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Improvement of automatic speech recognition skills of linguistics students through using ukrainian-english and ukrainian-german subtitles in publicistic movies

УДОСКОНАЛЕННЯ НАВИЧОК АВТОМАТИЧНОГО СПРИЙНЯТТЯ МОВЛЕННЯ СТУДЕНТІВ-ЛІНГВІСТІВ ЧЕРЕЗ СУБТИТРУВАННЯ УКРАЇНСЬКО-АНГЛІЙСЬКИХ ТА УКРАЇНСЬКО-НІМЕЦЬКИХ ПУБЛІЦИСТИЧНИХ КІНОФІЛЬМІВ

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Abstract

The increased world's attention to foreign language studies facilitates the development and improvement of its study system in higher education institutions. Such a system takes into account and promptly responds to the demands of today's multicultural society. All should start with the transformation and modernization of the higher education system. This system includes the introduction of innovative technologies in the study of English and German, which should be focused on the modern demands of the world labor market. All this has determined the relevance of the research. This article aims to establish ways for students to gain automatic recognition skills through subtitling Ukrainian-English and Ukrainian-German publicistic movies and series. The first assessment of new language audio and video corpus was developed

Анотація

Удосконалення навичок автоматичного сприйняття мовлення студентів-лінгвістів через субтитрування українсько-англійських та українсько-німецьких публіцистичних кінофільмів.
Посилена увага до вивчення іноземних мов в усьому світі сприяє розвитку та удосконаленню системи його вивчення в закладах вищої освіти, така система враховує та оперативно реагує на запити сучасного мультикультурного суспільства. Усе має починатись з реформування та модернізації системи вищої освіти, що передбачає запровадження інноваційних технологій у вивченні англійської та німецької мов, які також мають бути орієнтовані на сучасні запити світового ринку праці. Це й визначило актуальність досліджень. Метою статті є встановлення

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at the Admiral Makarov National University of Shipbuilding, using an automatic subtitling mechanism to improve linguistics students' recognition and understanding of oral speech. The skills and abilities that improved during the work with the educational movie corpus have been identified.

Keywords: English as a foreign language, EFL, higher education, video and audio corpus, subtitling, automatic speech recognition.

шляхів набуття навичок автоматичного сприйняття студентами усного мовлення через субтитрування українсько-англійських та українсько-німецьких публіцистичних кінофільмів та серіалів; перша оцінка нового мовного аудіо та відеокорпусу, що розроблений в Admiral Makarov National University of Shipbuilding, з використанням автоматичного механізму субтитрування з метою покращення сприйняття та розуміння студентами-лінгвістами усного мовлення; визначено ті вміння та навички, які покращилися в ході роботи з корпусом навчальних фільмів.

Ключові слова: English as a foreign language, EFL, вища освіта, video audiocorpus, субтитрування, автоматичне розпізнавання мовлення.

Introduction

There are influential research groups (Wang et al., 2018; Al Zoubi et al., 2019) and higher education institutions around the world (National Academy of Engineering and National Research Council, 2014; National Academies of Sciences, Engineering, and Medicine, 2020) that are actively developing and supporting innovations in the foreign language learning industry. The practice of using a corpus of Ukrainian-English and Ukrainian-German educational movies with subtitles is not an exception, as this methodology helps to form and develop automatic speech recognition and perception. It also expands the general intellectual level and awareness and supports the creative perception of a foreign language. These are simultaneous opportunities to learn, practice, experience the culture and traditions of other nations, enjoy learning, and most importantly, develop the European foundations of innovative education and professional linguistic training (Dweck, 2017). Also, an audio and video review of a foreign movies corpus raises current issues of modern Europe development. These are issues of gender inequality, ecology, energy conservation, community life, and freedom of speech (Partnership, 2020). This corpus of problems allows us to expand the research field of modern innovation and foreign language learning.

Speech technology in foreign language learning has considerable research potential, attracting high interest from practitioners and theorists in this field (Tyurina, 2019; Interspeech, 2019; Special Session, 2019). Thus, in the International Speech Communication Association (ISCA), there is a special unit (SIG), which also deals with modern digital technologies, the problem of subtitling in education. They regularly organize special seminars on this subject (WOCCI), where new technologies in language teaching are also considered.

This study aims to establish the ways to improve automatic listening recognition of spoken language by subtitling publicistic movies and series in Ukrainian-English and Ukrainian-German. The first assessment of a new corpus of movies and series was carried out. It was developed at the university using an automatic subtitling mechanism for Ukrainian students. All these things were done to improve the perception and understanding of spoken language. Also, there were identified the skills and abilities that improved during the work with the video and audio corpus of educational movies.

Based on the aim, the following research tasks were planned:

- to establish the level of automatic recognition of movies being shown with and without subtitles;
- to characterize the demographic and qualification characteristics of the respondents who took part in the project;
- to submit the rating of topical genres and thematic groups of Ukrainian-English and Ukrainian-German publicistic movies and series.

Literature review

The literature review on the subtitling and creation of educational movie corpus for learning English and German shows that, in the first place, there is a thesis on the numerous advantages, importance, and prospects of this type of learning for university education (Wang et al., 2018). The need to educate modern highly-qualified professionals is a priority (Banks & Barlex, 2014; Hudson et al., 2015; Shulman, 2018).

The development of specific audio and video corpora with and without subtitling in different languages is actively pursued, and new directions and techniques are being developed (Batliner et al., 2005). There are popular languages such as British English, English for Foreigners (Gerosa et al., 2009), German and Swedish (Kazemzadeh et al., 2005), Chinese (Wang et al., 2019), and Cantonese (Xiangjun & Yip, 2018).

The university education in Ukraine, especially for the training of specialists in philological areas, also needs new and modern movie corpus, teaching, and supporting material. Therefore, this study describes the work of the teaching staff and students of the Admiral Makarov National University of Shipbuilding with a new, constantly updated publicistic movie corpus designed to improve automatic speech recognition skills. Usually, students' speech recognition parameters vary, and subtitling, therefore, will be an additional element to build automatic speech recognition skills (Boghian, 2018).

German and English languages have a complex grammatical structure and verb tense system. Both languages are morphologically rich and have a wide vocabulary, so the task of creating a corpus of publicistic, educational, and documentary movies with subtitles is quite challenging. Moreover, automatic speech recognition and comprehension by linguistic students requires a huge level of knowledge and skills.

Some studies explore the first steps in collecting data on educational innovations, annotation programs, and text testing, which is also accompanied by recordings of children's and adults' speech (Pleva et al., 2019).

An important component in the development of foreign language learning methodologies is the technological revolution, as it enters the university process rapidly. Informational literacy is essential for the modern linguist; it provides the opportunity to work in progressive work environments. Some concepts of foreign language learning within a technological revolution involve the development of workable and effective self-supporting systems. There are several studies describing successful projects to implement artificial intelligence in communication and foreign language learning (Beelders & Blignaut, 2011; Aydın & Zhu, 2017).

The issues of introducing subtitling of Ukrainian-English and Ukrainian-German publicistic movies and their active involvement in the professional training of linguistic teachers remain unresolved. It is essential to form the skills of automatic speech recognition, to study students' vision of thematic clusters to such audio and video materials, the main content, and components of courses that use movie archives and subtitles.

Methods

A set of methods was used to conduct the study effectively. To realize the project, empirical (diagnostic) methods were used. These are the pedagogical experiment, as well as questioning (written form) and observation methods.

Linguistics students in the 3rd year of the first (bachelor) education level were involved in the experiment. The students expressed their willingness to participate in implementing the work with subtitled Ukrainian-English and Ukrainian-German publicistic movies in their educational activities.

The pedagogical experiment method was used for one academic semester (6 months) in 2020-2021 (December 2020 - June 2021). It was used to determine whether the effectiveness, clarity, technical feasibility, and challenges of engaging the practice of subtitled videos in university education are significant. In Eastern Europe, and Ukrainian higher education, the involvement of such techniques means restructuring the forms, contents, technical support of foreign language departments, linguistics students, and the whole system of humanitarian education. We have considered how effective is the introduction of the audio translation practice, namely publicistic and documentary movies and TV series into English and German language studies for linguistics students. The methods of observation and questionnaires were auxiliary to the pedagogical experience. Statistical methods were used to collect and assess the experiment results.

The above-mentioned questionnaire process was considered under the experimental conditions from the observation point of view. It was used to study the thematic ratings and the demographic and professional situation of the respondents. The observation method is empirical, so it cannot be intended to assess the obtained results and the effectiveness of the studied methods as systemic changes in the university education area.

Only 35 students studying German and English were involved in the experiment. They are 3rd-year students of the first (Bachelor's) education level, studying at the Admiral Makarov National University of Shipbuilding. All participants were grouped according to the language they were studying as their first language (either English or German).

The study continued uninterrupted in a mixed form, so it involved online classes under quarantine restrictions and face-to-face practical sessions and seminars. All respondents were combined into 2 groups: according to the preliminary questionnaire and the chosen primary language. The group consisted of 17 (G1) and 18 (G2) people.

The key component of the groups was the introduction of the courses approved in the curriculum for 2020, which provide the use of Ukrainian-English and Ukrainian-German publicistic movies with or without subtitles.

Stage 1. A preliminary survey was conducted to ascertain the demographic and educational characteristics of the respondents who make up the study groups (G1, G2) and participate in the pedagogical experiment. The collection and preparation of teaching and practical materials for the courses were carried out. Preliminary consultations with teachers and technical specialists, who will lead and accompany these courses, were held. The classrooms were prepared and equipped for display and guidance in the video and audio collections.

Stage 2. At this stage, a parallel survey was conducted in groups to determine the respondents' ratings of content, genre, and thematic priorities. The participants assessed the level of facilitation of automatic speech recognition while watching Ukrainian-English and Ukrainian-German publicistic movies with subtitles.

Stage 3. In the final stage, a survey determined the rating of the relevance of educational topics presented in subtitled documentaries and series.

As for the difficulties and challenges encountered during the research and the experiment, it is quite a significant time commitment (1 semester - 6 months). It is impossible to conduct a qualitative in-depth study and determine the reasons for changes in the respondents' ratings accordingly.

Result

Several thematic blocks with relevant and up-to-date content, highly informative (history, culture, architecture, futurism, natural sciences) were proposed to be included in the course content related to the acquisition of automatic speech recognition skills of linguistics students through subtitling of Ukrainian-English and Ukrainian-German publicistic movies. Furthermore, the effectiveness of involving such methodology and changing priorities in foreign language learning was assessed.

All these tasks were based on the recording of the respondents' demographic and professional qualification characteristics.

Table 1.
Demographic and qualification characteristics of respondents (author's elaboration)

		Г1	Г2
Age	20	9	10
	21	6	7
	Other	2	1
Gender	Female	12	10
	Male	5	8
Previously obtained qualifications	General High School Education	15	17
	Special Pedagogical Education	2	1
Total		17	18

According to the survey results, it is clear that all respondents are about the same age. From the gender perspective, there are more female respondents, but not significantly. There are also 3 people with special secondary education.

At the 1st (preparatory) stage, a collection of documentary movies produced in Ukraine, the UK, and Germany by the best artists and producers was created. For Ukraine, it is media holding 1+1 (Taiemnytsi heniia Shevchenka); Great Britain was represented by the BBC publicistic movies. The content of the video and audio corpus was changed according to the ratings provided by the respondents, as well as comments made by the teachers who worked on the project. Thus, an idea of the relevance of the educational topics proposed for the study was drawn up.

Stage 2. After conducting the basic learning anticipated by the work plans and curricula, the participants were surveyed and asked to determine the usefulness of subtitles regarding the list of offered publicistic movies. They were asked to determine whether subtitling facilitated automatic speech recognition in a foreign language. The participants also were separately asked to select the most relevant and interesting topics of documentaries. The result was calculated as a percentage.

Table 2.
Speech recognition level of movies with and without subtitles (Ukrainian-English movie archive) (author's elaboration)

TV series, episodes	Duration	Level of recognition with subtitles	Level of recognition without subtitles
The World In 2050	43.42	60%	72%
30 Most Beautiful Cities in the World	25.04	62%	68%
Best survival training, skills and tips from Spec Ops Bushcrafting	25.49	60%	70%
Easy Cellar PDF, Reviews, Bunker Plans & Book Download	34.48	58%	65%
Shaolin Kung Fu Training & Techniques	47.55	56%	68%

According to the results, 10% of respondents better understood English-language movies with subtitles compared to those who watched without them. The best result of subtitles in facilitating automatic broadcasting recognition was obtained by the BBC products, which considered futuristic architecture and martial arts as a technology and a cultural asset.

In the 2nd stage, the level of automatic speech recognition of Ukrainian-German publicistic movies was assessed along with the continuation of the learning according to the developed program. The emphasis was made on the best examples of the genre. Germany was represented by a documentary movie, which became the winner of several festivals and competitions in Europe and was rated positively by the critics.

Table 3.
Speech recognition level of Ukrainian-German TV series and movies with and without subtitles (author's elaboration)

TV series, episodes	Duration	Level of recognition with subtitles	Level of recognition without subtitles
Marko Vovchok. Taiemnycha zirka	23.28	72%	78%
Taiemnytsi heniia Shevchenka Part 1	47.22	75%	82%
Taiemnytsi heniia Shevchenka Part 2	47.12	73%	85%
Revision (2012) 1	44.31	66%	73%
Revision (2012) 2	41.11	68%	79%

Based on the obtained results, the respondents understood Ukrainian and German publicistic and documentary movies with German subtitles by 8% easier.

In the final stage (Stage 3), was organized a discussion on the topics related to the watched movies. The students' groups conducted a session on reviewing what they saw in Ukrainian-English and Ukrainian-German publicistic movies during the study process.

After each screening, was organized a separate discussion about 1 movie seen. Such activities were included in the compulsory activities block, which should also determine the respondents' thematic and educational priorities, aimed at evaluating the effectiveness and accessibility of this method of learning and improving their foreign language proficiency, as well as improving their intellectual level.

The main content axes that form the corpus of audio and video materials for the training programs were identified. The presented data show that certain topics and problems are more evident and significant for the respondents. The subtitling and watching of publicistic movies in foreign languages in the study groups contribute to the development of individual thematic ratings and the concept of new university education. The results are presented as a percentage.

Table 4.
Ranking of educational topics relevance for the students (author's elaboration)

№	Learning topic	G1	G2
1.	Modern technologies, future technologies	45%	38%
2.	Cultural Heritage of Nations	67%	35%
3.	History of literature	69%	54%
4.	Outstanding figures of art and culture of the world	78%	75%
5.	Skills of the XXI century.	73%	65%
6.	Architecture. History and Futuristics	58%	72%

As the survey results show, Theme 4, "Outstanding Figures of Art and Culture of the World," and Theme 5, "Skills of the XXI Century," occupy the highest positions in the thematic rating of the revised publicistic movies. The correlation between gaining knowledge and experience (the professional preparation of the language student) can be seen after going through the system of learning from the topics chosen by each group. The perceptions of the relevance of the proposed topics were shaped by the implementation of learning activities.

Discussion

The corpus of research on improving the automatic speech recognition skills of linguistics students through subtitling in a foreign language of publicistic movies and TV series has shown the effectiveness of introducing such a technique as one of the educational innovations related to the technologization and humanitarianization of university education (Kelley & Knowles, 2016; Ivanova et al, 2020).

A group of Slovak academic scientists, along with the Slovak Academy of Sciences, conducted research on automatic subtitling systems for Slovak television broadcasters and educational programs. The researchers used time-delayed deep neural network (TDNN) models. The subtitling techniques were found to be effective and positively assessed within the research project (Salgur, 2013; Pleva et al., 2019). According to our data, linguistics students had a positive perception and found the practice of subtitling movies convenient. It is an opportunity both to improve their foreign language skills and get familiar with new/modern technical solutions and constantly monitor the troublesome area.

The results of a study on the effectiveness and usefulness of foreign language course software, automatic speech recognition (ASR) techniques, and English subtitling for improving foreign language students' pronunciation showed that 65% of students reported that using the software and videos improved their pronunciation and automatic speech perception in English (Sidgi & Shaari, 2017). 50% of students reported that constant reading, repeating, and practicing English sounds, according to what they heard, improved their pronunciation. Overall, 50% of students found this practice helpful and agreed to continue working with it in the future. Only 5% of respondents said that mastering the new techniques required loads of effort, and 5% felt that listening to videos and visual graphic feedback did not improve their pronunciation. The results presented in the study found an overall 9% increase in respondents rated the use

of subtitling in Ukrainian-English and Ukrainian-German publicistic movies.

The system of increasing the number of technological solutions in foreign language learning is based on modern methods and innovations identified in the studies of current educators (Zhernova, 2018; Selin et al., 2016). However, the idea of involving video content contributes to the emergence of different concepts, a system of coordinates, and program axes in the training of future specialists in foreign languages (linguists). New technological institutions' use in education leads to the emergence and improvement of educational innovations and motivates thinking about innovative pedagogical practices (Anis, 2017). Our research has shown that even if linguistics students use watching audio or video materials for a learning purpose, they have a certain set of beliefs and tastes: they assess a set of topics at variance and may understand this innovation a bit differently. Therefore, we should keep surveying education seekers and modify the corpus of video and audio materials according to requests and learning needs.

Conclusion

This research proves that the use Ukrainian-English and Ukrainian-German publicistic movies with subtitles helps to improve automatic speech recognition skills. According to the survey, a 9% increase in respondents supported the use of subtitling techniques for video and audio materials within the learning process.

The improvement of linguistics students' automatic speech recognition skills via subtitling is welcomed by education seekers. The best automatic speech recognition occurs while watching movies with subtitles.

Historical and cultural content and the future of high technology are the relevant topics for linguistics students when watching publicistic movies and documentary series.

Our study is one of the innovative practices carried out on a university education basis, along with other activities. Everything is made possible through the active engagement of linguistics educators with high technology. Such programs provide substantial experience with the acoustic and linguistic features as part of documentaries and science-popular movies.

The future development of methods and models of foreign language teaching that involve using various audio and video materials and digital technology will continue. These require figuring out the models and pragmatics of forming a teaching corpus for foreign language learning. There are several research goals, first of all, the improvement of technical aspects in teaching and implementation of independent and creative work of linguistics students, the formation of particular collections of audio and video materials aimed at the subject-specific and professional use of English, and German-based on international cooperation.

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