MSc Computer Science & Big Data Analytics

ChatGPT: The advancement of knowledge and incorporation for its users. - Literature review

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# Literature Review

## Background and Aims

ChatGPT – is a large language Model (LLM) Artificial Intelligence (AI) tool created by Open AI which answers requests via Natural Language Processing (NLP) tasks [1], applicable in various practices. However, does ChatGPT allow for further education or knowledge enhancement for its users? Therefore, this chapter aims to examine currently available research and literature – or lack thereof - on whether users get to enhance knowledge further in that area from their perspective, and if so, is ChatGPT then incorporated into their day-to-day activities. The proceeding sections intend to highlight the literature reviewed and break out into separate themes uncovered.

## ChatGPT Evaluation and applications

The evaluation of ChatGPT and the applications it can use or used with, shows as the most dominating theme found in currently available research. The studies in the next paragraphs of this section represents the potential of ChatGPT adoption, but without external validation from users.

A study seen from Surameery and Shakor [4], examines ChatGPT use in solving programming bugs, understanding if the tool aids in debugging assistance, explanation, and corrections for software development procedures. Additionally, a comparison examined between ChatGPT against Integrated Development Environments (IDE’s) to trial effectiveness between practices; concluding that whilst IDE’s help with multiple features and capabilities but more complex to interpret, ChatGPT however allows for a more approachable, explainable, and intuitive way in handling programming bugs. This study extends further from works by Sobania et al [5] and Bang et al [6]. The study – in silo – provides partial context about how ChatGPT is useable and against other tools but provide no specific examples on what bugs examined and if solvable. Additionally, no research found on software developers using ChatGPT to solve any programming problems nor a perception of how this has helped them.

With Sobania et al [5], an evaluation performed back in January 2023 against ChatGPT on responses regarding if a piece of code has a bug and how it should be fixed; concluding a mostly positive but mixed results on performance – particularly where verification is needed, but better responses compared with other tools once context is applied on either side of the query. This study extends research from Surameery and Shakor [4], showing detailed examples of prompts used and responses from ChatGPT stating “would yield ChatGPT to be a viable tool that would help software developers in their daily tasks”. This excerpt from the research was not the focus and more a buildable foundation, where the research helps at least partially address gaps the above research presents.

Additionally, Bang et al [6] evaluates ChatGPT against a series of public datasets covering different tasks, and how it compares with other LLM’s – stating a satisfactory performance, but not without the risk of external hallucination – where a confident response provided without any justification from its training [33].

An article by Su, Lin, and Lai [29] suggests using ChatGPT to support students' argumentative writing in classrooms. The authors propose is that ChatGPT can help students formulate clear and logical claims supported by evidence to persuade others. They conducted experiments with ChatGPT using various prompts to measure its feedback performance. Additionally, they recommend that teachers instruct students to create their own outlines before seeking feedback and inspiration from ChatGPT for future learning. While this paper highlights the potential benefits of using ChatGPT in the classroom, it lacks an experimental exploration of student control and test groups to evaluate the impact on argumentative writing performance. Furthermore, the perspectives of both teachers and students regarding the use of ChatGPT in this context remain unexplored, presenting an opportunity for further investigation.

Based on studies presented above, similar themes occur by way of testing ChatGPT and its application with evaluation against different metrics, other LLM’s or other tools. More importantly, gaps seen through the literature thus far in that, whilst ChatGPT has been tested on performance and practice in silo for a particular use or topic, there appears to be little view from an array of users collected to understand whether users have adopted its practice on scenarios presented above, giving space for this research to help explore this gap.

## ChatGPT and the enhancement of user knowledge and incorporation

This section of the chapter groups together research found on the potential use of ChatGPT being able to enhance a user’s knowledge. The studies found below provide a great introduction into how ChatGPT has potential of utilisation both from an introductory or general view, as well as using specific cases evaluated against the tool. However, these show foundations of work that others could extend further.

Aljanabi [7] extends the notion of using ChatGPT, enabling possibilities and future directions for users and the software itself. This paper provides a great introduction into the use of ChatGPT and opportunities it presents, such as a potential for user personalisation, and alluding to integration for different working fields, and enhancing lives in meaningful ways. However, as Aljanabi [7] frames this work as an introductory piece into the subject, no specific provable claims are made here.

Similarly, an excerpt from Liberman [8] suggests ChatGPT as a tool to explore sources of information for users, focusing on students as a primary user, assisting with understanding context of a subject. Although, Liberman does go further to say that ChatGPT may not provide accurate information in all areas for its user. Again, this source does provide a highlight on what ChatGPT is and how it can assist with context, but little information of how it provides knowledge enhancement and detail is lacking to explain further, understood upon exploring this source considering the context provided.

Whilst sources above provide more of an introduction into ChatGPT as a field to explore rather than how users perceive the use of ChatGPT, the next set of sources delve further, albeit with limited range. A study produced by Kung et al [8] explored performance of ChatGPT on the United States Medical Licensing Exam (USMLE). Although the research’s primary focus was testing ChatGPT performance against the exam, a held discussion on the results was noted on whether ChatGPT can assist knowledge enhancement for users sitting the exam by providing insight into areas that needs development. However, limitations of this research keep it focused on ChatGPT and its output from USMLE, other than alluding exploration into knowledge enhancement for medical students sitting the exam and further incorporation into day-to-day use. Therefore, a gap in the study represented by no medical student participation shown against this study to explore the improvement of scoring in the USMLE.

A separate study found from Yue et al [9] explores use of ChatGPT providing financial knowledge to non-financial users, testing queries on how it can explain financial terms and metrics such as alpha, beta, earnings to price (EP) or Illiquidity to a user based on different context and publication approaches. This study is beneficial in that ChatGPT has capacity to help individuals gain financial knowledge to assist in making informed decisions. Nevertheless, no evidence located of assessing these exercises against participants to evaluate the claims made, on whether users understood the information provided, found helpful to them, as well as adds to their day-to-day routine of expanding knowledge further.

Firat [30] conducted research exploring the utilisation of ChatGPT to enhance the learning experience for autodidactic (self-taught) open education students. The research highlights ChatGPT's potential to transform students' learning experiences by offering personalised support, real-time feedback, and convenience of flexible working, among other benefits. However, the paper acknowledges limitations and emphasis for further research in this area. At time of writing, there is no evidence in this paper available regarding student use of ChatGPT in open education with autodidactic learning. Additionally, the lack of peer review raises concerns about the reliability and validity of the claims.

To summarise above, some evidence is found to exploring the notion of ChatGPT against users for knowledge enhancement, and a good introduction into possibilities that could be held here, although there seems to be a gap in measuring user engagement of the tool, instead focusing into more of what the tool can do.

## ChatGPT with user perception

Finally, this section focuses on available research regarding use of ChatGPT from a user perspective, and any indications as to what ChatGPT use is for the present and potential future user. Unfortunately, due to novelty of this view of research exploration there are limited pieces of research at present, but an aim here is presenting what is currently available and observed.

Tlili et al [10] conducted a case study on the use of ChatGPT by educational users. They explored initial user interactions and experiences, analysed Twitter networks and sentiments related to ChatGPT, and conducted interviews with participants. The study found that ChatGPT has potential as a learning aid and for idea generation. Although, whilst this source provides a solid foundation, there are limitations such as a small participant group, a narrow focus on education, and qualitative rather than quantitative research, meaning that user perspectives are immeasurable.

Haque et al. [31] conducted research on 12th December 2022, analysing sentiments of early adopters of ChatGPT using Twitter data. They employed Latent Dirichlet Allocation (LDA), an unsupervised topic modelling technique to understand user perceptions by grouping topics based on user sentiment [32]. The results indicate predominantly positive sentiments across all topics, with some negative and neutral seen as well. The study concludes that early adopters generally responded positively to ChatGPT, but also considered its implications for certain professions, due to its ability performing some required tasks. While this research provides valuable insights into early adopters' perceptions, it has limitations such as the potential changes in ChatGPT since the study and the lack of peer review, which affects the reliability and validity of the claims. Nevertheless, this research offers a useful indicator for the present-day user perception of ChatGPT.

To close off what is discovered in the above, two pieces of research is found concerning the measurement of user perception on ChatGPT. A great foundation is formed based on these where data is collected to understand how people have engaged with the tool. However, limited research is uncovered in this area and provides justification of this paper to explore further in terms of gathering current insight.

## Conclusion

This chapter evaluates existing research on individuals who have used ChatGPT to assess its impact on knowledge acquisition, both generally and within specific domains. It also examines the integration of ChatGPT into their daily activities. The findings suggest that ChatGPT is still relatively new since its release by OpenAI in November 2022 [2]. While there has been progress in this area, notable research gaps exist in understanding participant adaptation and interactions, with a focus found instead on isolated studies solely focused on the research topic. Furthermore, the scarcity of peer-reviewed resources due to the novelty of this research field.