Global Competence Development Among Computer Engineering and Information Technology Undergraduates in the English Language Classroom

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Abstract. **Nowadays higher education institutions are directly involved in the training of new personnel, so they should seriously puzzle one of the most obvious questions today, how to prepare students to meet the challenges of Industrial Revolution 4.0 in an increasingly globalised society. And although the unequivocal answer to this question doesn't exist, one thing is certain: while providing Education 4.0 through incorporating advanced technology into the curriculum for implementing best practices and innovative methodological approaches, methods and techniques, higher education institutions should do their best to shape the next generation of highly employable global citizens who can think and act from a global perspective. In the future students who specialise in the field of Computer Engineering and Information Technology will be at the forefront of advancing the technology available to all people in the world and, therefore, they should be globally competent. It means that they should possess a global competence to successfully compete on a global scale. Significant practical experience gained by the authors of the article made it possible to assume that being one of the humanities which is taught to Computer Engineering and Information Technology undergraduates in Ukrainian higher education institutions, English has a great potential for developing their global competence. Considering the fact that Ukrainian 15-year-old students were not a part of the PISA 2018 Global Competence assessment, the present research was aimed at finding out how the participants understood the concept of "global competence", their awareness of the importance of global competence development in accordance with the requirements and principles of Education 4.0 associated with the Industrial Revolution 4.0 and participants' views on the role of the English language in its development. For exactly this purpose the authors made a questionnaire in Google Forms. The research participants were 249 Computer Engineering and Information Technology undergraduates who were selected by means of a purposeful sampling method. The conducted research shows that the didactic uniqueness of the English language as an academic discipline aimed at developing global competence is manifested in the fact that it can be seen as both a learning goal and a learning tool. The results obtained became the basis for devising a paradigm defining strategy (the core strategy) and four sub-strategies effective for developing Computer Engineering and Information Technology undergraduates' global competence in the English language classroom.**

Keywords: Computer Engineering and Information Technology undergraduates, Education 4.0, English as a medium of instruction, global competence, global skills.

I. Introduction

Nowadays higher education institutions are directly involved in the training of new personnel, so they should seriously puzzle one of the most obvious questions today, how to prepare students to meet the challenges of Industrial Revolution 4.0 in an increasingly globalised society. And although the unequivocal answer to this question doesn't exist, one thing is certain: while providing Education 4.0 through incorporating advanced technology into the curriculum for implementing best practices and innovative methodological approaches, methods and techniques, higher education institutions should do their best to shape the next generation of highly

employable global citizens who can think and act from a global perspective [1] – [4]. In the future students who specialise in the field of Computer Engineering and Information Technology will be at the forefront of advancing the technology available to all people in the world and, therefore, they should be globally competent. It means that they should possess a global competence to successfully compete on a global scale. Significant practical experience gained by the authors of the article made it possible to assume that being one of the humanities which is taught to Computer Engineering and Information Technology undergraduates in Ukrainian higher education institutions, English has a great potential for developing their global competence. Considering the fact that Ukrainian 15-year-old students were not a part of the PISA 2018 Global Competence assessment, the present research was aimed at finding out how the participants understood the concept of "global competence", their awareness of the importance of global competence development in accordance with the requirements and principles of Education 4.0 associated with the Industrial Revolution 4.0 and participants' views on the role of the English language in its development.

II. LITERATURE REVIEW

Life in a globalised society provides young people with growth opportunities, on the one hand, but, on the other hand, it requires from them gaining new knowledge, skills and attitudes which can ensure their conscious and critical understanding of changes taking place in the world, active participation in the life of local and international communities, demonstrating behaviour typical of responsible global citizens [5]. Additionally, these new skills, knowledge and attitudes are thought to promote their successful employment on the global labour market. It means that to be able to compete globally and to succeed as an accomplished individual and a true professional, young people have to be equipped with skills essential for the work and life in the 21st century [6] – [9] including the global competence regarded as one of them [10]. And although the concept of "global competence" has been in a scientific circulation since the last century, the present-day pedagogical literature lacks a common, generally accepted definition. On the contrary, it has already accumulated various approaches to defining the concept of "global competence" and to identifying knowledge, skills and attitudes which constitute this concept.

In the document entitled "PISA 2018 Framework Plans" which became a first draft of the framework for assessing global competence as the additional domain of PISA 2018, global competence was defined as "the capacity of an individual to understand that we learn, work and live in an international, interconnected and interdependent society and the capability to use that knowledge to inform one's dispositions, behaviours and actions when navigating, interacting, communicating and participating in a variety of roles and international contexts as a reflective individual" [11, p. 9]. The drafters of the proposed document also identified a combination of knowledge, skills, attitudes and behaviours which comprised global competence and categories within which students should be able to apply this combination of knowledge, skills, attitudes and behaviours. These categories included language/communication, culture/identities, principles/values and systems/institutions/events/trends [11].

Comparing the concept of "global competence" with other concepts considered to be identical (for instance, global citizenship, intercultural communication, etc.), the next document "PISA 2018 Draft Global Competence Framework" reveals its essence in more detail [12]. According to it, the main thing which distinguishes global competence from related concepts is that "it combines interacting effectively and appropriately with people from other cultures with a knowledge and understanding of the interconnectedness of local and global issues, including the power of new communications and information technologies and the disposition to engage responsibly and effectively in a global environment, particularly in work-based settings" [12, p. 4-5]. The document also identifies four dimensions where a globally competent person can apply required knowledge, skills and attitudes in the contexts of learning, working and living, namely: "… (1) knowledge and interest in global developments, challenges and trends; (2) openness and flexibility; (3) emotional strength and resilience; and (4) communication and relationship management" [12, p. 14].

Document "Educating for Global Competence: Preparing Our Youth to Engage the World" defines global competence as "the capacity and disposition to understand and act on issues of global significance" [13, p. xiii]. It should be mentioned, that one of the main ideas raised in this document is that "to be competitive, ethical, and effective workers, today's students must understand key topics of global significance in areas like engineering, business, science, history, ecology, and other domains that may constitute their future work" [13, p. 2]. Therefore, the main four sub-competences which constitute the global competence can be manifested in students' ability (1) to investigate the world beyond their immediate environment, (2) to recognize perspectives, others' and their own, (3) to communicate ideas effectively with diverse audiences, (4) to take action to improve conditions [13, p. 11].

In the document entitled "*Teaching for Global Competence in a Rapidly Changing World*" developed by Asia Society together with OECD, it is possible to find a more detailed definition of the concept of "global competence": "Global competence is the capacity to examine local, global, and intercultural issues; to understand and appreciate the perspectives and world views of others; to engage in open, appropriate, and effective interactions with people from different cultures; and to act for collective well-being and sustainable development" [14, p. 5]. The document also identifies four aspects of global competence that are reflected in its definition. These four aspects of global competence are as follows: (1) "the capacity to critically examine issues such as poverty, trade, migration, inequality, environmental justice, conflict, cultural differences, and stereotypes" [14,

p. 5]; (2) "… the capacity to understand and appreciate different perspectives and world views" [14, p. 5]; (3) "… the ability to interact positively with people of different national, social, ethnic, and religious backgrounds, as well as those of different genders" [14, p. 5]; "… being willing to act constructively to address issues of sustainability and well-being" [14, p. 5].

Literature analysis clearly demonstrates that in the realities of the 21st century the development of soft skills including global competence promises to be a crucial supplement to engineering education in general [9], [15] – [17] and computer engineering education in particular [6] – [8]. The basis of their assertions is rooted in the belief that it is the global competence that connects "important knowledge, skills, and attitudes relating to intercultural communication and collaboration to a sustainability mindset" [15, p. 3]. Positing that global competence "is a continuum with no endpoint, rather than a have or have not quality" [15, p. 3], Kjellgren and Richter [15] claim that it combines two spheres, namely, a personal sphere and an interaction sphere. The scholars believe that whereas a personal sphere includes "the individual's own knowledge, skills, and attitudes" [15, p. 3], an interaction sphere is manifested in "the individual's behaviour in communication, collaboration, and relation-building" [15, p. 3].

In our research we can expand on Parkinson' idea and state that after graduating globally competent students who specialise in field of Computer Engineering and Information Technology will be able to become active agents of change capable of changing their own lives and the world for better through managing and directing their activities at a local, national and global levels [16]. Parkinson's rationale for developing global competence is based on the ideas described in the paper "Developing Global Competence in Engineers: What does it mean? What is most important?" written by him and his colleagues [17]. The rationale identifies following 13 dimensions of global competence specific to engineering profession: ability to appreciate other cultures, ability to communicate across cultures, knowledge on the history, government and economic systems of several target countries, ability to speak a second language at a conversational level, ability to speak a second language at a professional (i.e. technical) level, ability to work in or direct a team of ethnic and cultural diversity, ability to effectively deal with ethical issues arising from cultural or national differences, ability to understand cultural differences relating to product design, manufacture and use, ability to understand the connectedness of the world and the workings of the global economy, ability to understand implications of cultural differences on how engineering tasks might be approached, exposure to international aspects of topics such as supply chain management, intellectual property, liability and risk, and business practices, possibility to practice engineering in a global context, whether through an international internship, a service learning opportunity, a virtual global engineering project or some other form of experience;

viewing themselves as "citizens of the world," as well as citizens of a particular country [16].

Research analysed above enables us to identify the following attributes of global competence which we include in the online questionnaire and which are of interest to us, namely: (1) ability to appreciate other cultures; (2) ability to communicate across cultures; (3) knowledge on history, political and economic systems of different countries; (4) ability to understand multiple spheres of participation in local, national, and global communities; (5) ability to participate actively in local, national, and global communities; (6) ability to speak a foreign language; (7) ability of understand cultural differences relating to product design, manufacture and use; (8) ability to manage own work for ongoing improvement and adapting to change; (9) ability to work in a team of ethnic or cultural diversity; (10) ability to deal with ethical issues arising from cultural or national differences; (11) ability to understand current and future climate solutions.

III. MATERIALS AND METHODS

The researchers designed an online questionnaire using Google Forms. The online questionnaire included open-ended and close-ended questions. Moreover, respondents were offered to score the importance of global competence components on a 4-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree).

The research sample consisted of 249 Computer Engineering and Information Technology undergraduates who were selected by means of a purposeful sampling method. The researchers were interested in undergraduate students whose specialty was either Computer Engineering or Information Technology and who studied English at university. The researchers asked their colleagues who taught English to Computer Engineering and Information Technology undergraduates to share the link to the online questionnaire with them. Although, the researchers received a total of 264 responses back, but before analysing the results, they excluded 15 incomplete questionnaires from the data set.

These 249 research participants with complete questionnaires were representatives of three Ukrainian universities, namely, Kyiv National University of Technologies and Design (39.8%), Interregional Academy of Personnel Management (26.9%), Kryvyi Rih National University (33.3%). According to gender differences, male students represented 86.7% of the sample and female students represented of 13.3% the sample.

The online survey which lasted for 2 months during the 2022 autumn semester was anonymous.

The gender differences of online survey participants are given in Table 1.

TABLE 1 GENDER DIFFERENCES OF ONLINE SURVEY PARTICIPANTS

Higher Education Institution	Number of Participants			
	Male		Female	
	Number	Percent	Number	Percent
Kyiv National University of Technologies and Design	85	34.1	14	5.6
Interregional Academy of Personnel Management	74	29.7	9	3.6
Kryvyi Rih National University	57	22.9	10	4.1
Total	216	86.7	33	13.3

Source: own study (N=249)

Figure 1 illustrates the gender differences between research participants.
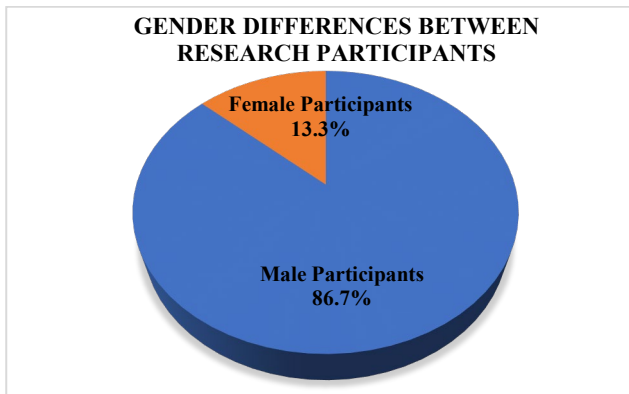

Fig. 1. Gender differences between research participants.

IV. FINDINGS AND DISCUSSION

The first question was focused on finding out if respondents had heard of the concept of "global competence" at all. Answering it, 82 respondents (32.9%) stated that they had not heard of the concept of "global competence" at all. 117 respondents (47.0%) replied that they had heard of it before and 50 respondents (20.1%) found it difficult to answer this question. Figure 2 presents the results concerning the first question.
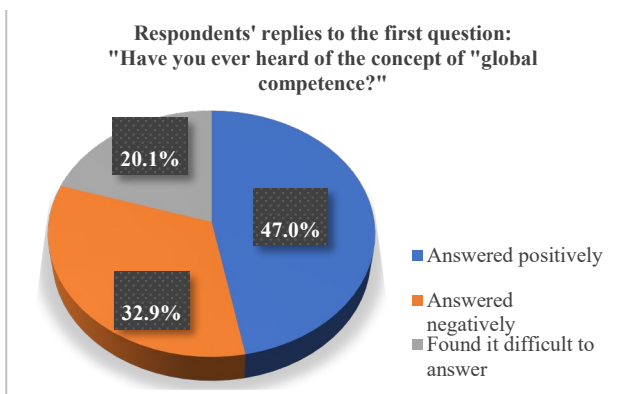

Fig. 2. Respondents'replies to the first question.

Then the respondents were asked to define the concept of "global competence". The respondents defined it as: (1) a person' ability to establish effective communication with people from different cultures and countries including foreign language skills (37.8%); (2) a person's ability to understand international and cultural differences (34.9%); (3) a person's ability to understand international relations between different countries in a present-day globalised world (18.9%); (4) a person's ability to understand the true reasons of social, political, economic and climate changes that occur all over the world and their consequences (8.4%).

Defining global competence as a person' ability to establish effective communication with people from different cultures and countries including foreign language skills, 94 respondents (37.8%) reply that they believe that their profession provides a bevy of job opportunities in various international companies in Ukraine or abroad and to succeed they should have knowledge about different countries, their traditions and cultures etc. They also point out that to communicate effectively with their colleagues who can be from other countries, foreign language skills are of particular importance. 87 respondents (34.9%) who define the global competence as a person's ability to understand international and cultural differences, are convinced that people who live in the present-day globalised world should love, appreciate and popularise the culture of their nation, but, at the same time, they should understand and appreciate the culture and traditions of other nations. 47 respondents (18.9%) consider that to be globally competent people should understand international relations between different countries. Answering this question, 21 respondents (8.4%) indicate that people have to understand the true reasons of social, political and economic changes that occur all over the world and their consequences. These respondents explain that despite the fact that life in a present-day globalised world is unpredictable people should have knowledge and skills which can help them take better decisions in planning their lives.

The researchers also intended to clarify to what degree respondents agreed that the proposed global competence components were of importance to them. The results obtained are presented in Table 2.

TABLE 2 RESPONDENTS' VIEWS ON IMPORTANCE OF GLOBAL COMPETENCE COMPONENTS

Variables	Strongly Disagree (N)	Disagree (N)	Agree (N)	Strongly agree (N)
Ability to Appreciate Other Cultures	0	5	76	168
Ability to Communicate Across Cultures	4	15	82	148
Knowledge on History, Political and Economic Systems of Different Countries	4	9	111	125
Ability to Understand Multiple Spheres of Participation in	4	12	127	106

Local, National, and Global Communities				
Ability to Participate Actively in Local, National, and Global Communities	3	14	121	111
Ability to Speak a Foreign Language	0	10	111	128
Ability of Understand Cultural Differences Relating to Product Design, Manufacture and Use	0	24	125	100
Ability to Manage Own Work for Ongoing Improvement and Adapting to Change	0	99	126	35
Ability to Work in a Team of Ethnic or Cultural Diversity	0	23	89	137
Ability to Deal with Ethical Issues Arising from Cultural or National Differences	0	14	101	134
Ability to Understand Current and Future Climate Solutions	11	25	112	101

Source: own study (N=249)

The next question was aimed at finding out whether respondents agreed that the English language could help them remain cognizant in various situations that occur in different countries for better adapting in the present-day globalised world. The results show that out of 249 respondents, only 3 (1.2%) responded negatively. 246 respondents (98.8%) gave a positive answer to this question. Respondents were also asked to give reasons for their answers. Below are some excerpts which provide an overall idea of students' views on the importance of the English language:

S1: English is a tool that helps to understand people, emotions they experience and values they hold regardless of their nationality and citizenship. ... But I do believe that nowadays you should not focus on one language, because the more languages you know, the easier and quicker you will be to understand what moral and humanistic values people from different countries have as life priorities.

S19: I have many friends who live in different countries and English helps me find common language with all of them. We often discuss what happens in the world, share some useful ideas and information, tell each other about the novelties in the world of technologies...

S137: ... Nowadays there are many online educational resources in English which can be used for gaining new knowledge and skills. The better you know English the more opportunities you have for your personal and professional development. Moreover, English helps me discover what is going on in the world from original sources and keep abreast of all the important events ...

S203: Undoubtedly, I agree with the fact that knowledge of the English language will help a person to adapt better in today`s globalised world. English language proficiency provides more opportunities for self-development, broadening one's horizons and developing critical thinking. And above all, it certainly helps in communicating with representatives of other cultures.

The strategies for global competence development in the English language classroom were formulated

considering the results obtained and the strategies targeted at enhancing soft skills among Computer Engineering and Information Technology undergraduates introduced in the process of learning English: "… a) combination of competence-based, action-oriented and blended-learning approaches in the English for Specific Purposes classroom, b) integration of formal, non-formal and informal learning, c) participation in specially focused network professional communities, d) use of open educational resources for learning English, e) use of open professionally-oriented educational resources, f) introduction of learning-style based activities in the English for Specific Purposes classroom for boosting students' soft skills" [8, p. 239].

The English language is one of the humanities which is taught to Computer Engineering and Information Technology undergraduates in Ukrainian higher education institutions. Computer Engineering and Information Technology undergraduates can learn such academic disciplines as "English as a Second Language" and "English for Specific Purposes" or both of them. It usually depends on curriculum approved by the rector of higher education institution. Thus, for instance, "English as a Second Language" can be taught during the first and second years of training and "English for Specific Purposes" can be taught during the third and fourth years of training. The results obtained enable us to conclude that the English language as an academic discipline has a much deeper potential for developing Computer Engineering and Information Technology undergraduates' global competence than other academic disciplines. In developing various 21st century skills (job skills of tomorrow, soft skills, social-emotional skills, communicative skills) including global competence the didactic uniqueness of the English language as an academic discipline is manifested in the fact that it can be seen as both a learning goal and a learning tool. Its main and ultimate learning goal is to develop Computer Engineering and Information Technology undergraduates' English language skills (reading skills, listening skills, writing skills and speaking skills). Simultaneous mastering of four English language skills contributes greatly to the development of Computer Engineering and Information Technology undergraduates' global competence and can become an effective learning tool for their developing. The following strategies can be applied in the English language classroom:

Strategy 1 – *Developing Computer Engineering and Information Technology undergraduates' global competence through modifying the content of such academic disciplines as "English as a Second Language" and "English for Specific Purposes".*

Drawing up the syllabus for "English as a Second Language" or the syllabus for "English for Specific Purposes", the emphasis should be placed on both the content of these academic disciplines used for absorbing information in general and information that is closely connected with the components of global competence in particular and methods and techniques aimed at mastering English language skills (reading skills, listening skills,

writing skills and speaking skills). We acknowledge this strategy as paradigm defining and do believe that its implementation will be effective under conditions of simultaneous implementation of four sub-strategies defined in accordance with four types of speech activity. It means that the content of mentioned academic disciplines should contain up-to-date information on events that occur in the world and consequences of these events, social-cultural diversity that exists in the world. The acquisition of such updated content should be realised through methods and techniques used in the English language classroom and targeted at promoting student's ability to identify a causal link between various events that happen worldwide and changes in the lives of people; cultural differences in communication; positive and negative effects of globalisation on social, political and economic spheres of life at local, national and global levels etc. While processing, interpreting, reproducing and retranslating updated information absorbed as a result of upgrading the content of either "English as a Second Language" or "English for Specific Purposes" or both of them, particular attention should be paid for enhancing the variety of 21st century skills (i.e., job skills of tomorrow, transformative skills, soft skills etc.). Involving Computer Engineering and Information Technology undergraduates into different types of speech activity which implies processing, interpreting, reproducing and retranslating updated information directly or indirectly connected with life in the present-day globalised world has unlimited didactic potential for both forming and developing Computer Engineering and Information Technology undergraduates' global competence (which is the subject of our research) and 21st century skills (i.e., job skills of tomorrow, transformative skills, soft skills etc.). According to various reputable sources [18] – [20], their forming and developing is of increasing importance for succeeding in personal life and professional development in the present-day globalised world.

The following sub-strategies are supposed to be effective in developing Computer Engineering and Information Technology undergraduates' global competence:

Sub-strategy 1 – *Developing Computer Engineering and Information Technology undergraduates' global competence through mastering English reading skills.*

Sub-strategy 2 – *Developing Computer Engineering and Information Technology undergraduates' global competence through mastering English listening skills.*

Sub-strategy 3 – *Developing Computer Engineering and Information Technology undergraduates' global competence through mastering English writing skills.*

Sub-strategy 4 – *Developing Computer Engineering and Information Technology undergraduates' global competence through mastering English speaking skills.*

V. RECOMMENDATIONS AND CONCLUSIONS

So, to sum up, we can state that the English language as an academic discipline has an unlimited didactic potential for developing Computer Engineering and Information Technology undergraduates' global competence. The didactic uniqueness of the English language as an academic discipline aimed at developing various 21st century skills (job skills of tomorrow, soft skills, social-emotional skills, communicative skills) including global competence is manifested in the fact that it can be seen as both a learning goal and a learning tool.

The results obtained became the basis for devising a paradigm defining strategy (the core strategy) and four sub-strategies effective for developing Computer Engineering and Information Technology undergraduates' global competence in the English language classroom:

The core strategy acknowledged as a paradigm defining is *Developing Computer Engineering and Information Technology undergraduates' global competence through modifying the content of such academic disciplines as "English as a Second Language" and "English for Specific Purposes"*. We consider that implementation of the core strategy will be effective under conditions of simultaneous implementation of four sub-strategies defined in accordance with four types of speech activity, namely:

Sub-strategy 1 – *Developing Computer Engineering and Information Technology undergraduates' global competence through mastering English reading skills.*

Sub-strategy 2 – *Developing Computer Engineering and Information Technology undergraduates' global competence through mastering English listening skills.*

Sub-strategy 3 – *Developing Computer Engineering and Information Technology undergraduates' global competence through mastering English writing skills.*

Sub-strategy 4 – *Developing Computer Engineering and Information Technology undergraduates' global competence through mastering English-speaking skills.*

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