

# The Capabilities of Large Language Models for Reducing Learning Fatigue

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**Abstract** – This article investigates the transformative role of large language models (LLMs), specifically ChatGPT, in contemporary education and their impact on learning fatigue. It examines both the potential benefits of LLMs use as personalized learning, automated content creation, interactive tasks, and real-time feedback from one point of view and the emerging challenges, including increased dependence on digital devices and the risk of digital fatigue - mental, physical, and emotional exhaustion caused by prolonged screen exposure from the other. The results show widespread familiarity with artificial intelligence tools and moderate relationships between AI use and perceived reductions in learning effort. Frequent use of ChatGPT appears to implement improvements in homework, highlighting the need to further develop students' digital literacy and prompting skills. The study concludes that the responsible, well-regulated integration of LLMs can enhance learning effectiveness while helping to mitigate risks associated with digital fatigue. This research is relevant for educators and institutions seeking to improve student outcomes through the thoughtful adoption of AI-based tools.

**Keywords** – Education, students' fatigue, LLM, ChatGPT.

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## 1. Introduction

In a rapidly changing world shaped by technology, the technological era and shifting standards demand a rethinking of teaching methods and strategies. Large Language Models (LLMs) are transforming education through personalized learning, automated content generation, dynamic feedback, and immersive simulations. Yet this transformation raises important concerns, including ethical use, equitable access, and the need to cultivate learners' critical thinking and decision-making skills [1]. Artificial Intelligence should serve as a reliable partner in learning, rather than a shortcut that undermines genuine academic effort.

LLMs represent a class of Artificial Intelligence specialized in processing and understanding human language. They are complex computer programs trained on vast amounts of textual data, enabling them to perform tasks such as text generation, translation, question answering, and the creation of creative content [2]. Broadly, LLMs can be classified into two main categories: generative models, which focus on producing new textual content such as poetry, programming code, scripts, musical compositions, and emails, and discriminative models, used for classifying and analyzing textual data. LLMs are built upon artificial neural networks, particularly transformer architectures, which effectively identify relationships between words and sequences in text. By analyzing extensive datasets, LLMs learn statistical patterns and probabilities, allowing them to predict subsequent words in sequences, provide comprehensive responses to questions, and generate human-like textual output [3], [4].

## 2. LLMs and Contemporary Trends in Education

Practical examples indicate that the integration of LLMs into education has become part of broader trends already reshaping the learning process. When applied effectively, these models support the implementation of innovative lessons, the expansion of global educational initiatives, and the enhancement of education toward a better future.

This transformation makes learning more personalized, interactive, and relevant to current students. Teachers obtain the opportunity to create dynamic learning environments that support both academic and personal development [5].

The AI-based chatbot ChatGPT, a representative of LLMs, was released for public use by OpenAI in November 2022. It is capable of generating informational, semantically, and contextually relevant human-like responses to user input [6]. The extent of ChatGPT's effectiveness varies across subject areas, yet the question of its educational applications and potential benefits draws considerable attention from researchers. ChatGPT can assist teachers by generating materials and ideas to support their teaching. It can also serve as a virtual tutor for students by answering questions and facilitating collaboration. Challenges such as producing inaccurate information remain. Still, ChatGPT's impact on education is undeniable [7].

Education has traditionally been slower than other sectors in adopting major technological shifts; however, it must adapt to the pace of contemporary learners. One means to do so is through the thoughtful integration of chatbots into school systems. Since they operate across languages, they can be used globally to support homework, assist in writing assignments, and help reduce teacher workload [8]. Additional applications of AI in education include personalizing learning based on individual needs, evaluating curriculum quality and content, and facilitating independent learning through diverse programs. Importantly, technology should complement rather than replace the teacher, and support rather than substitute the student's work, while simultaneously stimulating engagement [9].

The aim of this study is to investigate whether the responsible, purposeful, and ethically guided use of large language models can alleviate student fatigue resulting from heavy academic workloads and numerous assignments, thereby enhancing interest and motivation for learning and improving educational outcomes. At the same time, the study aims to identify strategies for mitigating a key issue in modern education - digital fatigue.

Large language models have the potential to be widely implemented in classrooms, significantly enhancing both teaching and learning. It can be stated with certainty that their deliberate and mindful use as tools for improving educational quality is preferable to scenarios that could lead to misuse or raise ethical, health-related, or other concerns. These models enable the creation of personalized instructional materials tailored to each student's needs and interests. They can generate texts on various topics and at different levels of subject mastery. Teachers may assign themes relevant to students' interests, and the models can produce texts aligned with those themes.

Moreover, LLMs can enrich instructional content with multimedia elements such as images, videos, and audio recordings, making learning more engaging and interactive.

Generative artificial intelligence models and large language models are revolutionizing educational technologies by introducing new approaches to assessing comprehension and refining learning processes. One of their core capabilities is generating diverse question formats, including multiple-choice tests, open-ended questions, and problem-solving tasks. These questions can evaluate different cognitive levels - from basic factual memory to deeper analytical reasoning, while providing immediate feedback that helps students identify areas requiring improvement.

LLMs are also capable of developing customized learning exercises based on each student's level of readiness. They can generate a variety of activities and interactive tasks that make learning enjoyable and engaging. In addition, these models may recommend resources aligned with students' individual needs and interests, such as relevant websites, applications, videos, and books that are currently relevant.

One of the major advantages of LLMs is their ability to adapt study materials to the learning pace and style of each student. They can offer supplementary exercises for students who require additional support and personalize content according to students' interests, such as sports, music, or technology. This personalization fosters increased engagement and improved motivation by aligning the learning process with students' preferences and individual learning needs.

Automated assessment represents another key function of LLMs. They are capable of evaluating student-produced texts by analyzing logical coherence and relevance of content, providing immediate feedback. In real-time, LLMs can propose corrections and offer detailed explanations that help students understand their mistakes and develop their critical thinking and reasoning skills.

Opportunities for communication, thesis formation, and argumentation across subject areas can be supported through conversational simulations, where LLMs engage students in dialogue, simulating real-world scenarios. In some cases, integrating speech recognition technologies can further assist students in developing oral communication skills. Additionally, the models can generate comprehension questions and summaries based on reading materials, helping students grasp central ideas and key details.

LLMs also support vocabulary enrichment by providing contextual definitions, example sentences, synonyms, and antonyms. They facilitate lesson planning by offering lesson outlines, activities, and curriculum-aligned resources, while generating interactive exercises that make learning more engaging.

The aforementioned advantages of applying artificial intelligence in education undoubtedly contribute to reducing the burden of academic tasks, offering opportunities for a personalized learning approach, and enabling the faster acquisition of knowledge by alleviating fatigue associated with processing large volumes of educational content. AI-based technologies are becoming indispensable tools for students, supporting their learning processes [10], [11]. At the same time, however, this leads to increased screen time and poses the risk of accumulating another form of fatigue - digital fatigue. Digital fatigue refers to the sense of exhaustion caused by excessive use of digital technologies [12] and is defined as “physical, mental, and emotional exhaustion resulting from continuous and intensive exposure to digital devices” [13]. It may lead to various issues, including eye strain, anxiety, decreased engagement, and reduced productivity [12], [14], [15]. These consequences have a negative impact on students’ physical health, well-being, and academic performance [12]. Moreover, the modern communication patterns of young people, who frequently interact through social media, further increase the amount of time spent in digital environments.

This raises the question of how to define the boundary between the beneficial use of technologies, to reduce fatigue caused by large volumes of information and learning tasks and the risk of generating additional negative effects, including digital fatigue. The study addresses issues related to the duration of digital device use, the subjective perception of fatigue resulting from this usage, awareness of the harmful effects of excessive screen exposure, and the attitudes of institutions - schools and families - regarding monitoring and regulating digital use to ensure that the positive impact is maintained. Considering the central role of Artificial Intelligence in the educational and social lives of students, it is essential to critically assess its influence on learning outcomes [16], [17], [18], [19].

In Bulgaria, two types of secondary schools are distinguished based on their aims and orientation - profiled schools and vocational schools. Discussion of this distinction is directly related to the type of fatigue experienced by students and the potential effectiveness of LLMs in reducing it. Profiled schools provide general academic education with specialization in areas such as mathematics, languages, or natural sciences, preparing students for further study in related fields at higher education institutions. Vocational schools, by contrast, offer professional training leading to a certification that allows students to enter the labor market after graduation. Their programs are often connected to industry and include practical components.

The acquisition of extensive theoretical knowledge in mathematics, languages, natural sciences, and technologies results in higher cognitive load for students in profiled schools, and thus creates greater potential for the use of LLMs or chatbots to reduce learning fatigue. In vocational schools, general academic education is combined with the development of occupation-specific practical skills, including physical activities, which reduces cognitive strain and leads to lower levels of mental fatigue. For students in these schools, it is reasonable to assume that chatbot use may contribute more to creativity and idea generation than to directly reducing learning fatigue. The results of the study provide an evidence-based answer to this assumption.

### 3. Research Framework

All of the above-mentioned benefits of applying LLM models, particularly ChatGPT, in education can be realized only within a controlled, well-planned, and purposeful instructional process. This necessitates examining the current state and attitudes of both students and parents regarding the use of artificial intelligence models in the learning process. A survey was conducted across 19 secondary educational institutions - 8 profiled high schools and 11 vocational high schools operating in the region of Ruse. As previously noted, research indicates that chatbot performance varies across subject areas, which is one of the reasons for including students from different types of schools (comprehensive secondary schools, profiled high schools, and vocational high schools) in the scope of this study.

The research aims to determine whether the adoption of new technologies can yield measurable benefits to learning outcomes by mitigating student fatigue. Previous research has demonstrated that fatigue reduces both motivation and performance in the learning process.

#### 3.1. Research Design and Questionnaire Structure

The study was conducted using a questionnaire (Table 1) consisting of 12 items formulated as closed-ended questions, some of which allowed personalization. The structure of the questionnaire enables the identification of positive, negative, and moderate response tendencies. The survey was administered anonymously.

The first four questions (Q1–Q4) provide information regarding familiarity with the possibility of using LLMs, particularly ChatGPT, during self-study to reduce workload, as well as students’ assessment of this effect. Q5 aims to identify potential difficulties and issues related to the use of ChatGPT and digital devices in independent learning.

Q7 and Q8 examine the potential risks of digital fatigue - Q7 measures the time spent using digital devices, while Q8 gathers data about the perceived fatigue resulting from such usage. The role of parents and educational institutions in promoting awareness and guidance on appropriate levels of digital technology use can be evaluated based on responses to questions 6, 9, and 10.

To differentiate levels of accumulated fatigue based on school type, profiled or vocational, the responses to Q7 and Q8 are compared. It is expected that students in profiled high schools spend more time using digital devices and, therefore, experience higher levels of fatigue. Q10 may provide insight into strategies for reducing the risk of digital fatigue.

The study is based on questionnaire data collected from a total of 875 ninth-grade students enrolled

across 19 secondary schools offering general and vocational education: 355 students from 8 profiled high schools and 520 students from vocational high schools.

The questionnaires were completed accurately and conscientiously, with no omissions that could compromise the final results. Therefore, the study contributes to forming a realistic understanding of how the integration of artificial intelligence applications in education supports learning and how the inclusion of various AI-based tools assists students in completing homework and managing academic content.

The questionnaire form on which students submitted their responses is presented in Table 1, along with the number of students selecting each response option.

Table 1. The questions within the questionnaire and their answers

| No  | Question                                                                                                                                                 | Possible answers                                                                                                                           | Count |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Q1  | Are you aware of how you could use AI (ChatGPT) to undo some of your efforts and reduce learning fatigue?                                                | a) No                                                                                                                                      | 159   |
|     |                                                                                                                                                          | b) Yes                                                                                                                                     | 624   |
|     |                                                                                                                                                          | c) I would be curious to know.                                                                                                             | 92    |
| Q2  | Do you use digital devices (phone, computer, tablet, etc.) and the Internet as an aid in preparing for a lesson or testing your knowledge?               | a) Daily                                                                                                                                   | 239   |
|     |                                                                                                                                                          | b) Sometimes                                                                                                                               | 358   |
|     |                                                                                                                                                          | c) Rarely                                                                                                                                  | 176   |
|     |                                                                                                                                                          | d) Never                                                                                                                                   | 102   |
| Q3  | Do you use ChatGPT when writing homework?                                                                                                                | a) Daily                                                                                                                                   | 165   |
|     |                                                                                                                                                          | b) Sometimes                                                                                                                               | 250   |
|     |                                                                                                                                                          | c) Rarely                                                                                                                                  | 277   |
|     |                                                                                                                                                          | d) Never                                                                                                                                   | 183   |
| Q4  | Does using ChatGPT and the assistance of digital devices in the learning process help reduce learning fatigue?                                           | a) Daily                                                                                                                                   | 169   |
|     |                                                                                                                                                          | b) Sometimes                                                                                                                               | 418   |
|     |                                                                                                                                                          | c) Rarely                                                                                                                                  | 125   |
|     |                                                                                                                                                          | d) Never                                                                                                                                   | 183   |
| Q5  | Are you having difficulty using ChatGPT and digital devices to facilitate learning?                                                                      | a) No, I always find the right information                                                                                                 | 233   |
|     |                                                                                                                                                          | b) Rarely, for more specific tasks (please specify)                                                                                        | 303   |
|     |                                                                                                                                                          | c) Sometimes, when I don't formulate the search keywords and the prompt well                                                               | 189   |
|     |                                                                                                                                                          | d) Often, because I have difficulty formulating the search keywords well                                                                   | 32    |
|     |                                                                                                                                                          | e) Always, because I have difficulty formulating the search keywords well                                                                  | 43    |
|     |                                                                                                                                                          | f) Other                                                                                                                                   | 75    |
| Q6  | Do your parents limit the use of digital devices (phone, computer, tablet, etc.) and the Internet as an aid in preparing for class or testing knowledge? | a) Completely prohibit                                                                                                                     | 154   |
|     |                                                                                                                                                          | b) In certain cases, which-describe                                                                                                        | 203   |
|     |                                                                                                                                                          | c) Support the use                                                                                                                         | 518   |
| Q7  | How much time during the day do you use digital devices and the Internet as an aid in preparing for class or writing homework?                           | a) Up to 1 hour                                                                                                                            | 516   |
|     |                                                                                                                                                          | b) Up to 2 hours                                                                                                                           | 204   |
|     |                                                                                                                                                          | c) Up to 3 hours                                                                                                                           | 105   |
|     |                                                                                                                                                          | d) More than 4 hours                                                                                                                       | 49    |
| Q8  | Do you feel tired after prolonged use of digital devices?                                                                                                | a) Yes                                                                                                                                     | 222   |
|     |                                                                                                                                                          | b) No                                                                                                                                      | 653   |
| Q9  | Have you been informed about the harmful effects of prolonged use of digital devices and by whom?                                                        | a) Yes, from parents, from teachers, from the Internet, from television, from trainings by non-governmental organizations, from (describe) | 690   |
|     |                                                                                                                                                          | b) No                                                                                                                                      | 185   |
| Q10 | Which factor has the greatest influence on limiting the use of digital devices?                                                                          | a) Reduced presence of digital tools in the learning material;                                                                             | 116   |
|     |                                                                                                                                                          | b) Amount of homework;                                                                                                                     | 171   |
|     |                                                                                                                                                          | c) Engaging in sports activities;                                                                                                          | 306   |
|     |                                                                                                                                                          | d) Going out with friends;                                                                                                                 | 265   |
|     |                                                                                                                                                          | e) Other (describe):                                                                                                                       | 17    |

### 3.2. Analysis of the Results

The responses given in the first part of the questionnaire indicate that students are familiar with the use of AI, and particularly ChatGPT. This is supported by the results for Question Q1, where 71% of respondents report using AI to reduce their effort and alleviate learning fatigue.

The use of AI, and specifically ChatGPT, for completing homework and preparing for lessons is reflected in the results of Questions Q2, Q3, and Q4, which are presented in Figure 1 and further examined in the conducted regression analysis.

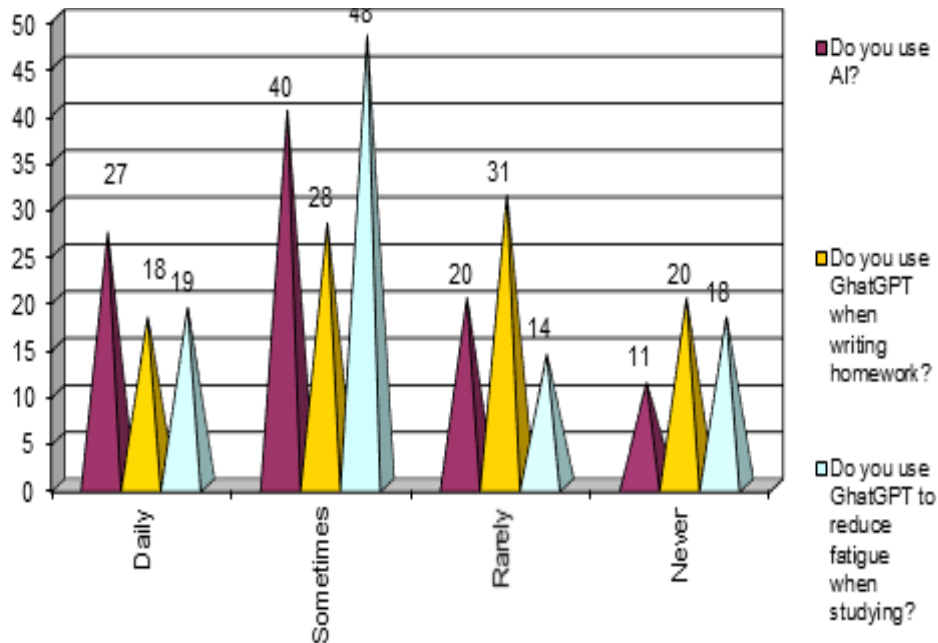


Figure 1. Summary of students' answers of Q2, Q3 and Q4

To examine whether there is a relationship between the use of technology in preparation and the perception of reduced fatigue, a classical multiple regression analysis was conducted using factors Q2, Q3, and Q4. The dependent variable was Q4. The analysis, performed using the SPSS software package, yielded the results presented in Table 2 and Table 3.

Table 2. The model summary

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1     | ,592 <sup>a</sup> | ,351     | ,349              | ,79786                     |

a. Predictors: (Constant), Do you use ChatGpt when writing homework? Do you use digital devices and the Internet?

Table 3. ANOVA analysis

| ANOVA <sup>a</sup> |                |     |             |         |                   |
|--------------------|----------------|-----|-------------|---------|-------------------|
| Model              | Sum of Squares | df  | Mean Square | F       | Sig.              |
| Regression         | 300,020        | 2   | 150,010     | 235,650 | ,002 <sup>b</sup> |
| Residual           | 555,096        | 872 | ,637        |         |                   |
| Total              | 855,115        | 874 |             |         |                   |

- Dependent Variable: Do you use ChatGPT in the learning process?
- Predictors: (Constant), Do you use ChatGPT when writing homework? Do you use digital devices and the Internet?

The multiple regression analysis revealed the following:

- The multiple correlation coefficient (Multiple R) was 0.592, indicating a unidirectional (linear) relationship among the factors Q2, Q3, and Q4. This suggests that any change in one factor is likely to affect the others. The coefficient of determination ( $R^2$ ) was 0.351, which clearly indicates a moderate strength of the relationship among the factors.
- The model is considered adequate, as evidenced by the significance level (Signif F) of 0.002, which is lower than the standard alpha level of 0.05.

The findings suggest that the use of AI, particularly ChatGPT, in completing homework and preparing for lessons is common among approximately half of the students. This usage aims to facilitate learning and reduce the effort required for academic tasks.

Responses in the second part of the questionnaire relate to student fatigue due to heavy academic workloads, daily homework and projects, and digital fatigue. Fatigue associated with prolonged daily use of digital devices (e.g., phones, computers, tablets) and the Internet as an educational aid has increased in recent years [20], [21]. In response to question Q7, it was confirmed that ninth-grade students use digital devices and the Internet to assist with lesson preparation and homework. Concerningly, around 20% of students reported using digital devices for 2–4 hours per day.

When analyzing Q7 according to school type, the following was observed:

- 49.6% of students in academic high schools use ChatGPT and digital devices for 1 hour per day, and 28.6% use them for 2 hours.
- 61% of students in vocational high schools use ChatGPT and digital devices for 1 hour per day, and 12% use them for 2 hours.

From this comparison, it can be concluded that a larger proportion of vocational high school students (73%) use large language models for shorter periods, whereas academic high school students (78.2%) tend to use them for longer durations. Although the overall percentage difference is not substantial, it should be noted that academic high schools have more than twice the proportion of students with prolonged usage.

Responses to Q5 regarding difficulties in using ChatGPT and digital devices to facilitate learning indicated that students struggle when they cannot find specific information or have difficulty formulating the precise keyword. No significant differences were observed when analyzing Q5 by school type; all students experienced some difficulty in finding accurate information. Only 26% of participants reported that ChatGPT significantly facilitated homework completion and lesson preparation. These findings highlight the need for improving prompting strategies when using ChatGPT.

Question Q8 indicated that 75% of students did not experience fatigue from using digital devices. When differentiated by school type, both academic and vocational high school students reported a similar positive response rate of 25%. Notably, among vocational high schools, responses varied: in four schools, only up to 10% of students reported not experiencing fatigue, while in six schools, 60% reported mild fatigue due to prolonged digital device use. The hypothesis that students in academic high schools, who spend more time on digital devices, would experience greater fatigue was not confirmed.

Question Q9 is particularly important regarding the productive and safe use of digital devices. Students need to be informed about proper work-rest organization and self-regulation to avoid health risks.

Responses to Q9 indicated that students are aware of the negative effects of prolonged digital device use, primarily through guidance from parents and teachers. Parents generally support the use of digital devices (phones, computers, tablets, etc.) and the Internet as educational aids. This aligns with responses to Q6, where 59% of parents endorsed their children's use of digital devices for learning.

The final question, Q10, addresses the rational use of digital devices. Student responses indicated potential strategies to limit screen time: 35% identified engagement in sports as a way to reduce device use, 30% cited socializing with friends, and 19% mentioned reducing homework load and the associated need for digital device use during self-study.

#### 4. Conclusion

This study aimed to examine the reasonable, ethically guided, and appropriately dosed use of digital devices, large language models (LLMs), and specifically ChatGPT. The research sought to determine whether their use could reduce fatigue in students caused by large volumes of study material and numerous individual and homework assignments, thereby enhancing interest, motivation, and overall learning outcomes.

The processed data provide insights that allow for conclusions regarding strategies to mitigate a contemporary problem: digital fatigue resulting from prolonged and uncontrolled use of digital devices (such as phones, computers, and tablets). Student awareness of proper daily and weekly scheduling encourages learning how to balance study and rest. Rest periods should include outdoor activities, sports, and leisure activities, with limited or no use of digital devices.

Students reported using digital devices intentionally and consciously as tools to improve learning quality. Approximately one-third of the students indicated that ChatGPT consistently provides accurate information, facilitating homework completion and lesson preparation.

While LLMs undoubtedly have transformative potential and can adapt learning material to individual needs, certain challenges and risks are associated with their excessive use. Students expressed increased interest in generative AI models and LLMs, which are increasingly entering and revolutionizing educational technology. Enhancing student awareness regarding their application could improve the formulation of precise search keywords, support knowledge generation, and enable the creation of diverse activities and interactive exercises that make learning engaging and enjoyable.

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