

## LARGE LANGUAGE MODELS IN ACADEMIA: A CASE STUDY AT THE TECHNICAL UNIVERSITY OF MOLDOVA

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**Abstract.** *Large Language Models (LLMs) have significantly impacted academic settings, presenting an innovative opportunity for learning and research, alongside challenges related to accuracy and ethics issues. To assess the effectiveness and acceptance of LLMs in educational environments, we conducted a comprehensive survey on 510 participants, including 470 students and 40 teaching staff, followed by a detailed exploratory data analysis of the results. The results show that LLMs exhibit parity in usage between men and women, while there is a strong imbalance in the frequency of LLM usage between students and teaching staff. Additionally, we observe a notable discrepancy in the daily usage rates, with 50% of students, employing LLMs on a daily basis, in contrast to only 18% of teaching staff. Both students and teaching staff predominantly use LLMs for searching information (21%), information analysis (20%) and code generation and editing (18%). Furthermore, the majority of participants express satisfaction with LLMs, with 91% of students and 85% of teaching staff recommending their usage. This high level of endorsement underscores the perceived value and utility of LLMs in academic contexts.*

**Key words:** *Large Language Models, survey, academia, data visualization*

### Introduction

With the advancement of technology in natural language processing and artificial intelligence, Large Language Models (LLMs) have become a tool of significant value in the world of science and education [1-3]. These powerful instruments, based on deep learning, are capable of generating texts, analyzing data, and performing a variety of other tasks with high accuracy efficiency and task execution speed. One of the inherent benefits of LLMs is their scalability. Once trained, they can handle a vast amount of text data and user interactions without the need for proportional increases in human resources [4]. LLMs also displays proficiency at tasks designed to test rapid adaption or on-the-fly reasoning, which include unscrambling words, performing arithmetic, and using novel words in a sentence after seeing them defined only once [5].

LLMs are capable of interpreting text and producing derived context, like annotations and summaries. The same applies for data analysis - AI can process almost any data input and propose hypotheses that should fit the given data. This set of capabilities makes these models a perfect copilot for educational purposes, aimed to provide assistance for students and academic staff in research, essay writing, and problem-solving. “Teachers were spooked when ChatGPT was launched a year ago. The artificial-intelligence (AI) chatbot can write lucid, apparently well-researched essays in response to assignment questions, forcing educators around the world to rethink their evaluation methods. A few countries brought back pen-and-paper exams. And some schools are ‘flipping’ the classroom model: students do their assignments at school, after learning about a subject at home [6].”

In addition, LLMs are also very capable of handling code related tasks. LLMs can automate repetitive coding tasks, generate complex algorithms, and even offer insights into optimizing existing codebases. Large Language Models (LLMs) for code generation are transforming the way software is developed. These AI-powered tools offer intelligent code

completion, error detection, and code refactoring, saving developers time and effort [7, 8]. Furthermore, their ability to understand and interpret programming languages enables them to adapt to various development environments, making them indispensable assets for developers across different domains [9, 10]. Whether it's speeding up development cycles, enhancing code quality, or fostering creativity in problem-solving, the impact of code generation by LLMs is reshaping the landscape of software development [11].

Language plays a fundamental role in facilitating communication and self-expression for humans, and likewise, communication holds paramount importance for machines in their interactions with humans and other systems[12]. Large Language Models have emerged as cutting-edge artificial intelligence systems designed to process and generate text, aiming to communicate coherently [13, 14]. They are capable of generating naturally sounding text, making them useful for streamlining routine tasks, such as writing emails, compiling reports, and formulating textual responses in other languages[15, 16].

The purpose of our study was to assess students and university teaching staff proficiency and familiarity with Large Language Models (LLMs) and determine their preferences for the models in education and research. We created a comprehensive survey directed to gauge the extent of engagement with LLMs among participants and to identify any existing gaps in their utilization. The result showed that most of the people (48%) using LLMs use them on a daily basis, the main purposes of using LLMs are information searching, data analysis and code creation and editing (all around 20% of total answers). In addition, participants noted the significant utility of using LLMs to explain material in a more accessible way. Our study highlights the growing interest in the use of LLMs for educational and research purposes, but also emphasizes the importance of addressing the associated challenges to maximize effectiveness.

## 1. Materials and Methods

The survey methodology involved distributing an online questionnaire among members of the Faculty of Computer Engineering, Informatics, and Microelectronics (FCIM), including both teaching staff with a total of 40 people and 470 students. The online survey form included questions about the goals and frequency of LLM usage, their suitability for specific tasks, their impact on idea generation processes, as well as the speed of access for students and faculty members to necessary and useful information.

The analysis was performed using the R programming language [17].

Firstly, we cleaned preliminary data to eliminate any anomalies or incomplete records. Second step was converting raw data of type "character" into "factor," as many statistical models in R operate more efficiently with factor variables. Additionally, the number of missing values was checked. There were no missing values in the dataset, indicating responsible survey form completion for each of the groups. Data visualization [18] gives us comparative analysis of both groups by purpose and frequency of LLM usage and preferred variation of the LLM tool.

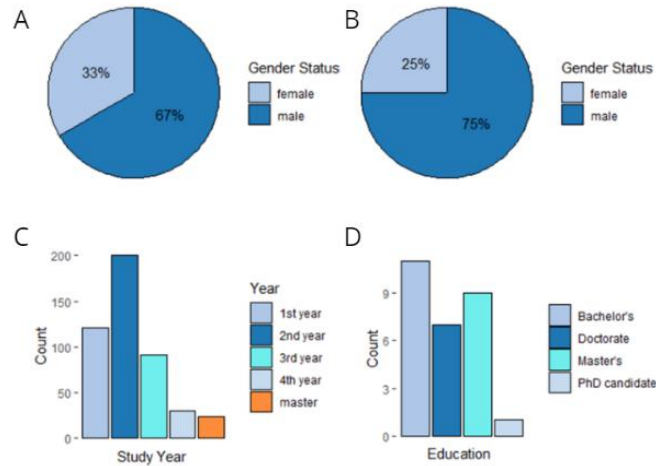
## 2. Results

Two datasets were collected, comprising responses to survey questions provided by two categories of respondents: students and teachers. Some questions included in the questionnaire for both groups were analogous, such as "*which model do you use most often*", "*purpose of usage*", or "*would you recommend it to colleagues*" while there were also specific questions, for example for teachers, regarding whether they utilize Large Language Models to enhance their educational materials.

Analysis of the respondents' personal data shows that general distribution by gender aligns with general distribution observed by the survey hosting faculty. According to the official data of the FCIM, the student enrollment is usually 70% male and 30% female, given the specificity of the professions. It is noted that a similar variation is evident in the statistics

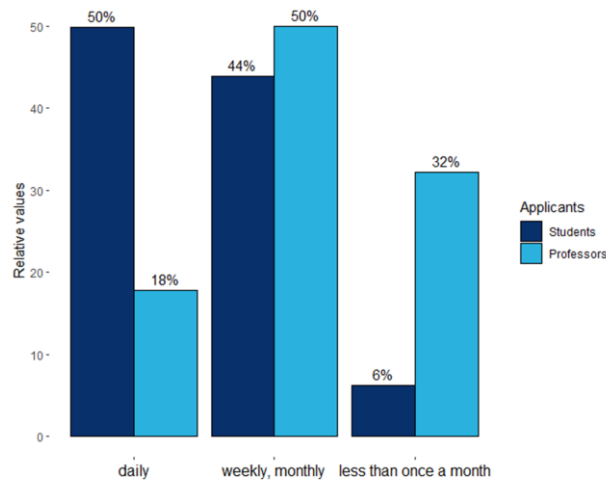
collected, where 67% males and 33% females are represented in the students group (Figure 1A), which confirms the sustainability of the mentioned dynamics in the context of student enrollment in this faculty. Among the faculty members male group is even more represented with 75% of the total respondents (Figure 1B).

The majority of respondents in the students group are 1st- and 2nd-graders of Bachelor's degree (Figure 1C). The faculty members, following the trend, prevail with Bachelor's and Master's education (Figure 1D), which indicates the interest of young faculty members in this type of research.



**Figure 1. Overview of participants in LLMs survey. (A), (B) Distribution of the Gender among Students and Teaching Staff; (C) Distribution of Study Year among Students; (D) Distribution of Education among Teaching Staff**

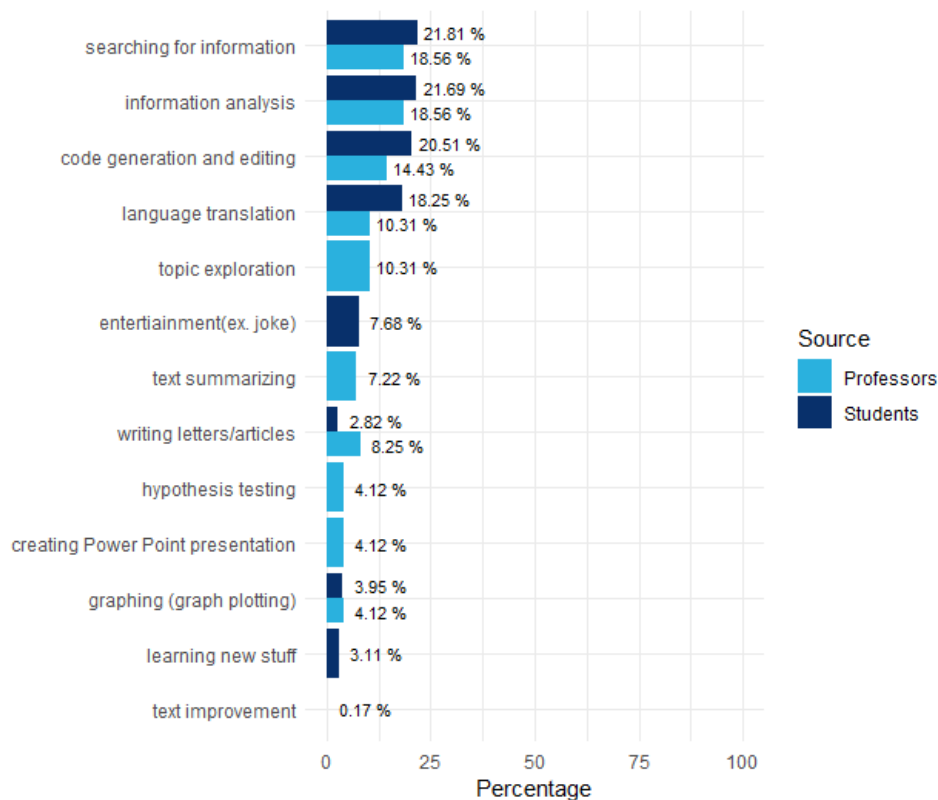
One of the crucial aspects of the survey was the question about the frequency of LLM model usage by the participants in their daily tasks. Respondents were asked to choose one of three response options reflecting the frequency of usage: "always" (use every day), "sometimes" (a couple of times a week), and "very rarely" (less than once a month or almost never use). Data analysis presented in Figure 2 indicates that half of the students reported daily usage of LLM models, while half of the teachers resort to them a couple of times a week. In the results 94% students use it and only 6% of them stated their very rare usage of such models, indicating that they are an integral part of students' lives.



**Figure 2. Survey summary frequency use of LLMs models by students and teaching staff**

Analysis of LLM usage purposes shows the wide versatility of such tools. Both segments of academia commonly use Large Language Models as a more efficient and quick way to access information, where for every question, users can find a brief and concise answer. This is believed by 22% of students and 19% of academic staff. Due to the large volume of information, both teachers and students find it difficult to 'digest,' as it requires too many resources. For this reason, they turn to models again for help, which are capable of condensing and analyzing the key aspects of the material. Thus, information analysis is also important for both groups, accounting for 21.69% among professors and 18.56% among students. It is not surprising that 20% of FCIM faculty students most often use models for writing and editing code, as almost 70% of their subjects involve programming skills. For 10% of teachers, translating text from one language to another is more important. These results are clearly presented in Figure 3.

There were also goals that were relevant for one group's usage but not interesting for the other. For example, in the context of students, 8% noted the use of LLM for entertainment purposes, while 3% indicated using it for 'learning new stuff.' In contrast, teachers were less likely to resort to these goals, but 10% of them used it for 'topic exploration,' and 4% used it for preparing PowerPoint presentations and testing hypotheses. Among other goals, 8% of teachers noted the use of LLM as a tool in the process of writing letters or articles, while only 3% of students engaged in this.



**Figure 3. The summary of purposes for using of LLMs in academia**

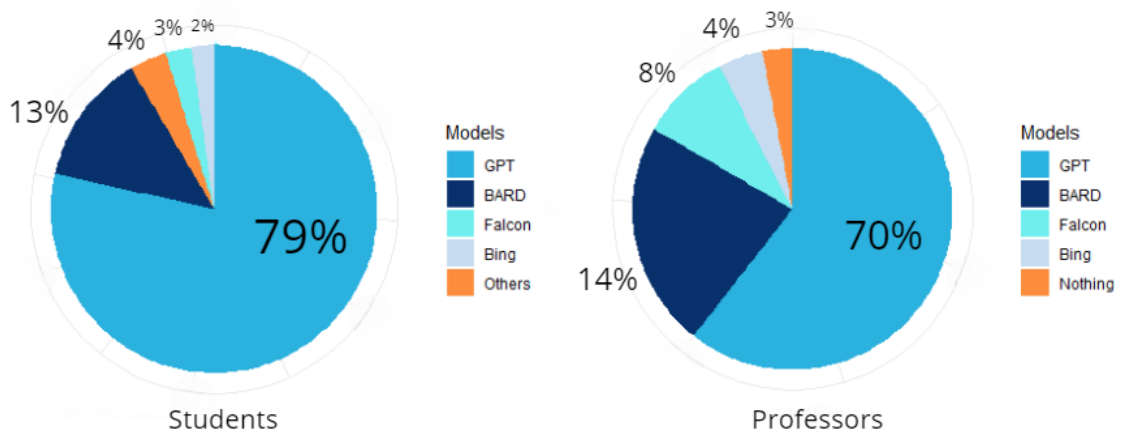
As part of the experiment, the choice of the most frequently used LLM models was also investigated, and as a result of this question, several language models could be selected among those presented: GPT, BARD (now known as Gemini), Cohere, and Falcon, plus with the option to specify one's own preferred variant.

Survey results showed that the GPT model was the most preferred among both students and teachers (Figure 4). This model stands out for its ease of use and wide adoption, appealing to almost 80% of students and 70% of academic staff. Following in popularity for both groups was BARD (now known as Gemini), with an average usage percentage of 14%.

The Falcon model attracted 8% of academic staff and 3% of students. Its feature of attaching original source links to responses helps to obtain additional information on the given topic, indicating that the first group may also value independently verifying the accuracy of the obtained results. Bing was the most common language model mentioned by respondents. The proportion of students choosing this model was 2%, and among academic staff, it was 4%, suggesting its continued relevance since it was not forgotten by respondents.

Among students, there was also a group labeled "Others," comprising 4% of the total respondents, including models such as "Cohere," "Claude," "Handmade," "BlackBox," "Chatsonic," and "Quillbot." Usage of these models was noted by fewer than 5 individuals, indicating a variety of preferences. Of particular interest is the mention of the "Handmade" model, indicating students' interest in personalizing the model to address personal tasks.

It was also observed that among academic staff, there was a group labeled "None," accounting for 3% of the total, indicating that some respondents do not use language models in their work at all. No instances of this group were noted among students, suggesting their familiarity with modern educational resources.



**Figure 4. The summary of preferences for LLMs use in academia**

In addition to similar questions, both groups were also subjected to separate, more specific inquiries. For example, students were asked whether they had ever used LLM language models to obtain explanations or additional information on topics covered in their courses. According to the survey data, 54% of students noted that they used LLMs because the presented material was difficult and unclear to them. 37% of students stated that they used language models solely to check their own understanding, while 9% claimed that they had fully grasped the subject matter through lectures alone. Thus, it can be concluded that the overwhelming majority of students experience difficulties in mastering the material and require additional explanations beyond lectures, with models serving as aides in this regard. Also 90% of students noted that the use of LLM models significantly improved their learning experience.

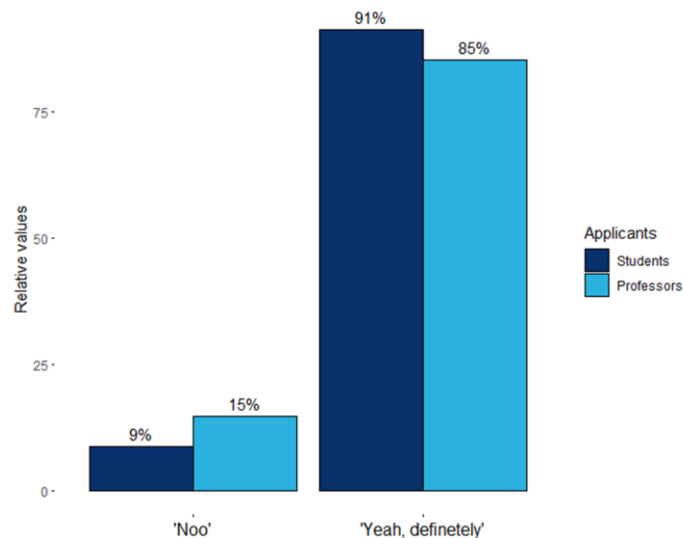
Additionally, 320 students (70 %) expressed the opinion that the use of Large Language Models in the learning process should be permitted, as it facilitates understanding of the material. Teacher opinions on this matter were evenly split, with 50% in favor and 50% against.

The speed of receiving responses by users was also a subject of investigation. According to the results, 70% both among students and teachers encountered frequent difficulties when using chats, noting the need to repeat the question twice due to unsatisfactory answers. Only 12% of students and 10% of academic staff are fully satisfied with the process of receiving answers.

The majority of teachers' opinions were divided regarding the integration of models into their teaching methodologies: one-half aims for the organic integration of these models into their teaching methods with minimal burden on students (53%), while the other half is not yet ready to

change their teaching approaches (47%). Additionally, 45% of teachers note some improvement in students' knowledge levels with the implementation of these technologies.

The next step was to ask whether they recommend or will recommend these technologies to others. From Figure 5, it is noticeable that the majority of participants express satisfaction with working with LLMs, with over 91% of students and 85% of teachers recommending their use. Such a high level of approval underscores the value and usefulness of LLMs in academic circles.



**Figure 5. Summary of recommended and non-recommended practices for utilizing LLMs by students and teachers groups.**

This finding indicates widespread confidence in the effectiveness of these technologies and their potential benefits for other users, underscoring their significance and prospects in the context of academic and practical applications.

## Discussion

Our analysis shows that study on the use of Large Language Models (LLMs) in the academic environment provide important insights into understanding the role and impact of using these models on learning and teaching processes, as well as the scientific research. The survey results conducted among teachers and students have revealed several key aspects. Firstly, the GPT model emerged as the most preferred among the study participants, confirming its significance and widespread application in the academic environment. This underscores GPT's effectiveness as both a tool for quick access to information and for text generation[19, 20]. Secondly, the use of LLMs, especially among students, is associated with an improvement in understanding study materials [21]. This highlights the potential of these models for educational purposes and their ability to assist students in grasping complex concepts. Language models can indeed assist teachers in various ways to enhance the learning experience for students. By providing additional details, examples, and explanations, LLMs can supplement classroom instruction and help students grasp concepts more effectively. This assistance can range from generating extra practice problems to offering alternative explanations tailored to individual learning styles. With LLMs supporting teachers, students can benefit from a more personalized and comprehensive educational experience.

The study results underscore the importance of further research of application of LLMs in the academic context, like in problems of research assistance, writing support, study aid, language learning, coding and math assistance and accessibility. The obtained results will have practical significance for developing effective strategies for implementing LLMs in the academic

environment providing support for personalized interactive lessons and personalized feedback, facilitate problem-solving, and deepen students' understanding of complex concepts across various subjects from educational curricula.

In contrast, uninformed and irresponsible use of LLMs can lead to unpleasant outcomes. These tools can't be fully trusted, especially for fact checking. Another issue is educational cheating with LLMs, which not only distorts the professor's understanding of students' academic performance, but also disables learning mechanisms for the students themselves.

Overall, the development of large language models represents a significant breakthrough in the field of artificial intelligence and natural language processing, opening up new opportunities for scientific and educational research.

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