

## COMPUTER VISUALIZATION IN TEACHING GENERAL TECHNICAL DISCIPLINES: THEORETICAL AND PRACTICAL ASPECTS

*Pohorielov Mykhailo*, PhD, Associate Professor of the Department of Theory and Practice of Technological and Vocational Education, HEI «Donbas State Pedagogical University», Slavyansk.

E-mail: [texfak@gmail.com](mailto:texfak@gmail.com)

ORCID: 0000-0003-4706-3263

*Prasol Artem*, Master's student, HEI «Donbas State Pedagogical University», Slavyansk.

E-mail: [allakodik1983@gmail.com](mailto:allakodik1983@gmail.com)

ORCID: 0009-0001-5832-5903

DOI: 10.32342/2522-4115-2024-1-27-21

**Keywords:** *visual methods, visualization, computer visualization, general technical disciplines, typology of computer visualization aids, teaching methods.*

*The article investigates the development of visual aids and visualization ideas in the organization of the educational process, particularly in teaching general technical disciplines. The article aims to review the development of visual aids and visualization ideas in education, clarify the essence of computer visualization, classify its types and kinds, and determine the directions of computer visualization usage in teaching general technical disciplines and the software applications that ensure their development for educational purposes. The study operates methods of retrospective, content, and semantic analysis, classification, generalization, and modelling.*

*The historical context of introducing electronic visualization tools in education has been considered in the study, starting from the first projectors in the 1930s to modern computer visualization technologies such as 2D and 3D visualization, stereoscopic 3D, virtual reality (VR), and augmented reality (AR). The essence of computer visualization as a general term for graphic methods of creating, analysing, and transmitting information has been defined. Differences between the didactic principles of visual aids and visualization have been clarified. It has been highlighted that visualization has a more complex structure since it includes actions for constructing images of investigated objects or phenomena.*

*The article identifies the directions for implementing computer visualization, including scientific, software, and information visualization. It has been established that all visual content can be divided into three subgroups: structured, artistic, and demonstrative visual objects, which can be static or dynamic, in one plane or three-dimensional space.*

*The impact of computer visualization on the methods of teaching general technical disciplines has been analysed. It has been shown that modern approaches to using computer visualization provide new opportunities for more effective and interactive learning, promoting the development of students' technical and spatial imagination, which is crucial for future engineers and technical specialists.*

*An approximate list of software for creating computer visualization tools, which can be useful in teaching general technical disciplines, has been provided. Among them are applications for creating presentations and infographics, 3D modelling, VR and AR-based applications and services, simulators, and emulators.*

*The main directions for using computer visualization aids in teaching general technical disciplines are identified, including auxiliary synopsis, diagrams, tables, block diagrams, graphs, frames, word clouds, domain structures, memory cards, comics, heuristic sketches, knowledge animation, infographics, multimedia presentations, educational videos, static and dynamic 2D and 3D models, VR and AR objects.*

*It has been concluded, that the didactic effectiveness of computer visualization in teaching general technical disciplines is ensured by certain provisions, namely: the focus on the quick and complete memorization of studied concepts, theories, and ideas by students; adherence to the principles of reliability, quality, completeness, sufficiency, logic, simplicity of perception, optimality, unity of graphics and text, and emphasis on key points; encouraging students to independently analyse and construct new, non-trivial didactic tasks allowing them to explore concepts, phenomena, or objects in terms of independent search and educational experimentation.*

## References

Aliksieieva, G., Novak, O., Miziuk, V., Saienko, Y. Visualization technologies for material development in professional training of future specialists. *Scientific Notes of the Pedagogical Department*, 2021, no. 48, pp. 91–100. doi: 10.26565/2074-8167-2021-48-11

Arnheim, R. (1974). *Art and visual perception: A psychology of the creative eye*. Oakland, University of California Press, 528 p.

Babych, O., Semenikhina, O. To questions about interpretation of clarity and visualization. *Physical and Mathematical Education*, 2014, issue 2(3), pp. 47–53. (In Ukrainian).

Biloshapka, N. Vykorystannia zasobiv kompiuternoї vizualizatsii pry formuvanni intelektualno-hrafichnoi kultury maibutnoho fakhivtsia [The use of computer visualization tools in the formation of the intellectual and graphic culture of the future specialist]. *Pedagogical Sciences: Theory, History, and Innovative Technologies*, 2018, no. 4, pp. 11-20. (In Ukrainian).

Bondarenko, T., Stetsenko, V. (2023). Innovatsiini tekhnolohii v osvithomu seredovyschchi: metodychnyi instrumentarii ta praktychna realizatsiia [Innovative technologies in the educational environment: methodological tools and practical implementation]. *Teoriia i praktyka profesii-noho stanovlennia fakhivtsia v innovatsiynomu osvithomu seredovyschchi* [Theory and practice of professional development of a specialist in an innovative educational environment]. Dnipro, Alfred Nobel University Publ., pp. 248–304. (In Ukrainian).

Buinytska, O.P. (2012). *Informatsiini tekhnolohii ta tekhnichni zasoby navchannia* [Information technologies and technical means of education]. Kyiv, Center for Educational Literature Publ., 240 p. (In Ukrainian).

Devin, V., Tkachuk, V., Skorobogatov, D. Use of the MDSolids software in studying discipline “Material and Construction Mechanics”. *Open educational e-environment of modern University*, 2018, vol. 5, pp. 77–87. (In Ukrainian).

Dodero, J.M., Val, A.M., del Torres, J. An extensible approach to visually editing adaptive learning activities and designs based on services. *Journal of Visual Languages and Computing*, 2010, vol. 21, no. 6, pp. 332–346.

Dotsenko, N.A. Technology of application of competence-based educational simulators in the informational and educational environment for learning general technical disciplines. *Journal of Physics: Conference Series*, 2021, vol. 1946, AN: 012014. doi: 10.1088/1742-6596/1946/1/012014

Drushlyak, M.G. Glossary of visual education: visibility, visualization, visual thinking. *Physical and Mathematical Education*, 2018, issue 1(15), part 2, pp. 78–83. (In Ukrainian).

Dziedzic, K., Włodarczyk, M., Paśnikowska, M. The usage of computer visualization in teaching technical subjects. *Advances in Science and Technology Research Journal*, 2014, vol 8, issue 2, pp. 72–75. doi: 10.12913/22998624/571

Honcharenko, S.U. (1997). *Ukrainskyi pedahohichnyi slovnyk* [Ukrainian Pedagogical Dictionary]. Kyiv, Lybid Publ., 376 p. (In Ukrainian).

Ivanova, H.I., Lavrentieva, O.O., Eivas, L.F., Zenkovych, I.O., Uchitel, A.D.. The students’ brainwork intensification via the computer visualization of study materials. *CTE Workshop Proceedings* [Online], 2020, vol. 7, pp. 185–209. doi: 10.55056/cte.346

Kokhan, L. Osoblyvosti vykorystannia naochnykh zasobiv navchannia v protsesi vyvchennia humanitarnykh dystsyplin [Features of the use of visual learning tools in studying humanities]. *Pedagogy of creative personality formation in higher and general academic schools*, 2016, issue 48(101), pp. 161–167. (In Ukrainian).

Mykhaylova, L.M. (Ed.). (2020). *Slovnyk terminiv i poniat suchasnoi osvity* [Dictionary of terms and concepts of modern education]. Severodonetsk, Luhansk Regional Institute of Postgraduate Pedagogical Education Publ., 194 p. (In Ukrainian).

Schwabish, J. (2021). *Better data visualizations: a guide for scholars, researchers, and works*. New York, Columbia University Press, 464 p.

What is data visualization? *Microsoft 365*. Available at: <https://www.microsoft.com/uk-ua/microsoft-365/visio/data-visualization> (Accessed 3 April 2024).

Yusoff, Z., Katmon, S.A., Ahmad, M.N., Miswan, S.H.M. (2013). Visual representation: enhancing students’ learning engagement through knowledge visualization. *2013 International Conference on Informatics and Creative Multimedia*. Kuala Lumpur, Malaysia, pp. 242–247. doi: 10.1109/ICICM.2013.48

Одержано 18.02.2024.