

Approach to Learning Machine Science by Future Technology Teachers

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Abstract. *The approach to organizing a practical course in mechanical science in the training of future technology teachers is described. Its essence is the implementation of an educational creative project in the process of solving a system of mechanical science problems by students. The bicycle transmission was chosen as the design object, and mechanical transmissions of machine drives were chosen as the objects for educational problems. It is argued that the educational activity of students will be activated and mechanical science literacy will be formed for everyone.*

Keywords: *technology teacher, practical course in mechanical science, bicycle transmission, educational creative project, system of educational problems.*

A permanent problem of professional training of future technology teachers in Ukraine is machine learning literacy as a component of their general technical competence. The main reason for this state of affairs is the lack of a concept of training future technology teachers in machine learning. The traditional concept of the similarity of the machine learning literacy of a future design engineer and a future technology teacher in practice demonstrates its complete ineffectiveness. Here there is only a similarity of terminology, but not the essence of professional activity. The design and construction activities of a design engineer in production and the organization of specialized training of high school students by technology teachers as design and technological activities when performing educational creative projects have different goals, different tasks and results of activity. In the technological education of schoolchildren, technology teachers form new technical knowledge, the ability to use them in practice, an attitude to machine learning and educational design and technological activities, a technical worldview as a component of the general culture of a high school student's personality. The purpose of high school students' machine learning literacy is the ability to express judgments in machine learning, the ability to make elementary decisions in machine learning, as well as the ability to professional self-determination after graduating from a secondary education institution. Thus, the scientific search for approaches to the formation of machine learning literacy of future technology teachers, on the basis of which they will be able to organize specialized training for high school students, is relevant.

R. Gurevich held the opinion that the main content of the training of future technology teachers is "... knowledge about the technology of production processes, about the structure of machines and mechanisms, the principles of operation of technical systems ..." [3, p. 50]. V. Sydorenko attributed to the reasons for the unprestigious professional activity of a technology teacher "... excessive focus of labor training on the production environment ...; low intellectual saturation of the subject content ..." [8, p. 134]. T. Kapelyushna argued that labor training of schoolchildren "... involves the formation of ... the ability to use common devices, devices, mechanisms ... to increase one's own technological literacy" [6, p. 115]. V. Yurzhenko came to the conclusion that the formation of a new content and structure of the educational field "Technology" occurs on the principles of cultural correspondence, activity, systematicity and synergy [10]. D. Thorzhevsky argued that a general idea of technological machines is given by knowledge of their drive [9]. S. Ryabets emphasized that in technology lessons it is necessary to form professional interests in high school students, which will help them choose a future profession in accordance with their own capabilities [7]. P. Dmytrenko identified the following levels of the integration approach: interdisciplinary, professional orientation, motivation of the educational process, reconstruction of the content and structure of academic disciplines, systematization of content [4]. V. Getta gave the following characteristics regarding the technical knowledge of future technology teachers "... characteristic of a specific science. ... it is necessary to take care not only of understanding their content, but also of including existing concepts in the system, developing technical thinking ... the perception of technical concepts is complicated by the fact that they are associated with details, nodes and mechanisms, which are mainly in both physical and functional connection" [2, p. 210]. O. Gadvillo advised to reconstruct the traditional labor training of schoolchildren into "... primary technical education ... creation of a fundamentally new educational subject of technocultural orientation" [1, p. 234].

Based on the fact that the machine science knowledge of future technology teachers should be worldview in nature, and relevant to their professional activities in purpose, we propose organizing a workshop on machine science as students' work on an educational creative project, the result of which will be machine science literacy for all future technology teachers. The means by which the educational creative project will be carried out will be, in our opinion, a specially developed system of educational machine science tasks. We propose a bicycle chainring cassette as the object of educational design (fig. 1) [12].

The choice is justified by the following considerations: this is the first vehicle in the life of the majority of young people, the work of the bicycle transmission is perceived directly through their own muscular efforts, which is not the case in other technical systems, and also that the drives of any machines are characterized by

fractality, which makes it possible to freely transfer the open technical phenomena in the bicycle transmission to different types of working machines, that is, to have mechanical literacy for everyone. Fig.1 clearly shows that in the cassette of the driving sprockets they are planted in the form of a truncated cone, and there is also a mechanism for rearranging the chain on sprockets of different diameters. Driving sprockets of different diameters are also located near the pedals, to which cyclists apply muscular efforts. As a result of the purposeful solution of the system of educational machine science tasks by future teachers, they will become aware of the technical phenomena of the transmission of rotational motion in space, changes in the kinematic parameters of rotational motion on the drive shafts, changes in the force parameters of rotational motion on the drive shafts [5; 11].



Fig. 1. Bicycle drive sprocket cassette

We propose the following structure of the system of educational machine science tasks for future teachers: the first block for performing component analysis of the machine drive; the second block for interdisciplinary educational discovery of the essence of the phenomenon of speed change and the essence of the phenomenon of torque change; the third block for performing kinematic analysis; the fourth block for performing force analysis. The objects of study will be various types of mechanical transmissions, a combination of mechanical transmissions, and a working machine drive.

Thus, organizing a machine science workshop for future technology teachers as an educational creative project and its implementation in the process of solving a system of machine science educational tasks will allow forming machine science literacy for everyone, as well as gaining experience in using relevant machine science activities in the professional activities of a technology teacher. We see further research in the development of educational tasks for each block of the system of educational machine science tasks.

References

1. Гедвілло О. І., Носова І. О. Проблеми формування конструкторсько-технологічних знань та вмінь студентів. *Збірник наукових праць "Педагогічні науки"*. 2004. Вип. 37. С. 231–235. URL: <https://ps.journal.kspu.edu/index.php/ps/issue/view/9> (дата звернення: 20.12.2025).

2. Гетта В. Г. Використання штучного інтелекту для формування в студентів предметних компетентностей. *Вісник Національного університету "Чернігівський колегіум". Серія : Педагогічні науки*. 2025. № 33. С. 209–214. <https://doi.org/10.58407/visnik.253333>.

3. Василенко Н. Сучасні парадигми профільного навчання: науковий часопис академіка Р. С. Гуревича. *Сучасні інформаційні технології та інноваційні методики навчання в підготовці фахівців: методологія, теорія, досвід, проблеми*. 2018. Вип. 50. С. 47–51.

4. Дмитренко П. В. Зміст фахової підготовки вчителів трудового навчання у вищих педагогічних навчальних закладах. *Наукові записки : педагогічні та історичні науки*. 2004. Вип. LV (55). С. 3–9. URL: <https://enpuir.udu.edu.ua/entities/publication/6ab04140-7ed0-4aad-8e84-cc597f3f0775> (дата звернення: 02.01.2026).

5. Іванчук А. В. Машинознавча складова загальнотехнічної підготовки майбутніх учителів технологій у контексті культурологічної концепції технологічної освіти. *Сучасні інформаційні технології та інноваційні методики навчання в підготовці фахівців : методологія, теорія, досвід, проблеми*. 2018. Вип 50. С. 274–278.

6. Капелюшна Т. Особливості технологічної освіти на початку третього тисячоліття. *Сучасна іншомовна освіта в Україні: стан, проблеми, перспективи : матеріали міжнар. наук.-практ. інтернет-конф., м. Умань, 16 жовт. 2014 р. м. Умань : ФОП Жовтий О. О., 2014. С. 114–116.*

7. Рябець С. І., Іваниця Ю. С. Формування на уроках трудового навчання професійного інтересу до сучасних технологій та машин. *Наукові записки. Серія: Педагогічні науки*. 2023. Вип 210. С. 173–177.

8. Савченко А. Науково-педагогічна спадщина професора В. К. Сидоренка полтавського періоду. *Педагогічні науки*. 2018. Вип. 72. С. 132–137. <http://doi.org/10.5281/zenodo.2178291>.

9. Тхоржевський Д. О. Методика трудового і професійного навчання та викладання загальнотехнічних дисциплін: навч. посіб. Київ : Вища школа, 1992. 334 с.

10. Юрженко В. В. Теоретичні засади змісту і структури освітньої галузі "Технологія" в основній школі : автореф. дис.... д-ра. пед. наук : 13.00.02. Київ, 2014. 35 с.

11. Ivanchuk A., Podolyanchuk S., Marushchak O. Feature of engineering training for future technology teachers. *Environment. Technology. Resources. Proceedings of the International Scientific and Practical Conference*. 2025. Vol.3. P. 145–150. <https://doi.org/10.17770/etr2025vol3.8519>.

12. Specialized S-Works Tarmac (Custom Paint). *District cycle works* : веб-сайт. URL: <https://www.districtcycleworks.com/builds-blog/2016/1/4/specialized-s-works-tarmac-custom-paint> (дата звернення: 02.01.2026).