodological approaches. The analysis of the specifics of marketing competence formation among employees within corporate training settings in engineering companies serves as a basis for developing new theoretical perspectives in the broader field of continuous professional education and corporate training specifically.

According to the principle of systematisation, this study examines the formation of marketing competence in corporate training environments from the perspective of scientific analysis comprehensiveness and a hierarchical knowledge structure, progressing from individual empirical facts characterising corporate training to the broader theory of pedagogical science. Additionally, the study considers the relationship between corporate training and the development of a company's human capital, as well as the interplay between the motivational, cognitive, and praxeological components of marketing competence and their application in professional activities as a fundamental aspect of employees' professional competency within engineering companies.

The principle of systematisation in scientific and pedagogical research necessitates the alignment of theoretical knowledge, methodological approaches, and corresponding research methods to ensure a systematic and comprehensive examination of the study's object. It also supports the sequential execution of research tasks aimed at achieving the overall goal of the study.

The foundation of scientific research on the principle of determinism necessitates an examination of causal relationships that explain the absence of marketing competence among

employees of engineering companies specialising in water treatment and wastewater purification at the kick-off of the pedagogical experiment. This principle also justifies the specificity of corporate training organisation, ensures the replicability and reliability of obtained results, and upholds the objectivity and accuracy of scientific conclusions. Identifying the regularities governing the formation of marketing competence in engineering company employees allows for the prediction and modelling of the development of other competencies, the demand for which is influenced by rapid changes in the labour market, water engineering, and water technologies development.

According to the cognitive principle, scientific inquiry into corporate training in general, and the formation of marketing competence in engineering company employees in particular, emerges from complex cognitive operations that define research as a process of comprehending factual information, analysing, synthesising, structuring, and integrating it into a broader knowledge system. Specifically, the scientific investigation of marketing competence formation among engineering company employees entails cognitive processing, comprehension, critical analysis, and experimental verification of hypotheses, etc.

The application of the principles of decomposition and the progression from abstraction to concreteness has enabled a substantiated analysis of the content and structure of marketing competence among employees of an engineering company, focusing research attention on each of its components (motivational, cognitive, and praxeological). These principles have facilitated the modelling and forecasting of competence formation within corporate training environments, aligned with the proposed program. Additionally, they have outlined the application of theoretical foundations, refined general research intentions, ensured logical consistency in scientific inquiry, and strengthened comprehension of the study's subject matter.

Considering these scientific-pedagogical principles, and in accordance with the study's goal and objectives, the research is built upon a comprehensive set of methodological approaches, substantiated in academic literature.

Through the systemic approach, marketing competence is conceptualised as a network of interrelated components (motivational, cognitive, and praxeological), the formation of which occurs within the corporate training system of an engineering company, which, in turn, operates as part of a continuously learning organisation. It is relevant to incorporate fundamental characteristics of a system, such as hierarchy (the structured progression of marketing competence formation, from the acquisition of theoretical knowledge to its practical application), dynamism (the formation of marketing competence in employees is shaped by both external factors (labour market demands) and internal factors (company's needs and corporate training structures), etc.

Within the holistic approach, marketing competence among employees of an engineering company is examined as an integrated system, emphasising the unity of its structural components and their interactions. Its formation occurs during the implementation of a corporate training program, designed based on systemic integration principles and aimed at ensuring the harmonious development of employees.

According to the synergetic approach, the formation of marketing competence among engineering company employees is explored from the perspective of a self-organised system, characterised by its ability to self-regulate. Additionally, this approach highlights emergence, wherein the interaction between motivational, cognitive, and praxeological components serves as the basis for the formation of marketing competence as a distinct property.

The personality-oriented approach was deemed appropriate for this study, as the pedagogical experiment sought to account for individual characteristics of employees, including their motives, intentions, interests, and needs regarding marketing competence formation. The research design also incorporated adaptation and modification of the corporate training program to align with these individual factors. This approach provided a rationale for the cognitive and praxeological development of employees, aimed at enhancing efficiency and effectiveness in professional activities, a process rooted in optimisation, self-organisation, and adaptability.

According to the activity-based approach, the formation of marketing competence among employees of engineering companies specialising in water treatment and wastewater purification is analysed as a process of active interaction between employees and their professional environment.

Given the specific nature of corporate training, the relevance of applying the contextual approach is justified, as it emphasises bringing learning closer to real professional conditions. To achieve this, before conducting the pedagogical experiment, we examined the operational specifics of

engineering companies specialising in water treatment and wastewater purification, reflected on our own professional experience, conducted employees' surveys, and held interviews with company leadership to identify actual industry needs and employees' interests. These insights formed the basis for developing the corporate training program.

Conclusions

Based on a comprehensive analysis of scholarly and pedagogical literature, the study establishes a methodological framework for examining the formation of marketing competence among employees of engineering companies specialising in water treatment and wastewater purification within corporate training settings. The findings are structured around several fundamental principles: objectivity ensures that the formation of marketing competence is examined through verifiable, replicable, and empirically validated pedagogical conditions, supporting logical justification and evidential rigour; unity between theory and practice integrates previous scientific-pedagogical research with interdisciplinary insights from philosophy, psychology, management, marketing, engineering, and pedagogy, confirming the validity of scientific theories and methodological approaches; systematisation frames competence formation within a hierarchical knowledge structure, linking empirical observations of corporate training to broader pedagogical theories and human capital development; determinism identifies causal relationships in competence formation, allowing for predictive modelling and adaptation to market dynamics in water engineering and related industries; cognitive processing highlights scientific inquiry as a structured intellectual operation, encompassing analysis, synthesis, critical evaluation, and hypothesis testing; decomposition and progression from abstraction to concreteness enable examination of motivational, cognitive, and praxeological components, facilitating modelling and forecasting of marketing competence formation.

Additionally, the study applies multiple methodological approaches to refine the understanding of competence formation: the systemic approach conceptualises competence as a network of interrelated components, formed within corporate training as part of a continuously learning organisation; the holistic approach ensures the integration of structural components, promoting a balanced employee development strategy; the synergetic approach views competence formation as an emergent phenomenon arising from inter-component interactions in a self-organising system; the personality-oriented approach considers individual employee characteristics, allowing adaptive modifications in corporate training programs; the activity-based approach defines competence formation as an interactive process between employees and their professional environments; the contextual approach strengthens the practical applicability of training programs by aligning education with real-world work conditions.

These conclusions underscore the strategic importance of corporate training in fostering marketing competence and provide a structured foundation for further research in professional development within engineering industries.

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