

APPLICATION OF MODERN APPROACHES IN PHYSICS TEACHER TRAINING

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Abstract. The article provides information about the models applied in physics teacher training in different countries. Modern theories, their importance, role and functions in education were reflected in the conducted research. Canada, Denmark, Finland, China, Hong Kong, Japan, Australia, South Korea, Germany, France, Spain, Israel, etc. experiences of countries were examined and various models were analyzed.

Keywords: *model, determinants, management system, educational services, creative-predictive management*

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1. Introduction

At the present stage of the development of the education system, two strategically important directions of its development have been identified: the first is aimed at achieving specific educational goals (degree of training); the second is focused on achieving the so-called goals-vectors (the degree of learning ability, the level of self-actualization, socialization etc.). Such goal setting determines an understanding of the essence of education as a process and result of mastering knowledge, skills, competences and the amount of competences brought in line with certain standards; in the second case, education is presented in the form of a continuous process of personal development and formation, through the formation of its need-motivational, cognitive, emotional-volitional sphere and professionally important qualities (Lee *et al.*, 2009). There are differences in the implementation tools used in the context of the given guidelines and the vision of the training content. Thus, in the first case, developed and approved standards, curricula, forms, methods and means of teaching, including ways to control learning outcomes, are used in practice, in the second case, the development of new conceptual ideas of management, content and applied technologies is included in the tasks of implementation (Kessler *et al.*, 1995). In the global academic educational space, characterized by pronounced dynamism, occurring under the influence of numerous factors of change, the role of creating new projects that necessitate the adoption of effective management decisions is increasing (Hunt *et al.*, 2010). In the context of the above, it should be noted that the principles, methods and means of management traditionally used to date are not

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able to ensure the effective development of the modern education system, achieving a high level of competitiveness in the context of a globalized society (Breslau *et al.*, 2008). Thus, it can be concluded that it is necessary to develop new approaches and the influence of new theories in the management of the educational system, one of which may be the theory of creative-predictive management. A number of researchers trying to solve problems in the field of management processes state that management should be understood in the broad sense of the word as the process of influencing and interacting with a particular system of the manager:

- 1) making decisions on strategically important issues of activity;
- 2) selection, placement, training and retraining of personnel;
- 3) coordinating the activities of the executives and subdivisions of the organization.

Thus, the content of the manager's activity is determined by the need to perform a complex of managerial functions, in particular:

- administrative, characterized by the coordination of the individual activities of each member of the team in order to achieve the specified indicators - the results of activities;
- goal-setting, related to the specification of the priority of operational and tactical goals of joint activities, the establishment of methods and means to achieve them;
- disciplinary, which provides for the maintenance of a given performance in the collective during the course of work by each of its members within the framework of specific duties;
- goal-setting, related to the specification of the priority of operational and tactical goals of joint activities, the establishment of methods and means to achieve them;
- communicative-regulatory, within which the regulation of functional-role relationships is carried out;
- representative, by means of ensuring the representation of the organization in external circles of interactions;
- educational, focused on the formation and development of team cohesion in the course of joint activities, with the achievement of the level of maximum involvement of each member of the team in the labor process;
- psychotherapeutic, through which the ability to promptly prevent the formation of stress factors or resolve conflict situations is revealed.

Managerial activity provides for the ability to manage the activities of subordinates, which requires mastery of the technique of creative and predictive management, which should be understood as the ability to anticipate in a timely manner and make an optimally effective, pragmatic and promising decision, based on strategic and tactical goals, implementing them in practice, taking into account the variety of influencing factors and conditions of a particular situation (Arango *et al.*, 2018).

In the context of using the technique of creative and predictive management in practice, a management decision acquires creative characteristics, and the criteria for a creative product are:

- 1) degree of originality;
- 2) level of meaningfulness;
- 3) degree of transformation / overcoming conventional restrictions;
- 4) level of integration/connectivity of experience components.

Having studied the positions presented in scientific research on the creative component of educational products, we came to the conclusion that productive activity combines well-known techniques and methods of mental activity while creating a new

system of action, during which previously unknown patterns are revealed, and as its result are products of creative activity. The results of such activity should be considered creative if they are both new and sufficient for the current situation that cannot be solved according to the well-known algorithm (Bowman *et al.*, 2020). In terms of pedagogical tasks that can be solved through creative activity, then the subjective novelty of the product of creativity can be taken into account. Attention should be focused on the need to create a problem situation in this case, pushing the “researcher” to search for new creative ways to solve the problem problem, relying on previously acquired knowledge of theory, methodology and management technology (Carroll *et al.*, 2020).

The mechanism of innovative development of countries in the field of vocational education is represented by competitive subjects-educational organizations that possess scientific and intellectual potential, significant in the international educational space. One of the dominants of the high competitiveness of vocational education is its research potential, which can be considered as a kind of reflection of the innovative potential of the country. The foregoing finds his confirmation in the words of S. Marjanson, according to which “the nation has a high level of research potential, are able to effectively manage their strategic development within the framework of the global knowledge economy”.

2. Material and methods

According to American researchers, professional education in the context of globalization acquires the opportunity to construct a holistic educational system that acts as one of the component (economics, politics, culture) of the social structure of society is focused on solving the social problem of facilitating its life. Based on the results obtained during the theoretical analysis of the concepts of competitiveness of vocational education in the context of globalization, it became possible to systematize the key determinants of its competitive success (see the Figure 1).

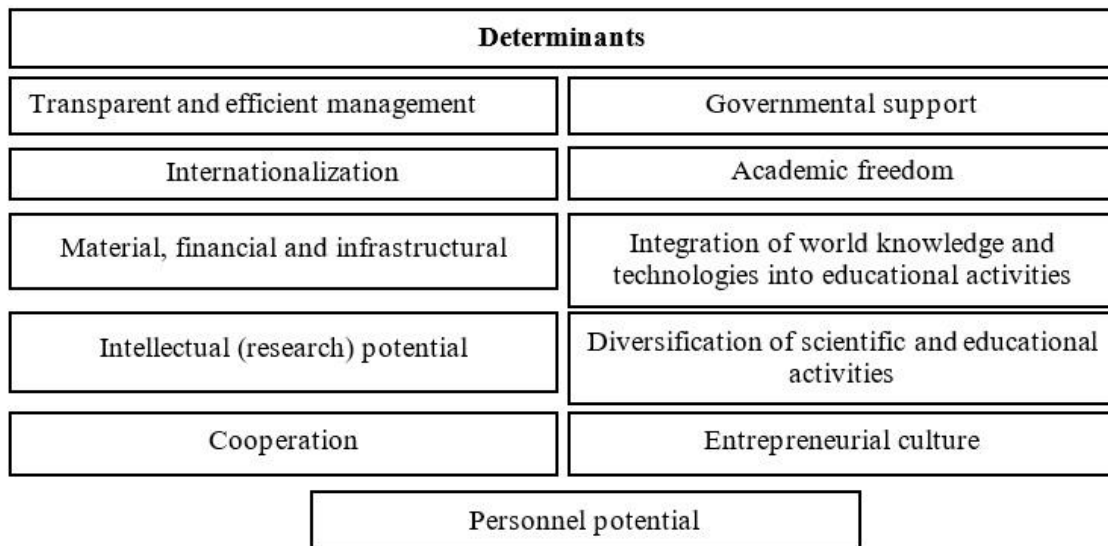


Fig 1. Determinants of competitiveness of vocational education in the context of globalization

From our point of view, “professional education in the context of globalization” is an education system that is characterized by stability in the international market of educational services, high knowledge intensity achieved by “investing” intellectual

potential in the production of a high-quality scientific and intellectual product by an innovative system of personnel and financial resource management, thanks to which a high level of quality of education is ensured (Leach *et al.*, 2012).

Based on the foregoing, it should be emphasized that the competitiveness of vocational training in the current conditions of globalization is determined by the sum of advantages of international importance: 1) the level of significance of scientific results; 2) high level of quality of educational services; 3) solution of socially significant problems (Cvetkovski *et al.*, 2018).

Thus, in order to achieve a high level of competitiveness, it is necessary to pay attention to the above-mentioned competitive advantages, achieved through the following factors:

- 1) having a high level of intellectual capital capable of generating unique intellectual products;
- 2) creation of a creative and predictive management system, the structural and functional base of which is consistent with the principles of academic freedom;
- 3) availability of material and infrastructure base;
- 4) application of research with the achievement of important results for world science;
- 5) achievement of high educational standards built taking into account the integration of scientific achievements into the process of providing educational services;
- 6) provision of state institutional and financial support.

In addition to the above, a number of scientists appeal to “accelerating determinants” that are able to increase the high rates of competitiveness of vocational education in the context of universal globalization, in particular:

- 1) intensive practical implementation of the opportunities offered by national diasporas during the implementation of modernization processes in the framework of vocational education;
- 2) using knowledge as a basis;
- 3) specialization of the orientation of vocational education in relatively narrow areas of specialist training;
- 4) the introduction of proven-effective world experience of modernization of activities.

For this reason, while state policy is implemented in the management of vocational education, it is necessary to focus on the above factors in synergistic interactions (Marginson, 2016). An attempt to systematize, which we undertaken, allowed the following models. The “Breadth-strategy” model, as a specific feature of which its orientation should be highlighted, determined by the movement from high-quality mass vocational education to the world level. This model makes it possible to achieve high values of indicators that meet international standards by increasing the availability of educational services offered by organizations in the modern market with powerful research potential (Western Europe).

The “Depth-strategy” model, focused on improving the level of ongoing research, the end result of which are indicators of the innovative component of the research being implemented in the field of knowledge translation by providing financial support to the subjects of vocational education from the state (McLeod *et al.*, 2004). It should be borne in mind that such a model is designed for educational organizations with powerful (in

accordance with international requirements) research potential (East Asia, Saudi Arabia, Brazil etc.).

Combined model (breadth-depth-strategy). This model is most widely used in the USA and China. Within the framework of the “deep into” strategy, special attention should be paid to the international practice called “initiatives to achieve outstanding results” (excellence initiatives), successfully implemented in Canada, Denmark, Finland, China, Hong Kong, Japan, Australia, South Korea, Germany, France, Spain, Israel, etc.).

In this case, the initiative shown by the government and international organizations, whose combined activities make it possible to finance programs aimed at achieving the specified parameters of the quality of educational services, is emphasized. One of these programs is the German initiative (2004), aimed at stimulating advanced studies in Germany”. Such autonomous programs are currently working with special orientation (teaching -excellence initiatives) in some countries, especially in France, Finland and Great Britain (Li *et al.*, 2020).

From the results obtained during the research carried out by the World Bank “Global trends in the management of vocational education” (2008), the modernization of management systems is regulated by a set of uniform factors (external, internal) combining the following components:

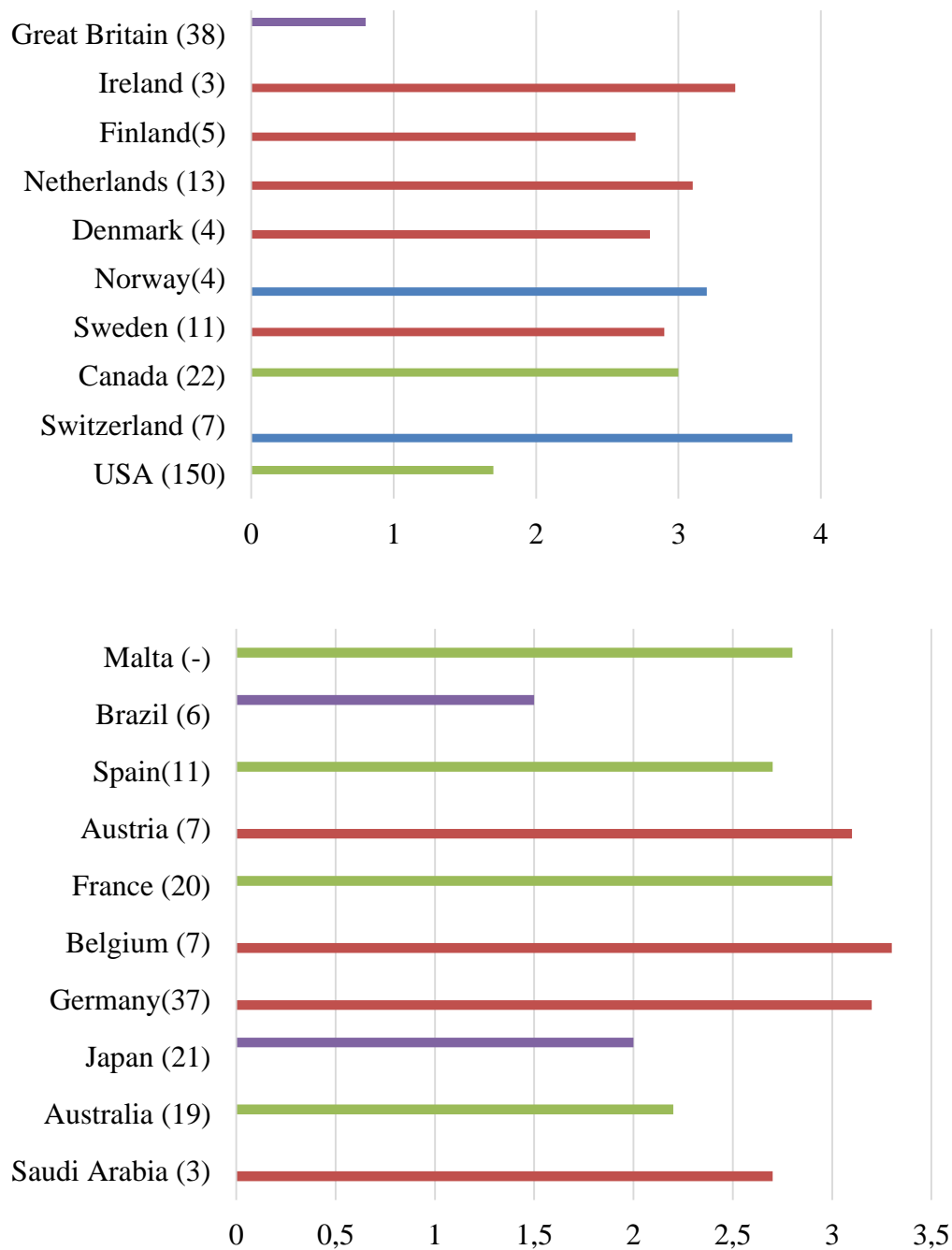
- 1) regulatory and legal regulation of the permissible degree of academic freedom of subjects of vocational education;
- 2) a decrease in the level of control measures by the state by partial transfer of functional powers to the subjects of vocational education;
- 3) the creation of “buffer” organizations that perform a series of monitoring measures in financial support and consulting support positions if necessary;
- 4) introduction of financing models that allow you to increase the degree of academic freedom and provide a greater range of incentives for the search for new income resources;
- 5) organization of external agencies acting as a controller for the functioning of the quality and volume of training courses implemented in the field of vocational education;
- 6) development of new forms of reporting, presented in the form of the results of the activities of educational organizations, equated with the achievements of national development goals within the framework of state tasks.

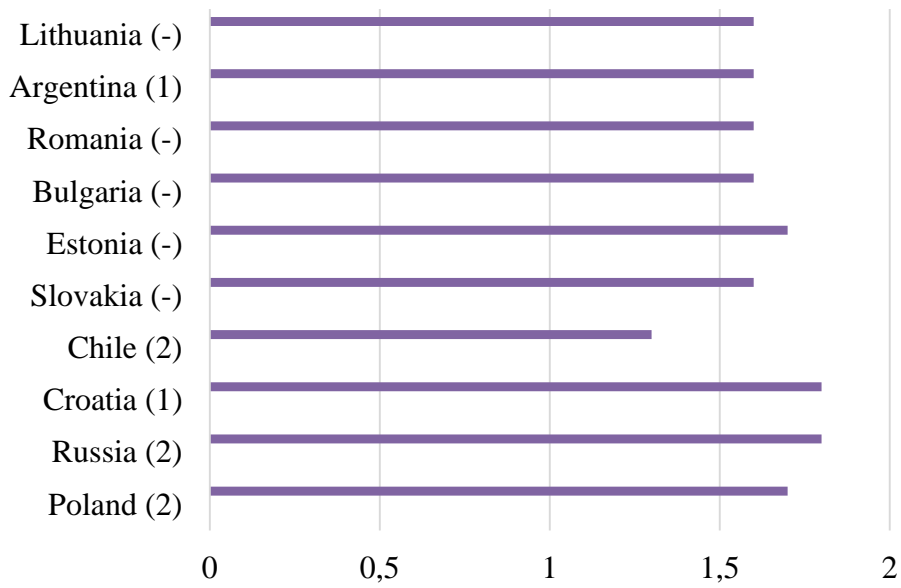
3. Results and discussion

Analysis of the current situation in the field of reforming the management system of vocational education, allowed us to make a private conclusion that in order to improve the quality of the activities carried out, with a limited resource base, state financial support is provided by direct investment of the research potential of the subjects of vocational education (the “depth” strategy), and modernization of the management system, which allows you to create a competitive educational space (the “breadth” strategy). In addition to the above, it was found that the achievement of global competitive advantages is possible through the use of combined strategies for the formation of a world-class professional education system. In the course of developing a national strategy for improving the international competitiveness of the national vocational education system, it is necessary to justify the most optimal amounts of resource provision for reforms

carried out under the conditions of globalization, establishing optimal proportions based on world statistics.

For the practical implementation of the above-mentioned goal, an experiment was organized in which 50 countries of the world took part. Analytical data were grouped according to the levels of tertiary education 5 and 6 in accordance with the requirements of the International Standard Classification of Education (ISCED), which made it possible to form a sample combining 450 educational institutions classified as a high level of competitiveness. The assessment of the quality of vocational education was carried out using the “Global Competitiveness Index” methodology, and the results of the analysis of the disposition of countries are presented in Figure 2.





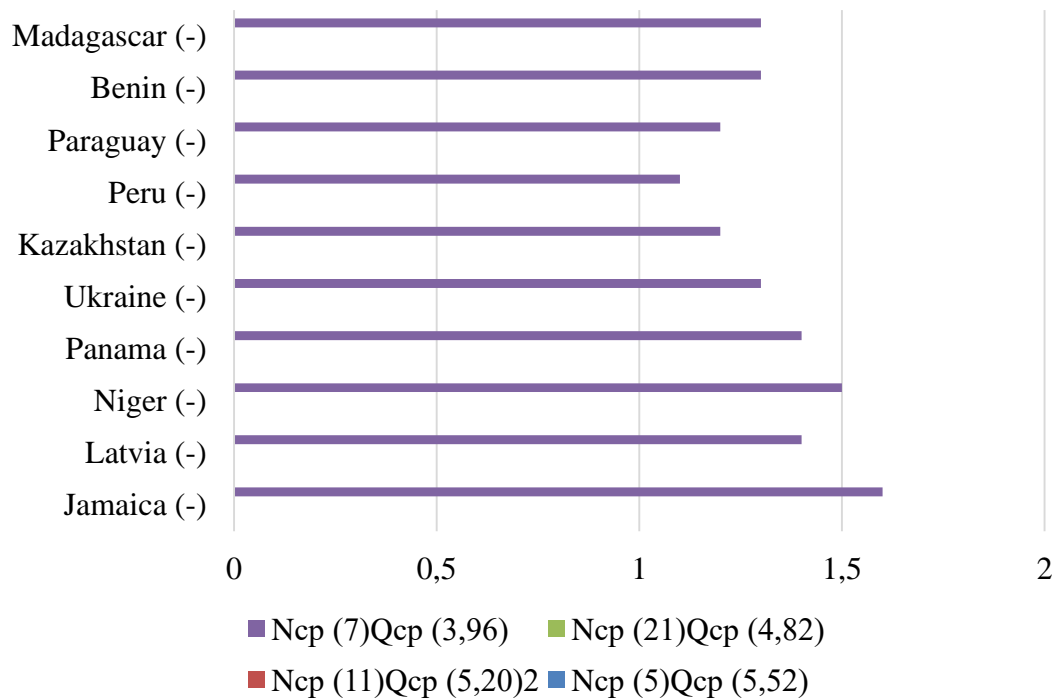


Fig. 2. Distribution of countries by the level of expenditures on vocational education, its quality and the number of world-class educational organizations (compiled by the author on the basis of international statistics). Symbols: N– number of world-class educational institutions (Shanghai index); Q– assessment of the quality of vocational education (WEF); $N_{cp}Q_{cp}$ – average values of indicators

4. Conclusion

The data shown in Figure 4 and their analysis allowed us to draw a number of conclusions:

- most of the national vocational education systems have achieved a high level of competitive status, which allows us to conclude that the quality of training is high. However, such indicators were achieved due to a high aggregate of government expenditures, while their dynamics are largely due to them;
- gradations of countries in accordance with the volume of public investment exceeding the same indicator in world-class educational institutions assigned to the second group. At the same time, with the subsequent increase in government spending, the number of highly competitive educational organizations decreases, with a simultaneous increase in the values of indicators characterizing the quality of education (Markoulakis., 2013).

The foregoing determines the importance of maintaining the optimal average amount of government spending, which allow the maximum representation of educational organizations in world ratings, while maintaining the high quality of the educational services provided. The growth of state expenses is ineffective;

- in the course of grouping countries into groups by cutting off quartiles, it was found that most world-class educational organizations are part of the first group, and an increase in government spending does not lead to an increase in the dynamic stability of their number.

Based on the results, it is obvious that the value of the average indicator of the number of world-class educational organizations is increasing if financial support is introduced by the state. This situation causes a decrease in the number of countries in which such educational organizations are located. In the light of the above, it can be noted that the level of quality of the services offered in the situation described above is increasing, but the intensity of the pace reflected in the dynamics curve remains insignificant, which is confirmed by statistical data in a number of countries (Martin., 2010).

The totality of the conclusions allows us to conclude that in the amount of state funding there is a certain optimally set value that can provide a specific number of educational organizations with a world level and, accordingly, high quality of vocational education. At the same time, an increase in state funding that exceeds the optimal amount is permissible only in a number of countries (Republic of Korea, Brazil, Japan, Australia, Great Britain, Canada, USA) practicing the Anglo-Saxon model of vocational education. At the same time, the most acceptable in the current conditions of modern realities are combined development strategies (“breadth-depth”), the development of which continues to the present time.

Based on the above, we can conclude that it is possible to consider the value of indicators of state financing of vocational education as a guideline, with the inclusion of which, during the development of an effective model of vocational education, it is possible to achieve the specified parameters of its quality corresponding to the world-class level.

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