RESEARCH-ARTICLE

Areas of use of ChatGPT and other Large Language Models among Hungrian universities, focusing on the Generation Z and the business world

PÉTER NAGY, Faculty of Economics and Business, Debrecen, Hajdu-Bihar, Hungary

BOGLARKA NAGY-TOTH, Faculty of Economics and Business, Debrecen, Hajdu-Bihar, Hungary

ADRIAN SZILARD NAGY, Faculty of Economics and Business, Debrecen, Hajdu-Bihar, Hungary

Open Access Support provided by:

Faculty of Economics and Business

Published: 11 July 2025

ICEME 2025: 2025 16th International Conference on E-business, Management and Economics
July 11 - 13, 2025
Beijing, China

Areas of use of ChatGPT and other Large Language Models among Hungrian universities, focusing on the Generation Z and the business world

Peter Nagy*
University of Debrecen Faculty of Economics and Business Institute of Applied Economics
Debrecen, Hungary
nagy.peter@econ.unideb.hu

Boglarka Nagy-Toth
University of Debrecen Faculty of Economics and Business Institute of Applied Economics
Debrecen, Hungary
toth.boglarka@econ.unideb.hu

Adrian Szilard Nagy
University of Debrecen Faculty of Economics and Business Institute of Applied Economics
Debrecen, Hungary
nagy.adrian@econ.unideb.hu

Abstract

The rapid evolution of artificial intelligence, particularly large language models (LLMs) like ChatGPT, is transforming how Generation Z engages with education and business. This study explores the adoption and perceived impact of LLMs among Hungarian university students, a demographic considered digital natives. Combining a systematic literature review with a quantitative survey of 442 respondents across 17 institutions, the research examines usage patterns, academic benefits, and business-related applications. Contrary to prior studies suggesting significant academic enhancement via LLMs, findings indicate a neutral perception of LLMs' contribution to university research and project work. However, students using LLMs for business purposes report greater entrepreneurial stimulation and innovative thinking. Statistical analyses further reveal that students with jobs are more likely to find LLMs effective, and those from the Budapest region tend to rate them higher than their rural peers. The results underscore both the potential and limitations of integrating LLMs into educational and business ecosystems. Recommendations include structured LLM adoption in curricula, rethinking plagiarism policies, and promoting AI literacy. The findings contribute to the broader discourse on preparing Gen Z for a future shaped by intelligent systems.

CCS Concepts

• **General and reference, Document types, Surveys and overviews**;

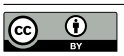
Keywords

ChatGPT, GenerativAi, LLMs, GenerationZ

ACM Reference Format:

Peter Nagy, Boglarka Nagy-Toth, and Adrian Szilard Nagy. 2025. Areas of use of ChatGPT and other Large Language Models among Hungrian universities, focusing on the Generation Z and the business world. In *2025 16th International Conference on E-business, Management and Economics (ICEME) (ICEME 2025), July 11–13, 2025, Beijing, China.* ACM, New York, NY, USA, 14 pages. https://doi.org/10.1145/3760557.3760590

*Correspondence



ICEME 2025, Beijing, China

ACM ISBN 979-8-4007-1587-7/2025/07
https://doi.org/10.1145/3760557.3760590

1 INTRODUCTION

In our thesis, we investigate the potential and impact of ChatGPT and other large language models among Hungarian university students, with a focus on Generation Z students. Currently, this generation is the most numerous in higher education in Hungary (due to their age). Generation Z includes people born between 1997 and 2012. They are often described as "digital natives" who have grown up in the age of the internet and smartphones, and are therefore able to handle new technologies and online platforms without problems. In social and political affairs, they often emphasize social justice and, they are open to diversity (Dimock, 2019). In recent years, AI and LLMs have increasingly penetrated the business environment, opening up new dimensions in business development and business strategy design (Teubner et al., 2023). Currently, the integration of LLMs is facing problems in several areas, two of which we would like to highlight in the light of our research:

1. Integration into teaching: Academic teaching institutions are facing an increasingly difficult task to find a balance between traditional teaching methods and the use of language models (Hober, 2019).
2. Career development: how can these models be successfully applied in the business fields to support the professional development of different generations and prepare them effectively for the labour market (Pinto et al., 2023).

These questions and challenges fundamentally shape the context and challenges of applying ChatGPT and other large language models. Addressing them adequately is essential to ensure that LLMs and AI can facilitate the development of university students in the future. The research aims to explore in general terms the concepts and applications of ChatGPT and other LLMs based on the relevant literature. In addition, we would like to build a comprehensive picture of how Generation Z university students use these tools and what their expectations are of these tools in Hungary. The study has two main parts. First, we reviewed the literature on the functioning and presence of ChatGPT and other large language models in education in general. A systematic literature review was used, which detailed in Chapter 2. Second, a survey was conducted, where domestic Generation Z university students was asked about ChatGPT and other large language models in general, and also covered the business usability.

Firat's (2023) research indicates that the utilization of ChatGPT has a beneficial impact on undergraduate students' academic progress. As this study was conducted in an international context,

our first hypothesis is grounded in these findings. Furthermore, Vrontis et al. (2023) argue that the use of AI-powered tools, such as ChatGPT, is essential for enhancing efficiency and productivity within organizations, thereby contributing to competitive advantage. Based on this, our second hypothesis assumes that similar patterns of adoption and utility can be observed among Generation Z university students.

Study questions:

- Does the use of large language models contribute to academic progress?
- Does the use of language models stimulate creative thinking?

Research hypotheses:

- H1: LLMs help students to carry out research and project-based learning activities at university more efficiently and effectively.
- H1/a: Undergraduates studying in the Capital (Budapest) region use LLMs to conduct research and project-based learning activities at university more efficiently and effectively than those studying at rural universities.
- H2: The use of LLMs promotes the development of new business models and innovative solutions and stimulates entrepreneurial thinking among university students.
- H2/a: The use of LLMs promotes the development of new business models and innovative solutions and stimulates entrepreneurial thinking among students who use them for business purposes.
- H2/b The use of LLMs is perceived as more effective by students who have a job than those who do not.

While prior studies have explored the role of LLMs in education, limited research has systematically analyzed their impact on Generation Z students in Hungary. This study aims to address this gap by employing a systematic literature review and empirical survey research.

2 MATERIALS AND METHODS

2.1 Systematic Literature Review

A systematic literature review was used to review the literature. This method differs from the traditional review in that it follows a transparent and reproducible process (Mengist et al., 2020). The method helps to properly delineate the topic and avoid the risk of bias and bias in order to increase the quality and reliability of the research (Xiai - Watson, 2019). This systematic literature review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency, reproducibility, and methodological rigor (Liberati et al., 2019). For the exploration, we used Webster - Watson's (2002) method of conducting a systematic literature review in 5 steps, which we summarized for better transparency.

First, we defined the focus of the research, which is the role of ChatGPT and other similar large language models in education. The focus of the exploration does not include the following areas: regulation, feasibility issues (how exactly it could be implemented in specific educational domains). Second, conceptual overview of the topic: we identified the most relevant researches on the topic, which we used to define the keywords for the search: GPT-3, GPT-4, ChatGPT in education, Large Language Models, and LLM, University.

We applied the following filtering criteria to the databases:

- Year: from 2019
- Language: English
- OpenAcces
- Database: A systematic search was conducted using Web of Science Core Collection and Google Scholar to ensure comprehensive coverage of peer-reviewed literature from 2019-2024 onwards.

Studies were included if they examined the role of ChatGPT or other LLMs in education or business contexts, particularly regarding student engagement, effectiveness, or innovation. Studies were excluded if they primarily addressed regulatory aspects, ethical debates, or feasibility studies unrelated to pedagogical or business applications.

Third, a three-stage screening process was applied: (1) initial title and abstract screening, (2) full-text assessment, and (3) quality appraisal based on relevance, methodological rigor, and citation impact.

Inclusion Criteria:

- Relevance to LLMs in Education or Business – Studies that explicitly examine the role, impact, or application of large language models (LLMs) such as ChatGPT in educational settings (e.g., student learning, research productivity, academic integrity) or business environments (e.g., workplace efficiency, entrepreneurship).
- Empirical or Systematic Review Studies – Research articles that employ empirical methods (quantitative, qualitative, or mixed methods) or systematic literature reviews that adhere to a structured methodology (e.g., PRISMA).
- Publication Date and Peer-Review Status – Studies published in peer-reviewed journals or conference proceedings from 2019 onward to ensure the inclusion of recent advancements in LLM research.

Exclusion Criteria:

- Regulatory and Ethical Debates without Empirical Analysis – Papers that focus exclusively on legal, ethical, or philosophical discussions about AI and LLMs without empirical data or systematic analysis.
- Studies on Non-Educational or Non-Business Applications – Research that primarily examines LLMs in unrelated fields (e.g., medical diagnostics, cybersecurity, creative writing) without connections to education or business.
- Low-Quality or Non-Peer-Reviewed Sources – Preprints, opinion pieces, and non-academic sources (e.g., blog posts, news articles) that lack methodological rigor or citation impact.

For step four, the selected studies were systematically categorized based on thematic alignment with the key chapters of this thesis. The initial database search yielded 175 scholarly publications (Google Scholar: 62, Web of Science: 113). Following a rigorous screening process, 111 studies were excluded due to their limited relevance to the research focus, methodological weaknesses, or

the availability of higher-quality studies on the same topic. Consequently, a total of 64 publications were retained for in-depth analysis and synthesis in this study.

In the final stage, the structure of the literature review was refined to ensure coherence and alignment with the research objectives. The selected studies informed the development of thematic sections, which encompass: (1) the conceptual delineation of large language models, (2) the chronological evolution of LLMs, (3) a synthesis of the most prominent LLMs currently available, (4) an analysis of their general applications, (5) their potential impact on education, (6) an evaluation of the advantages and limitations of their use, and (7) a synthesis of key findings and research gaps.

2.2 Questionnaire

A questionnaire survey was conducted between 2023 september - 2024 september as part of the primary research to map the opinions of Generation Z students in Hungary. The data was collected online in a self-completion format, and was completed voluntarily and anonymously. Questions were asked about the use of ChatGPT and other major language models in general and also specifically about the business use of Generation Z students. In total, the questionnaire consisted of three main sets of questions:

1. Part 1: revealed the socio-demographic characteristics of the respondents,
2. Part 2: respondents had to answer questions about the general use, quality and effectiveness of the large language models.
3. Part 3: the last part of the questionnaire focused specifically on business use and its effectiveness.

A key consideration in the selection of the sampling method was the ease of access to the questionnaire and the speed with which it could be completed. The questionnaire was completed by a total of 442 respondents (Appendix A). To complete the questionnaire, the respondent had to be a university student and his/her year of birth had to fall within the Generation Z category (1997-2012). Participants were recruited through a combination of convenience and snowball sampling. Invitations were distributed via university mailing lists and student social media groups to ensure diverse representation across faculties and institutions. The survey instrument was pre-tested with a pilot sample of 30 students to ensure clarity and content validity. Cronbach's alpha was calculated for key Likert-scale items, yielding a reliability coefficient of 0.86, indicating high internal consistency.

The composition of the respondents and the scope of the questionnaire are presented in Appendix A and B.

The data extracted from the primary research was analysed using the following methods:

- Descriptive statistics
- t-test
- Independent samples t-test
- Levene test

3 RESULTS FOR SYSTEMATIC LITERATURE REVIEW

3.1 Aspects of Large Language Models

In the initial phase of our research, we aim to conceptualize large language models (LLMs) through five key dimensions: technical, application-oriented, academic, user, and governmental.

- Technical aspect: LLMs are deep learning-based systems trained on massive datasets to interpret and generate human-like natural language. With billions of parameters optimized during training, they represent a significant advancement in machine learning and NLP, enabling tasks once considered unattainable (Marino et al., 2023).
- Application-oriented aspect: LLMs serve as the core engine behind various services such as chatbots, virtual assistants, content generators, and writing support tools, improving the automation and quality of language-based tasks (Glaser, 2023).
- Academic aspect: LLMs constitute a major field of research in AI, focusing on enhancing language understanding, minimizing algorithmic biases, and leveraging multilingual and multimodal capabilities (Bill et al., 2021).
- User aspect: For users, LLMs function as interactive digital assistants that support a range of tasks—writing, coding, question answering—effectively extending human cognitive capacities (Garg et al., 2023).
- Governmental aspect: Policymakers are increasingly addressing the regulation of LLMs, particularly concerning data security, content moderation, and the mitigation of misuse, such as disinformation campaigns (Li et al., 2023).

A key component of this study is the examination of ChatGPT, a representative of LLMs based on the Generative Pre-trained Transformer (GPT) architecture developed by OpenAI. While ChatGPT is widely used, it is one among several LLMs. GPT refers to a specific deep learning framework, currently in its fourth iteration (GPT-4), which exemplifies the most advanced capabilities of this model family (Gozalo et al., 2023).

3.2 Uses of LLMs

Large language models (LLMs) have emerged as transformative tools across multiple domains, driven by their capacity to generate and interpret human language at a level previously unattainable by earlier computational systems. Among their most prominent applications is the automation of chatbot interactions, where LLMs simulate human dialogue with increasing sophistication—serving not only in customer support but also in technical troubleshooting and digital assistance (Tlili et al., 2023). In the commercial sector, LLMs enable the generation of targeted marketing content and sales messaging by analyzing consumer data, thereby reducing operational costs and improving outreach effectiveness (Dwivedi et al., 2023). These capabilities are underpinned by advancements in Natural Language Processing (NLP), where LLMs enhance performance in tasks such as text summarization, keyword extraction, and semantic analysis (Wang et al., 2023). The integration of LLMs into research workflows marks another significant frontier. When fine-tuned with academic datasets, these models can assist in drafting

publications that align with disciplinary standards in methodology, structure, and style (Cotton et al., 2023). Similarly, their utility in data analysis is evident in the automation of reporting and trend detection in large-scale datasets, offering real-time insights critical for strategic decision-making (Dai et al., 2023). Within software development, models like GPT-3 facilitate code generation from natural language prompts, streamlining programming workflows while also necessitating vigilance regarding the accuracy and security of generated outputs (Ray, 2023).

In the educational sphere, LLMs offer unprecedented opportunities for personalized learning. Their adaptive capabilities support individualized instruction, enabling learners to progress at their own pace while receiving real-time feedback (Pericles, 2023). Instructors benefit through automated assessment tools and AI-supported curriculum design, which can be tailored to student needs and learning trajectories (Lo, 2023). Research shows that LLMs can enhance critical thinking by exposing students to diverse perspectives and encouraging analytical reasoning (Kilinc, 2023; Benuyenah, 2023). Furthermore, they enable student-led inquiry and project-based learning by simplifying access to complex datasets and supporting independent exploration (Cox-Tzoc, 2023; Rasul et al., 2023). Nevertheless, the integration of LLMs into education raises concerns regarding content validity and epistemic reliability. Given that models are trained on internet-based corpora, the risk of reproducing misinformation necessitates critical engagement from both educators and students (Hong, 2023). Despite this, the potential for dynamic learning environments—including digital simulations and emotionally responsive systems—positions LLMs as a cornerstone in the evolution of inclusive and human-centred education (Sun & Hoelscher, 2023; Biswas, 2023; Enkelejda et al., 2023; Ying, 2023). As their adoption deepens, the challenge will be to harness their generative power responsibly, aligning technological innovation with pedagogical integrity.

According to Mehmet's (2023) research, students' perceptions of the use of large language models in universities are as follows:

- Rethinking the role of instructors
- The development of personalised learning
- Rethinking the assessment system
- The development of a new approach to teaching and learning
- Ethical and social considerations
- The evolution of learning and teaching systems
- The future of work and employability
- AI as an extension of the human brain
- The development of human characteristics

According to Lund et al. (2023), large language models (LLMs) offer significant educational advantages, such as streamlined text generation for research proposals and manuscripts, rapid analysis of extensive textual data, effective machine translation of multilingual research materials, automated summarisation of scientific literature, and domain-specific question-answering capabilities. Since their introduction, models like ChatGPT have gained popularity but received mixed evaluations due to perceived benefits and substantial concerns regarding their limitations (Srivastava, 2023).

Supporters argue that LLMs effectively imitate human dialogue (Moqbel et al., 2023) and exhibit multifunctionality, including tasks such as text generation, data processing, complex problem-solving, and creative writing, widely applicable in education, research, healthcare, and business contexts (Pardos & Bhandari, 2023; Gupta et al., 2023; Cao et al., 2023; Mohamadi et al., 2023). These models continuously evolve, promising greater accuracy and reliability (Hosseini & Horbach, 2023; Junyi et al., 2021). Their extensive databases contribute significantly to knowledge dissemination and personalised educational experiences (Kocon et al., 2023; Dwivedi et al., 2023; Jahic et al., 2023). Additionally, LLMs improve workflow efficiency and offer creative support by generating diverse textual content and translations, promoting global communication and collaboration (Hong, 2023; Mijwill et al., 2023; Su & Yang, 2023; Mhlanga, 2023; Moqbel, 2023).

However, the use of generative AI in education presents several critical concerns. These include the lack of genuine human interaction, potentially diminishing educational experiences (Dehouche, 2021), and limited conceptual understanding, as models rely primarily on statistical patterns rather than meaningful comprehension (Wang et al., 2020). Moreover, biases inherent in training datasets may produce unfair outcomes, affecting educational equity (Ray, 2023; Hadi et al., 2023). Further limitations include reduced creativity and originality in responses due to overreliance on previously learned patterns (Chen et al., 2022; Zhai, 2022). LLMs' dependency on data quality significantly impacts their efficacy, with insufficient data limiting performance (Sullivan et al., 2023). Contextual misunderstanding further restricts these models, resulting in inappropriate or irrelevant outputs (Gui et al., 2021). Ethical concerns such as copyright infringement and plagiarism risks also arise when models reproduce verbatim content from their training datasets (Cox & Tzoc, 2023). Excessive reliance on AI-generated content can diminish students' critical thinking and problem-solving abilities, particularly evident in programming and technical education (Rahman & Watanobe, 2023). Evaluating AI-generated texts poses additional challenges due to their increasingly indistinguishable quality from human-generated content, necessitating advanced detection and evaluation tools (Elkins & Chun, 2020; Cotton et al., 2023).

Finally, sustainability and ethical considerations are critical for the long-term adoption of LLMs in education. High computational demands lead to significant energy consumption, necessitating renewable energy-based distributed infrastructure and efficient computational strategies to mitigate environmental impacts (Haque et al., 2022). Transparent model training and rigorous monitoring practices remain essential to ensuring ethically responsible and sustainable integration into educational environments.

4 RESULTS OF THE QUESTIONARE

We conducted a quantitative questionnaire survey (see Appendix B for full questionnaire), constructed based on our hypotheses to thoroughly investigate the role of major language models within higher education contexts. Our target population comprised Generation Z undergraduates, born between 1997 and 2012; however, the survey specifically targeted respondents born from 1997 to 2005. Altogether, 442 students from 17 Hungarian universities participated, representing approximately 0.16% of the total Hungarian student population of 280,000 (Tempus, 2023). Although the sample cannot be considered statistically representative, we argue that the findings

Table 1: Relationship between questions and hypotheses

Hypotesis	Number of question
H1	9,10,11,12
H1/a	2,9,10,11,12
H2	17
H2/a	18,19,20,21,22,23
H2/b	4,9,10,11,12

reflect broader student perceptions. Institutions were categorized geographically into two main groups: Budapest region universities (23% of respondents; BME, CORVINUS, ELTE, MATE, NKE, BGE, PPKE, SE, OE) and rural universities (77%; DE, SZTE, SZE, PTE, PE, KJE, ME, EKKE). Demographic details of the respondents are provided in Appendix A. The distribution of participants by academic year was as follows: first-year students comprised the largest group at 35.3% (156 respondents), second-year students represented 27.6% (122 respondents), third-year students accounted for 21.7% (96 respondents), fourth-year students constituted 12.7% (56 respondents), and fifth-year students formed the smallest proportion at 2.7% (12 respondents). Regarding employment and entrepreneurship status, the survey indicated that 35.3% of the respondents were employed, whereas 64.7% were unemployed. Entrepreneurial activity among participants was notably limited, with only 4.5% reporting self-employment, while 95.5% did not engage in entrepreneurial activities.

The research questions of the questionnaire were formulated according to the following hypotheses:

- H1: Undergraduates will conduct research and project-based learning activities at university more efficiently and effectively with the help of LLMs.

Sub-hypothesis:

- H1/a: Undergraduates studying in the Budapest region use LLMs to conduct research and project-based learning activities at university more efficiently and effectively than those studying in rural universities.
- H2: The use of LLMs promotes the development of new business models and innovative solutions and stimulates entrepreneurial thinking among university students.

Sub-hypotheses:

- H2/a: The use of LLMs promotes the development of new business models and innovative solutions and stimulates entrepreneurial thinking among students who use them for business purposes.
- H2/b The use of LLMs is perceived as more effective by students who have a job than those who do not.

We included additional items beyond hypothesis testing and socio-demographic variables to explore future-oriented perspectives, detailed in questions 6–8, 13–16, and 24–25. Hypothesis testing outcomes, based on Table 10, are presented later in this chapter. Our findings confirmed ChatGPT's market dominance among the studied language models, as it was recognized by 95.9% of respondents, significantly ahead of DeepL Ai (34.4%), Jasper.Ai (8.1%), Copilot (6.3%), and Google's Gemini (2.7%). Notably, only 1% were familiar with Bing Ai or reported no familiarity with language models. Despite considerable media attention, a noteworthy minority (4.1%) had not encountered ChatGPT, a somewhat surprising outcome.

Regarding frequency of use, 49% of participants reported minimal or no experience with large language models, whereas 51% indicated varying degrees of regular engagement, including daily (3%), multiple weekly (12%), weekly (13%), or monthly (23%) usage. On a Likert scale assessing frequency from "very rarely" (1) to "very often" (5), respondents predominantly marked infrequent usage (32.6% rated as 1, and 29.9% as 2), while active or frequent users constituted smaller proportions (14.5% rated 4, 11.5% rated 5). We further assessed satisfaction levels toward these language models' services and content. The majority (38.5%) indicated a positive satisfaction rating (4 on a 5-point scale), while only 6.8% reported complete satisfaction (5), and 31.7% maintained a neutral stance (3). Conversely, dissatisfaction ratings (1–2) accounted for 23% of responses.

Respondents also detailed their specific use cases: predominant applications were translation (192 respondents), thesis writing and literature searches (each 184), followed by self-development (102) and language learning (92). Remarkably, 102 participants reported not engaging with language models at all. In business or workplace contexts, very few (5%) foresaw no application, while major anticipated areas included data processing (238 respondents), content production (194), and automation or coding tasks (188), indicating significant potential for language models among Hungarian Generation Z students in professional settings.

As we mentioned earlier, in addition to the questions for the hypothesis testing, we also formulated questions related to further research and the conclusions and vision for the future. The survey also addressed the perceptions of Generation Z students on the impact of the use of large language models on their thinking and learning processes. 61.5% of the respondents said that it had no negative impact on them, while 38.5% disagreed. This is not a unanimous response, so further research in this area may be worthwhile.

The survey also looked at what respondents think about the strict regulation and prohibition of this technology in universities. 76% of the respondents disagree with strict regulation and prohibition, while 24% of the respondents would subject large language models to strict regulation or possibly prohibition. Here the response rates have changed in a different direction, in our opinion there is a correlation between regulation and prohibition as well as the bad impact on university students.

On the contrary, 2/3 of the respondents would not change the current situation, which suggests that these technologies will have to be adopted in universities sooner or later, in the hope that students will use them to increase their efficiency and knowledge. To test our hypotheses, we used the statistical software IBM SPSS. Our questionnaire data were tested using a t-test, independent samples t-test, and Levene's test. Our first hypothesis is that undergraduates will be more effective and efficient in carrying out research and project-based learning activities at university with the help of LLMs. For testing, we used questions 9,10,11 and 12 and ran a simple t-test in SPSS. The results were as follows.

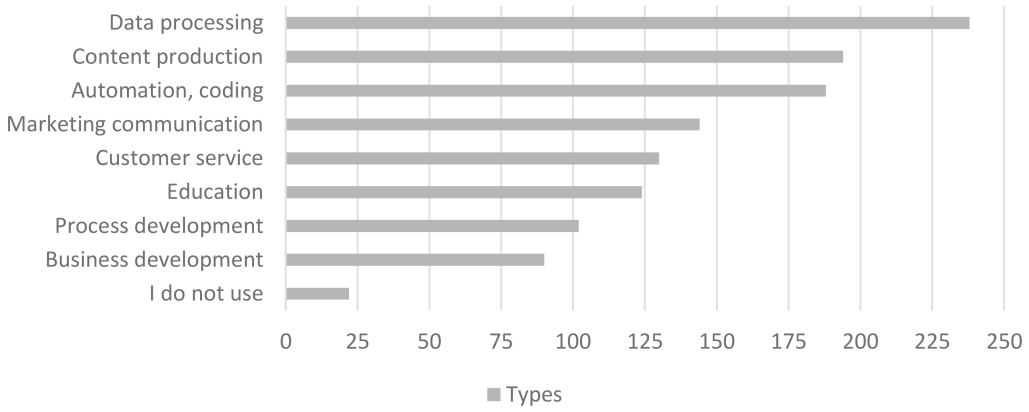


Figure 1: Work and business based use cases according to respondents' views (N=442)

Table 2: T-test statistical datas (N=442)

	N	Mean	Std. Deviation	Std. Error Mean
9. question	442	3,226	1.0620	,0505
10. question	442	2,756	1.2396	,0590
11. question	442	2,914	1.2802	,0609
12. question	442	3,086	1.3458	,0640

Table 3: T-test (N=442)

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
9. question	4,479	441	,000	,2262	,127	,326
10. question	-4,144	441	,000	-,2443	-,360	-,128
11. question	-1,412	441	,159	-,0860	-,206	,034
12. question	1,343	441	,180	,0860	-,040	,212

The analysis was conducted at a 5% significance level, with an expected neutral mean value of 3 on a Likert scale ranging from 1 (lowest) to 5 (highest). To support our primary hypothesis, mean values significantly above 3 were required across the four relevant survey items. Statistical results indicated significant deviations from neutrality only in questions 9 ($t = 4.479$, $p = 0.000$, positive deviation) and 10 ($t = -4.144$, $p = 0.000$, negative deviation). Consequently, we reject our primary hypothesis, concluding that respondents generally do not perceive large language models as significantly enhancing the effectiveness of their university research and project-based learning activities.

We formulated a sub-hypothesis to investigate potential regional differences, hypothesizing that undergraduates studying in the Budapest region utilize large language models more effectively than their counterparts in rural universities. To test variance equality between these two groups, we employed Levene's test at the same significance level (5%), performed using IBM SPSS (Mitev & Sajtos, 2007).

The survey analysis encompassed 442 respondents categorized into two geographical groups: Budapest region and rural region. To evaluate the sub-hypothesis, we applied the same questionnaire items (9–12) as previously employed. While the overall data reaffirm the rejection of the primary hypothesis, notable regional discrepancies emerged, indicating higher average scores among Budapest-based respondents (see Appendix C for independent samples test results).

The second hypothesis examined whether the use of large language models promotes entrepreneurial thinking and facilitates innovation in business contexts. This hypothesis was specifically tested through survey item 17, which assessed students' perceptions regarding the impact of large language model usage on their business-related creativity. A T-test at a 5% significance level was conducted using IBM SPSS to evaluate this hypothesis.

The results indicated a significant deviation from neutrality ($t = -6.758$, $p = 0.000$), with responses evaluated on a Likert scale from 1 (not stimulated) through 3 (neutral) to 5 (highly stimulated),

Table 4: Group statistics (N=442)

	Region	N	Mean	Std. Deviation	Std. Error Mean
9. question	Bud	98	3,347	,9643	,0974
	Rural	344	3,192	1,0871	,0586
10. question	Bud	98	2,959	1,1299	,1141
	Rural	344	2,698	1,2646	,0682
11. question	Bud	98	3,122	1,1777	,1190
	Rural	344	2,855	1,3034	,0703
12. question	Bud	98	3,286	1,3316	,1345
	Rural	344	3,029	1,3463	,0726

Table 5: T-test statistics (N=442)

	N	Mean	Std. Deviation	Std. Error Mean
17. question	442	2,606	1,2247	,0583

Table 6: T-test (N=442)

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
17. question	-6,758	441	,000	-,3937	-,508	-,279

Table 7: T-test statistics (N=442)

	N	Mean	Std. Deviation	Std. Error Mean
19. question	70	3,559	1,0979	,1331
20. question	70	3,353	1,0895	,1321
23. question	70	3,471	1,0144	,1230

and the test value set at 3. Due to the observed negative deviation, hypothesis H2—asserting that large language models stimulate business creativity among Generation Z students—was rejected. Subsequently, we explored sub-hypothesis H2/a, targeting respondents who had explicitly reported developing new entrepreneurial or workplace ideas through language model usage (question 18). Of the original sample (N=442), 16% (n=70) met this criterion, and additional related questions were directed exclusively toward this subgroup. To evaluate sub-hypothesis H2/a—proposing that the use of LLMs fosters entrepreneurial thinking specifically among students applying them in business contexts—a T-test was conducted at a 5% significance level, utilizing responses to three relevant supplementary questions. The remaining two questions' outcomes are presented subsequently in the context of hypothesis H2/b.

The statistical analysis revealed significant positive differences (Q19: t=4.197, p=0.000; Q20: t=2.671, p=0.009; Q23: t=3.826, p=0.000) compared to the neutral midpoint of 3 on a five-point Likert scale. Consequently, hypothesis H2/a was accepted, confirming that the application of large language models (LLMs) indeed fosters entrepreneurial thinking and supports the creation of innovative business models among students who actively use these tools in business contexts.

Furthermore, additional insights were gathered from this subgroup (n=70). Specifically, 30% of these respondents intend to launch a business based on entrepreneurial concepts inspired by LLMs, representing 4.75% of the entire sample (N=442). Additionally, 64% of the subgroup affirmed that engagement with LLMs enhanced their business-related creativity, corresponding to approximately 10.2% of the total surveyed population. We assessed sub-hypothesis H2/b, exploring perceived effectiveness differences between employed and unemployed students regarding LLM utilization. The analysis involved the complete sample (N=442) and utilized Levene's test at a 5% significance level (IBM SPSS), applying the same survey items (Q10–12) used previously in the primary hypothesis assessment.

The analysis revealed significant differences between employed and unemployed student groups regarding their perception of large language model (LLM) effectiveness (Question 10: $t = 2.268$, $p = 0.024$; Question 11: $t = 3.094$, $p = 0.002$; Question 12: $t = 2.123$,

Table 8: T-test (N=442)

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
19. question	4,197	69	,000	,5588	,293	,825
20. question	2,671	69	,009	,3529	,089	,617
23. question	3,826	69	,000	,4706	,225	,716

Table 9: Group statistics (N=442)

	Van munkahelye	N	Mean	Std. Deviation	Std. Error Mean
10. question	Yes	156	2,936	1,2785	,1024
	No	286	2,657	1,2088	,0715
11. question	Yes	156	3,167	1,3384	,1072
	No	286	2,776	1,2279	,0726
12. question	Yes	156	3,269	1,3695	,1096
	No	286	2,986	1,3245	,0783

Table 10: Hypothesis and results

Hypothesis	Method	Result
H1: LLMs help students to carry out research and project-based learning activities at university more efficiently and effectively.	t-test	Not supported
H1/a: Students studying in the Budapest region use LLMs to carry out research and project-based learning activities at university more efficiently and effectively than those studying at rural universities.	Levene-test	Not supported
H2: The use of LLMs promotes the development of new business models and innovative solutions and stimulates entrepreneurial thinking among students.	t-test	Not supported
H2/a: The use of LLMs promotes the development of new business models and innovative solutions, and stimulates entrepreneurial thinking among students who use them for business purposes.	t-test	Supported
H2/b: The use of LLMs is considered to be more effective for students who have a job than for those who do not.	Levene-test	Supported

p = 0.034), as confirmed by Levene's test (see Appendix D). Consequently, sub-hypothesis H2/b was accepted, indicating that employed students perceive and utilize LLMs more effectively than their unemployed counterparts.

In conclusion, responses to the statement about the negative impact of LLMs on creativity, learning, and critical thinking were notably divided: 58.6% disagreed, whereas 41.4% agreed. This nearly balanced result highlights the complexity and ambiguity surrounding perceptions of LLMs' influence on cognitive development, underscoring the necessity of further research (particularly related to questions 15 and 16) to explore the underlying reasons for these divergent opinions.

Contrary to findings from Firat (2023), where ChatGPT was linked to increased academic efficiency, our results indicate a more neutral impact among Hungarian university students. This suggests that factors such as digital literacy, institutional support, and discipline-specific applicability may moderate LLM adoption effects.

5 CONCLUSIONS

Through a systematic literature review, this research successfully conceptualized ChatGPT and other large language models (LLMs), identifying their primary application areas and exploring their educational roles. Given the rapidly evolving nature of this field, periodic reviews are advisable to track shifts in scholarly perspectives, especially regarding usability and associated risks. Following the secondary research, primary data was collected via a questionnaire involving 442 Generation Z university students. The majority of respondents were first- and second-year students, with 35.3% employed and 4.5% managing their own businesses—highlighting significant employment engagement among this demographic, warranting future exploration. ChatGPT emerged as the most widely recognized LLM; however, nearly half of the respondents (49%) reported minimal or no usage. This unexpectedly low adoption rate may reflect the respondents' academic stages, suggesting that upper-year students, particularly those undertaking theses, might exhibit higher engagement. Primary application areas identified included translation, literature search, and thesis writing. For workplace applications, data processing, content generation, and automation

ranked highest, likely reflecting a motivation among employed students to optimize productivity.

Two main hypotheses were formulated based on existing literature. Firat (2023) posited that ChatGPT enhances academic efficiency, leading to the hypothesis (H1) that undergraduates would use LLMs to improve their research and project-based learning. Similarly, Vrontis et al. (2023) indicated that LLMs could drive innovation and entrepreneurial thinking, prompting the second hypothesis (H2) regarding LLMs' role in fostering business innovation among students. Surprisingly, neither hypothesis was supported by empirical findings, contradicting prior literature. This discrepancy suggests that either the original studies' conditions were unique or that the present sample lacked representativeness. Although respondents generally valued LLMs, perceived benefits in academic and entrepreneurial activities were limited. Nonetheless, notable minorities reported increased creativity (10.2%) and entrepreneurial initiative (4.75%), warranting further research. Sub-hypotheses explored deeper demographic and usage patterns. H1/a tested regional differences (Budapest vs. rural) through Levene's test, revealing no significant variance. H2/a, focusing on respondents using LLMs specifically for business, found significant positive perceptions using a T-test, indicating greater efficacy in business contexts compared to general academic use. H2/b, comparing employed versus unemployed students using Levene's test, also identified a significant perception of increased effectiveness among employed users.

The unexpected rejection of both hypotheses may be attributed to contextual and sample-specific factors. The predominance of early-year students with limited academic or entrepreneurial experience could have constrained the perceived relevance and utility of LLMs in these domains. Furthermore, a potential lag between technological capability and user adaptation may explain the discrepancy between the widely acknowledged benefits of LLMs and their underutilization in practice.

Based on these findings, several recommendations emerge:

1. Adoption of LLMs: Institutions should systematically integrate LLMs across disciplines, incorporating AI literacy to enhance educational and research outcomes.
2. Ethical Considerations: The use of LLM-generated content should not be equated with plagiarism but viewed as a supportive tool, given the likelihood of substantial human refinement prior to dissemination.
3. Continued Research: Given the potential identified, ongoing and expanded research into the evolving capabilities and impacts of LLMs remains essential.
4. Future Directions: Combining LLMs with deep learning and automated machine learning represents a promising area, underscoring the need for continuous monitoring of advancements to maximize educational and professional benefits.

AUTHOR CONTRIBUTIONS

Conceptualization, N.P. and N.A; methodology, N.P.; validation, N.P. and N.A and NTB.; formal analysis, N.P. and N.A; investigation, N.A.; resources, N.P. and N.A.; data curation, N.P. and N.A.; writing—original draft preparation, N.P. and N.A.; writing—review and editing, N.P. and N.A and NTB.; supervision, N.A and NTB. All authors have read and agreed to the published version of the manuscript.

FUNDING

This research received no external funding.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

References

[1] Atlas, S. (2023): ChatGPT for higher education and professional development: A guide to conversational AI. Retrieved March 12, 2023, from https://digitalcommons.uri.edu/cba_facpubs/548/
[2] Baidoo-Anu D., Owusu A., Leticia (2023): Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT in Promoting Teaching and Learning Available at SSRN: https://ssrn.com/abstract$=$4337484 or http://dx.doi.org/10.2139/ssrn.4337484
[3] Benuyenah, V. (2023): Commentary: ChatGPT use in higher education assessment: Prospects and epistemic threats. Journal of Research in Innovative Teaching & Learning, 16(1), 134-135. https://doi.org/10.1108/JRIT-03-2023-097.
[4] Bill C, Mary K, and Duane S. (2021): Artificial intelligence for education: Knowledge and its assessment in ai-enabled learning ecologies. Educational Philosophy and Theory, 53(12):1229–1245
[5] Biswas, S. (2023): Role of Chat GPT in Education Available at SSRN: https://ssrn.com/abstract$=$4369981
[6] Brown, T. B., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., Amodei, D. (2020): Language Models are Few-Shot Learners. Retrieved March 15, 2023, from https://arxiv.org/abs/2005.14165
[7] Cao, Y., Li, S., Liu, Y., Yan, Z., Dai, Y., Yu, P. S., & Sun, L. (2023): A comprehensive survey of ai-generated content (aigc): A history of generative ai from gan to chatgpt. arXiv preprint arXiv:2303.04226.
[8] Chen, J., Guo, H., Yi, K., Li, B., and Elhoseiny, M. (2022): Visualgpt: Data-efficient adaptation of pretrained language models for image captioning
[9] Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2023): Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. Innovations in Education and Teaching International, 1-12.
[10] Cox, C., & Tzoc, E. (2023): ChatGPT: Implications for academic libraries. College & Research Libraries News, 84(3), 99. https://doi.org/10.5860/crln.84.3.99.
[11] Dai, H.; Liu, Z.; Liao, W.; Huang, X.; Wu, Z.; Zhao, L.; Liu, W.; Liu, N.; Li, S.; Zhu, D. (2023): ChatAug: Leveraging ChatGPT for Text Data Augmentation. arXiv preprint arXiv:2302.13007
[12] Dehouche, N. (2021): Plagiarism in the age of massive Generative Pre-trained Transformers (GPT-3). Ethics in Science and Environmental Politics, 21, 17-23.
[13] Dimock, M. (2019): Defining generations: Where Millennials end and Generation Z begins. Pew Research Center, 17(1), 1-7.
[14] Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., & Albanna, H. (2023): "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. International Journal of Information Management, 71, 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642.
[15] Elkins, K., & Chun, J. (2020): Can GPT-3 pass a writer's Turing test?. Journal of Cultural Analytics, 5(2).
[16] Enkelejda K., Kathrin S., Stefan K., Maria B., Daryna D., Frank F., Urs G., Georg G., Stephan G., Eyke H., Stephan K., Gitta K., Tilman M., Claudia N., Jürgen P., Oleksandra P., Michael S., Albrecht S., Tina S., Matthias S., Jochen W., Jochen K., Gjergji K., (2023). ChatGPT for good? On opportunities and challenges of large language models for education, Learning and Individual Differences, Volume 103, 102274, ISSN 1041-6080, https://doi.org/10.1016/j.lindif.2023.102274.
[17] Firaina, R., Sulisworo, D. (2023): Exploring the usage of ChatGPT in higher education: Frequency and impact on productivity. Buletin Edukasi Indonesia, 2(01), 39–46. https://doi.org/10.56741/bei.v2i01.310.
[18] Firat, Mehmet. (2023): "What ChatGPT means for universities: Perceptions of scholars and students." Journal of Applied Learning and Teaching 6.1
[19] Garg, R. K., Urs, V. L., Agrawal, A. A., Chaudhary, S. K., Paliwal, V., & Kar, S. K. (2023): Exploring the Role of Chat GPT in patient care (diagnosis and Treatment) and medical research: A Systematic Review. medRxiv,
[20] Glaser, N. (2023): Exploring the Potential of ChatGPT as an Educational Technology: An Emerging Technology Report. Technology, Knowledge and Learning, 1-8.
[21] Gozalo-Brizuela, R., & Garrido-Merchán, E. C. (2023): A survey of Generative AI Applications. arXiv preprint arXiv:2306.02781.

[22] Gui, J., Sun, Z., Wen, Y., Tao, D., & Ye, J. (2021): A review on generative adversarial networks: Algorithms, theory, and applications. IEEE Transactions on Knowledge and Data Engineering. doi: 10.1109/TKDE.2021.3130191.
[23] Gupta, B. Mufti, T. Sohail, S.S. Madsen, D.Ø. (2023): ChatGPT: A Brief Narrative Review . Preprints, 2023040158. https://doi.org/10.20944/preprints202304.0158.v1
[24] Hadi, M. U., Qureshi, R., Shah, A., Irfan, M., Zafar, A., Shaikh, M. B., Mirjalili, S. (2023): A Survey on Large Language Models: Applications, Challenges, Limitations, and Practical Usage. TechRxiv. https://doi.org/10.36227/techrxiv.23589741.v1
[25] Haque, M.U. Dharmadasa, I. Sworna, Z.T. Rajapakse, R.N. Ahmad, H. (2022):" I think this is the most disruptive technology": Exploring Sentiments of ChatGPT Early Adopters using Twitter Data. arXiv preprint arXiv:2212.05856
[26] Hobert, S. (2019): How are you, chatbot? Evaluating chatbots in educational settings – Results of a Literature Review. In Gesellschaft für Informatik e.V. (Ed.), DELFI 2019 (pp. 259–270). Bonn.
[27] Hong, W. C. H. (2023): The impact of ChatGPT on foreign language teaching and learning: Opportunities in education and research. Journal of Educational Technology and Innovation, 5(1), 37-45. https://jeti.thewsu.org/index.php/cieti/article/view/103.
[28] Hosseini, M., Horbach, S.P. (2023): Fighting reviewer fatigue or amplifying bias? Considerations and recommendations for use of ChatGPT and other Large Language Models in scholarly peer review.
[29] Jahic, I., Ebner, M., Schön, S. (2023): Harnessing the power of artificial intelligence and ChatGPT in education–a first rapid literature review. Proceedings of EdMedia+ Innovate Learning 2023, 1462-1470.
[30] Junyi L., Tianyi T., Wayne X. Z., Ji-Rong W. (2021): Pretrained language models for text generation: A survey. arXiv preprint arXiv:2105.10311
[31] Khalil, M., Er, E. (2023): Will ChatGPT get you caught? Rethinking of plagiarism detection. Retrieved March 15, 2023, from https://arxiv.org/abs/2302.04335
[32] Kilinç, S. (2023): Embracing the future of distance science education: Opportunities and challenges of ChatGPT integration. Asian Journal of Distance Education, 18(1), 205-237. c http://www.asianjde.com/ojs/index.php/AsianJDE/article/view/721
[33] Kocoń, J., Cichecki, I., Kaszyca, O., Kochanek, M., Szydło, D., Baran, J., Bielaniewicz, J., Gruza, M., Janz, A., Kanclerz, K. (2023): ChatGPT: Jack of all trades, master of none. arXiv preprint arXiv:2302.10724
[34] Li, L., Ma, Z., Fan, L., Lee, S., Yu, H., & Hemphill, L. (2023): ChatGPT in education: A discourse analysis of worries and concerns on social media. arXiv preprint arXiv:2305.02201.
[35] Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C.,6, Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Mohe, D. (2009): The PRISMA statement for reporting systematic reviews & meta-analyses of studies that evaluate healthcare interventions: explanation & elaboration. BMJ, 339. https://www.bmj.com/content/339/bmj.b2700
[36] Lo, C. K. (2023): What is the impact of ChatGPT on education? A rapid review of the literature. Education Sciences, 13(4), 410. https://doi.org/10.3390/educsci13040410.
[37] Lund, B. D., Wang, T. (2023): Chatting about ChatGPT: How may AI and GPT impact academia and libraries? Library Hi Tech News. , Available at SSRN: https://ssrn.com/abstract$=$4333415 or http://dx.doi.org/10.2139/ssrn.4333415
[38] Lund, B.D., Wang, T., Mannuru, N.R., Nie, B., Shimray, S., Wang, Z., (2023): ChatGPT and a new academic reality: Artificial Intelligence-written research papers and the ethics of the large language models in scholarly publishing Volume74 Issue5 Page570-581 DOI10.1002/asi.24750
[39] Marino, M. T., Vasquez, E., Dieker, L., Basham, J., & Blackorby, J. (2023): The Future of Artificial Intelligence in Special Education Technology. Journal of Special Education Technology, 01626434231165977.
[40] Mehmet F. (2023): What ChatGPT means for universities: Perceptions of scholars and student, RESEARCH ARTICLES Vol. 6 No. 1. https://journals.sfu.ca/jalt/index.php/jalt/article/view/769
[41] Mengist, W., Soromessa, T., Legese, G. (2020): Method for conducting systematic literature review and me¬ta-analysis for environmental science research. Met¬hodsX, 7, 100777.
[42] Mhlanga, D. (2023) Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning. SSRN: 4354422. http://dx.doi.org/10.2139/ssrn.4354422
[43] Mijwil, M. M., Hiran, K. K., Doshi, R., Dadhich, M., Al-Mistarehi, A. H., Bala, I. (2023): ChatGPT and the future of academic integrity in the artificial intelligence era: A new frontier. Al-Salam Journal for Engineering and Technology, 2(2), 116-127. https://doi.org/10.55145/ajest.2023.02.02.015
[44] Mitev A. - Sajtos L. (2007): SPSS kutatási és adatelemzési kézikönyv Alinea Kiadó, ISBN: 978-963-9659-08-7.
[45] Mohamadi, S., Mujtaba, G., Le, N., Doretto, G., & Adjeroh, D. A. (2023): ChatGPT in the Age of Generative AI and Large Language Models: A Concise Survey. arXiv preprint arXiv:2307.04251.
[46] Moqbel, M. S. S., Al-Kadi, A. M. T. (2023): Foreign language learning assessment in the age of ChatGPT: A theoretical account. Journal of English Studies in Arabia Felix, 2(1), 71-84. https://doi.org/10.56540/jesaf.v2i1.62.
[47] Pardos, Z.A.; Bhandari, S. (2023): Learning gain differences between ChatGPT and human tutor generated algebra hints. arXiv preprint arXiv:2302.06871
[48] Pericles R. (2023): Artificial intelligence in teaching and learning: what questions should we ask of ChatGPT?, Interactive Learning Environments, 31:1, 1-3, DOI: 10.1080/10494820.2023.2180191
[49] Pinto G., Cardoso-Pereira I., Monteiro Ribeiro D., Lucena D., Alberto de S., Kiev G. (2023): Large Language Models for Education: Grading Open-Ended Questions Using ChatGPT, SBES EDU Track https://doi.org/10.48550/arXiv.2307.16696
[50] Rahman M.M., Watanobe Y. (2023): ChatGPT for Education and Research: Opportunities, Threats, and Strategies. Applied Sciences. 13(9):5783. https://doi.org/10.3390/app13095783
[51] Rasul, T., Nair, S., Kalendra, D., Robin, M., de Oliveira Santini, F., Ladeira, W. J., Sun, M., Day, I., Rather, R. A., Heathcote, L. (2023): The role of ChatGPT in higher education: Benefits, challenges, and future research directions. Journal of Applied Learning & Teaching, 6(1), 41-56. https://doi.org/10.37074/jalt.2023.6.1.29.
[52] Ray, P. P. (2023): ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope. Internet of Things and Cyber-Physical Systems, 3, 121-154. https://doi.org/10.1016/j.iotcps.2023.04.003.
[53] Rudolph, J., Tan, S., Tan, S. (2023): ChatGPT: Bullshit spewer or the end of traditional assessments in higher education?. Journal of Applied Learning & Teaching, 6(1), 342-363. https://doi.org/10.37074/jalt.2023.6.1.9.
[54] Shahriar, S., Kadhim H. (2023): Let's have a chat! A Conversation with ChatGPT: Technology, Applications, and Limitations. arXiv preprint arXiv:2302.13817
[55] Srivastava, M. (2023): A Day in the Life of ChatGPT as a researcher: Sustainable and Efficient Machine Learning- A Review of Sparsity Techniques and Future Research Directions.
[56] Su , J., & Yang, W. (2023): Unlocking the Power of ChatGPT: A Framework for Applying Generative AI in Education. ECNU Review of Education, 6(3), 355–366. https://doi.org/10.1177/20965311231168423
[57] Sullivan, M., Kelly, A., & McLaughlan, P. (2023): ChatGPT in higher education: Considerations for academic integrity and student learning. Journal of Applied Learning & Teaching, 6(1), 31-40. https://doi.org/10.37074/jalt.2023.6.1.17.
[58] Sun, G. H., Hoelscher, S. H. (2023): The ChatGPT storm and what faculty can do. Nurse Educator, 48(3), 119-124. https://doi.org/10.1097/NNE.0000000000001390.
[59] Susnjak, T. (2022): ChatGPT: The end of online exam integrity?. arXiv preprint arXiv:2212.09292.
[60] Tempus Közalapítvány (2023): https://tka.hu/nemzetkozi/9518/a-felsooktatas-rendszere-magyarorszagon accessed: 2023.11.10.
[61] Teubner, T., Flath, C.M., Weinhardt, C. (2023): Welcome to the Era of ChatGPT *et al.*. Bus Inf Syst Eng 65, 95–101 (2023). https://doi.org/10.1007/s12599-023-00795-x
[62] Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., Agyemang, B. (2023): What if the devil is our guardian angel: ChatGPT as a case study of using chatbots in education. Smart Learning Environments, 10(1), 15. https://doi.org/10.1186/s40561-023-00237-x
[63] Vrontis D, Chaudhuri R, Chatterjee S. (2023): Role of ChatGPT and Skilled Workers for Business Sustainability: Leadership Motivation as the Moderator. Sustainability. 15(16):12196. https://doi.org/10.3390/su151612196
[64] Wang, J.; Hu, X.; Hou, W.; Chen, H.; Zheng, R.; Wang, Y.; Yang, L.; Huang, H.; Ye, W.; Geng, X. (2023): On the Robustness of ChatGPT: An Adversarial and Out-of-distribution Perspective. arXiv preprint arXiv:2302.12095
[65] Wang, W., Chen, Y., & Heffernan, N. (2020): A generative model-based tutoring system for math word problems. arXiv preprint arXiv:2010.04.
[66] Webster, J., Watson, R. T. (2002): Analyzing the Past to Prepare for the Future: Writing a Literature Review. MIS Quarterly, 26(2), xiii–xxiii.
[67] Xiao, Y., Watson, M. (2019): Guidance on Conducting a Systematic Literature Review. Journal of Planning Education & Research, 39(1), 93–112. https://doi.org/10.1177/0739456X17723971
[68] Yong Z. (2023): ChatGPT for Teaching and Learning: An Experience from Data Science Education. In The 23rd Annual Conference on Information Technology Education (SIGITE '23), October 11–14, 2023, Marietta, GA, USA. ACM, New York, NY, USA, 10 pages. https://doi.org/10.1145/3585059.3611431
[69] Zhai, X. (2022): ChatGPT User experience: Implications for education. (December 27, 2022). Available at SSRN: https://ssrn.com/abstract$=$4312418 or http://dx.doi.org/10.2139/ssrn.4312418.

Appendix A

Number and distribution of responders

A Appendix B

1. What year were you born?

1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005 2. Which university are you a student at? 3. What year are you a student?

Distribution of respondents by year of birth	Responds	%
1997	20	4,5%
1998	26	5,9%
1999	32	7,2%
2000	28	6,3%
2001	80	18,1%
2002	64	14,5%
2003	82	18,6%
2004	88	19,9%
2005	22	5%
Distribution of respondents by region	Responds	%
Budapest region	100	22,6%
Rural region	342	77,4%
Distribution of respondents by faculty	Responds	%
Humanities	56	12,7%
Economics	158	35,7%
Information Technology	22	4,9%
Legal	32	7,2%
Agriculture	36	8,1%
Engineering	36	8,1%
Medical	38	8,6%
Pedagogical	36	8,1%
Law	8	1,8%
Natural Sciences	20	4,5%
Distribution of respondents by year of class	Responds	%
First	156	35,3
Second	122	27,6%
Third	96	21,7%
Fourth	56	12,7%
Fifth	12	2,7%
Distribution of respondents by job	Responds	%
Have job	156	35,3
Do not have job	286	64,7
Distribution of respondents by own company	Responds	%
Have own company	20	4,5%
Do not have own company	422	95,5%
Distribution of respondents by frequency of use of language models	Responds	%
Daily	14	3,2%
Several times a week	54	12,2%
Once a week	56	12,7%
Monthly	100	22,6%
I have tried it once	122	27,6%
I do not use	96	21,7%

1, 2, 3, 4, 5 4. Do you have a job? Yes, No 5. Do you own your own business? Yes, No 6. How often do you use Large Language Models in general? Answer one of the following. Daily, Several times a week, Once a week, Once a month, I have tried it once, I don't use it, Other: 7. Which Large Language Models do you know? Choose the ones you have heard of or use. Chat GPT, Gemini AI, Copilot, DeepLAI, Jasper.AI, Other: 8. How often do you use a Large Language Model in your research or learning activities? Tick the appropriate box to indicate your answer. Never 1-5 Very Often 9. How would you rate the effectiveness of the Large Language Models in your research and project-based learning activities? Tick the appropriate box to indicate your answer. Very low effectiveness 1-5 Very high effectiveness 10. Has the use of the Large Language Models improved your research and project-based learning outcomes at university? Tick the appropriate box to indicate your answer. Not at all improved 1-5 Very significantly improved 11. How much do you feel that the learning process using the Large Language Models makes your progress at university more effective? Tick the appropriate box to indicate your answer. Does not make it more effective at all 1-5 Makes it very effective 12. Has the use of the Large Language Models significantly accelerated the research work you have done during your studies? Tick the appropriate box to indicate your answer. Did not speed it up at all 1-5 Very significantly speeded it up 13. How satisfied are you with the services and

content provided by the Large Language Models? Tick the appropriate box to indicate your answer. I am not satisfied at all 1-5 I am very satisfied 14. In your studies, for what kind of projects or tasks do you use the Large Language Models? Select the appropriate answer(s). You can tick more than one. Literature search, Submission, Writing a thesis or dissertation, Making presentations, Language learning, Translation, Self-development, Other: 15. Do you agree with the following statement? The use of Large Language Models for various tasks and projects at university has a negative impact on the thinking and learning process of students. Agree, Disagree 16. Do you agree with the following statement? ChatGPT and similar language model applications should be strictly regulated and banned in universities. Agree, Disagree 17. To what extent do you feel that the use of the Large Language Models) has stimulated your creative thinking in business? Tick the appropriate box to indicate your answer. Not at all stimulated 1-5 Very stimulated 18. Did using any of the Large Language Models give you new ideas for business or work? Tick the appropriate box to indicate your answer. Yes, No 19. If your answer to question 18 is yes: To what extent do you feel that your entrepreneurial ideas supported by the Large Language Models are innovative and novel? Tick the appropriate box to indicate your answer.

Not innovative at all 1-5 Very innovative 20. If your answer to question 18 is yes: How do you rate the effectiveness of the use of the Large Language Models in developing new business models? Tick the appropriate box to indicate your answer. Very low effectiveness 1-5 Very high effectiveness 21. If your answer to question 18 is yes: Do you plan to start a business in the future based on the entrepreneurial ideas you have generated using the Large Language Models? Tick the appropriate box to indicate your answer. Yes, No, I already have a business 22. If your answer to question 18 is yes: Do you have a business plan based on the Large Language Models? Have you noticed that working with large scale models makes it easier for you to come up with creative ideas in business? Tick the appropriate box to indicate your answer. Yes, No 23. If your answer to question 18 is yes: To what extent do you feel that your thinking supported by the Large Language Models can contribute to your success in the business world/workplace? Tick the appropriate box to indicate your answer.

Not at all contributes 1-5 Very much contributes 24. In what areas would you use the Large Language Models in your own business or workplace projects? You can tick more than one. Content production, Customer service, Data processing, Automation, coding, Marketing communication, Education, Business development, Process development, Other: 25. Do you agree with the following statement? The use of Large Language Models for various tasks and projects in everyday life has a negative impact on the development of human creativity, thinking and learning. Yes, No

B Appendix C

Independent samples test (N=442) for hypothesis H1/a

C Appendix D

Independent samples test (N=442) for hypothesis H2/b

		Levene's Test for Equality of Variances		t-test for Equality of Means		t-test for Equality of Means			t-test for Equality of Means	
									95% Confidence Interval of the Difference	
		F	Sig	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
9. question	Equal variances assumed	1,330	,249	1,276	440	,203	,1551	,1215	-,0837	,3939
	Equal variances not assumed			1,364	173,514	,174	,1551	,1137	-,0693	,3795
10. question	Equal variances assumed	4,767	,030	1,847	440	,065	,2615	,1415	-,0167	,5397
	Equal variances not assumed			1,967	172,379	,051	,2615	,1330	-,0009	,5239
11. question	Equal variances assumed	1,942	,164	1,832	440	,068	,2678	,1462	-,0195	,5551
	Equal variances not assumed			1,938	170,637	,054	,2678	,1382	-,0049	,5405
12. question	Equal variances assumed	,039	,843	1,669	440	,096	,2566	,1538	-,0456	,5589
	Equal variances not assumed			1,679	157,933	,095	,2566	,1528	-,0452	,5585

		Levene's Test for Equality of Variances		t-test for Equality of Means		t-test for Equality of Means			t-test for Equality of Means	
									95% Confidence Interval of the Difference	
		F	Sig	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
10. question	Equal variances assumed	,198	,657	2,268	440	,024	,2786	,1228	,0372	,5199
	Equal variances not assumed			2,231	303,727	,026	,2786	,1248	,0329	,5242
11. question	Equal variances assumed	2,716	,100	3,094	440	,002	,3904	,1262	,1424	,6385
	Equal variances not assumed			3,016	296,042	,003	,3904	,1294	,1357	,6452
12. question	Equal variances assumed	1,775	,183	2,123	440	,034	,2832	,1334	,0210	,5454
	Equal variances not assumed			2,102	309,667	,036	,2832	,1347	,0181	,5483