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REALITIES AND PROSPECTS OF ENGINEERING TRAINING OF FUTURE TECHNOLOGY TEACHERS IN UKRAINE

Abstract*. The author's approach to solving the problem of clear understanding by the general public of the content of the school subject "Technology" is revealed. It is emphasized that in practice, the basis for choosing the content and structure of the educational material of this subject is the concept of engineering design, which cannot be fully implemented due to objective reasons. A guideline for solving the problem of understanding the goals and objectives of technological education is proposed - this is the content of the activity of a mechanical engineer. The differences in engineering approaches to the technosphere and the essence of the advantages of the content of the activity of a mechanical engineer for technological education are highlighted.*

Keywords*: technology teacher, problems of technological education, technological literacy, activity of a design engineer, activity of a mechanical engineer, worldview mechanical science knowledge.*

From the analysis of literary sources and practice it follows that the problems associated with teaching the subject "Technology" are, without exaggeration, international [1, 2, 5]. In particular, there is a lack of understanding of the goals and objectives of technological education by both the administration of secondary education institutions and the parents of schoolchildren, which is why its potential opportunities are leveled. Lack of understanding of the practical value of the subject "Technology" generally forms an attitude towards it as secondary. The main reason for this state of affairs is that modern production is so complex that it is impossible to make objective evaluative judgments without professional knowledge, this is one of the reasons for the total underestimation of this educational subject.

A significant step towards solving this problem was taken in the USA, when the goal was called technological literacy for all [5]. However, even now, with a clear generally accepted guideline, the problem is far from being solved. Here, first of all, there is a different understanding of the concept of "technology" by researchers, as well as their different views on the means of forming technological literacy for everyone and, accordingly, different types of technological literacy.

More than 20 years ago, it was proposed in the USA to form the technological literacy of schoolchildren on the basis of engineering design [5]. However, for some reason, the authors of this proposal believed that any schoolchild can master the basics of engineering activity and, most importantly, the basics of engineering training do not require propaedeutics. However, these arguments should not be neglected, because the problem of the secondary nature of the subject "Technology" is not solved only by using slogans and propaganda regarding the assimilation of the achievements of modern production through the acquisition of knowledge in engineering design. In our opinion, first of all, it is necessary to give a generalized description of the professional activities of a design engineer and a mechanical engineer. The most generalized activity of design engineers is associated with the creation of technical information used to manufacture technical objects, and mechanical engineers with the operation of technical systems (technical objects) [4]. There is a fundamental difference here - for a design engineer, the image of a technical device needs to be created, while a mechanical engineer uses existing technical devices (the image does not need to be created). If we assume that the technical image is an obligatory component of a person's technical thinking, then the orientation of technology teachers to the activity of a mechanical engineer has an obvious advantage.

Let us lower the level of generalization somewhat and consider again the activities of a design engineer and a mechanical engineer. Regarding the activities of a design engineer, it can be stated that he first designs and then constructs technical objects [4]. The basis of the design activity of a design engineer is design and verification calculations of machine parts [3]. In the simplest version, the essence of design calculations of machine parts lies in determining the geometric dimensions, for example, of shafts or gears, and verification calculations are reduced to checking the strength of machine parts, for example, for bending, torsion, etc. The content of the mechanical engineer's activities is fundamentally different, which boils down to the fact that during the operation of technical objects they need to be adjusted, maintained, repaired, and disposed of. Since to perform their useful function, technical objects need energy, the source of which is the engine, and the adapter to local conditions is the machine drive, the mechanical engineer must be able to identify the kinematic chain from the engine to the working (executive) body, to conduct elementary kinematic and force calculations for it. So, the term "kinematics" suggests that the support for the mechanical engineer is knowledge of the "Mechanics" section of the physics course. As we can see, the content of the mechanical engineer's activities is quite realistic to simplify to the level of understanding of schoolchildren, because the knowledge of schoolchildren from the school subject of physics will be propaedeutic and, as noted above, it is not necessary to create an image of a technical object in the imagination, it is enough to have a real technical object or its model in the lesson on the subject of "Technology".

What will be the formation of technical literacy of schoolchildren? Since in any production technology operations are performed by a technical object, it is permissible to speak of the technical literacy of schoolchildren as a type of their technological literacy or as a necessary condition for the formation of technological literacy for all. On the way to the working body of any machine is the machine drive. Moreover, the drive is an attribute of any type of machine, therefore it has a clear sign of worldview machine science knowledge, which is important for the technological education of secondary school students. The drive manifests three universal technical phenomena - the transmission of mechanical motion in space, the change in the kinematic parameters of the machine drive along the kinematic chain and the change in the power parameters of the machine drive along the kinematic chain. Actually, these will be the three content lines of the formation of the technical literacy of schoolchildren. Thus, we have radically solved the problem of the vagueness of the goals of the technological education of schoolchildren, which cannot be said about the approach of the American researcher of this problem R. Wicklein [5]. Understanding how any technological machine works will become a basic component of the mechanical science examination of schoolchildren. They will have a visible, not an imaginary object of study (for example, the drive of a technological machine), they will be able to transfer worldview mechanical science knowledge to both household appliances and equipment that is operated in various fields of human activity (medicine, trade, equipment repair, operation of one's own car or tractor, etc.). The presence of technical literacy will allow students to make a conscious decision about professional self-determination after graduating from a secondary education institution.

Further research should focus on the development of didactic tools for the process of forming technical literacy of schoolchildren when they study the subject "Technology", as well as the content of educational projects.

References

1. Андрощук І., Андрощук І. (2017). Особливості професійної підготовки майбутніх вчителів трудового навчання в Польщі та Великій Британії. *Порівняльна професійна педагогіка*, *7* (1), 134–139.

2. Андрощук І., Андрощук І. (2017). Методика підготовки майбутніх учителів технологій та інженерії у США. *Порівняльна професійна педагогіка*, *7* (3), 124–129.

3. Іванчук А. В. (2018). 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*, *50*, 274–278. URL: http://nbuv.gov.ua/UJRN/mitimpt_2018_50_57

4. Півень О. М., Товстолуг З. М. (2023). Інженерне проєктування технології: навч. посіб. Харків: НТУ "ХПІ", 136 с.

5. Wicklein, R. C. (2006). Five good reasons for engineering as the focus for technology education. *The Technology Teacher, 65*(7), 25–29. https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1065&context=ncete_publications.