

# Praxeological Orientation of Professional Training Formation of Future Primary School Teachers

Vita PAVLENKO<sup>1</sup>,  
Olena KONDRATIUK<sup>2</sup>,  
Tetiana VASIUTINA<sup>3</sup>,  
Olha LUKIANCHENKO<sup>4</sup>,  
Svitlana BOBROVYTSKA<sup>5</sup>,  
Viktoriia KOVAL<sup>6</sup>

<sup>1</sup> Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine, [pavlenko\\_vita@meta.ua](mailto:pavlenko_vita@meta.ua), ORCID ID:

<https://orcid.org/0000-0001-8528-4054>

<sup>2</sup> National Pedagogical Drahomanov University, Kyiv, Ukraine, [elena.kondratyuk@gmail.com](mailto:elena.kondratyuk@gmail.com), ORCID ID: <https://orcid.org/0000-0002-5673-4754>

<sup>3</sup> National Pedagogical Drahomanov University, Kyiv, Ukraine, [tetyana.vasyutina@gmail.com](mailto:tetyana.vasyutina@gmail.com), ORCID ID: <https://orcid.org/0000-0003-0253-1932>

<sup>4</sup> National Pedagogical Drahomanov University, Kyiv, Ukraine, [mecco\\_2411@ukr.net](mailto:mecco_2411@ukr.net), ORCID ID: <http://orcid.org/0000-0002-5554-0819>

<sup>5</sup> Sumy Makarenko State Pedagogical University, Sumy, Ukraine, [onlyforme.yulia@gmail.com](mailto:onlyforme.yulia@gmail.com), ORCID ID: <http://orcid.org/0000-0002-7815-3918>

<sup>6</sup> T. H. Shevchenko National University “Chernihiv Colehium”, Chernihiv, Ukraine, [kovalchernigov@gmail.com](mailto:kovalchernigov@gmail.com), ORCID iD: <https://orcid.org/0000-0002-3673-2583>

**Abstract:** The study addresses to the modern praxeological approach of professional training of future primary school teachers on the research results application of modern neuroscience. The essence of praxeology as a science and praxeological approach in pedagogical activity is considered. The expediency of praxeological orientation during the professional training of future primary school teachers is substantiated. Theoretical bases of neurosciences studies in the system of pedagogical education and neuropedagogy formation are also considered. Based on the neuromyths spread, the problem of obtaining neuroscientific knowledge by future teachers in the context of praxeological orientation is actualized, which will significantly help to orient the latter to effective and efficient professional activity. The key structural components of the author’s model of primary school teacher’s training using a praxeological approach in the context of modern neuroscience are proposed and described in the study. The key theoretical provisions of the motivational and target component, organizational and procedural, semantic, operational and technological, diagnostic and effective components of the specified model are generalized. The theoretical provisions of modern neuroscience are detailed, which are the basis of the semantic component of the model. The purpose and tasks of the author’s course “Modern neuroscience in the education system” are determined, which is the basis of the content component of the model of training future primary school teachers. Perspective directions of future scientific studies are outlined - research of biological and neural feedback in educational activity.

**Keywords:** *praxeology, neuropedagogy, professional pedagogy, efficiency of pedagogical activity, neuromyths in pedagogy, reform of primary education, training of primary school teachers.*

**How to cite:** Pavlenko, V., Kondratiuk, O., Vasiutina, T., Lukianchenko, O., Bobrovytska, S., & Koval, V. (2022). Praxeological Orientation of Professional Training Formation of Future Primary School Teachers. *Revista Românească pentru Educație Multidimensională*, 14(2), 330-347. <https://doi.org/10.18662/rrem/14.2/584>

## Introduction

Socio and economic changes and processes of Ukraine's integration into the European educational space, reform of primary education, new approved standard of primary education, active informatization of education and general processes of globalization of the Fourth Industrial Revolution necessitated urgent modernization of primary school teachers. Today it a priority to train a new teachers' generation remains the same in order to be capable to carry out professional activities through wide use of the latest findings, including in neuroscience. Therefore, the question of the lack of focus on the application of modern results of neuroscience research is relevant according their professional activities in the content training of future primary school teachers.

Despite the rapid technology development, the system of training teachers remains almost unchanged. The transition period during the reform of the education system (the New Ukrainian School and the new system of pedagogical staff training), surely, causes difficulties for the education system as a whole. On the one hand, the state initiates reforms and lays the groundwork at the legislative level, on the other hand, the content of teacher's training remains unchanged, which depends on the research and teaching staff of the higher educational institution. The content of educational programs for the future primary school teachers' training is approved by the academic councils of higher educational institutions (Melnyk, 2021; Komogorova, 2021; Palamarchuk, 2020; Melnyk, 2019; Sheremet, 2019; Onishchuk, 2020; Maksymchuk, 2020a; Maksymchuk, 2020b).

Modern praxeology, as a science of the effectiveness of practical activities, allows to identify the nature of the interaction development between the society needs and the requirements of reform and compliance with the education of future teachers. Modern praxeology allows us to predict possible scenarios for the implementation of certain reforms and changes in educational programs for the training of future teachers.

At the same time, a high interest in neurobiological research on the part of primary school pupils' parents and teachers themselves leads to the introduction of the latter ones in teaching. However, the lack of teachers' qualified training to apply the results of neuroscience in their professional activities leads to unsystematic and sometimes inappropriate (or harmful) use of research in modern neuroscience. Thus, the ideas incorrect or out of context about the development and functioning of the children's brain in primary school age, which teachers use during training (Grospietsch &

Mayer, 2018) are confirmed. In order to achieve the effectiveness of the implemented reforms of primary education and the future primary school teachers' training, the content of their pedagogical education remains relevant.

**The aim of the study** is to present a model of professional training of primary school teachers using a praxeological approach in the context of modern neuroscience.

In general, today the problems of praxeological orientation of future teachers' training and the use of scientific research in modern neuroscience in teaching are not new and are actively explored by European and Ukrainian researchers.

Thus, general issues of praxeology, the concept of improving the effectiveness of pedagogical activities are explored by Andrushchenko (2018), Kremen (2019) and others, who emphasize the importance of the future teacher's competence forming to think rationally and use teaching aids in the context of their focus on performance (Dzhanda, 2019). A separate area of research in pedagogical praxeology is represented by the research of Semenikhina O., Semenog O. Drushliak M. (2018) and others, who focus their research on the availability of methodological and practical basis for future teachers to practice their pedagogical skills (Semenikhina, 2018).

The vast majority of studies in pedagogical praxeology in Ukraine focuses on substantiating the praxeological approach in pedagogical activities (both training of teachers and during the educational process in general secondary education) (Romanovska, 2016) and the separation of praxeological training in a separate component of the educational program of future teachers (Maiboroda, 2012); the emphasis on the combination of the main categories of praxeology and scientific provisions to clarify the essence of pedagogical activity (Dzhanda, 2019).

In the last decade, neural mechanisms of learning have become of paramount interest. The emergence of neuropedagogy as a science is associated with Hart L. (1999). The latter states that without understanding how the brain functions one cannot create an effective educational environment (Hart, 1999).

Numerous studies have been conducted by modern neuroscientists in recent years, and a number of studies have confirmed the existence of neuromyths (Understanding the Brain, 2002) – incorrect ideas among educators about the development and functioning of the brain (Deligiannidi, 2015).

Our analysis and the author's experience show that the application of praxeological approach and neuropsychological techniques and methods are not new in research, they are a universal tool for stimulating the cognitive processes of students.

Actually, there are numerous studies on the implications of using a praxeological approach in professional training of future primary school teachers training. In the context of neuropedagogy, however, these studies are rather sporadic. Therefore, it is essential to encourage Ukrainian scholars to raise the problem of praxeological orientations especially in terms of neuroscience.

### **Praxeological orientation of modern approaches to professional training of future teachers**

Systematic modernization of the educational branch involves changes in both the school education system and the system of future teachers' training. There are many contradictions in the training of future primary school teachers, and one of the main ones is that professional training takes place in the process of high-quality and significantly different activities, which is significantly different from the professional environment. One of the ways to resolve this contradiction is the scenario of mastering the profession in the process of dynamic transition from academic, educational and professional, to proper professionalism through simulated professional situations. Therefore, modern approaches to the training of primary school teachers involve the implementation and specification of the paradigm of personality-oriented education, which include the following approaches: personal, individual, cultural, axiological, activity, contextual and praxeological.

Praxeology is a research branch that studies human activities in terms of its effectiveness. The praxeological orientation of the training of future primary school teachers presupposes preparation for the activities performance that must be effective and successful. The success of a teacher's professional activity is assessed as the effectiveness of pedagogical action. Under the success of pedagogical action, we understand the result of professional activity of primary school teachers, which has a positive external and internal assessment of quality activities. Therefore, the effectiveness of primary school teachers, we understand the activities of teachers who are most focused on achieving the results of the State Standard of Primary Education, where the general learning outcomes defined as "a set of knowledge, skills, ways of thinking, views, values and other personal

qualities of primary school students. education that meets the general goals of the education sector” (State Standard of Primary Education, 2018).

In order to achieve this effectiveness of primary school teachers at the national level in 2020, the Ministry of Economic Development, Trade and Agriculture approved a professional standard for the following professions: “Primary school teacher of general secondary education”, “Teacher of general secondary education”, “Primary school teacher (with a diploma of a junior specialist)” (On the Statement of the Professional Standard, 2020). Part 4 of the Standard summarizes the general competencies that primary school teachers should have, namely: civil, social, cultural, leadership and entrepreneurship ones.

We agree with the researches and continue to develop the idea of the implementation of the Professional Standard for Primary School Teachers and focus on achieving the results of the State Standard which should be the most practiced praxeological approach, especially at the stage of professional training of future teachers.

The main concepts of the praxeological approach in the context of the above mentioned are the following: efficiency, rationality, purpose, planning, result, productivity (Malykhin, 2014). That is why the successful activity of future primary school teachers is facilitated by the appropriate level of the skills formation, such as: analytical, prognostic, constructive, organizational, communicative, diagnostic, reflective one. Achieving the following skills in future primary school teachers is most effective provided the implementation of the praxeological approach, as it provides not only efficiency and effectiveness, but also occurs with the least resource costs (Skoryk T. And Hytsyk N., 2020).

Therefore we consider it necessary to choose and use a praxeological approach during the training of primary school teachers, which will maximize the process of training through the actualization of its categories, thus it will serve as a methodological guide in implementing the model of teacher training for quality, successful and result-oriented professional activity.

### **Professional training of future primary school teachers in the context of modern neuroscience**

One of the complex reform results of general secondary education (reform of the New Ukrainian School) is the training of highly qualified teachers, which is impossible without reforming the higher educational system. Regarding the fact, one of the priorities of higher education today is

to train highly qualified teachers to work in general secondary education institutions that have key competencies, cross-cutting skills, and modern teaching methods and are able to implement partnership pedagogy in education (Educational Reform, 2019).

To achieve this goal at the National Level by the order of the Ministry of Education and Science of Ukraine dated 16.07.2018 № 776 the Concept of development of pedagogical education was approved, which covers all elements of training teachers to carry out their professional activities. As for the content of future teachers' training, it is determined by the Educational Program and approved by the Academic Council of the higher educational institution (paragraph 8 of Article 36 and subparagraph 17 of the 1st part of Article 1 of the Law of Ukraine "On Higher Education"). Thus, the quality of teacher training is mainly the responsibility of higher education institutions; and therefore the content of the educational program, which trains such teachers, should correspond to modern scientific ideas about the teaching effectiveness.

As we have already mentioned, the main task of the praxeological approach in the process of future teachers's training is to research, master and use the necessary knowledge to carry out effective professional activities. That is why the implementation of the results of modern neuroscience research in the content of curricula of future teachers, in our opinion, can be extremely effective and efficient.

Neuroscience is a set of scientific disciplines that study the nervous system at various levels, from the molecular level to the whole organism. In recent decades pedagogical research has confirmed the need to study the neural mechanisms of teaching and education (Organization for Economic Co-operation and Development, 2002), which has led to the isolation and development of a new direction of pedagogical education – neuropedagogy, mastering of which allows to more effectively carry out the process of professional training of future primary school teachers (Chojak M., 2018).

The very idea of using neurobiology research in the pedagogical process is not new and is a fairly common practice in the last 10-15 years. Neuropedagogy combines the efforts of researchers in the field of cognitive neurobiology, developmental neurobiology, educational psychology, pedagogy and didactics, in order to study the relationships between biological processes and educational activities. Most often to study the neurobiological mechanisms of reading, mathematical calculations, attention to solve or facilitate learning in dyslexia, dyscalculia.

In the context of the recent reforms of the primary school (New Ukrainian School) and the reform of teachers' staff training who will work in

the reformed system of general secondary education, we believe that the results of neuroscience research should be integrated into the curriculum of future primary school teachers. And the content of this knowledge and practices should be focused not on the inclusion of individual students who have learning difficulties, but on the coverage of modern and effective methods and teaching of all students. The result of such a systematic use of neuroscience will be a teacher who will be able to organize an effective and efficient educational environment for each child.

It should be noted that the teachers' interest in brain studies and the use of these results in education and teaching practice in the absence of sufficient knowledge leads to widespread misconceptions about the development and functioning of the brain, the so-called neuromyths. That is why the question of integration of the results of neuroscience research in the content of the curricula of future teachers leaves no doubt.

Neuromyths are misconceptions about the development and functioning of the brain that have arisen "due to misunderstandings, misinterpretations or incorrect citations of scientifically sound facts from brain research to justify the use of brain research in education. A number of recent studies initiated by Howard-Jones P. (2012) have confirmed the existence of neuromyths among educators at different levels of education in many countries (Dekker S., 2012).

One of the reasons for the widespread use of neuromyths is that almost all researchers call it the lack of scientific knowledge and skills of teachers needed for critical evaluation of the results of neurobiological studies and the application of experimental data in teaching practice (Grospietsch F., 2020). This leads to simplification and misinterpretation of the results of brain studied, attempts to see in these studies a direct connection with the practical actions of the teacher. Usually, neuromyths contain a certain element of the real fact, but its interpretation is simplified or distorted.

It is clear that mixing facts and myths in teachers' perceptions creates conditions for choosing inadequate approaches and teaching methods (Horvath J., 2018), so following neuromyths creates risks of using incorrect methods and intensifying learning at the stage of adaptation in the first grade, unreasonable division of children, inadequate methods of correction of school problems and wrong attitude to children with special needs. There are studies that show the increasing teachers' knowledge of brain development and functioning which reduces their belief in neuromyths (Papadatou-Pastou M., 2017).

Thus, there are several reasons that need serious attention to the widespread use of neuromyths in education. First, myths can become limiting beliefs that disrupt the learning process and limit students' opportunities. Second, myths can be the basis for choosing inadequate and ineffective teaching methods. Third, beliefs in myths create a false impression of children's abilities, which leads to unreasonable expectations or unjustified restrictions.

For example, the belief in the myth that children are "visuals", "kinesthetes", «audials» and that they learn better if they receive information according to their learning "systems", leads to the fact that teachers were willing to build their learning based on inaccurate and misperceived information (Organization for Economic Co-operation and Development, 2002).

These and other similar neuromyths lead to misinterpretation of the results of neuroscience research, attempts to find in these studies a direct relationship with their practical application in the professional activities of the teacher.

Teachers' interest in the development and functioning of the brain, on the one hand, is combined with insufficient, fragmentary and unsystematic neurobiological knowledge. That is why we consider it necessary to systematically integrate the results of neuroscience research into the curricula of future primary school teachers.

### **Professional training of primary school teachers using a praxeological approach in the context of modern neuroscience**

When building a model of professional training of primary school teachers using a praxeological approach in the context of modern neuroscience, we relied on the definition of Bykov V. (2014) that the concept of "model" as a representation of a system that designs and reflects the features and properties of this system which in its turn ensures the purposes achieving of formation and the use of the model (Bykov V., 2014). The purpose of building our model, or its effective result, is a professionally trained future primary school teacher who knows, can and who is ready to systematically and consistently use in their professional activities the results of neuroscience research and all his professional activities are praxeologically oriented.

Our proposed model covers several components, which are defined according to the general theory of the activity structure:

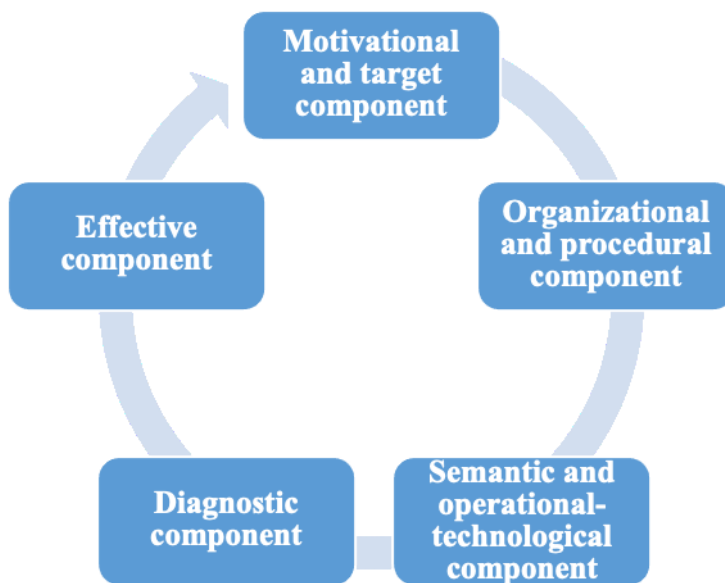
- *motivational and target component*, which provides the purposes



and objectives of the educational process of future primary school teachers;

- *organizational and procedural component*, which determines the principles of implementing organizational-pedagogical conditions in professional training of future primary school teachers;
- *semantic and operational-technological component*, which determines the content of educational programs in the context of modern neuroscience and the application of praxeological approach;
- *diagnostic and effective components* that determine the criteria and indicators of the effectiveness of professional training of primary school teachers using a praxeological approach in the context of modern neuroscience.

The didactic system of the mentioned model is shown in Figure 1.



**Fig. 1.** Didactic system of the model of future teachers' training in accordance with the general theory of the activity structure of (Dubaseniuk, 2003)

As we have defined, the final result of our model of future primary school teachers' training using a praxeological approach in the context of modern neuroscience is a teacher focused and oriented on productive professional activity. Achieving effective activity is a subject to the consistent formation of the following algorithm: purpose setting (targeting), implementation of processes to achieve the purpose (activity), achieving the

intended result (purpose), monitoring of activities (efficiency) (Skoryk T., 2020).

The conceptual block of the model is based on the following theoretical statements of modern neuroscience:

- the brain can recreate i neural connections with the aim of adapting to the environment (Brault F., 2020);

- human actions, accompanied by the activation of the corresponding structure of neurons in his brain cause the activation of the same structure of neurons in the brain of another person who monitors these actions. This phenomenon is called the “action of mirror neurons” (Rizzolatti G., 1998);

- insights on the functions of the brain limbic formations ensuring motivational activities during information acquisition (Vovkanich L., 2020);

- psychophysiological mechanisms which regulate intellectual activity, as well as higher mental functions (Kushch O., 2014);

- the brain self-organization theory which explains how active thinking, memory, attention and behaviour work (Kushch O., 2014);

- insights on an individual profile of interhemispheric functional asymmetry, which includes a certain functional antagonism;

- insights on child’s development in the context of genetic development programmes and social factors (Druzhilovskaya O., 2020).

The motivational and organizational component of our model of training future primary school teachers using a praxeological approach in the context of modern neuroscience is based on the following statements:

- every brain is unique due to many different parameters (productivity, memory, flexibility, information processing speed), which in turn emphasizes that learning should be only personality-oriented;

- extremely important is emotions during the educational process. And the emotions of both learners and teachers are important;

- emotions of students are related to their cognitive processes, so emotional intelligence is one of the key factors in successful learning;

- brain is able to perceive information both focused and peripheral, so the background of learning is important, in which students are;

- nature of the brain is focused on active knowledge of the world and curiosity, so there should be constant activities focused on creativity, research, development of thinking of the inventor;

- brain activity is focused on finding relationships and patterns, so learning should include such activities;

- brain functions most successfully in conditions of freedom of expression, so a democratic style of learning and creating a democratic educational environment are important;
- neuro-educational resources are a powerful tool for significantly improving the students' success;
- diversity (content, forms, methods, techniques, etc.) are an important element of a successful strategy of consolidating educational material;
- feedback on each stage of learning is the basis of neuropedagogy, which can significantly increase the effectiveness of learning;
- overload of brain activity, as well as insufficient load of brain activity negatively affects the success of learning.

In this regard, we suggest implementing a course, titled "Modern neuroscience in education", in our model of professional training for future primary school teachers. The course aims to provide future primary school teachers with relevant knowledge about the ways of using neuroscientific findings in their professional activities.

The key task of the course can be the studying of the educational process patterns, considering the neuro-ontogenetic transformations in accordance with the age stages.

The content of this course, in our opinion, should include the following topics: cognitive styles of individual topological features; neuroplasticity of the brain and the application of this feature in the educational process; provisions on the functions of limbic formations in the context of motivation to learn; praxiological mechanisms of one's creative thinking; theory of self-organization of brain activity; insights on an individual profile of interhemispheric functional asymmetry.

We consider it important to emphasize neuronal plasticity in the educational process in primary school; motivational activity of educational activity of children of primary school age at dominance of right hemisphere functions; organization of the educational process taking into account the left hemisphere dominance and the level of limbic activity, which leads to the expression of emotions and creative ideas; forms and methods of activation of right hemisphere functions together with left hemisphere application of verbal instructions.

Given that neuropedagogy integrates neurophysiology, neuropsychology, psychophysiology, anthropology, neurogenetics and other modern neurosciences, we consider it necessary to introduce courses on the basics of modern neuroscience. This can be an introductory course in

neuroscience or separately for each of them. It is important for future primary school teachers to gain basic understanding of the neural organization of mental and other activities of primary school children, which will prevent the future spread of neuromyths in pedagogical practice.

In the implementation of the operational component of the model of professional training of future primary school teachers, we consider it appropriate to use the method of biological feedback, which will assess and train cognitive abilities. Today, modern information and communication technologies allow you to choose a variety of tools that allow for biological feedback - biofeedback (Erickson H., 2021). Also of interest may be "neurofeedback" – is a neural feedback that can be realized on the basis of various parameters of the electroencephalogram of the brain (Kumari M., 2020). We are critical of the technical capabilities of pedagogical higher educational institutions in Ukraine, but assume that research and teaching staff can initiate research for budget funds, grants and other resources to purchase equipment for biofeedback and neurofeedback research. These methods (Ratanasiripong P., 2014) deserve attention in the context of modern neuroscience and praxeological approach in teacher's professional training (Oman D., 2018), which will allow the latter ones to study the adaptability of primary school children to learning and education at school, assess the current psychological state of students, to optimize the physical and cognitive activity of participants in the educational process (Salam U., 2013).

In the diagnostic component of the training model of future primary school teachers the praxeological self-assessment can be a systematic analysis of pedagogical activities and professional reflection.

Thus, our proposed model of future primary school teachers' training, considering the praxeological approach in the context of modern neuroscience, includes several components that are defined according to the general theory of activity structure: motivational and target component (which provides goals and objectives of the educational process); organizational and procedural component (which determines the principles of constructing the educational process and fulfilling organizational-pedagogical conditions); content and operational-procedural components (which determines the content of the curriculum); diagnostic and effective components (which determine the criteria and indicators of the effectiveness of the curriculum).

## Conclusion

Analysis of modern approaches to the development of primary school children in the context of modern neuroscience allows to draw the following conclusions:

- the reforming educational system (New Ukrainian School. Reform of the Teacher's Training) requires the training of highly professional primary school teachers who will be ready, able and motivated to implement all the provisions of reforms in primary school education;
- the studies of modern neuroscience confirm the effectiveness of the praxeological approach and actualize their active use in pedagogical practice;
- the unsystematic approach to the training of future teachers can contribute to the emergence of neuromyths, which significantly complicate the effectiveness of the educational process;
- the modern research in neuroscience requires the training of future teachers who will be ready to apply these results in their professional activities, which is result-oriented itself;

That is why we believe that curricula for the study of brain activity of primary school children should be built interdisciplinary using adapted methods of brain research in pedagogy.

The proposed model of future primary school teachers' training in the context of modern neuroscience and praxeological orientation will allow to obtain highly qualified teachers focused on effective professional activity.

The prospect areas of further research are the development of the author's programs in neuropedagogy and their implementation in the system of professional development and retraining of teachers. Scientific research on biological and neural feedback during educational training remains promising.

## Acknowledgement

The contribution of the authors to the research is equal in the following fields: documentation, data gathering, data processing, writing, other activities related to the research.

---

## References

---

- About the Statement of the Professional Standard (2020). *Ministry of Economic Development, Trade and Agriculture* (Order №2736 dated 23.12.2020).  
[https://osvita.ua/doc/files/news/787/78704/Nakaz\\_2736\\_3\\_.pdf](https://osvita.ua/doc/files/news/787/78704/Nakaz_2736_3_.pdf)

- Andrushchenko, V. (2018). Application of modern teaching methods as a tool to improve the quality of higher education in Ukraine. *Hilea: scientific bulletin*, 137, 10, 287-290.  
<http://gileya.org/index.php?ng=library&cont=long&id=163>
- Brault Foisy, L., Matejko, A., Ansari, D., & Masson, S. (2020). Teachers as orchestrators of neuronal plasticity: effects of teaching practices on the brain. *Mind, Brain, and Education*, 14(4), 415-428.  
[https://www.cell.com/trends/neurosciences/fulltext/S0166-2236\(98\)01260-0?\\_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0166223698012600%3Fshowall%3Dtrue](https://www.cell.com/trends/neurosciences/fulltext/S0166-2236(98)01260-0?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0166223698012600%3Fshowall%3Dtrue)
- Bruer, J. (1997). Education and brain: A bridge too far. *Educational Researcher*, 26(8), 4–16. <https://doi.org/10.3102/0013189X026008004>
- Bykov, V. (2014). *Ključovi chynnyky ta suchasni instrumenty rozvytku systemy osvity* [Key reasons and modern tools to the development of education system].  
<https://core.ac.uk/download/pdf/32306741.pdf>
- Dekker, S., Lee, N., Howard-Jones, P., & Jolles, J. (2012). Neuromyths in education. Prevalence and predictors of misconceptions among teachers. *Frontiers in Psychology*, 3, 429. <https://doi.org/10.3389/fpsyg.2012.00429>
- Deligiannidi, K., & Howard-Jones, P. (2015). A. The neuroscience literacy of teachers in Greece. *Procedia – Social and Behavioral Sciences*, 174, 3909–3915.  
<https://doi.org/10.1016/j.sbspro.2015.01.1133>
- Druzhilovskaya, O. (2020). Neurosciences as a source of formation of a new direction of modern pedagogical education. *CITISE*, 3, 314-321.  
<http://doi.org/10.15350/2409-7616.2020.3.27>
- Dubaseniuk, O., Semeniuk, T., & Antonova, O. (2003). Profesiiina pidhotovka maibutnoho vchytelia do pedahohichnoi dialnosti: monohrafia [Professional training of future primary school teachers to pedagogical activities: monograph]. *Zhytomyr State Pedagogical University*, Zhytomyr.  
<http://eprints.zu.edu.ua/8387/1/%D0%90%D0%BD%D1%82%D0%BE%D0%BD%D0%BE%D0%B2%D0%B0%20%D0%9F%D1%80%D0%BE%D1%84%D0%B5%D1%81%D1%96%D0%B9%D0%BD%D0%B0%20%D0%BF%D1%96%D0%B4%D0%B3%D0%BE%D1%82%D0%BE%D0%B2%D0%BA%D0%B0.pdf>
- Dzhanda, G. (2019). Potentsial prakseolohichnoho pidkhotovu v profesiinii pidhotovtsi maibutnykh uchyteliv pochatkovykh klasiv [The potential of the praxeological approach in the professional training of future primary school teachers]. *Theory and methods of vocational education*, 15(2).  
[http://www.innovpedagogy.od.ua/archives/2019/15/part\\_2/12.pdf](http://www.innovpedagogy.od.ua/archives/2019/15/part_2/12.pdf)

- Educational Reform (2019).  
<https://mon.gov.ua/storage/app/media/Serpneva%20conferentcia/2019/Prezentacii/Institut-zbirnik.pdf>
- Erickson, H. (2021). Mobile Apps and Biofeedback in Voice Pedagogy. *Journal of Singing*, 77(4), 485-500.  
[https://www.nats.org/Library/JOS On Point/JOS 077 04 2021 485.pdf](https://www.nats.org/Library/JOS%20On%20Point/JOS%20077%2004%202021%20485.pdf)
- Grospietsch, F., & Mayer, J. (2018). Professionalizing pre-service biology teachers' misconceptions about learning and the brain through conceptual change. *Education Sciences*, 8(3), 120–143. <https://doi.org/10.3390/educsci8030120>
- Grospietsch, F., & Mayer, J. (2020). Misconceptions about neuroscience – prevalence and persistence of neuromyths in education. *Neuroforum*, 26(2), 63–71. <https://doi.org/10.1515/nf-2020-0006>
- Hart, L. (1999). *Human Brain, Human Learning*. London: Longman.  
<https://archive.org/details/humanbrainhuman100hart/page/n227/mode/2up>
- Horvath, J., Donoghue, G., Horton, A., Lodge, J., & Hattie, J. (2018). On the irrelevance of neuromyths to teacher effectiveness: comparing neuro-literacy levels amongst award-winning and non-award winning teachers. *Frontiers in Psychology*, 9, 1666. <https://doi.org/10.3389/fpsyg.2018.01666>
- Komogorova, M., Maksymchuk, B., Bernatska, O., Lukianchuk, S., Gerasymova, I., Popova, O., Matviichuk, T., Solovyov, V., Kalashnik, N., Davydenko, H., Stoliarenko, O., Stoliarenko, O., & Maksymchuk, I. (2021). Pedagogical Consolidation of Pupil-Athletes Knowledge of Humanities. *Revista Romaneasca Pentru Educatie Multidimensionala*, 13(1).  
<https://doi.org/10.18662/rrem/13.1/367>
- Kremen, V. (2019). Transformation of the academic life in the 21st Century. *Education: Modern Discourses*, 2, 6-13.  
[http://emdnaes.org.ua/index.php/Educ\\_Mod\\_discourse/article/view/29/32](http://emdnaes.org.ua/index.php/Educ_Mod_discourse/article/view/29/32)
- Kumari, M., & Sharma, A. (2020). Neurofeedback Training for Social Cognitive Deficits. *JOE*, 16(10), 151. [https://www.researchgate.net/profile/W-Strasse/publication/345199778\\_Thermal\\_Variations\\_in\\_Osteoporosis\\_After\\_AclastaR\\_Administration\\_Case\\_Study/links/5fbcf0e1458515b79764e2cc/Thermal-Variations-in-Osteoporosis-After-AclastaR-Administration-Case-Study.pdf#page=151](https://www.researchgate.net/profile/W-Strasse/publication/345199778_Thermal_Variations_in_Osteoporosis_After_AclastaR_Administration_Case_Study/links/5fbcf0e1458515b79764e2cc/Thermal-Variations-in-Osteoporosis-After-AclastaR-Administration-Case-Study.pdf#page=151)
- Kushch, O. (2014). Vzaemodia mekhanizmviv praksysu z tvorchym myslenniam v productyvnyii dialnosti osobystosti [Praxis mechanisms of contrreaction with creative thinking in productive human activities]. *Pedagogical process: theory and practice*, 1, 159-163. [http://nbuv.gov.ua/UJRN/pptp\\_2014\\_1\\_26](http://nbuv.gov.ua/UJRN/pptp_2014_1_26)

- Maiboroda, V. (2012). Problemy rozvytku prakseolohichnykh umin maibutnykh kompetentnosti fakhivtsiv vyshchoi shkoly Ukrainy [Problems of development of praxeological skills of future competent specialists of higher education of Ukraine]. *Higher education in Ukraine*, 4, 31-36. [http://nbuv.gov.ua/UJRN/vou\\_2012\\_4\\_7](http://nbuv.gov.ua/UJRN/vou_2012_4_7)
- Maksymchuk, B., Gurevych, R., Matviichuk, T., Surovov, O., Stepanchenko, N., Opushko, N., Sitovskiy, A., Kosynskiy, E., Bogdanyuk, A., Vakoliuk, A., Solovyov, V., & Maksymchuk, I. (2020a). Training Future Teachers to Organize School Sport. *Revista Romaneasca Pentru Educatie Multidimensionala*, 12(4), 310-327. <https://doi.org/10.18662/rrem/12.4/347>
- Maksymchuk, B., Matviichuk, T., Solovyov, V., Davydenko, H., Soichuk, R., Khurtenko, O., Groshovenko, O., Stepanchenko, N., Andriychuk, Y., Grygorenko, T., Duka, T., Pidlypniak, I., Gurevych, R., Kuzmenko, V., & Maksymchuk, I. (2020b). Developing Healthcare Competency in Future Teachers. *Revista Romaneasca Pentru Educatie Multidimensionala*, 12(3), 24-43. <https://doi.org/10.18662/rrem/12.3/307>
- Malykhin, A. (2014). Sutnist i pryntsyipy prakseolohichnoho pidkhotu v metodychnii pidhotovtsi maibutnoho vchytelia tekhnolohii [The essence and principles of the praxeological approach in methodical preparation of the future teacher of technologies]. *Ternopil Volodymyr Hnatiuk National Pedagogical University. Serie: Pedagogy*, 3, 72-77. [http://nbuv.gov.ua/UJRN/NZTNPU\\_ped\\_2014\\_3\\_14](http://nbuv.gov.ua/UJRN/NZTNPU_ped_2014_3_14)
- Melnyk, N., Bidiuk, N., Kalenskiy, A., Maksymchuk, B., Bakhmat, N., Matviienko, O., Matviichuk, T., Solovyov, V., Golub, N., & Maksymchuk, I. (2019). Modely y orhanyzatsyone osobyne profesyonalne obuke vaspytacha u pojedynym zemlyama Evropske Unyje y u Ukrayiny [Models and organizational characteristics of preschool teachers' professional training in some EU countries and Ukraine]. *Zbornik Instituta za pedagogska istrazivanja*, 51(1), 46-93. <https://doi.org/10.2298/ZIPI1901046M>
- Melnyk, N., Maksymchuk, B., Gurevych, R., Kalenskiy, A., Dovbnya, S., Groshovenko, O., & Filonenko, L. (2021). The Establishment and Development of Professional Training for Preschool Teachers in Western European Countries. *Revista Romaneasca Pentru Educatie Multidimensionala*, 13(1). <https://doi.org/10.18662/rrem/13.1/369>
- Oman, D., Shapiro, S., Thoresen, C., Plante, T., & Flinders, T. (2008). *Meditation Lowers Stress and Supports Forgiveness Among College Students: A Randomized Controlled Trial*. [https://www.academia.edu/1121114/Meditation\\_lowers\\_stress\\_and\\_supports\\_forgiveness\\_among\\_college\\_students\\_A\\_randomized\\_controlled\\_trial](https://www.academia.edu/1121114/Meditation_lowers_stress_and_supports_forgiveness_among_college_students_A_randomized_controlled_trial)
- Onishchuk, I., Ikonnikova, M., Antonenko, T., Kharchenko, I., Shestakova, S., Kuzmenko, N., & Maksymchuk, B. (2020). Characteristics of Foreign Language Education in Foreign Countries and Ways of Applying Foreign



- Experience in Pedagogical Universities of Ukraine. *Revista Romaneasca Pentru Educatie Multidimensionala*, 12(3), 44-65.  
<https://doi.org/10.18662/rrem/12.3/308>
- Organization for Economic Co-operation and Development. Understanding the Brain (2002). *Towards a New Learning Science*. Paris: OECD.  
<https://www.oecd.org/education/ceeri/understandingthebrainthebirthofalearningscience.htm>
- Palamarchuk, O., Gurevych, R., Maksymchuk, B., Gerasymova, I., Fushtey, O., Logutina, N., Kalashnik, N., Kylivnyk, A., Haba, I., Matviichuk, T., Solovyov, V., & Maksymchuk, I. (2020). Studying Innovation as the Factor in Professional Self-Development of Specialists in Physical Education and Sport. *Revista Romaneasca Pentru Educatie Multidimensionala*, 12(4), 118-136.  
<https://doi.org/10.18662/rrem/12.4/337>
- Papadatou-Pastou M., Haliou E., & Vlachos F. (2017). Brain knowledge and the prevalence of neuromyths among prospective teachers in Greece. *Frontiers in Psychology*, 8, 804. <https://doi.org/10.3389/fpsyg.2017.00804>
- Ratanasiripong, P., Ratanasiripong, N., & Kathalae, D. (2014). *Biofeedback Intervention for Stress and Anxiety among Nursing Students: A Randomized Controlled Trial*.  
[http://www.heartmath.com/wpcontent/uploads/2014/04/biofeedback\\_intervention\\_stress\\_nursing\\_students.pdf](http://www.heartmath.com/wpcontent/uploads/2014/04/biofeedback_intervention_stress_nursing_students.pdf)
- Rizzolatti, G., & Arbib, M. (1998). Language within our grasp. *Trends in Neurosciences*, 21, 188-194. <https://pubmed.ncbi.nlm.nih.gov/9610880/>
- Romanovska, L. (2016). Prakseolohichniy pidkhid do pidhotovky maibutnikh pratsivnykiv sotsialnoi sfery [Praxeological approach to the training of future social workers]. *Scientific Bulletin of Uzhhorod National University. Series: "Pedagogy. Social work"*, 2(39), 214-216.  
[http://nbuv.gov.ua/UJRN/Nvuuped\\_2016\\_2\\_58](http://nbuv.gov.ua/UJRN/Nvuuped_2016_2_58)
- Salam, U., Abdul Wahab, M. (n.d.). *Drug Addiction Students and Heart Rate Variability Biofeedback: A Study on Solat Effect*.  
[http://umpir.ump.edu.my/id/eprint/5067/2/Poster\\_Venice.pdf](http://umpir.ump.edu.my/id/eprint/5067/2/Poster_Venice.pdf)
- Semenikhina, O., Semenog, O., & Drushliak, M. (2018). Formuvannia u maibutnikh uchyteliv umin ratsionalno obyraty programnyi zasib: prakseolohichniy pidkhid [Formation of future teachers' ability to rationally choose a software tool: a praxeological approach]. *Information technologies and teaching aids*, 63(1), 230-241. <https://doi.org/10.33407/itlt.v63i1.1820>
- Sheremet, M., Leniv, Z., Loboda, V., & Maksymchuk, B. (2019). The development level of smart information criterion for specialists' readiness for inclusion implementation in education. *Information Technologies and Learning Tools*, 72, 273-285. <https://journal.iitta.gov.ua/index.php/itlt/article/view/2561>
- Skoryk, T., & Hytsyk, N. (2020). Realizatsia prakseolohichnoho pidhodu u konteksti pidhotovky maibutnoho vchytelia do uspishnoi profesiinoi

- dialnosti [Praxeological approach realisation in the context of primary school teachers' training to professional activities]. *Scientific work collection "Pedagogy and psychology"*, 63, 151-157.  
<http://journals.hnpu.edu.ua/index.php/pedagogy/article/view/3285/3348>
- State Standard of Primary Education (2018).  
<https://zakon.rada.gov.ua/laws/show/87-2018-%D0%BF#Text>
- Understanding the brain: towards a new learning science (2002). *OECD*, 69-77.  
<http://www.oecd.org/education/ceri/31706603.pdf>
- Vovkanich, L. (2020). *Fiziologia kintsevoho mozku: sbosta lektsia "Normalna fiziologia liudyny"* [Physiology of the brain: the 6th course "Normal human physiology"].  
<http://repository.ldufk.edu.ua/handle/34606048/24432?mode=full>
- Chojak, M. (2018). Neuropedagogy as a scientific discipline: interdisciplinary description of the theoretical basis for the development of a research field. *International Journal of Business, Human and Social Sciences*, 11(8), 1084–1087.  
<https://doi.org/10.5281/zenodo.1474341>