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Research Article

Perceptions of Senior Pharmacy Students Towards the Impact of Artificial Intelligence on University Education and Scientific Writing: A Qualitative Study

Samer Imad Mohammed^{1*} , Ali Lateef Jasim¹ , Ali Azeez Al-Jumaili^{1,2} , Ehab Mudher Mikhael¹ ,
Fatima Zuhair Ali¹ 

¹Department of Clinical Pharmacy, College of Pharmacy, University of Baghdad, Baghdad, Iraq; ²Department of Public Health, Davis School of Medicine, University of California, CA, USA

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Abstract

Background: The roles of AI in the academic community continue to grow, especially in the enhancement of learning outcomes and the improvement of writing quality and efficiency. **Objectives:** To explore in depth the experience of senior pharmacy students in using artificial intelligence for academic purposes. **Methods:** This qualitative study included face-to-face individual interviews with senior pharmacy students from March to May 2023 using a pre-planned interview guide of open-ended questions. All interviews were audio-recorded. Thematic analysis was used to analyze the data. **Results:** The results were obtained from 15 in-depth face-to-face interviews with senior pharmacy students (5th and 4th years). Eight participants were male, and seven were female (21–25 years old). All participants used ChatGPT for a few months for academic purposes, especially when writing take-home assignments. The perceptions were positive about the students' gains from using ChatGPT. Still, at the same time, they admitted that AI might negatively impact the student's motivation to learn new academic skills. **Conclusions:** The students believed that AI was very helpful, with concerns that it did not enhance their critical thinking or writing skills. Thus, educators need to change their strategies for teaching and testing students to improve student skills and identify students' own work.

Keywords: Artificial intelligence, Academic purposes, ChatGPT, Iraq, Pharmacy students.

تصورات طلاب السنة النهائية للصيدلة نحو أثر الذكاء الاصطناعي في التعليم الجامعي والكتابة العلمية: دراسة نوعية

الخلاصة

الخلفية: تستمر أدوار الذكاء الاصطناعي في المجتمع الأكاديمي في النمو، لا سيما في تعزيز نتائج التعلم وتحسين جودة الكتابة وكفاءتها. **الأهداف:** استكشاف تجربة طلاب الصيدلة في استخدام الذكاء الاصطناعي للأغراض الأكاديمية بعمق. **الطرائق:** تضمنت هذه الدراسة النوعية مقابلات فردية وجها لوجه مع طلاب الصيدلة الكبار من مارس إلى مايو 2023 باستخدام دليل مقابلة مخطط مسبقاً للأسئلة المفتوحة. تم تسجيل جميع المقابلات صوتياً. تم استخدام أسلوب التحليل الموضوعي لتحليل البيانات. **النتائج:** تم الحصول على النتائج من 15 مقابلة متعمقة وجها لوجه مع طلاب الصيدلة الكبار في المرحلتين الرابعة والخامسة. و كان ثمانية مشاركين من الذكور، وسبعة من الإناث (21-25 سنة). استخدم جميع المشاركون ChatGPT لبضعة أشهر للأغراض الأكاديمية، خاصة عند كتابة الواجبات المنزلية. كانت التصورات إيجابية حول مكاسب الطلاب من استخدام ChatGPT. ومع ذلك وفي الوقت نفسه، اعترفوا بأن الذكاء الاصطناعي قد يؤثر سلباً على دافع الطالب لتعلم مهارات أكاديمية جديدة. **الاستنتاجات:** اعتقد الطلاب أن الذكاء الاصطناعي كان مفيداً للغاية، مع مخاوف من أنه لم يعزز مهارات التفكير النقدي أو الكتابة لديهم. وبالتالي، يحتاج التدريسيون إلى تغيير استراتيجياتهم لتدريس الطلاب واختبارهم لتحسين مهارات الطلاب وتحديد عمل الطلاب.

* **Corresponding author:** Samer I. Mohammed, Department of Clinical Pharmacy, College of Pharmacy, University of Baghdad, Baghdad, Iraq; Email: samer.jameel@copharm.uobaghdad.edu.iq

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INTRODUCTION

John McCarthy coined the term "artificial intelligence" (AI) in 1956 and defined it as the science of creating intelligent machines, particularly computer programs that are capable of thinking and acting like people. Recently, AI has appeared to be present and valuable in different parts of humans' daily lives [1]. The roles of AI in the academic community continue to grow, especially in the enhancement of learning outcomes and improvement of writing quality and efficiency [2] by offering suggestions about grammar, sentence structure, assembly, and general clarity [3], as well as helping students save effort and time while they solve problems, perform assignments, and understand lectures [4,5]. Additionally, AI serves multiple functions in various fields of medical and pharmaceutical sciences, including drug design and development, disease diagnosis, medical treatment [6,7], and patient education [8]. Despite these advantages, AI programs have certain concerns, such as ethical issues, biases, and making mistakes [9]. Therefore, it is crucial to measure the knowledge and perceptions of university students in these sciences regarding their opinions about the ease of use and usefulness of AI programs, which would influence their future applications of these programs [10,11]. Generative Pre-Trained Transformer (ChatGPT) is a type of AI software that was developed and released in late 2022 for the purpose of simulating

communications with human users [12]. The ChatGPT was programmed and equipped with algorithms to understand the inputs of natural language and respond with appropriate answers. Both written sources and ChatGPT itself [8] may provide these answers. Before the COVID-19 pandemic, Iraqi pharmacy students had inadequate experience in terms of using electronic and informational technologies (IA) for academic purposes [13,14]. However, this changed dramatically during and after the pandemic [15,16]. The utilization of artificial intelligence (AI) has the potential to alleviate the stress associated with education, which is one of the major obstacles that face pharmacy students [17]. Scarce studies were performed to assess the awareness or perceptions of medical students towards AI in the Arabic region [8]. To the best of our knowledge, this was the first study in Iraq investigating the use of AI in academia. This study aimed to explore in depth the experiences of senior pharmacy students using artificial intelligence for academic purposes.

METHODS

This qualitative study included face-to-face individual interviews with senior (4th and 5th year) pharmacy students. The interviews were semi-structured using a pre-planned interview guide of open-ended questions with follow-up questions (Table 1).

Table 1: The interview guide

No.	Main Questions	Follow-up questions
1	What are the most common AI programs that you use? Why?	How long have you been using this program?
2	Have you ever used AI programs in writing your assignment? Tell us about your experience with AI use	How did you learn how to use them?). What are the potential advantages of using AI in writing your assignments?).
3	What are your expectations on the effect of AI programs on the student's writing skills?	How?
4	What are the skills the students will gain or lose due to relying on AI in doing their H.W. and academic writing?	
5	Have you ever used AI programs to understand some points in your lectures? Tell us about your experience in this regard.	How did you learn how to use them?).
6	What are your expectations about the effect of AI in your university education?	Can you tell me your opinion about the future of education in the presence of AI?
7	Do you have any further comments?	

The interviews took place in person within the colleges of pharmacy from March to May 2023. All interviews were audio-recorded. The interview guide was organized to explore in-depth the student perceptions about the use, advantages, and disadvantages of artificial intelligence (AI). In addition, the possible obstacles to the execution of this program were also explored.

Setting

The study included students at two large pharmacy colleges in Baghdad: one public and one private. The researcher interviewed the pharmacy students in person within the college buildings. The interviews lasted between 20 and 45 minutes.

Inclusion criteria

Fifth- and fourth-year pharmacy students who have experience using AI. We included the last two-year students, and as we expected, they have more experience and knowledge. It was worth noting that the pharmacy program in Iraq lasts for five years after high school [18].

Participants' recruitment

There were two ways of sampling: purposeful and snowballing. First, the researchers announced the recruitment of the students (who have experience in the use of AI) via the students' representatives. Participation

was optional. The researchers explained the study objectives to the students who signed up for participation. The researcher also used a "snowball" technique to ask the participating students about their classmates who may have used any AI program. And willing to participate in the study. Those who accepted the invitation received confirmation about keeping their identities confidential. The researcher continued to conduct interviews with students until reaching the saturation point. The interviews were audio-recorded after obtaining verbal consent from the participants. To overcome any language barriers, the participants were free to answer the English questions in the guide in either Arabic or English. However, only one participant used the English language in the interview. Then, two bilingual researchers transcribed the interview verbatim into English.

Ethical approval

The Central Scientific Committee at the University of Baghdad College of Pharmacy approved the research proposal. Verbal consent was obtained before starting the interview. To maintain the confidentiality of the participants, the interview did not require mentioning the participants' names. In the interview transcription, the authors used pseudo-names for the participants. The participants did not receive any rewards.

Thematic analysis

As is well known, the thematic analysis relies on participants' quotes, subthemes, and themes. The authors have used the transcript of the interview records to identify recurring themes and subthemes. Representative quotes were selected to support each subtheme. The research team (with two experts in qualitative studies) followed Braun and Clarke's (2006) six steps for thematic analysis. These steps include reviewing the comments (answers) carefully, generating codes, searching for themes, assessing themes, defining and labeling themes, and finally writing the results [19]. The transcription was cross-checked by three members of the research team. Because it is a qualitative study, an inductive analytic methodology (data-driven) was used, and a constructivist paradigm was followed [20]. In other words, the authors constructed the themes from common trends emerging from the participants' answers. Thereafter, peer checking was conducted three times to validate the findings.

RESULTS

A total of 15 in-depth face-to-face interviews were conducted with senior (fifth and 4th year) pharmacy students. Eight participants were male, and seven were female. The participants' ages ranged from 21 to 25 years, with a mean of 23.2 years. Most students (n=10) were from a public pharmacy college and five were students at a private pharmacy college. Two of the

interviewees were enrolled in the PharmD program, and 13 were bachelor students (Table 2).

Table 2: The characteristics of the participating students

Participant	Gender	Age	Study Year	Program type	Collage type
Student 1	male	23	5th	BSc	government
Student 2	male	23	5th	BSc	private
Student 3	female	23	5th	BSc	government
Student 4	female	25	5th	BSc	private
Student 5	female	25	5th	BSc	private
Student 6	male	23	5th	BSc	government
Student 7	male	23	5th	BSc	government
Student 8	male	21	5th	BSc	government
Student 9	male	21	4 th	PharmD	government
Student 10	female	23	5th	BSc	government
Student 11	female	23	5th	BSc	government
Student 12	male	21	4th	PharmD	government
Student 13	female	23	5th	BSc	government
Student 14	female	23	5th	BSc	private
Student 15	male	23	5th	BSc	private

Regarding the duration of using AI programs, it was about one month for seven participants, two months for four participants, and three months or more for four participants (mostly in the first 3–4 months of 2023). All participants used ChatGPT, which was the most popular AI program, whereas only one participant used Tome, Curiosity, and Prezi. The themes obtained in this study are shown in Table 3. Thirteen participants mentioned that they tried to use AI programs to help them in their academic studies. In addition to the academic purposes, two participants used AI programs in entrepreneurship (n=1) and as psychotherapists (n=1). "I was curious to try ChatGPT to find its benefit in my academic study" [student 3, female, 23 years]. "In addition to using it in my study, I attempted to apply it to several fields outside my area of expertise, including entrepreneurship, which was really helpful." [Student 5, female, 25 years]. Nine participants reported that they used ChatGPT for two academic purposes: writing their homework assignments and/or graduation projects. Seven participants reported using AI programs to comprehend difficult material in lectures. Meanwhile, the students used ChatGPT to comprehend some courses: chemistry (n=7), therapeutics (n=3), therapeutic drug monitoring (n=2), and industrial pharmacy (n=1). One participant mentioned that he used these programs to find key points and possible questions in a lecture. "I asked Chat GPT to summarize the therapeutic lecture. On the other hand, I asked the application to provide me with common questions about the Advanced Pharmaceutical Analysis subject, and it helped me a lot." [student 11, male, 25 years]. "I frequently use ChatGPT to understand difficult topics in chemistry lectures. In fact, I used the application to get answers to numerous questions and find hidden information in the lecture. It has really helped me to comprehend many topics in chemistry." [Student 1, male, 23 years]. "I used it (ChatGPT) to get information about my graduation project." [Student 7, male, 23 years].

Table 3: Themes and subthemes of the study

Theme	Themes
ChatGPT is the most commonly used AI program AI (ChatGPT) is used for academic purposes primarily.	All the 15 participants have used ChatGPT Academic purposes Business purposes(entrepreneurship) Medical purposes
AI Application (ChatGPT) is used for multiple academic purposes.	Understanding difficult topics Academic writing Answering homework questions
AI programs have several advantages for academic purposes for students	Saving student's time Provision of accurate answers Improve writing skills
AI Programs may negatively impact students' academic performance	Diminish writing skills Provision of false or fake information Loss of motivation in searching books and reliable websites
AI would have a future impact on university education	Positive: Enhance the teaching process Negative: Lessen the role of teachers Negative: Spread of misleading information

"I used ChatGPT in writing therapeutics and biotechnology assignments because it gives quick and specific answers." [Student 10, female, 23 years]. Most participants revealed several advantages of AI in academic duties (Table 4).

Table 4: The perceived benefits of AI in academic assignments by the participating students

Perceived Benefits of ChatGPT	Number	Percentage
Gives a quick and specific answer	4	26.70
Rephrases and correct grammar	2	13.30
Improves the understanding and solving assignment	4	26.70
Saves time	4	26.70
Give notes on writing	3	20.00

Four students reported that AI helps them save time while completing tasks. Four participants considered AI programs advantageous in their ability to provide prompt and precise answers to different questions (Table 1). Five students stated that such programs, if used correctly, could improve their English writing. Some students felt they communicated with a person as they asked, and AI answered in both Arabic and English. "The use of ChatGPT speeds up the work and makes it easier for the student to solve their homework." [Student 1, male, 23 years]. "It (ChatGPT) provides a variety of potential responses to certain questions and can provide multiple solutions. It is efficient and dependable at the same time." [Student 14, female, 23 years]. "ChatGPT shortens the study time. I feel that I am talking to someone I ask; it answers in any language, Arabic or English, and if I repeat the question, it gives other additional answers." (Student 9, male, 21 years, 4th year, PharmD). Most students raise more than one issue against the use of AI programs. Primarily, the students revealed that AI may negatively impact their motivation to learn essential academic skills. For example, 11 students agreed that the use of AI programs would diminish students' writing skills. Four students reported that AI programs can provide students with unreliable

information. Five students claimed AI programs reduce their motivation to search for information in scientific sources. "When a student finds what he wants rapidly through the application, there is a great possibility of using the (copy-paste) technique without trying to write anything. So, I think these applications can lower students's writing skills." [Student 13, female, 23 years]. "These programs would cause a negative effect, as the student's impulsiveness to search for information from different sources decreases; thus, the student's skill in extracting information decreases." [Student 1, male, 23 years]. "I believe that improper use of artificial intelligence would have a negative impact on students' writing skills. This is because most students would rely on its quick and readily available information instead of searching for its source. Meanwhile, much of the ChatGPT information is inaccurate and without reference." [Student 15, male, 23 years]. "Without using AI, the students would become lazy because they get information easily and without effort." (Student 9, male, 21 years, 4th year, PharmD). "If students rely on AI completely, they would be less motivated to learn and develop skills" (Student 12, male, 21 years, 4th year, PharmD). Seven students had positive attitudes toward the future of education in the presence of AI, as they believed in its ability to enhance the teaching process. On the other hand, eight students had negative attitudes towards the effects of AI programs on the educational process, in which all of them considered the availability of such technology would diminish the professor's role in education. Two participants had additional negative beliefs about AI, as AI could harm the education system by disseminating scientifically inaccurate information. "The teaching process can be improved because AI can increase the teacher's performance in explaining hard subjects to the student, and thus the success of students in exams will be increased." [Student 1, male, 23 years]. "AI would have a negative impact on the education process. The students' scientific level would decrease, and AI would not develop academic abilities." [Student 13, female, 23 years]. "The current education would be

extinct, and the number of students who attend theoretical lectures would decrease." [Student 7, female, 23 years].

DISCUSSION

Almost all participating pharmacy students have experience using ChatGPT for academic purposes. A similar finding was obtained by recent studies in the UK and Sweden assessing the benefits of AI (Chatbots) among other healthcare students [21,22]. Meanwhile, this finding is highly expected since ChatGPT is the most commonly used Chatbot among the current study participants. It has a high ability to enhance the learning and education process by providing answers to any keywords entered by students [23]. A previous Iraqi study covering more than 3,000 pharmacy students from several colleges across the nation found that the students use information technologies (IT) when they are useful and easy to use [13]. This can explain why Iraqi pharmacy students are utilizing ChatGPT, probably because it is helpful in their academic duties and easy to use. Other Iraqi studies reveal that colleges of pharmacy across the country moved to electronic and hybrid education during COVID-19 [15,16]. This shift added new experience and skills to the students in terms of using IT and online applications. Therefore, pharmacy students in Iraq acquired more experience in using IT in the last few years, consequently encouraging them to try other new AI applications such as ChatGPT. Regarding the academic benefits of AI, this study showed that two-thirds of participating students used ChatGPT to write different assignments. A recent article indicates that AI programs can perfectly answer and write simple but not complicated or advanced assignments [24]. Thus, the current finding indicates the danger of AI tools to students' ability to write any home assignment. Therefore, it is highly recommended to solve this problem by providing students with either advanced assignments or at least restricting assignments to in-class and avoiding homework. In addition, the current study participants reported that they use AI ChatGPT to comprehend difficult material in lectures. Similarly, Chang *et al.* found that mobile Chatbots can enhance the self-efficacy of nursing students in learning difficult topics [25]. Regarding the advantages of using AI Chatbots, about one-third of the participating students mentioned that such applications can improve their writing skills. Similarly, a review article of 25 studies about the roles of AI found that it is used for academic and scientific writing [26]. In addition, some of the participating students in the present study reported that AI can save time while completing different academic tasks. Medical students at the University of Warwick in the UK also reported a similar benefit, which they considered the retrieval of information by the Chatbot to be faster than manual searching in other resources [21]. Furthermore, the participants in the current study considered AI programs advantageous in their ability to provide prompt and precise answers to different

questions. Students from Ghanaian University also reported this finding. Meanwhile, this function of the AI Chatbot may be highly useful to enhance the academic performance of shy students who have inadequate interaction with their teachers during class sessions [27]. Despite the numerous advantages of AI for students, the present study showed that most participants raised three issues against the usage of AI programs. One of the most commonly reported issues was the effect of AI ChatGPT on students' writing skills. Other studies also critique AI's effect on diminishing students' ability to gain creative writing skills [3, 8]. Additionally, some of the participating students perceived that AI could eventually reduce students' motivation to search for and read information from scientific sources. The provision of unreliable information to students is another criticism of AI that the current study participants reported. In this regard, a recent study showed that AI can generate misleading and fake information that is difficult to detect even by experts [9]. The students expressed hopes and concerns about the impact of AI on university education and learning. As they were impressed by its helpful functions, they also revealed concerns that students would rely on the easily available answers without actually learning or improving their thinking and writing skills. Likewise, a recent scoping review (2023) indicated that ChatGPT could diminish student's ability to engage in critical thinking [26]. On the other hand, eight students had negative attitudes towards the effect of AI programs on the educational process, and all of them considered the availability of such technology could diminish the professor's role in education. Two participants had additional negative beliefs about AI. They perceived that AI could harm the education system by spreading scientifically inaccurate information. A Canadian article refers to the potential positive effects of ChatGPT on nursing education, but at the same time, the information that comes from AI could be biased or unreliable [28]. Finally, AI could inflect more struggle on educators to identify between students' work and AI answers in their homework assignments. One of this study's strengths was that it covered both BS and PhD students. It was worth mentioning that there are only two public pharmacy colleges that have introduced PharmD programs with 25 students per cohort [29]. The study had some limitations. As with other qualitative studies, the generalizability of the findings may be limited. Additionally, the study included two pharmacy colleges in one province (Baghdad). However, we believe those two colleges are good representatives for Iraqi pharmacies since one was public and the other was a private college. Therefore, a future, larger-scale quantitative study would be helpful to confirm our findings.

Conclusions

AI, particularly ChatGPT, has been used by some Iraqi pharmacy students (for a few months) for academic purposes, particularly writing take-home assignments.

The students are happy with the amount of help they receive from the AI; however, they expressed concerns that it does not enhance their critical thinking or writing skills. The new era of education and learning after the emergence of AI would impose more responsibilities on educators. They need to change their strategies for teaching and testing students to improve student skills and identify students' own work from the AI information.

Conflict of interests

No conflict of interests was declared by the authors.

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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