Minimising Intercultural Communication Difficulties when Teaching International Students with the Help of an Electronic Educational Complex

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Abstract

This study describes the use of an electronic educational complex for international engineering students. While doing so, it analyses whether the studied complex can reduce intercultural interaction difficulties and thus become a motivating factor in the educational process as a whole.

Keywords: Electronic Educational Complex; Modular-Rating Technology; Visualisation of Functioning Schemes; Intercultural Communication

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Introduction

Globalisation unifies knowledge by simplifying access to education around the world via increased interstate interaction, which has influenced international education. The increased form of interconnectedness has enabled students from different countries, bearing different cultures and ethnic groups to be brought together.

Indeed the universities, teachers, and methodologists need to take into account intercultural interaction features while developing educational plans (AL-Hunaiyyan, Al-Huwail, & Al-Sharhan, 2008; Šverc, Pesek, & Flogie, 2014; Slabin, 2019). The "intercultural communication" subject should be studied at universities as it can prevent intercultural (interracial, interethnic, etc.) conflicts in the educational process. However, it is still not included in many curricula. For technical specialities, "intercultural communication" remains unexplored since it is a subject of humanities (Nikolaeva et al., 2018) and does not relate to engineering training (Azad, 2011; Sanganyado & Nkomo, 2018). However, engineering students face daily intercultural communication problems, even while communicating with their teachers, since teachers are not always ready to adjust the training material to the needs and values of international students (Aixia & Wang, 2011; Hisham, Saud, & Kamin, 2018). Besides, the aspects of control over the ethics and tolerance of teachers during the educational process remains problematic.

Electronic education allows minimising intercultural communication difficulties as it provides the students with unified information (Epifanov, Bratanovskii & Vasilyeva, 2019). In this case, information can be easily checked for ethical correctness and moderated if necessary (Agyei & Voogt, 2011). At the same time, the learning process can be technically personalised for the student (taking into account his/her cultural and personal characteristics) (Aktaruzzaman, Shamim, & Clement, 2011).

At present, electronic resources are used in professional education. There are theoretical generalisations and numerous methodological works on the use of e-resources in the educational process at university (Lucke, Dunn, & Christie, 2017; Hamilton, Lesh, Lester, & Brilleslyper, 2008). However, currently, there is a limited number of e-resources aimed at improving the training process of future teachers. E-resources cover only some of the disciplines (such as radio electronics, physics and electrical engineering) (Borrego, Foster, & Froyd, 2014; Sabirova, 2016). Electronic textbooks and other e-teaching materials are not sufficiently developed. Traditional training forms are not appropriate for modern educational processes.

The electronic educational complex (EEC) is designed following methodological requirements. EEC is a means for professional skills formation. EEC helps e-learning students to form a systematic view on the professional activity, to master complex technical material of the subject, etc.

It is important to identify the features of the designing and application of EEC. Future teachers should be trained on how to use EEC so that they will be able to teach disciplines by this technology.

However, at present, there are not enough studies concerning the design and application of EEC in the process of teaching engineering disciplines (Ilyashenko, 2017).

The implementation of EEC in the learning process of engineering and technical students will improve the efficiency and effectiveness of the learning process by almost 1.5 times. EEC will also consolidate interdisciplinary connections and strengthen the practical orientation of some disciplines. It is also necessary to adapt students and teachers to the specifics of EEC and to improve the quality of students' independent work. Such an adaptation will increase the professional level of teachers and will adapt them to productive work in the intercultural space.

The researchers consider the theoretical statements of the development and improvement of EEC in a technical university and analyses the improved EEC in mathematics. The study begins with a description of the research design and other methodological issues that have been applied in the research. This follows a critical analysis and discussions of the results of the study.

Methods

Research Design

The first stage is a preliminary acquaintance with separate actions (according to the instructions, description) to form an orientation basis of activity. A system of instructions is presented for the accomplishment of the training action. The second stage is the accomplishment of activities on the computer. At the same time, the student controls the accomplishment of each operation, which is included in the activity. The third stage is a discussion of operations that are being mastered for their generalisation, reduction, and automation. In the fourth stage, students repeat a sequence of operations to intensify and generalise the activity. The fifth stage is the internal transition of activity. The activity automates when the student mentally reproduces it. The modular electronic training in mathematics improves the quality of education. Electronic modular training has proved its effectiveness before and after the experimental work. The data obtained in Table 1.

Table 1: The Obtained Data—Control and Experimental Groups				
Control Group			Experimental Group	
Point	The number (in %) before the experiment	The number (in %) after the experiment	The number (in %) before the experiment	The number (in %) after the experiment
5	22	23	21	31
4	49	47	50	56
3	29	30	29	13
Source: Developed by the Authors				

Sample

A pedagogical study was conducted based on a branch of the Tyumen Industrial University and the Kazan Federal University. These two universities occupy average places in the statistics of qualified personnel, which allowed testing the effectiveness of EEC. Thus, the analysis of academic performance allowed identifying the percentage of marks achieved by students, that is, "adequate", "good" and "excellent". Therefore, on average, half of the students received "good" marks, almost a third of the students received "adequate" marks.

At the beginning of the experimental work, the initial level of basic training of first-year engineering-technical students was checked (Kelly, Lesh, & Baek, 2014). The latter required only 60% of the students, who agreed to pass the experiment, 23% refused, and 17% just observed the experiment. Among 60% of the students, the majority were male because engineering speciality is more popular among the male graduates. This allowed identifying weaknesses in the training of students and correcting the training modules.

Experiment

The tasks included the identification of the initial level of education quality of students in computer graphics. For this purpose, an ascertaining diagnosis of the quality of students' education in computer graphics was carried out. Students were given questionnaires. It was necessary to read each statement and to express their attitude to the discipline under study, choosing and marking their answer among the proposed set of possible answers: "true", "perhaps true", "perhaps false", and "false". Students tabulated the answers. For each matching with a key-answer, the student was awarded one point. The higher was the total

score, the higher was the indicator of the internal motivation of studying the discipline.

At a low cumulative score, the extrinsic motivation of studying the subject dominated. Thus, the results of the survey indicate that students do not show much interest in theoretical issues in this discipline; they are more interested in practical classes. Besides, students show low interest in educational information. Only 10% of the respondents in their free (personal) time without the requirements of the teacher are engaged in self-education in the field of computer graphics and create images in graphic editors. According to the results of the current and intermediate control, the level of students' performance was determined. The latter was expressed in marks, which were set down in the record journal. Questioning and conversations with students allowed determining their level of educational motivation. In addition, students had tests on the basics of computer graphics. Students' creative works were analysed. The obtained data were correlated with the aforementioned levels of education quality. Further, to check the EEC application in mathematics, groups were divided into experimental and control. In the control group, training sessions were conducted, using standard EEC. In the experimental group, advanced EEC in mathematics was actively used, taking into account the technology of modular-rating training (Kelly, Lesh, & Baek, 2014). Students completed various mathematical tasks with different levels of complexity, worked on creative assignments, performed and corrected two-dimensional drawings. Among the tasks, there was also three-dimensional modelling of spatial objects in the graphic system AutoCAD. Practical techniques of work were mastered by producing two-dimensional drawings of reinforced-concrete structures. Students produced a drawing of reinforced-concrete structures of the building, as well as created three-dimensional models of machine parts and fragments of the building. The task for the experimental group was to create engineering structures, taking into account soundness, rigidity, and stability while meeting the requirements of reliability, economy and

durability at the same time. Students formed their ratings on the discipline (Banday, Ahmed, & Jan, 2014). Thus, the comparative analysis of the data showed the effectiveness of EEC developed by the researchers. The findings demonstrated that the quality of students' education in computer graphics was improved.

Assessment

To assess the quality of students' theoretical knowledge, a computer version of testing has been developed. Testing was created in the computer program Microsoft Office Excel 2010. Through computer testing, the accurate and objective assessment of students' knowledge of computer graphics was carried out, as there was no subjective choice of questions or subjective teachers' judgments. Computer testing also allowed mass standardised academic performance rating. Computer testing as well made it possible to count efficiency about the correct answers and obtain results.

Results and Discussion

Based on the analysis of literature and existing EEC, a new EEC on computer graphics has been created for students of the specialisation "Design and computer graphics". The purpose of creating the EEC was to improve the quality of the educational process. EEC on computer graphics was created as an independent comprehensive educational tool. The solution to the problem of education quality requires modern approaches to education quality management for all disciplines (Zhang & Bhattacharyya, 2008). EEC serves as an instrument for improving the quality of education. EEC of the discipline can be represented as a set of organisational and methodological documents and materials that contribute to the effective and efficient mastering of the educational material by students. The current level of informational and communicational technologies opens up new opportunities for educational and methodological support of the learning process. One of the means of implementation of informational and communicational technologies in the process of studying at university is the creation of EEC in the disciplines.

EEC is a set of materials for educational purposes in electronic presentation formats, providing all kinds of educational activities with a sufficient level of individualisation.

The required competencies for engineers are enhanced through the use of e-learning (Pitchian & Churchill, 2002). E-learning is still at a very early stage of adoption. The introduction of e-learning, especially in developing countries, faces various challenges (Klamma et al., 2007; Tarhini, Hone & Liu, 2013), which are multidimensional and heterogeneous (Benchicou, Aichouni, & Nehari, 2010). Education with the use of EEC creates the conditions for the formation of additional soft skills in students, which allows for implementing knowledge immediately in practice, turning them into a skill.

The structure of the EEC is divided into two components – invariant and variable. The invariant component is the content base of the discipline, which includes a theoretical data bank. The variable component is the methodological basis of EEC, which contains the operational bank of data. Knowledge and methodological components integrate continually, represent the integrity of the discipline.

Based on theorising, EEC was created and implemented in the system of support of the educational process of EduCon in mathematics, taking into account the modular-rating, based on the search-independent work of engineering and technical students and active cooperation with the teacher of the discipline. The modular-rating technology is actively involved in the creation of EEC through the organisation of the educational process, through the modular version of textbooks or study guides, tests are also the integral part. This technology allows combining classwork with independent work, which significantly activates mental activity in the course of training (Choshanov, 1997). Moreover, such technology will enable one to take into account the cultural specifics and characteristics of students, which leads to a significant increase in the effectiveness of their learning process.

With the help of evaluation tools, the teacher conducts incoming control based on the control test, the final control over the quality of the acquired knowledge. If the student has some difficulties in learning the training material, he/she returns to the stage where the problem has occurred (Ilyashenko, 2017).

When developing EEC, first of all, it is necessary to pay attention to students with a low level of academic performance. Therefore, one should not focus mainly on the content part of the sources of information (textbooks, lectures, etc.), but on their methodological content.

At the end of the second study year, control and experimental group students had a final test on "Basic concepts of probability theory" (see Table 2).

Table 2: The Level of Knowledge of Students of Experimental and Control Groups				
Level of knowledge in points	Experimental group		Control group	
	Incoming testing	Final testing	Incoming testing	Final testing
92 – 100 (excellent)	14%	52%	15%	18%
76 – 91 (good)	72%	36%	69%	24%
61 – 75 (adequate)	14%	12%	16%	58%
Less than 61 points	0	0	0	0
Source: Developed by the Authors				

Qualitative progress in experimental group students, where EEC was used, is much higher than in the control group.

In addition, at the end of the fourth semester {the end of 2nd year of studies), the students of control and experimental groups participated in the Internet exam in the field of vocational education (Federal examination in the field of higher professional education (FEPE)}. It was held in the form of computer testing (44 tasks). FEPE allows assessing students' knowledge objectively, taking into account the requirements of the Federal state educational standard (Table 3).

Table 3: The Results of the Online Exam		
Group	Number of students (X ≥ 80 %)	Number of students (50%≤ X < 80%)	Number of students (X < 50%)
Control	4	12	14
Experimental	10	17	3
Note: X – Number of Tasks in Testing **Source: Developed by the Authors**		

It is believed that a student has passed the test and has a high level of development if he/she successfully completes at least 80% of the tasks (in this case, 35-44 tasks). An average level, if he/she correctly completes not less than 50%, but less than 80% (in this case, 22-34 tasks). A low level — if less than 50% (that is, less than 22 tasks) (Banday et al., 2014). The last Table, that is Table 3, shows that the test results in the experimental group are better than in the control group. At the experimental group, a positive trend is noted, as 10 students completed at least 80% of the tasks, which shows an increasing level of students' theoretical knowledge.

Thus, the level of general theoretical knowledge in the control group students can be characterised as average and high, four students completed 80% of the tasks. The corresponding indicator is the number of students who completed less than 50% of the tasks – in the control group, the number of students was 14, which is much more when compared to those who have coped with the tasks. In the experimental group, the number is three, which is much less when compared to those who have coped with the tasks. The education quality indicators were compared (concerning computer graphics knowledge) and thus, significant improvements were noted. Therefore, the use of EEC in computer graphics improves education quality.

Besides efforts at institutional, national and international levels, people are very active in developing educational facilities for engineering education (Ebner & Holzinger, 2007).

EEC allows acquiring knowledge and skills such as teamwork and communication skills and respect to different ideas. Cagiltay (2008) proved the relationship between learning styles of engineer students and their performance.

At the moment, there are few studies in the field of engineering education, the purpose of which is to study how the educational needs of students and labour force change. Based on this, the study would have to examine which of the necessary skills and experience young engineers require to be ready for the industry 4.0 infrastructure (Kagermann, 2015). At the heart of industry 4.0, there is interethnic synergetic interaction, which once again emphasises the importance of developing intercultural communication skills among engineering students.

The main vital assets of the Industry 4.0 infrastructure are people because the workforce is an essential component of the transformation of digital business (Perminov, Gadjiev, & Abdurazakov, 2019).

The following are the scientific and technical abilities, which are related to specific education:

- Typical mechanical engineer skills, represented by numerical and higher mathematical knowledge.
- Problem-solving, creativity, and design skills.
- Research and experimental skills.
- Information processing.
- Computer programming and knowledge of specific software (Shestak & Volevodz, 2019).

Besides, a mechanical engineer must have a strong understanding of industry standards and be a proficient computer user, as much of the time of the mechanical engineers spent on product design, modelling and testing. Compared with academic directions based on the so-called liberal education model ("in the spirit of free arts"), professional disciplines occupy an essential place in such programmes (Solodikhina & Solodikhina, 2019). At the same time, the aspect of intercultural communication in the classical programme is either not taken into account at all, or is presented in the form of a thematic discipline that does not take into account the real situation in teaching international students. The use of EECs solves this problem quickly and with minimal financial costs. Besides, the quality of control over teaching is expected to increase.

The main ways to implement EEC on the disciplines in the educational process of technical universities are continuous improvement and development of methodological support; improving the professional level of training teaching staff with the help of EEC; the use of modern information technologies and programmes, such as EduCon.

To improve EEC in mathematics, it is recommended to create a shared database of the best EEC in academic disciplines studied by the engineering students. It would also be useful to regularly exchange the best practices of teaching teams concerning the use of EEC.

At the same time, it is necessary to establish a degree or limits of EEC use. On the one hand, EEC can facilitate the educational activities of the students; on the other hand, EEC allocates particularly complex elements of knowledge and

facilitates learning. Teachers are responsible for the proper establishment of these degrees or limits of EEC use.

Conclusion

The central aim of this study was to minimise intercultural communication difficulties in teaching international students using EEC. Hence, based on EEC, this study has proposed a teaching methodology. To integrate the subject and methodological training, multi-level integrative tasks were used. These tasks provided for the following:

- Independent implementation of actions with EEC.
- Search for the necessary information.
- Formation of the need for cognitive activity.
- Ability to deal with professional and pedagogical tasks.

The complexity of tasks is determined by the content, type of instructions, the nature of the actions, and the source of information.

EEC increases the learning process for students and allows them to study in an environment adapted to their cultural and personal characteristics. EEC creates the conditions for the formation of intercultural communication skills among engineering students. It minimises intercultural communication difficulties in the education process and creates a set of soft skills necessary for engineers.

Electronic solutions provide unified information for students to study. While the information can easily be checked for ethical correctness and moderated if necessary; at the same time, the learning process is technically personalised for the students (for his/her cultural and personal characteristics), which maximises the effect of specialised engineering education.

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