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Analysis of Technical Specialists' Scientific Training: The Role of Written Academic Discourse

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Abstract. *The development and implementation of the written academic discourse course as one of the aspects of technical specialists' scientific training gives students an opportunity to get acquainted with research culture that promotes the introduction and development of research skills in future engineers. The article presents an overview of the existing practices of written academic discourse in the process of scientific training technical specialists on the basis of interdisciplinary theoretical understanding. The authors review the previous experience of research that reflects the linguacultural, psychological, communicative characteristics of written academic discourse in the context of analysis of the main types of students' scientific training. The authors consider in detail the characteristics of written academic discourse in the expanded understanding of the term, conduct a comparative analysis of domestic and foreign experience, outline ways of further research of its influence on the process of technical specialists' teaching. The present study was carried out in the of implementation of the project «Intensification of scientific and professional language training of technical specialists in the context of education digital transformation» for 2023-2025, with the financial support of the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. 19678460). In this paper the authors analyze the main types of scientific training of students on the basis of comparative analysis of the domestic and international best practices and consider in detail the aspects of written academic discourse and its impact on the training process in the sphere of research.*

Keywords: *scientific training, technical university, technical specialist, academic discourse, scientific written and oral communication.*

Introduction. At the present, the requirements of modern society to the training of technical specialists have changed. Higher professional education should be flexible, mobile, competitive. The innovative nature of modern education has exacerbated the contradiction in the content of scientific training, which is an important research ability and skill that allows to explain, understand and discuss issues related to science. In the society of the information age of XXI century, where knowledge becomes the main wealth, a special place is assigned to research training of future specialists to obtain new information necessary for the fulfilment of professional tasks, which is formed in the course of researching a problem situation, the ability to find a technically competent solution.

A number of foreign (Archer-Bradshaw, Miller, Murcia, etc.) and domestic researchers, considering the importance of scientific training, describe it in the form of three main dimensions: scientific knowledge, the nature of science, the relationship between science and technology. Accordingly, the understanding of the nature of science and the development of scientific knowledge affects human thinking. In other words, «if one does not know how scientific discoveries are made, how can one make an informed judgement on a scientifically valid question or problem?». Scientific research can be defined as «intellectually controlled study that leads to advances in knowledge through the discovery and codification of new information». Teaching and scientific research are mutually enriching and lead to the discovery and transfer of knowledge.

As an example, consider the research training process at Khon Kaen Research University (Thailand), where the teachers have implemented the Teaching-Research Nexus (TRN) strategy, which links teaching and research and involves students learning from research results.

The integration of research-based learning into the educational process through:

- training in research methods, techniques and skills;
- developing learning assignments on contemporary scientific issues;
- involving students in research projects;
- encouraging students to experience a research culture;
- considering the latest research in the context of classroom teaching;
- using their own research findings in course design and teaching [1].

In the process of implementing the Teaching-Research Nexus (TRN) strategy by using the case study method, it was found that scientific training develops research skills and helps students to establish strong intellectual and practical links between scientific research and their own learning and it is at a high level. The results of the TRN strategy prove the importance of scientific training in shaping the professional qualities of a specialist who can effectively conduct communication during research activities.

At the present stage of education, great importance is attached to the quality of scientific training, as the pace of innovation processes taking place in all spheres of activity is great, and the range of professional competences to be mastered by a future specialist is constantly expanding. Valuable in the process research skills' formation of is a written academic discourse, which is interpreted as:

- collective social practice in an academic discursive society [2];
- complex skills related to textual language activity, which allow not only to critically evaluate, analyze and correctly interpret various information, but also to produce and justify new knowledge [3];
- combination of process – activity of creating a written text, product – result, i.e. text, practice – experience accumulated in the process of working on the text;
- an important competence that allows global academic communication between representatives of the scientific community [4];
- integration into the academic community and assistance in learning disciplines [2].

Technical specialists at all levels of education at the beginning of their career should focus on professional writing skills [5], develop scientific communication and public speaking skills, independently master new knowledge and methods, acquire and develop independent work skills to solve modern engineering and technical problems.

Research Methods. The methodological basis of the research is a complex system of scientific methods. Methods of the primary information data collection, its sources and application for solving the project tasks, ways of data processing, as well as ensuring their reliability and reproducibility are the main ones in the formation of the research base. The study uses methods of theoretical analysis of international and domestic sources on the research problem, generalization, concretization and classification of scientific, pedagogical, methodological and linguistic information.

Research results and discussion. Modern labor market requirements set a new level of highly qualified specialists' training for the digital economy, including the research training in the educational environment.

In the works of many researchers scientific training is considered as an important component of the general intellectual environment that promotes the development of skills in collection, information processing, interpretation of empirical and experimental data. Employers point out that the problems solved in term and diploma projects of future engineers have a weak academic orientation. In modern teaching practice, as it is known, disciplines of humanitarian character are referred to «non-core», which reduces the overall quality and level of scientific training, does not allow to form all the necessary knowledge, skills, abilities, competences. Currently, technical universities are oriented towards CDIO (Conceive – Design – Implement – Operate), develop and implement integrated learning programs, which draw attention to the importance of humanities knowledge, without which «it is impossible to prepare not only a certified and knowledgeable «technician», but even a mechanic, because, in addition to the technical environment, he lives in a humanitarian one».

The humanities disciplines develop the research priorities of a future engineer, since an engineering specialist, being capable of humanitarian expertise, will be able to predict the socio-cultural consequences of engineering decisions. The practice of written communication becomes an essential element of a technical specialist with developed critical thinking.

Nevertheless, despite the general importance of humanities disciplines, students of technical universities of all levels are not able to effectively carry out professional written and oral communication, have a weak interest in written academic discourse, and do not see the need to improve their academic skills [6].

In the world practice, a well-established system of written academic discourse development has been successfully functioning for several decades.

In the USA, where the quality of higher education is particularly high, the modern concept of written academic discourse is «an institutional commitment of universities and colleges» [7]. A number of foreign scholars, noting the growing interest of undergraduate, Master and PhD students in socializing in new communities of written academic discourse, emphasize that learners must have a good level of written academic discourse in order to be recognized in academic circles, and attach great importance to such a concept of academic knowledge [8]. To this end, they propose the professional relationship development in the form of mentoring between supervisor and trainee to rethink the role of 'language' in the graduate context, to explore the norms of the academic discourse society and to prepare graduates for the communicative expectations of Master, PhD programs and thesis writing.

In the Republic of Kazakhstan, the importance of implementing a written academic course in the scientific training of students at all levels has been repeatedly highlighted in normative-legal and legislative acts. In the context of our study, the types of written academic discourse are of interest on the example of domestic experience. Thus, at the International University of Tourism and Hospitality (Turkestan) [9], through a questionnaire survey was identified the need for the formation of skills of academic and professional discourse of future specialists of the tourism industry. The teachers developed and tested the methodology of mastering the skills of academic writing in the framework of a specific discipline «Introduction to Academic Writing», argued the effectiveness of its implementation in junior students. the effectiveness of the implementation of methods of mastering special competences was analyzed step by step, the main competences were defined. In Al-Farabi Kazakh National University (Almaty) researchers consider the issues of research competence of students of different levels in the conditions of digitalization of education, which should be organized in the framework of both physical experiment and computational-theoretical research. For this purpose, they propose to improve educational programs for training specialists both for production and for the educational sphere. In the Kazakh Academy of Transport and Communication by named M. Tynyshpayev (Almaty) teachers found out that the majority of Master students experience difficulties of different nature when writing an English-language abstract. In this regard, they state that the formation of scientific writing skills: writing a scientific article, scientific reports, dissertation should begin already in the junior courses.

The survey conducted among teachers of Abylkas Saginov Karaganda Technical University (n = 28) has shown that the level of competences in the field of written academic discourse among Master and PhD students is extremely low. This is expressed, for example, in the inability to work with information, to structure, analyze, critically process it, in the lack of skills in writing essays, scientific articles, skills of oral presentation, data presentation, participation in discussions, etc. The level of competence in the field of written academic discourse is extremely low.

Moreover, the faculty survey revealed that senior students also have a poor understanding of scientific writing, serious problems in linguistic skills, in universal skills of scientific style and in skills related to professional technical discourse. Already in the lower courses it is necessary to inform students about the research conducted by professors, to invite them to scientific seminars, to lectures by visiting scholars, to encourage their participation as a member of the academic community, to develop their research culture.

These data are confirmed in the works of many researchers [9], who note that such problems may be related to significant differences between languages (Kazakh, Russian, English) and a scientific discourse in the three languages. Experience shows that students, Master and PhD students of technical universities, who do not have scientific training for academic and professional purposes, subsequently face problems that are more related to communication and management of scientific knowledge, with appropriate interactive interpersonal skills in the professional sphere.

In order to solve the tasks of the research we made an attempt to systemize the international experience of written academic discourse development. (Table) Based on the presented data, it can be seen that in a number of countries the development of a written academic discourse skills is already observed in the secondary education system. For example, in Hong Kong secondary school's trans-linguistic practices are promising to familiarize students with academic concepts and terminology [10].

In some countries, there is a growing need to understand the plurality of texts of academic practices of ethno-linguistically diverse academic discourses. For example, PhD programs in North American institutions are unique educational contexts in which cultures and texts merge to create alternative and diverse practices of academic literacy [11]. International students participating in written academic dis-

Characteristics of approaches and areas in the development of academic and professional discourse on the example of foreign experience		
No.	**Author, country, source**	**Characteristics**
1	Megan M. Siczek George Washington University (USA)	The authors present a pedagogical approach to socialize students into their new academic discourse communities that foster transformative learning in which they can share their experiences. Through this approach, students can use their own cultural, linguistic, disciplinary and intellectual strengths to enhance their communicative capabilities.
2	Rachel Moglen, Kiran Prakash Chawla, Patricia Levi and others University of Texas, Stanford Law School, Berkeley University and etc. (USA)	The authors present the field of MES as a way to unify linked interdisciplinary research. MES can bring together researchers from many disciplines, including engineering, economics, public policy and other sciences, each offering methodological tools and research perspectives for their disciplines.
3	Marcus Warnby Stockholm University (Sweden)	The majority of graduates in Swedish schools have large differences in their knowledge of academic vocabulary, indicating a mismatch with the level of academic training. The lack of knowledge of academic words makes academic texts hard to understand for most learners. For this reason, the authors suggest that academic English language training programs should be included in Swedish university entrance curricula.
4	Gulsah Tikiz Erturk & Kadim Ozturk Amasya University (Turkey)	A study of academic writing practices among PhD students in Turkish universities has shown that they cannot master academic language appropriately, have difficulties in synthesis and summarizing information, have problems in expressing their thoughts, and feel the need for supervisory help. Therefore, teachers need to develop and offer academic writing courses to students in order to raise their academic literacy.
5	Natalia Bobyreva Kazan Institute of International Relations (Russia)	Since the curriculum involves learning English for both general and special purposes, as well as mastering the skills necessary for the relevant sphere of professional communication, this affects the content of the material studied and the structure of the learning process. The authors propose to develop and implement a three-stage model of teaching English to students of technical specialties. At the first stage to study English for general purposes, at the second stage – to learn the appropriate technical vocabulary, to be able to translate terms in professional discourse. In the third stage, students can choose to study academic or business language depending on their professional expectations.
6	Alexandra V. Ruchina Tomsk Polytechnic University (Russia)	The authors study the research work of undergraduates of technical universities in the context of innovative changes in modern education. Since research work is an important component of undergraduates' training, the process of formation of a future specialist through individual cognitive activity aimed at obtaining new knowledge, solving theoretical and practical problems, self-education and self-realization.
7	Grebenkina A.S. Academy of Civil Defence of the Ministry of Emergency Situations (DPR)	While organizing cadets' learning and cognitive activities, the authors suggest to organize research work within the discipline: to increase the number of training tasks developed on the basis of situations, to specify the professional competences of a fire safety engineer formed in the process of solving training tasks in the methodological recommendations. Professionally oriented tasks should meet the criteria of reflecting interdisciplinary content and «taking into account the subject matter». The authors believe that the above factors contribute to the development of scientific thinking, increase the level of cadets' readiness for self-education.

course at the PhD level have great difficulty in academic writing and they have to «adapt smoothly to the linguistic and social environment of the host country and to the culture of their academic departments», understand the very different dynamics of academic writing [12, 13]. Shyam Sharma, Professor at the State University of New York states that the process of learning and doing graduate-level writing required multilingual STEM students an increasing ability to traverse and engage myriad physical, disciplinary and social-cultural spaces [14]. The George Washington University professor, Megan M. Siczek showed the significance of the study made on developing critical language awareness at graduate-level using a discovery-oriented approach [15]. All these international educators propose their approaches to understanding an academic discourse: socialization of students into academic, discourse communities where they can share their experiences, improvement of academic vocabulary at the level of school education, the field of MES as a way to unify related interdisciplinary studies, the three-stage model of language teaching (see Table). Reviewing these sources, we conclude that the values of academic discourse include the acquisition of knowledge, continuous improvement of knowledge, improvement of qualification academic level, continuity of the transfer process, acquisition and exchange of knowledge. The academic discourse creates a communicative space and reflects the idea of a knowledge-based society.

It is well known that scientific training involves a combination of teaching universal knowledge and skills of scientific writing with the study of the peculiarities of scientific text, which are conditioned by cultural, lexical-grammatical and professional-discursive factors.

Consequently, the academic discourse develops skills in information processing and interpretation of experimental and empirical data; teaches how to formulate and solve problems arising in the course of research work; helps to select the necessary research methods; provides readiness for professional self-improvement; develops innovative thinking, creativity and necessary professional skills; promotes self-discipline and improves social and interpersonal skills.

To improve the skills of a written academic discourse, a number of active measures should be taken, from the development of research courses and programs, to the discipline of «Academic Writing». In this way, students can build professional competences through the study of written academic discourse, gain enough skills to conduct research in the field of technical sciences. The learning outcome should be the preparation and writing of a research article. But for this, students should take a number of pre-courses that cover the elements of research articles, different research designs, and methods of evaluating scientific literature.

Conclusions. Thus, the analysis of the state of scientific training of technical specialists has shown, on the one hand, the need to introduce an academic course, on the other hand, the lack of attention to this problem in the conditions of modern higher technical education. Academic course implies obtaining knowledge that can be applied on the basis of scientific problems.

Therefore, today an extremely important goal of training at a technical university should be a course of written academic discourse with interdisciplinary content, which, in our opinion, will thoroughly elaborate the discursive and linguistic aspects of scientific training, namely, will contribute to the development of scientific writing skills, critical evaluation of scientific literature. The teaching system should provide a three-stage model of teaching languages to students of technical profile with the possibility of analyzing the research character in the profile of training, which will contribute to the development of a sufficient level of academic discourse, critical evaluation of research skills in the framework of scientific communication.

Teaching academic discourse as one of the key elements of scientific training of specialists should be carried out using the transformational method of learning, the method of unification of interdisciplinary research and professional orientation of self-education. Taking this course will allow future technical specialists to accumulate research experience and improve the level of competence in the field of written academic discourse.

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Техникалық бейіндегі мамандардың ғылыми даярлығын талдау: жазба академиялық дискурстың рөлі

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Аңдатпа. *Техникалық бейіндегі мамандарды ғылыми даярлаудың бір аспектісі ретінде жазбаша академиялық дискурс курсын әзірлеу және енгізу студенттерге зерттеу мәдениетімен танысуға мүмкіндік береді, болашақ инженерлерде зерттеу дағдыларын енгізуге және дамытуға ықпал етеді. Пәнаралық теориялық тұжырымдамаға негізделген мақалада техникалық бейіндегі мамандарды ғылыми даярлау процесінде жазбаша академиялық дискурстың қолданыстағы тәжірибелеріне шолу жасалады. Авторлар студенттердің ғылыми дайындығының негізгі түрлерін талдау контекстінде жазбаша академиялық дискурстың лингвомәдени, психологиялық, коммуникативтік сипаттамаларын көрсететін зерттеулердің алдыңғы тәжірибесін жинақтайды. Авторлар жазбаша академиялық дискурстың сипаттамаларын терминді кеңейтілген түсінуде егжей-тегжейлі қарастырады, отандық және шетелдік тәжірибеге салыстырмалы талдау жүргізеді, оның техникалық бейіндегі мамандарды оқыту процесіне әсерін одан әрі зерттеу жолдарын белгілейді. Осы зерттеу Қазақстан Республикасы Ғылым және жоғары білім министрлігі Ғылым комитетінің 2023-2025 жылдарға арналған гранттық қаржыландыру бойынша «Білім берудің цифрлық трансформациясы жағдайында техникалық бейіндегі мамандарды ғылыми-кәсіптік тілдік даярлауды қарқындату» жобасын іске асыру барысында жүзеге асырылды (ИРН 19678460).*

Кілт сөздер: *ғылыми дайындық, техникалық ЖОО, техникалық профиль маманы, академиялық дискурс, ғылыми жазба және ауызекі қатысым.*

Анализ научной подготовки специалистов технического профиля: роль письменного академического дискурса

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Аннотация. *Разработка и внедрение курса письменного академического дискурса как одного из аспектов научной подготовки специалистов технического профиля дает возможность студентам познакомиться с исследовательской культурой, способствует внедрению и развитию исследовательских навыков у будущих инженеров. В статье на основе междисциплинарного теоретического осмысления представлен обзор существующих практик письменного академического дискурса в процессе научной подготовки специалистов технического профиля. Авторы обобщают предыдущий опыт исследований, отражающих лингвокультурные, психологические, коммуникативные характеристики письменного академического дискурса в контексте анализа основных видов научной подготовки студентов. Авторы детально рассматривают характеристики письменного академического дискурса в расширенном понимании термина, проводят сравнительный анализ отечественного и зарубежного опыта, намечают пути дальнейшего исследования его влияния на процесс обучения специалистов технического профиля. Настоящее исследование осуществлено в ходе реализации проекта «Интенсификация научно-профессиональной языковой подготовки специалистов технического профиля в условиях цифровой трансформации образования» по грантовому финансированию на 2023-2025 гг. Комитета науки Министерства науки и высшего образования Республики Казахстан (ИРН 19678460).*

Ключевые слова: *научная подготовка, технический вуз, специалист технического профиля, академический дискурс, научная письменная и устная коммуникация.*

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