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FUTURE ENGINEERS’ PSYCHOLOGICAL READINESS FOR COMMON COMPETENCIES DEVELOPMENT IN THE PROCESS OF STUDYING “PROFESSIONAL PSYCHOLOGY”

The paper deals with the issue of psychological readiness of engineering students for the development of common competencies while studying the course “Professional Psychology”. As an alternative to the existing education system, which provides classical social and humanities courses in the engineers’ curriculum, it is proposed to create integrative courses that place social studies and humanities in a profession-related context. The aim of the article is to evaluate the psychological readiness of future engineers for the development of common competencies through the “Professional Psychology” training. 30 students participated in the study (18 boys, 12 girls). Research methods are as follows: survey, statistical methods of data processing (Wilcoxon test for paired samples, factor analysis). According to the results of the study, having studied the course the students show a statistically significant increase in the self-assessment of such competencies as the ability to learn and master knowledge, generate new ideas, plan and manage time, make decisions. They also demonstrated positive attitude to the course, understanding its importance for the development of common competencies and readiness for further self-development.

Keywords: *common competencies, engineering students, professional development, social science and humanities.*

Introduction

In recent decades in Ukraine a scientific interest to the issue of humanization and socialization of higher technical education has increased significantly. Higher educational institutions have opened a number of departments of philosophy, cultural studies, sociology, pedagogy and psychology. Social sciences and humanities have been implemented into the training of future engineers. The main tasks of their inclusion in the system of engineering education are as follows: 1) developing social skills of future professionals (Shnyrenkov, E.) [10]; 2) increasing the level of personal educational motivation of students (Gruzhevsky, V.A.) [4]; 3) improving the general culture and developing the values of future engineers (Dyba, T.) [5]. Pedagogical researchers began to understand that classical technical education was too focused on the development of specific engineering knowledge, skills and abilities and ignored the presence of interpersonal and cultural aspects in the work of an engineer. No modern professionals can act in isolation from the society, and therefore there is a need to study not only engineering subjects.

There was also another trend – more and more students complained that social sciences and humanities only took their time and did not teach anything useful for future work. Among the main disadvantages of teaching social sciences and humanities Ukrainian engineering students mentioned the following: 1) knowledge in these subjects was too general and difficult to adapt to profes-

sional life; 2) information was poorly related to other subjects; 3) the number of academic hours allocated to studying these disciplines sometimes exceeded the time spent on some special disciplines. Teachers of engineering subjects agreed and shared students’ indignation. Engineering community began developing the idea that the project teaching method could replace the study of social sciences and humanities (Belova, Yu., Lutsenko, G.): in the process of implementing a joint project activity students developed communication and interaction skills naturally [2, 8].

This view is not clearly true. Formed common competencies provide not so much blindly using the template methods of communication, as a deep understanding of others and oneself, and the nature of interpersonal processes in a professional or personal life. This deep understanding underlies the ability to purposeful activity, the establishment and maintenance of interpersonal connections, the successful planning and implementation of a working strategy. To form the common competencies an “alliance” of social sciences and humanities and engineering is required, which absence makes it impossible to nurture a successful modern engineer (Sjursen, H.P., Khalid, A., Bowker, G.) [3, 6, 11].

Such an alliance can be provided by the disciplines that include social and humanities knowledge in a professional context. These disciplines could help future engineers to not only broaden their overall outlook, but also develop an idea of professional activity in unusual con-

texts: cultural, philosophical, sociological, psychological, and pedagogical. The “Professional Psychology” could be an example of such disciplines, it is a course that has been developed and implemented in the training process of engineers at National Technical University “Kharkiv Polytechnic Institute”. Understanding the importance of this course by students for their professional development, and not only the efficiency in forming common competencies and promoting the development of special competencies, was of particular importance for the course authors.

The aim of the paper is to evaluate psychological readiness of future engineers for the development of common competencies through the “Professional Psychology” training. The discipline design included professional features of future engineers and created conditions to help students to develop the understanding of themselves and others.

The main objectives of the study are as follows: 1) to analyze the sources of negative attitude of engineering students to the disciplines of social and humanitarian cycle; 2) to develop a questionnaire for assessing the level of development of common competencies; 3) to determine factors of development of common competencies; 4) to conduct statistical analysis of changes in the self-assessment of the development of students’ common competencies in the process of studying “Professional Psychology”.

Research Methods

The research is based on the survey and statistical methods of data processing (nonparametric Wilcoxon test for related samples, factor analysis with Varimax rotation).

30 Master-degree students in “Computer Designing of Transport Systems” (18 boys and 12 girls) were the participants of the study. They attended the course “Professional Psychology” not electively but on the order of the faculty.

According to the Law of Ukraine “On Higher Education”, the Ministry of Education and Science of Ukraine develops and approves higher education standards for each specialty [12]. Within each of the standards there is a list of special and common competencies. Special competencies reflect the specific knowledge, skills and abilities which a professional should have to perform specific actions professionally (Bakhrushin, V.). Special competencies are formed on technical courses and improved during practice [1].

Common competencies reflect the fundamental knowledge and skills, which ensure the ability of a person to master the profession, readiness of a person for professional interaction, the ability to be effective, the ability to work, etc. Standards of various engineering specialties contain various common competencies, but the most common are as follows: 1) ability to conduct a research, 2) ability to learn and master modern knowledge, ability to generate new ideas (creativity), 3) ability to demon-

strate initiative and entrepreneurship, 4) ability to plan and manage time, ability to design and manage projects, 5) ability to make informed decisions (decision making), 6) ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge / types of economic activity), 7) ability to work in team (teamwork ability).

These competencies formed the basis of the designed survey. In the process of self-assessment, students had to assess the development of these competencies according to the 10-point Likert scale. This assessment was carried out twice: at the beginning and at the end of the course.

After the first survey, the obtained data were statistically processed using factor analysis with Varimax rotation. Factor analysis was used to determine the factors of the common competencies formation.

After completing the “Professional Psychology” course students took a survey for a second time. The obtained data were statistically compared with the Wilcoxon test in order to clarify the changes that students experience in the development of common competencies.

Research Results and their Discussion

Common competencies are not directly related to special courses. Quite the contrary: traditionally, the study of technical courses in Ukraine is associated with strict discipline, which often blocks the manifestations of creativity and suppresses the readiness of students to interact with others. It is appropriate to assign social disciplines and humanities that open up more opportunities for personal development of future engineers to form these competencies. One of the most important conditions for the formation of common competencies is the psychological readiness of students to develop common competencies within the framework of the course “Professional Psychology”. Psychological readiness includes positive attitude to the course, understanding its importance for personal growth, and awareness of its capabilities in shaping the common competencies needed by a modern engineering specialist.

Before starting the course students were asked to evaluate the development of 9 common competencies in the form of the author’s questionnaire. Factor analysis of the data allowed to distinguish 2 factors that described 100% dispersion (Table 1).

The first factor included 5 indicators and was called “Activity”. All competencies included in this factor reflect various forms of interpersonal and professional activity of future engineers. The development of these competences requires training and practice.

The second factor included 4 indicators and was named “Internal self-development”. Competencies that are part of this factor reflect the skills and abilities of self-discipline, learning, self-development, decision-making. In our opinion, the competencies included in the second factor form the basis for the development of activity competencies.

Table 1.

Factors of Development of Future Engineers' Common Competencies

Competencies	Factor 1 (55,5% of dispersion)	Factor 2 (44,5% of dispersion)
Ability to conduct a research	0.806	
Ability to learn and master modern knowledge		0.804
Ability to generate new ideas		0.716
Ability to demonstrate initiative and entrepreneurship	0.687	
Ability to plan and manage time		0.863
Ability to design and manage projects	0.753	
Ability to make informed decisions		0.821
Ability to communicate	0.809	
Ability to work in team	0.711	

The main goal of the “Professional Psychology” course is personal and professional development of individual psychological traits that contribute to effective formation of common competencies.

Duration of the course is 24 lessons (48 hours), for each module with 8 classes (16 hours in total). Such a construction is conditioned by the specifics of the educational process of the technical university in Ukraine.

The tasks for the students of the course:

- 1) comprehension of peculiarities of one's own self, personal attitude to the profession and self-realization in it;
- 2) awareness of the need to develop certain qualities (individually-psychological and professionally important) to achieve the highest level of professionalism;
- 3) constructing the own professional purpose and means of its realization;
- 4) awareness of the emergence of psychological contradictions, crises and barriers during the professional development;
- 5) constructing one's own self as a professional, which is possible in case of integration of self-assessments and assessments of others, building constructive interaction with representatives of professional community and own activity.

The course results in: 1) understanding the presence of certain personality traits, which promote or do not promote professional self-realization; 2) desire to develop the qualities that ensure the formation of professionalism; 3) setting their own professional purpose and determining the concrete ways of its implementation; 4) the ability to constructively and productively solve professional contradictions and crises, overcome professional barriers; 5) existence of specific effective practices for designing oneself as a professional.

In the “Professional Psychology” course the following pedagogical methods were used: mini-lectures, brainstorming, exercises, drawing, demonstration, testing, intellectual and role-playing games, presentations, creative tasks, teamwork, project activities. The structure of every block and the lesson includes the introduction, the main part and the feedback.

There are 3 “Professional Psychology” course modules:

- personal, focused on the development of individual psychological traits that provide professional competence, academic achievement and generally contribute to personal development and orientation to successful self-realization;

- professional, the purpose of which is the development of professionally important qualities that will result in successful professionalization;

- integral, ensuring the formation of the components of a future professional engineer.

The first module of the course (8 classes) was focused on the personal sphere of the future engineer. The goal of the module is to increase the participants' awareness about the presence, absence or insufficiency of such individual and psychological traits that will increase the professional competence and academic success, and those that will help in personal and professional growth. Based on our own empirical studies, observations and certain theoretical achievements, we refer the following ones: the motives of creative self-realization, the ability to strike a balance between the desire to dominate and subordinate, in accordance with the situation to be flexible or defend one's own interests, direct oneself to finding the new, understanding the importance of what is already acquired, and also professional motivation, constant self-development, etc. In general, the participants of the training should not only understand, but also optimize their own attitude towards their personalities, which was facilitated by exercises, focused on their own personalities by perceiving the statements of others about themselves in the so-called “mirror of relations”, the constant verbalization of their own feelings, emotions and reflections.

The second module (8 lessons) is dedicated to the specific professional qualities development of a future engineer.

The third one (8 lessons) is aimed at ensuring the formation of the future professional engineers' components and awareness of the emergence of psychological contradictions, crises and barriers in professional development, as well as the design of one's own personality as a professional, which is possible in case of integration of self-assessments and assessments of others. There were

mini-lectures, brainstorming sessions and some exercises at every lesson.

The final lesson was held to analyze the results, discuss positive and negative points of the training, reflection of behavior, and feedback for further personal and professional development.

After completing the course, a re-interview was conducted: students were asked to evaluate the level of development of common competencies after completing the course. The obtained results were compared with the data of the first stage of the survey (Table 2).

Table 2.

Comparative Research of Students' Attitude towards Developing Common Competencies through "Professional Psychology" Training (in Points)

Competencies	Start of the course	End of the course	Z-Wilcoxon
Ability to conduct a research	4.91±1.25	4.97±1.75	-0.408
Ability to learn and master modern knowledge	3.84±1.95	5.08±1.34	-3.724**
Ability to generate new ideas	4.78±1.73	5.43±1.53	-1.94*
Ability to demonstrate initiative and entrepreneurship	5.03±1.27	4.89±1.48	-0.236
Ability to plan and manage time	4.48±2.16	5.48±1.19	-2.034*
Ability to design and manage projects	4.51±1.23	4.78±1.63	-0.771
Ability to make informed decisions	4.75±1.73	5.48±1.12	-2.154*
Ability to communicate	5.51±1.14	6.78±2.01	-2.906*
Ability to work in team	4.73±1.46	5.13±1.41	-1.644

** – $p \leq 0.01$. * – $p \leq 0.05$

Statistical analysis has shown that the greatest changes students felt about the ability to learn and master new knowledge ($Z = -3.724$, $p \leq 0.01$), ability to generate new ideas ($Z = -1.94$, $p \leq 0.05$), ability to plan and manage time ($Z = -2.034$, $p \leq 0.05$), ability to make informed decisions ($Z = -2.254$, $p \leq 0.05$), ability to communicate ($Z = -2.906$, $p \leq 0.05$). Most of these indicators were included into the "Internal self-development" factor. Thus, the obtained results indicate that the "Professional Psychology" course led to changes in the self-assessment of competencies that reflect readiness for further self-development and create the basis for the formation of activity competencies.

The analysis of students' statements at the end of the course indicates a significant increase in understanding the possibilities of developing common competencies. At the end of the course, students maintained a positive attitude to the study of psychology, and understanding of the opportunities that it opens for personal development.

Within the framework of the developed course, concrete measures were taken to assess the existing level of common competencies, the formation of professionally important qualities, motivational-value, cognitive, individual-typological, operational components of competence, as well as designing the personality of a student as a professional. All this contributed to a more value-attitude of students towards learning and professional self-development.

The psychological readiness of future engineers to develop common competencies is a key condition. If students are not positively involved with the course, they wouldn't realize its opportunities of the course in forming common competencies, and also consider it a waste of time. Any well thought out program, that uses the latest pedagogical teaching techniques, will not reach its goal, if students are not ready to accept it.

Despite the scepticism about social and humanities courses, which grew over the last years in the engineering environment, the study has shown that future engineers have positive attitude about the possibilities of studying "Professional Psychology". This attitude towards studying psychology was noticed even at the beginning of the course. The confidence in students' statements about the importance of developing not only professional skills, but also common psychological skills was evident.

Conscious learning does not originate spontaneously, it must be awakened by special approaches (Liang, X., Pazez, B.L.) [7, 9]. The course "Professional Psychology" creates the conditions for such an awakening.

After completing the course the students demonstrated such features of psychological readiness: 1) stable positive attitude to study professional psychology; 2) readiness for creative self-disclosure; 2) understanding the possibilities of professional psychology for personal development; 3) awareness of the impact of professional psychology on the formation and development of common competencies of the engineer. The statements of the students and survey results indicate that they began to understand the psychological aspect of the profession better. With the help of training exercises and simulations of professional situations they have seen that psychology is necessary not only in their personal lives, but also in the work. Thus, we can argue that the course "Professional Psychology", which immerses psychological knowledge in the context of professional activity of an engineer, contributes to the development of common engineer competencies, and the students themselves demonstrating the readiness to study it confirm this.

Conclusions

The "Professional Psychology" course introduced at National Technical University "Kharkiv Polytechnic Institute" is an example of the course from social and humanities

cycle that takes into account the peculiarities of engineering activity and “incorporates” the conscious attitude of students towards professional training. The experimental implementation of the course shows that future engineers are ready to develop common competencies while studying it. Psychological knowledge about future professional activities contributes to raising the level of creativity and positive attitude towards learning in general.

The conducted research has shown that common competencies, depending on their level of development and direction, can be divided into two basic groups: activity competencies and internal self-development competencies. After completing the course the students experience a significant increase in self-esteem competencies of internal self-development: the ability to learn and master

modern knowledge, the ability to generate new ideas, the ability to plan and manage time, the ability to make informed decisions, ability to communicate. The development of these competencies is associated with a high level of personal meaningfulness, focus on self-development, capacity for setting realistic life and professional goals, awareness of opportunities for personal growth in professional activities.

Though the study has shown that there were no significant changes in the level of the students’ research skills, the ability to identify initiative and entrepreneurship, the ability to design and manage projects, and teamwork skills. These competences are developed in the process of real activity and their development requires time and experience.

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ПСИХОЛОГІЧНА ГОТОВНІСТЬ МАЙБУТНІХ ІНЖЕНЕРІВ ДО РОЗВИТКУ ЗАГАЛЬНИХ КОМПЕТЕНТНОСТЕЙ ПРИ ВИВЧЕННІ «ПРОФЕСІЙНОЇ ПСИХОЛОГІЇ»

У статті розкривається проблема психологічної готовності студентів інженерних спеціальностей до розвитку загальних компетентностей при вивченні курсу «Професійна психологія». Розглядаються витoki скептичного ставлення студентів та викладачів інженерних спеціальностей до вивчення курсів соціально-гуманітарного циклу. В якості альтернативи існуючої системи освіти, що передбачає введення класичних соціально-гуманітарних курсів у програму навчання майбутніх інженерів, пропонується створення інтегративних курсів, які розміщують соціально-гуманітарні знання в контекст майбутньої професійної діяльності. У статті наводиться докладний опис курсу «Професійна психологія», що викладається майбутнім інженерам, які навчаються в Національному технічному університеті «Харківський політехнічний інститут». Курс складається з трьох модулів: особистісного, професійного та інтегративного, під час вивчення якого студенти отримують можливість розвинути професійно важливі особистісні якості та сформувані ціннісні ставлення до навчання. У дослідженні прийняли участь 30 студентів: 18 хлопців та 12 дівчат. Основними методами дослідження виступали: анкетування, математичні методи обробки даних (критерій Вілкоксона для парних вибірок, факторний аналіз). У якості інструменту дослідження було використано анкету, спрямовану на визначення психологічної готовності студентів до розвитку загальних компетентностей у процесі вивчення «Професійної психології». Опитування проводилося двічі: на початку та наприкінці курсу. Факторний аналіз даних, отриманих під час дослідження дозволив засвідчити два чинники розвитку загальних компетентностей: практичну діяльність та внутрішнє ставлення до саморозвитку. За результатами дослідження визначено, що студенти після проходження курсу «Професійна психологія» показують статистично значуще зростання в самооцінці компетентностей, пов'язаних з внутрішнім ставленням до саморозвитку (здатність вчитися і оволодівати сучасними знаннями, генерувати нові ідеї, планувати та управляти часом, приймати обґрунтовані рішення, здатність до спілкування), а також демонструють позитивне ставлення до курсу, розуміння його важливості для розвитку загальних компетентностей та психологічну готовність до подальшого їх розвитку. Формування цих компетентностей пов'язано з високим рівнем осмисленості особистості, спрямованістю на саморозвиток, здатністю до постановки реалістичної життєвої та професійної мети, усвідомленням можливостей особистісного росту в професійній діяльності.

Ключові слова: загальні компетентності, майбутні інженери, професійний розвиток, соціально-гуманітарні дисципліни, інтегративний підхід.

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