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# Threat of Artificial Intelligence to the higher education services: statistical analyses in selected Eastern European countries

# Zagrożenie sztucznej inteligencji dla usług szkolnictwa wyższego: analizy statystyczne w wybranych krajach Europy Wschodniej

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**Abstract.** The rapid development and adoption of Artificial Intelligence (AI) is sparking numerous discussions about the pros and threats of AI technologies. Businessmen and entrepreneurs are beginning to increasingly use AI in healthcare, marketing, hospitality, science, art and education. In turn, lawyers, science fiction authors, academics, and select AI consumer groups are urging more and more caution. AI has also entered the practices of higher education. The purpose of the publication is to provide new scientific data that can serve as a basis for evidence-based planning and forecasting, as well as for multi--level management decisions. The main hypothesis of the study is the following: there are no students who think "Artificial Intelligence is a threat to the higher education services in the nearest 5 years". The hypotheses of the study were transformed into a pair of statistical hypotheses: the Research hypothesis and the Alternative one. The authors adopted the Customer Service Theory as the theoretical basis of the study. Therefore, they surveyed 1744 consumers of educational services (students) from 8 universities in 5 Eastern European countries. The authors used reliable standard research methods. These are literature review, questionnaire survey of respondents using cloud technologies and AI tools, graphical representation of the results and statistical analysis. The primary processing and graphical representation of the survey results showed that 23.05% of the total number of respondents thinks that AI is a threat to the higher education in the nearest 5 years. Further, the authors investigated separately the opinions of students for each group of respondents. Verification of statistical hypotheses resulted in rejection of the research hypothesis for all groups of respondents. The alternative hypothesis was accepted for each group of respondents: the number of students who think Artificial Intelligence is a threat to the higher education in the nearest 5 years is greater than zero, if random variations are not taken into account. The alternative hypothesis is accepted with a high significance level of 0.01. This means that university governments and managers can make plans and forecasts, and make multi-level management decisions based on new scientific evidence. These plans, forecasts and management decisions will be made with accurate, predictable probability. The purpose of the following study is to explore in detail the threats that students see in the application of AI in higher education.
**Keywords:** Artificial Intelligence, higher education services, threat, opinion research, statistical analysis

**Abstrakt.** Szybki rozwój i wdrożenie Sztucznej Inteligencji (SI) wywołują liczne dyskusje na temat zalet i zagrożeń związanych z technologią SI. Biznesmeni i przedsiębiorcy coraz częściej wykorzystują SI w dziedzinach, takich jak opieka zdrowotna, marketing, branża hotelarska, nauka, sztuka i edukacja. Z kolei prawnicy, autorzy fantastyki naukowej, naukowcy oraz niektóre grupy konsumentów SI coraz głośniej apelują o ostrożność. SI zagościła również w praktykach szkolnictwa wyższego. Celem niniejszej publikacji jest dostarczenie nowych danych naukowych, które mogą stanowić podstawę do opracowania naukowo uzasadnionych planów i prognoz, a także podejmowania wielopoziomowych decyzji zarządczych. Hipoteza badawcza brzmi: nie ma studentów, którzy uważają, że „Sztuczna Inteligencja stanowi zagrożenie dla szkolnictwa wyższego w najbliższych 5 latach". Hipoteza badawcza została przekształcona w parę hipotez statystycznych: Badawcza i Alternatywna. Autorzy przyjęli Teorię Obsługi Klienta jako teoretyczną podstawę badania. Dlatego zbadali opinie 1744 konsumentów usług edukacyjnych (studentów) z 8

uniwersytetów 5 krajów Europy Wschodniej. Autorzy zastosowali rzetelne standardowe metody badawcze. Były to przegląd literatury, ankietyzacja respondentów z użyciem technologii chmurowych i narzędzi SI, graficzne przedstawienie wyników oraz analiza statystyczna. Pierwsza faza przetwarzania danych i graficzne przedstawienie wyników ankiety pokazały, że 23,05% ogólnej liczby respondentów uważa, że SI stanowi zagrożenie dla szkolnictwa wyższego w najbliższych 5 latach. Następnie autorzy zbadali osobno opinie studentów dla każdej grupy respondentów. Weryfikacja hipotez statystycznych doprowadziła do odrzucenia hipotezy badawczej dla wszystkich grup respondentów. Alternatywna hipoteza została przyjęta dla każdej grupy respondentów: liczba studentów uważających, że Sztuczna Inteligencja stanowi zagrożenie dla szkolnictwa wyższego w najbliższych 5 latach, jest większa od zera, jeśli nie uwzględnia się losowych fluktuacji. Alternatywna hipoteza została przyjęta z wysokim poziomem istotności 0,01. Oznacza to, że rządy krajowe i liderzy uniwersytetów mogą tworzyć plany, prognozy oraz podejmować wielopoziomowe decyzje zarządcze na podstawie nowych danych naukowych. Te plany, prognozy i decyzje zarządcze będą realizowane z precyzyjnym, przewidywalnym prawdopodobieństwem. Celem kolejnego etapu badania będzie szczegółowe zbadanie zagrożeń, które studenci dostrzegają w zastosowaniu SI w szkolnictwie wyższym.
**Słowa kluczowe:** sztuczna inteligencja, usługi szkolnictwa wyższego, zagrożenie, badania opinii, analiza statystyczna

## Introduction

Two articles published in the journal Modern management systems were the inspiration for writing our manuscript. In the article (Vidu, Pinzaru, Mitan, 2022), the authors discuss the main risks that managers of small and medium-sized enterprises (SMEs) should understand regarding Artificial Intelligence (AI). These authors discuss the challenges arising when implementing AI in business. Their study is based on a semi-structured literature review. It concerns the countries of Central and Eastern Europe. At the end of the article, they conclude that the vast majority of SMEs are not among the digital leaders. The most important reason for that state of affairs is a managerial mindset that does not favour the widespread adoption of digital tools and the subsequent restructuring of business processes and structures. According to the authors, every manager who decides to implement AI systems should recognise its potential benefits, costs and conceptual challenges.

The author of another paper (Maternowska, 2022) continued her research on AI threats, similar to the aforementioned study (Vidu, Pinzaru, Mitan, 2022). Relying on a literature review and several pieces of legislation, the author outlined the problems associated with robot torts. The author has attempted to assess the challenges faced by decision makers with respect to the regulation of robots controlled by Artificial Intelligence. The author writes that adequate risk protection is necessary to ensure that the public can trust new technologies despite the possibility of harm.

The authors of this manuscript decided to investigate the third side of AI threat assessment. Therefore, our manuscript has several differences and limitations.

First, the authors of the above-mentioned articles researched academic sources. The authors of our manuscript investigated the opinion of young people. They were students from selected Eastern European higher education institutions. These students did not major in studying AI.

The next difference of this manuscript: it was an analysis of students' statistical opinions about the threat of AI in higher education services.

Finally, the authors of our manuscript limited themselves to selected countries in Eastern Europe.

The aim of the research is to study students' opinions and provide new scientific data that can become the basis for making scientifically-based plans and forecasts, as well as for making multi-level management decisions.

**The hypothesis** of the study is the following: there are no students who think that "Artificial Intelligence is a threat to the higher education in the nearest 5 years".

## 1. Literature review

Back in 2019, Harry E. Pence (2019) wrote "Artificial intelligence (AI) applications are becoming commonplace in all segments of American life; AI is used for online search, entertainment, transportation, social media, finance, online advertising, marketing, online music, and many other areas. It is also becoming popular in many homes in the form of AI-enabled personal assistants such as Alexa or Google Nest. There are many predictions that AI will cause massive changes in employment" (Pence, 2019).

Also, AI tools are being used in management and bureaucracy (Bullock, 2019). Higher education is no exception. University professors will soon find that the nature of their work is also changing.

In a new paper (Gellai, 2023), it has been confirmed that AI-based technologies are becoming more and more prevalent in many fields, and education is no exception. The author sees AI as an inevitable element of the present and future. Scholars (Suh, Ahn, 2022) write that many countries including the United States, Singapore, China, Korea, Australia, and European Union countries are exploring ways to effectively integrate AI education into their curriculum.

At present, the first challenge of AI is its inaccessibility for teachers who are not technology savvy (Alyahyan, Düştegör, 2020). Moreover, Geerling, et al. (2023) estimate that the emergence of AI poses a serious challenge to traditional assessment methods in higher education. The results of the study show that ChatGPT is capable of providing responses that exceed average student responses (Geerling, Mateer, Wooten, Damodaran, 2023). In each study, the ChatGPT provided responses that exceeded the median of average responses for the subjects. The authors of the article (Abdelwahab, Rauf, Chen, 2023) argue that the use of AI is forcing universities to change their curricula and work environments. Woods, Doherty and Stephens (2022) described another challenge for higher education. They surveyed the views of 60 senior managers in 24 retail companies in Ireland. The survey showed that advances in technology are increasing the need for soft skills so that the potential of new technology can be

fully understood and utilised. This is a major challenge for higher education (Woods, Doherty, Stephens, 2022). The authors of the paper (Gado, Kempen, Lingelbach, Bipp, 2022) tested 218 psychology students. The study helped to find a way to reduce possible limitations regarding the use of AI. This is an AI acceptance model based on established technology acceptance models (Gado, Kempen, Lingelbach, Bipp, 2022).

Researchers AlZaabi, AlMaskari and AalAbdulsalam (2023) surveyed 82 physicians and 211 medical students about the readiness to use AI in healthcare settings. Half of the participants believed that both the manufacturer and physicians should be held legally responsible for medical errors arising from AI tools. Senior physicians are less familiar with AI and more concerned about legal liability than younger physicians and students (AlZaabi, AlMaskari, AalAbdulsalam, 2023). Another article (Getchell, Carradini, Cardon et al., 2022) argues that AI technologies can change the nature of collaborative work and team communication. Therefore, business schools and universities have some obligations to teach students personal responsibility and ethics. The problem of legal liability for the use of AI was also considered in another recent paper (Maternowska, 2022). A set of rules aimed at ensuring the functioning of the market (market-enhancing integration), social protection (market-shaping integration) and emancipation (which includes the prohibition of discrimination) are included in the draft AI Law (Mazur, Włoch, 2023). However, the AI Law sets a very high threshold for the prohibition of AI systems (Mazur, Włoch, 2023).

Luo, et al. (2021) present several warnings associated with the use of Artificial Intelligence (AI) trainers to train sales agents. The authors showed that lower ranking agents face the most serious problem of information overload with AI compared to a human trainer.

Hockly (2023) emphasised the ethical problems of using Artificial Intelligence in English Language Teaching. Cheruvalath (2023) also explores the ethical aspects of using AI: "The problem associated with developers is that they themselves lack ethics training. Makers developing an artificial ethical agent must be able to anticipate ethical issues and have knowledge of ethical decision-making to improve the ethical use of AI-enabled machines".

The article (Vicsek, Bokor, Pataki, 2022) explores expectations about future work, drawing on 62 interviews with non-technical students at Hungarian universities. Interestingly, AI developments were not a factor in the career plan (Vicsek, Bokor, Pataki, 2022). Perhaps this is because the EU explicitly assumes the role of a defender of the social rights of workers threatened by the use of AI systems (Mazur, Włoch, 2023).

Okulicz-Kozaryn (2023) argues that AI may pose a threat to the quality of higher education services. This research is done based on the study of scientific sources and the compilation of a model of the educational services market after 2017. Before that, it was highlighted that there is a lack of in-depth research on young people's views on automation and work (Vicsek, Bokor, Pataki, 2022).

Therefore, the authors of this manuscript decided to investigate students' perceptions of the threat posed by AI. All respondents were students studying in non-technical specialities. The respondents were located within the higher education system. This decision was made to limit the study in the first phase. Therefore, in the first phase, the authors investigated the students' views on the threat of AI when applied in higher education.

## 2. Research methodology

### 2.1. Common information

This part of the study was carried out in May-November 2023. The experimental basis of the research was the following:

1. University of Business (NLU) in Nowy Sącz, Poland.
2. Humanitas University, Poland.
3. Mieszko I University of Applied Sciences in Poznan, Poland.
4. AMBIS University, Czech Republic.
5. Beketov Karaganda University, Kazakhstan.
6. University of Economics in Bratislava, Slovakia.
7. Khortytsia National Educational and Rehabilitation Academy, Ukraine.
8. Sumy State University, Ukraine.

The authors adopted the Customer Service Theory as the theoretical basis of the study. This theory was at the centre of the ideas of the father of economics, Adam Smith (Smith, 1776). According to the Customer Service Theory, a service is an action, benefit or a way of satisfying a need that one party offers to the other. And services are usually provided at the request of consumers and with their consent. That is why the authors interviewed consumers of educational services. In other words, the authors interviewed students.

The research methods include literature review, opinion research (questionnaire survey) of respondents using cloud technologies and AI tools, graphical representation of the results and statistical analysis (verification of statistical hypotheses).

### 2.2. Respondents and dataset collection

The study of this socio-economic phenomenon is based on a selective method. It consists in determining the summary characteristics of not all, but only a part of the members of the general population taken for the sample. The theoretical basis of the sampling method is the Law of Large Numbers (Selvamuthu, Das, 2018; Singpurwalla, 2015). The selection was carried out in series (they are the units of the population). In our case, faculties (or students' specialties) are accepted as series. For example, at the National Louis University, one of the co-authors interviewed

816 students majoring in psychology. That is, our sampling method is called serial. Students of this specialty who took part in the survey are called a "group". All students participated in the survey voluntarily and anonymously.

In selecting the respondent groups (countries of origin), the authors sought to maximise diversity and used the approach described in the publications (Selvamuthu, Das, 2018; Singpurwalla, 2015). Therefore, the following countries were selected for the study of respondents' views:

- Countries that are fully part of Eastern Europe and countries that partly belong to Eastern Europe;
- Countries belonging to the European Union and countries not belonging to the European Union;
- Countries with strong economies and countries with weak economies;
- Public and private universities.

The questionnaire was prepared electronically and hosted on Cloud of the National Louis University. The questionnaire included 4 preliminary questions and 12 essential questions.

The authors used the questionnaire that is described in the article (Okulich-Kazarin, Artyukhov, Skowron et al., 2024). Question #10 in this manuscript was used for statistical analysis. The question reads: Do you think "Artificial Intelligence is a threat to the higher education in the nearest 5 years"?

Respondents chose one of 5 response options: Definitely yes, Rather yes, Hard to say, Rather not, Definitely no.

All the respondents were warned that the survey was voluntary and anonymous. Survey of respondents was carried out by using an electronic questionnaire and cloud technologies. Information about respondents is provided in table 1.

Table 1. Data on respondents

| No. | University | Gender (M/F/O) | Number of respondents, N |
|---|---|---|---|
| 1. | National Louis University | 129/687/0 | 816 |
| 2. | Mieszko I University of Applied Sciences in Poznan | 39/17/0 | 56 |
| 3. | Akademia Humanitas | 13/9/0 | 22 |
| 4. | AMBIS University | 37/57/0 | 94 |
| 5. | Beketov Karaganda University | 28/43/1 | 72 |
| 6. | University of Economics in Bratislava | 33/28/0 | 61 |
| 7. | Khortytsia National Educational and Rehabilitation Academy | 48/289/2 | 339 |
| 8. | Sumy State University | 145/134/5 | 284 |
| | Number | 472/1264/8 | 1744 |

Source: authors' own processing

Table 1 shows the total number of respondents is 1744. There are 472 male (M) and 1264 female (F) among respondents. Eight respondents identified their gender as "other" (O).

The maximum number of respondents in one group of respondents is 816. The minimum number of respondents in one group is 22 (table 1). In order to level out the difference in group size, the authors performed statistical analysis of the survey results for each separate group of students.

### 2.3. Statistical analysis

Statistical processing and verification of statistical hypotheses were performed according to standard procedures (Business_Statistics, 2010). Verification of statistical hypotheses (Okulich-Kazarin, Zhurba, Bokhonkova, Losiyevska, 2019) is based on comparing the Average of the sample $M_{(x)}$ with a given number $\mu_0$.

**The main hypothesis** (there are no students who think "Artificial Intelligence is a threat to the higher education in the nearest 5 years") was transformed into a pair of statistical hypotheses:

- a Research Hypothesis;
- an Alternative hypothesis.

The research hypothesis is that a number of students who think "Artificial Intelligence is a threat to the higher education in the nearest 5 years" equals to zero, if random variations are not taken into account.

The research hypothesis: $\mu_0 = 0.00$.

The alternative hypothesis is that a number of students who think "Artificial Intelligence is a threat to the higher education in the nearest 5 years" is greater than zero, if random variations are not taken into account.

The alternative hypothesis: $\mu_0 > 0.00$.

The authors adopted one-sided test as the number of students cannot be less than zero. The authors also accepted a high significance level $\alpha = 0.01$.

After analysing and discussing the results, the authors formulated conclusions.

## 3. Results

### 3.1. Theoretical brief

Let us discuss the definition of "Artificial Intelligence".

According to Coppin (2004, p. 4), "Artificial intelligence is the ability of machines to adapt to new situations, deal with emerging situations, solve problems, answer questions, device plans, and perform various other functions that require some level

of intelligence typically evident in human beings". At present, AI is becoming a key variable in the fields of the technology, economy, and politics (Suh, Ahn, 2022).

According to the article (Saridis, Valavanis, 1988) "Artificial intelligence draws upon the idea that machines (computers) should mimic the human brain's cognitive processes and act accordingly by using specific software and algorithms. Specifically, they would reproduce human attributes such as learning, speech, and problem-solving". In the paper (Pantano, Scarpi, 2022) it is shown, that AI is often named like a "hybrid-human machine apparatus".

"Artificial intelligence is a generic term that refers to a number of versatile and diverse technologies that rely on computing power and are based on techniques in fields such as machine learning to advance automated and increasingly autonomous decision-making and action" (Schippers, 2020).

Artificial Intelligence can be brought into life in the form of a computer or an information network that can perform any kind of intellectual work together with or instead of humans (Okulicz-Kozaryn, 2023). In the first case, AI can be embedded in a humanoid robot (The machine, 2022; AI, 2001; The Terminator, 1984) or another device for solving intelligent problems such as programmable calculator, taxi without a driver, cameras and facial recognition system (Okulicz-Kozaryn, 2023). In the second case, AI can function without an image that we see with our eyes (Scopus classification system; excel tables; Google search engine). The Skynet network (Terminator, 2003) is one more of examples.

Now let us return to the articles published on this important topic in the journal Modern management systems. These are the two articles (Vidu, Pinzaru, Mitan, 2022; Maternowska, 2022) with which the authors started this manuscript.

In the first article, the authors discuss the problems arising when implementing AI in business. Rather, it is more about the loss of benefits in the slow pace of adoption of AI tools in SMEs.

The author of the second article writes about the need for adequate protection against risks and possible damage. That is, the author believes that measures should be taken so that the public can trust AI technologies (Maternowska, 2022).

Jungherr (2023) argues that the application of AI is accompanied by speculations about Artificial Intelligence with human and superhuman abilities. At the same time, this author suggests taking into account real threats and opportunities. The author proposes to monitor the impact of AI on democracy through the coordination of experts in sociology and computer science. Back in 2017, Aleksander (2017) suggested the emergence of a threat to job market by AI.

If AI solves intellectual tasks peculiar to humans, then we can hypothesise that AI can pose a threat to society. There are criminals in society (murderers, thieves, robbers, rapists, swindlers) who have human intelligence. So, machines and information networks can also commit illegal actions.

### 3.2. General analysis of respondents' opinions

Table 2 summarises the respondents' answers to question 10: Do you think "Artificial Intelligence is a threat to the higher education in the nearest 5 years"?

The following abbreviations are adopted in table 2: DE (Definitely yes), RE (Rather yes), HS (Hard to say), RN (Rather not), DN (Definitely no).

Table 2. Answers of respondents

| No. | University | DE | RE | HS | RN | DN |
|---|---|---|---|---|---|---|
| 1. | National Louis University | 45 | 120 | 292 | 270 | 86 |
| 2. | Mieszko I University of Applied Sciences in Poznan | 4 | 12 | 24 | 13 | 3 |
| 3. | Akademia Humanitas | 3 | 6 | 8 | 4 | 1 |
| 4. | AMBIS University | 17 | 28 | 22 | 18 | 7 |
| 5. | Beketov Karaganda University | 9 | 14 | 27 | 29 | 4 |
| 6. | University of Economics in Bratislava | 2 | 4 | 27 | 24 | 2 |
| 7. | Khortytsia National Educational and Rehabilitation Academy | 17 | 54 | 124 | 114 | 28 |
| 8. | Sumy State University | 17 | 50 | 81 | 96 | 39 |
| | Number | 114 | 288 | 605 | 568 | 170 |

Source: authors' own processing

Table 2 shows that a greater number of students' choices relate to the answers "Hard to say" and "Rather not" for the total number of respondents. The number of respondents who agreed with the statement that Artificial Intelligence is a threat to the higher education in the nearest 5 years was 23.05%. These are the students who chose the answers "Definitely yes" and "Rather yes".

The number of students who disagree with this statement was 42% in total. This amount is almost two times higer than the number of students who agree with the statement. The number of students who are undecided is 35%.

Thus, the overall picture (table 2) leads us to accept the alternative hypothesis: the number of students who think Artificial Intelligence is a threat to the higher education in the nearest 5 years is greater than zero, if random variations are not taken into account.

However, the respondent groups contained different numbers of respondents. This may have influenced the overall picture. Therefore, the authors cannot unconditionally accept the alternative hypothesis.

To accept the hypothesis with accurate and predicted probability, the authors performed statistical hypotheses verification for each group of respondents.

### 3.3. Calculation of statistical indicators for each group of respondents

In order to verify the statistical hypotheses, we first need to digitise the respondents' answers. For this purpose, we assume the following conditions:

- Answers "Definitely yes" and "Rather yes" equate to 100.00%;
- The answers "Hard to say", "Rather not" and "Definitely no" are equated to 0.00%.

After that we can calculate the statistical indicators:

- expected value, $M_{(x)}$;
- standard deviation for the group of respondents, $\boldsymbol{\delta x}$;
- standard deviation for the general population, $\boldsymbol{\delta x\text{-}1}$.

The statistical indicators are summarised in table 3.

Table 3. Statistical indicators for each group of respondents

| No. | Indicator | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| 1. | number of respondents, N | 816 | 56 | 22 | 94 | 72 | 61 | 339 | 284 |
| 2. | expected value, $M_{(x)}$ | 20.59 | 28.57 | 40.91 | 50.00 | 16.67 | 10.53 | 21.53 | 23.94 |
| 3. | standard deviation for the group, $\boldsymbol{\delta_x}$ | 40.43 | 45.16 | 49.17 | 50.00 | 37.27 | 30.69 | 41.10 | 42.67 |
| 4. | standard deviation for the general population, $\boldsymbol{\delta_{x\text{-}1}}$ | 40.46 | 45.59 | 50.32 | 50.27 | 37.53 | 30.96 | 41.17 | 42.75 |

Source: authors' own processing

Table 3 shows that the value of mathematical expectation varies from 10.53% to 50.00%. Standard deviation for the group of respondents varies from 30.69% to 50.00%. This difference suggests the possibility of rejecting the alternative hypothesis in some cases. In such cases it is possible to accept the Research Hypothesis: the number of students who think "Artificial Intelligence is a threat to the higher education in the nearest 5 years" is equal to zero.

### 3.4. Verification of statistical hypotheses for each group of respondents

The results of statistical hypotheses verification are summarised in tables 4a and 4b. Table 4a combines the calculations for groups 1-4. Table 4b combines the calculations for groups 5-8.

Tables 4a and 4b show that the value $|t_{stat}|$ is higher than $t_{tabl}$ when $\mu_0 = 0.00$ % for each group of respondents. The research hypothesis should be rejected. Therefore, the authors accepted the alternative hypothesis: the number of students who think "Artificial Intelligence is a threat to the higher education in the nearest 5 years" is greater than zero, if random variations are not taken into account. This decision is accepted with a high significance level of 0.01.

Table 4*a*. Calculations for groups 1-4

| No. | Indicator | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1. | number of respondents, N | 816 | 56 | 22 | 94 |
| 2. | expected value, $M_{(x)}$ | 20.59 | 28.57 | 40.91 | 50.00 |
| 3. | standard deviation for the group, $\boldsymbol{\delta_x}$ | 40.43 | 45.16 | 49.17 | 50.00 |
| 4. | average error, $\dot{S}_{\bar{X}} = \boldsymbol{\delta x}/\sqrt{N}$ | 1.415 | 6.035 | 10.483 | 5.157 |
| 5. | value $\lvert t_{stat}\rvert = (M_{(x)} - \mu_0)/\dot{S}_{\bar{X}}$ for $\mu_0 = 0.00$ % | 14.551 | 4.734 | 3.902 | 9.695 |
| 6. | value $t_{tabl}$ for high level of significance α (0.01) | 2.326 | 2.326 | 2.518 | 2.326 |
| 7. | $\lvert t_{stat}\rvert > t_{tabl}$ | Yes | Yes | Yes | Yes |

Source: authors' own processing

Table 4b. Calculations for groups 5-8

| No. | Indicator | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|
| 1. | number of respondents, N | 72 | 61 | 339 | 284 |
| 2. | expected value, $M_{(x)}$ | 16.67 | 10.53 | 21.53 | 23.94 |
| 3. | standard deviation for the group, $\boldsymbol{\delta_x}$ | 37.27 | 30.69 | 41.10 | 42.67 |
| 4. | average error, $\dot{S}_{\bar{X}} = \boldsymbol{\delta x}/\sqrt{N}$ | 4.392 | 3.929 | 2.232 | 2.532 |
| 5. | value $\lvert t_{stat}\rvert = (M_{(x)} - \mu_0)/\dot{S}_{\bar{X}}$ for $\mu_0 = 0.00$ % | 3.795 | 2.680 | 9.645 | 9.455 |
| 6. | value $t_{tabl}$ for high level of significance α (0.01) | 2.326 | 2.326 | 2.326 | 2.326 |
| 7. | $\lvert t_{stat}\rvert > t_{tabl}$ | Yes | Yes | Yes | Yes |

Source: authors' own processing

Returning to figure 1, we can assume that the number of students who think "Artificial Intelligence is a threat to the higher education in the nearest 5 years" is 23.05%, if random variations are not taken into account.

## 4. Discussion

The discussion of the findings is hypothetically summarised in the direction: Is there a threat to higher education services from Artificial Intelligence?

Al-Amoudi (2023) widely discusses the impact of AI and other modern innovations on human intellectual and emotional abilities. The very possibility of superhuman intelligent AI poses serious political questions and requires serious political decisions (Damnjanović, 2015). Schippers (2020) cites data on the impact of AI on the minds of nearly 50 million American voters. The data analysis methods used by Cambridge Analytica have become a symbol of the growing use of artificial intelligence.

Health researchers see a threat to ethical standards when using AI in medical education (De Gagne, Hwang, Jung, 2023).

The New York City Department of Education had even restricted the use of ChatGPT in January 2023 (Rosenblatt, 2023). But the Department has lifted the ban four months later. Later, David Banks, chancellor of New York City Schools, acknowledged that integrating ChatGPT into education should include a discussion of ethical complexities (Abrams, 2024).

The author of the article (Okulicz-Kozaryn, 2023) points out that there is a new player in the market of educational services. This player is called "Artificial Intelligence". Taking into account the warning from the article (Aleksander, 2017), it would be logical to assume that AI tools will be able to replace university teachers. Moreover, the authors of the paper (Okulich-Kazarin, Artyukhov, Skowron et al., 2024) have already shown that 10.85% of Eastern European university students believe that AI tools will replace university teaching staff within the next 5 years.

In our manuscript, it is statistically proven that 23.05% of Eastern European university students see the threat of AI to higher education within 5 years. The difference between these two figures (23.05% and 10.85%) suggests that students envisage additional threats from AI tools other than the dismissal of university teachers. A list of these possible threats could become a topic for future studies.

Thus, the results described in the manuscript correlate with the current level of scientific research both qualitatively and quantitatively.

The adoption of reliable standard research methods, including literature review, questionnaire surveys utilizing cloud technologies and AI tools, visual representation of results and statistics, ensures the rigor and credibility of the findings.

## Conclusions

The novelty of the research lies in its comprehensive approach to examining the attitudes of students towards the integration of AI in higher education, because the specific implications for higher education remain relatively underexplored. This research fills this gap by providing new scientific data of students' perspectives regarding the impact of AI on higher education services. In this research, the authors presented new scientific data on students' opinions. These opinions of 1744 students showed the expectation of threats to higher education services from Artificial Intelligence. This view is held by 23.05% of respondents. It is difficult to ignore the opinion of such a large number of students. Therefore, the new scientific data can be the basis for making science-based plans and predictions.

The study's main hypothesis has challenged the notion that there are no students who perceive AI as a threat to higher education services in the near future. The main hypothesis (there are no students who think "Artificial Intelligence is a threat to

the higher education in the next 5 years") was transformed into a pair of statistical hypotheses. These were the research hypothesis and the alternative hypothesis. Verification of the statistical hypotheses led to acceptance of the alternative hypothesis: the number of students who think "Artificial Intelligence is a threat to the higher education in the nearest 5 years" is greater than zero, if random variations are not taken into account. This decision is accepted with a high significance level of 0.01.

This research provides a new evidence base on the opinions of Eastern European university students. By empirically investigating the attitudes of 1744 students from 8 universities across 5 Eastern European countries, the study offers valuable insights that can inform strategic decision-making at multiple levels of university governance and management. Based on this new scientific knowledge, governments and higher education managers can make plans, forecasts and multi-level management decisions with accurate and predictive probability.

The aim of the study has been achieved. The next aim is to examine in detail the factors that students consider as threats to higher education services.

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