Journal of Learning Development in Higher Education ISSN: 1759-667X
Issue 34 February 2025

Discovering how students use generative artificial intelligence tools for academic writing purposes

Heather Johnston
University of Liverpool, UK

Maria Eaton
University of Liverpool, UK

Isabel Henry
University of Liverpool, UK

Eva-Marie Deeley
University of Liverpool, UK

Bryony N. Parsons
University of Liverpool, UK

Abstract

The aim of this project was to identify ways in which students are using Generative Artificial Intelligence (GAI) technologies for the planning and researching stage of essay style assignments. The study recruited 30 students from various subject areas and levels of study and with different self-reported levels of confidence in using GAI tools. Each student was given three essay questions to choose from and 50 minutes to research their topic, make notes from sources, and put together an essay plan, using GAI tools if they deemed them useful. Their screens were recorded to facilitate a natural planning process and they were encouraged to narrate to provide insight into their reasoning. Of the 30 participants, 21 (70%) used GAI technologies within their process. ChatGPT 3.5 (Open AI) was the most frequently chosen, with 18 students (60%) using this. The most popular use of GAI was asking for definitions, explanations, or examples; or creating an essay plan or structure. The study also provided insight into students' searching process, revealing that Google was the most popular starting point (chosen by 30% of students). Journal articles were the most popular source type (used by 80% of participants), and skim reading a section of a source was the most common method used to decide if it was relevant, with 63.3% of students doing this. When examining referencing behaviour, 80% of the students

included some form of references in their essay plan, but none of the students created references for any GAI tools they had used.

Keywords: artificial intelligence; generative artificial intelligence; higher education; ChatGPT; academic skills; information literacy.

Introduction

GAI tools are advancing rapidly and when ChatGPT was launched in 2022, over a million users downloaded it within the first week (Stokel-Walker, 2022). GAI tools are able to generate ‘human-like responses’ to questions or prompts entered by the user, creating an ‘expert system available on demand’ (Bobula, 2024, p.2). This shift has caused some debate in educational settings, with many expressing worries around the impact on ‘originality and plagiarism’ in written work (Lim et al., 2023, p.2), but others considering ways in which it can be used to provide a more ‘customised learning experience’ (Hamerman et al., 2024). Essay writing has long been a component of university study, as the process encourages students to engage actively and critically with academic perspectives (McCune, 2004; Dahl et al., 2023). With the increased prominence of GAI, there are debates as to how or if usage should be restricted in relation to written university assignments, or whether universities should encourage the use of these tools (Crawford et al., 2023; Dwivedi et al., 2023). So far, university guidance is perceived by students to be ‘lacking, ambiguous, or applied inconsistently’ (Attewell, 2024, p.7).

There are several studies that explore the potential uses of GAI for university students. Kasneci (2023) states that it can be used positively to summarise texts, organise their thoughts, and provide resources on themes or topics. Dalalah and Dalalah (2023) discuss both the threats and opportunities, including 24/7 access to instant help, the ability for GAI to be able to handle multiple enquiries, and the breadth of subjects they can answer questions on. The threats included potential for bias, ethical challenges, potential for plagiarism, and inaccurate outputs. JISC (2024a, p.8) reported that there is awareness amongst students relating to these threats and concern around the possibility of misinformation generation and the spreading of bias in relation to ‘race, gender and socioeconomic status’.

A previous study by Johnston et al. (2024) showed that GAI is already being widely used amongst the student population for academic purposes, with 51% of respondents claiming to use or have considered using tools for this. Purposes included using it to understand concepts, plan assignments, search for resources, assist with referencing, and to help with spelling and grammar. The wide variety of usage even in the early stages of these technologies suggests that in order to help students develop their digital literacy, universities need to provide guidance on how to use these tools in a productive and effective manner. Kazley et al. (2024) conducted a survey of health students and found that 34.7% of respondents had used a GAI tool, with ChatGPT being the most popular and 30.6% of students choosing this. Within this study, 76.4% of students believed that using GAI to write a paper is cheating, but the majority believed that using it to research for a paper is acceptable. Studies by Obenza et al. (2024) and Baek et al. (2024) surveyed 500 to 1,000 students and noted strong intentions to use ChatGPT but with some concern around plagiarism and producing inaccurate information.

The JISC (2024a) student digital experience insight survey also offered an insight into how students were using GAI tools. The JISC survey found that 22% of respondents stated that they had used AI as part of their learning, but only 16% claimed to have been offered training in how to use these tools, suggesting there is a gap in support offered to students.

Although these studies have all provided clarity that students are choosing to use these tools to assist in various ways with their assignments, the use of surveys as the predominant method of data collection for all of these studies has meant there is still a lack of understanding of how they are using them, and to what level of proficiency.

There are several research papers on the ways students plan for and write their assignments which do not include the use of GAI. Dahl et al. (2023) used questionnaires and focus group interviews to explore student approaches to scientific essay writing more broadly. They found that students generally took an ‘impulsive and unplanned approach’ (Dahl et al., 2023, p4.), and the same challenges that were visible in previous research by West et al. (2019), such as poor structure, being too descriptive, and not integrating academic sources well enough were present. Furthermore, a Swedish study reported that students considered writing more important than searching, and that students overestimated their information literacy skills (Avdic and Eklund, 2010).

The purpose of the study is to explore in a more in-depth manner the ways in which students are using GAI technologies for the planning and researching stage of essay style assignments. Students are keen to receive more detailed guidance on how to use these tools effectively and develop themselves for the job market (Attewell, 2024), and the insights provided by this study will help inform what needs to be included in content created by academic staff and learning developers to enhance student confidence in using these tools.

Methods

The University of Liverpool is a Russell Group University and one of the UK's leading research-intensive institutions, with around 35,000 students.

In order to recruit participants, a survey for students to express their interest in taking part was created using JISC online surveys. This was open for two weeks at the start of semester two in the 2023-24 academic year and was promoted via an announcement sent to all students via the VLE (Canvas). The survey contained questions asking for the students' name, email, school, level and year of study, level of confidence in using GAI technologies (rated from 1 – not confident at all to 5 – very confident), and potential days and times they were available to come into the library for an hour and take part in the study. Students from all subjects were invited to take part in the study to have a broad variety to represent the student population at the university.

In the present study, 948 students completed the expression of interest survey. In order to choose 30 to participate, the responses were exported and the spreadsheet was sorted by level of confidence in using GAI technologies. From the 948 students who completed the expression of interest survey, 6 students who identified at each of the five levels of confidence were recruited and an online number generator was used to randomly select from each category.

Each time a student did not reply to an invite, or did not turn up to a dedicated slot, we randomly selected a new student from the same GAI confidence category. Throughout the study we had to generate replacements 35 times.

This resulted in the following students taking part (Table 1), where 66.7% were undergraduate (UG) and 33.3% were taught postgraduate (PGT). There were 46.7% from the faculty of Humanities and Social Sciences, 26.7% from Health and Life Sciences, and 26.7% from Science and Engineering.

Table 1. Confidence in using GAI, subject, and degree level of participants.

GAI confidence Level 1	**GAI confidence Level 2**	**GAI confidence Level 3**	**GAI confidence Level 4**	**GAI confidence Level 5**
PGT Archaeology	PGT Human Resource Management	PGT Advanced Biological Sciences	PGT Computer Science	PGT Football Industries
PGT Occupational Therapy	PGT Environmental Assessment and Management	PGT Data Science and AI	PGT Advanced Aerospace Engineering	PGT Advanced Computer Science
UG yr 3+ Veterinary Science	UG yr 2 Psychology	UG yr 3+ Biochemistry	UG yr 3+ Psychology	UG yr 3+ History
UG yr 2 Politics and International Business	UG yr 2 Geography	UG yr 3+ History	UG yr 3+ Sociology	UG yr 3+ Mechanical Engineering
UG yr 1 Medicine	UG yr 1 Communications, Media and Politics	UG yr 3+ Law	UG yr 2 Accounting and Finance	UG yr 3+ Law
UG yr 1 Archaeology	UG yr 1 Medicine	UG yr 2 Physics	UG yr 1 Business Management	UG yr 1 English

PGT= Taught postgraduate (Masters)
UG= Undergraduate

The hour-long research slots took place in a study room in the library. The students logged into a laptop provided, watched a short video explaining the research study and how all data collected would remain anonymous, and were given the opportunity to ask questions. Each student was given three essay questions of similar difficulty to choose from, relating to their subject area and appropriate to their level of study, but told they only needed to focus on one within the session. The questions were developed by PhD writing tutors,

liaison librarians, and learning developers, all of whom have regular engagement with students from different subject areas and access to a variety of examples of questions. An example of an undergraduate Law question was, ‘Critically assess whether the English legal system limits or supports the power of judges to change the law, especially in cases where there are compelling reasons to do so’. They were given 50 minutes to research their topic, use and make notes from any sources as they normally would for their assignments, and put together a plan for the essay. Everything they did was recorded using Canvas Studio (Instructure, 2024) screen recorder, and they were encouraged to narrate what they were doing and why. They were informed that for any part of the process, if they deemed it useful or appropriate, they could use GAI technologies if they wished. Students were reassured that they would not be identifiable and would receive no consequences for anything they did within the study environment to try and minimise students behaving in a way they considered to be appropriate, rather than in a way that was natural to them. We hoped that by not being present in the room we captured a more authentic version of their planning habits and would gain more detailed insight than we would have gained from surveys or focus groups. However, this did mean we could not ask further questions about the students’ behaviours and were reliant on their commentary to gain understanding around their choices.

Once the hour slot was complete, the recording was saved and the student was rewarded with a £30 Amazon voucher. These were purchased with funding granted by the ALDinHE research fund.

The recordings were then reviewed by the research team, which consisted of two learning developers and three student assistants. When reviewing the recording, a table was produced in Word, detailing step by step the process the participant followed, and any comments they made to explain their process. To ensure consistency, at least two recordings looked at by each reviewer were double-reviewed.

Statistical analysis was performed using SPSS version 28 (IBM, 2024). A Mann-Whitney U test was used to examine the difference between median confidence (in using GAI) scores and whether or not students used GAI in the study, and whether or not students showed awareness of GAI limitations. A Spearman’s Rank Correlation was used to examine the relationship between confidence in GAI and number of uses for GAI in the study. Ethics approval was granted by The University of Liverpool Ethics committee, ref 12737.

Results

GAI tools used

Of the 30 participants, 21 (70%) used GAI technologies within their process. Chat GPT 3.5 (Open AI) was the most popular, with 18 students (60%) choosing to use this. Table 2 details the other technologies used and any reasons given for their choice, although there were limited comments on why they chose a particular tool over another. It was noted that 7 of the students (23.3%) used more than one technology in their process.

Table 2. **Types of GAI technologies used by participants in the study.**

GAI tool	**Number of students who used this**	**Any reasons given for choice of GAI over another**
ChatGPT	18 (60%)	'ChatGPT is my go-to AI, don't know any others to use – I use it for almost all my essays'.
Perplexity	2 (6.7%)	'More confident using Perplexity than ChatGPT because it gives you the resources it got information from'.
QuillBot	2 (6.7%)	
CoPilot	2 (6.7%)	'I use CoPilot because it gives me key information and tells me what website they got it from'. 'CoPilot provides references which are

		correct, unlike ChatGPT where the references are often wrong'.
Grammarly	1 (3.3%) (and 2 mentioned they would use it in assignments usually).	'I like Grammarly as it makes my sentences sound better'.
PopAI	1(3.3%)	'I really like this AI as it summarises content for you which makes prepping for seminars easier too'.
JotBot	1 (3.3%) (opened but found confusing so did not use).	
Vertex	1 (3.3%)	'Vertex is a better AI than CoPilot or ChatGPT if you want a more in-depth explanation of something'.

Confidence in using GAI was related to use of GAI in this study, with the median confidence of students who used GAI in the study = 4, and median confidence of students who did not use GAI = 2, U=46.5, $P<0.05$, N=30.

Ways GAI was used

Students chose to use GAI in a variety of different ways, with 15 of the students (50%) using it in more than one way throughout the process. There was a strong positive correlation between confidence in GAI and number of uses for GAI in the study $r_s = 0.555$, $P<0.001$.

Table 3 sorts the different uses of GAI into nine different categories. It shows how many students chose to use GAI for each purpose, and examples of prompts they entered. It

also contains example comments which explain their reasons for using GAI for this purpose.

Table 3. **Types of use of GAI in the study by participants**.

Use of GAI	**Number of students who used GAI and did this (n=21)**	**Example prompts**	**Example comments – why they chose to use GAI for this purpose**
Asking for explanations, examples, or definitions.	15 (71.4%)	'Explain 3 principles of quantum mechanics' 'what is paternalism basic'	'I often find it quicker to ask ChatGPT a basic question than Google'. 'ChatGPT is good to find current developments on a topic'. 'I like that you can ask for more details about a specific example'.
Generating an essay plan or structure	13 (61.9%)	'how could I structure an essay about how DNA polymerases, helicases, and primases coordinate to ensure	'ChatGPT is good for thinking of suggestions I hadn't thought about'.

		accurate DNA synthesis?' 'draft a structure for an essay on comparing the properties and types of AI and computer vision'	'ChatGPT is good to help me come up with ideas'. 'ChatGPT is good to help with what direction to take and make sure I don't forget something key in my plan'.
Recommending sources	6 (20%)	'What are some sources on social class on the Titanic' 'provide me with research papers to refer these points'	'Suggested resources by ChatGPT are often useful and can also generate keywords'.
Paraphrasing, rewording, or expanding on own work	6 (20%)	'please re write this (using the same style of writing) to make it more clear and concise' 'expand by adding two sentences'	'ChatGPT is good for making things more concise'. 'ChatGPT produces wording that sounds more professional'. 'I use ChatGPT a lot to correct grammar mistakes, or to

			make my writing clearer and more concise'.
Paraphrasing or summarising sources	4 (19%)	'Paraphrase' 'Rephrase'	'This is useful so you don't waste time reading if it is not what you need'.
Creating sections of the essay	2 (9.5%)	'write me an introduction for a report evaluating the impact of digital media on football marketing strategies.'	'Can train ChatGPT to use the same style of writing as myself'.
Generating prompts or alternative terms to search for	2 (9.5%)	'other words for processes'	'I think ChatGPT comes up with better ways to phrase things'.
Asking for feedback on their work	2 (9.5%)	'This is a plan for my essay. The question is about modelling techniques for engineering, what do you think of the plan'	'Useful to get feedback on what I have written to check I am on the right lines'.
Referencing sources in a certain format	1 (4.8%)	'can you help me reference the link in an oscola referencing manner'	'Just experimenting to see if this works'.

Student awareness of GAI limitations

Of the 21 students who used GAI, 12 students (57.15%) indicated that they were aware of the limitations of the tool they were using and the need to check what it produces and find

more academic sources. There was no statistically significant difference between the median confidence scores of students who were aware vs. unaware of GAI limitations.

Below are some of the comments made:
‘I would not trust everything it says – but it is a good starting point for researching further’.
‘I always check suggested references in Google Scholar as often they don’t exist or are slightly wrong’.
‘I use it to get an idea about structure but won’t just use it blindly’.
‘I would always re-read the paragraph to confirm ChatGPT’s summary is correct’.

Ineffective examples of use

There were some cases where GAI was used ineffectively. These mostly seemed to be due to a lack of awareness of the purpose of the GAI tool, or what it was capable of. Participant 2 (GAI confidence level 4) pasted a sentence from a journal article into QuillBot, asked it to paraphrase, and stated that ‘QuillBot paraphrases your text so you are not plagiarising’. They also took sentences from ChatGPT and pasted them into QuillBot for paraphrasing, stating that they were ‘paranoid’ a plagiarism detector would ‘find out if they copied and pasted from ChatGPT into their essay’.

Participant 5 used Perplexity to find sources on their topic. They stated that they prefer Perplexity to ChatGPT because Perplexity has a list of ‘corresponding sources’ to show where the information in the answer has come from. However, after using Ctrl and F to find the words in the source to match with what was in Perplexity, none of the words they searched for were present, suggesting that this was incorrectly referenced by Perplexity. Despite this, they continued to use Perplexity and the sources it suggested.

Only one participant used only GAI tools for the entire process. Participant 25 used three different GAI tools – ChatGPT, Vertex, and CoPilot. They would enter a similar prompt into all three tools and then compare the responses. They did not use any sources other than GAI tools to find content for their essay.

Starting the research process

Students chose to start their research process in a variety of places. The most popular was Google, with 9 of the students (30%) choosing to begin here and 6 students (20%) began with a GAI tool (Table 4). Table 4 also details some of the comments made around the reasons for choosing a particular starting point.

Table 4. **Platform used as a starting point when participants searched for sources.**

Starting point	**Number of students**	**Comments made around reason for choice**
Google	9 (30%)	‘Google Search is really easy to access and understand’. ‘Google is good to find basic sources on a topic’. ‘Google is good to find definitions’. ‘I like the ‘people also ask’ section in Google search’.
Google Scholar	6 (20%)	‘Google Scholar is the most reliable source to begin with’. ‘I like Google Scholar as it shows the keywords highlighted in bold’. ‘Google Scholar is easy to use’.

ChatGPT	5 (16.7%)	‘ChatGPT gives a good overview of what I have to do’. ‘ChatGPT is useful to help decide what direction to take and make sure I don’t forget something key’. ‘ChatGPT is a good starting point although I wouldn’t trust everything it says’.
Library Search	4 (13.3%)	‘I find Library sources easier to navigate than Google Scholar’. ‘Library search is the most helpful starting point’.
Subject databases	4 (13.3%)	
Perplexity	1 (3.3%)	‘I prefer Perplexity as it gives links to resources’.
Unknown	1 (3.3%)	

Searching throughout the process

Table 5 shows the different places students performed searches for sources throughout their research slot.

Table 5. Searches used at any point during the study.

Resource	Number of students who searched here
Google	16 (53.3%)
Google Scholar	16 (53.3%)
Subject databases	9 (30%)
ChatGPT	6 (20%)
Library Search	5 (16.7%)
CoPilot	2 (6.7%)
Perplexity	1 (3.3%)
Vertex	1 (3.3%)

Throughout the allocated time, 14 of the students (46.7%) only used one resource to search for information, and when examining where students accessed their information from, 6 of the students (20%) chose to go via the university library website to find their resources. It was noted that one of the participants found the library search less useful than other search engines for finding articles but that it was useful for finding DOIs of articles found via Google Scholar. Participant 5 reported that the 'hardest part about writing an essay is finding the sources'. Within these searches, the most common types of sources accessed were journal articles, followed by websites and GAI (Table 6).

Table 6. Number of students who used each resource type throughout the process.

Resource type	Number of students who used this
Journal articles	24 (80%)
Websites	8 (26.7%)
GAI tools	8 (26.7%)
eBooks	5 (16.7%)
Newspapers	3 (10%)
Blog posts	3 (10%)
Wikipedia	2 (6.7%)
Conference papers	2 (6.7%)
Study sharing sites	2 (6.7%)
Social media	1 (3.3%)
Market reports	1 (3.3%)

Some students commented on how they would decide whether a source was appropriate and worth reading in depth or using in their essay. Table 7 summarises the ways in which they decided this and includes some examples of comments that were made.

Table 7. The ways participants decided upon the appropriateness of sources.

Ways of deciding the appropriateness of a source	**Number of students who mentioned this**	**Examples of comments made**
Skim reading a section of the source	19 (63.3%)	'I will usually read the introduction to decide if it is relevant'. 'The abstract of an article is usually good to explain the context'.
Using Ctrl and F to search for keywords within the source	6 (20%)	'I use Ctrl and F to see if there are bits I actually need rather than reading the whole article'.
Choosing familiar sources or those lecturers have recommended	5 (16.7%)	'I know my lecturer uses this journal a lot'. 'I have definitely heard of this journal before'.
Following up on references that another source has used	4 (13.3%)	'I usually follow references when I find a good paper'. 'I usually leapfrog to other sources'.

Looking at the number of citations a source has had	3 (10%)	'I like to use items that have been cited by a good number of people'. 'If an item hasn't been cited much then it won't be that useful'.
Selecting 'recommended' or 'suggested' items within the source	3 (10%)	
Looking for the most recent content	3 (10%)	'I think an article published in 2010 would be too old'.
Looking for UK-based content	2 (6.7%)	
Choosing sources that have been peer reviewed	1 (3.3%)	'I like to filter by peer review to find trusted sources'.
Choosing primary sources	1 (3.3%)	'I always try and find primary sources on a topic'.
Considering credentials of the author	1 (3.3%)	

Searching techniques

Of the students who took part, 22 (73.3%) searched using keywords and 16 students (53.3%) then edited their search with alternative terms if their initial search did not bring back the results they were hoping for. Conversely, 8 of the students (26.7%) typed their question or the majority of their question straight into their chosen search tool.

There were 11 students (36.7%) who used filters when they were searching for information on their topic. These included filtering for a certain date range (8 students – 26.7%); filtering for a certain resource type (3 students – 10%); filtering for English language (1

student – 3.3%); and filtering for full text (1 student – 3.3%). At least one example of Boolean techniques were used by 8 students (26.7%) throughout their searching process.

Referencing of sources

Within the essay plans, 24 (80%) of the students included some form of references and 14 (46.7%) consistently matched the reference to the information so it could be clearly seen which content was taken from each source used. None of the students created references for any GAI tools they had used throughout the process or commented about their choice not to do this.

Their methods for referencing can be seen in Table 8. As at this stage they were only being asked to create a plan, the most popular course of action (40%) was to add links to their Word or Google document to the sources they had used.

Table 8. Referencing methods.

Referencing method	Number of students
Pasted link to item	12 (40%)
Used MyBib to create reference	4 (13.3%)
Used Google Scholar ‘cite’ option	3 (10%)
Creates full reference manually	2 (6.7%)
Used Library Search to create reference	1 (3.3%)
Used Bibliography feature in Word	1 (3.3%)
Added author name and date manually	1 (3.3%)

Discussion

Use of generative artificial intelligence in relation to student confidence

Most students in this present study chose to use GAI to search and/or plan their essay. It was observed that students rarely used the information from GAI alone in their essay plan and most relied on their own knowledge to expand on certain points or suggest topics to discuss (an advantage of tailoring the essay question to their subject). There was a positive association between confidence in using GAI and using GAI for the task in this

study. Similar results have been recorded by Kelly et al. (2023) where student confidence in using GAI ethically was positively associated with experience of using GAI. ChatGPT 3.5 (Open AI) was the predominant GAI technology used, despite its disadvantages compared to other Large Language Models like Copilot, such as not being connected to the internet or providing accurate references which the user can follow up on (Dao, 2023; Diaz, 2024). Participants indicated that reasons for preferring this technology were due to various factors, such as not being aware of other technologies, the speed of its response, its ability to make suggestions, and the interactive element of asking it for specific details. Conversely, the students who used technologies such as Perplexity and Copilot suggested these GAIs were more advantageous as they provide sources and do not provide artificial references which participants believed was a limitation of ChatGPT. Participants in a study by Obenza et al. (2024) also noted concern around inaccurate information provided by ChatGPT. GAI was mostly used to explain concepts, provide definitions, and to create an essay plan/structure. These findings are supported by previous work where using GAI for understanding concepts and planning were amongst the most commonly suggested uses (Johnston et al., 2024). Confidence in GAI was also positively associated with more diverse use of GAI, comparable to findings of Chan and Hu (2023) who reported a positive correlation between knowledge of GAI and frequency of use.

Inappropriate use was observed rarely and included asking GAI to paraphrase journal articles without referencing (plagiarism), using sources provided by GAI even when the sources couldn't be verified and using only GAI as a source. Of these instances, two students had a confidence level of 3, and the student who used GAI to plagiarise had confidence level 4. This suggests that confidence in using GAI does not necessarily increase awareness of GAI limitations or good practice in using GAI. Similar findings have been reported by others where students' self-reported confidence in using GAI was overestimated (Kelly et al., 2023).

Searching for sources

Half the students began their search with either Google or Google Scholar, while five started with GAI and eight initiated searches using the library search or subject databases. Throughout the entire session, Google and Google Scholar remained most used, with participants stating reasons such as ease of access and clarity. Participants also appreciated features such as 'people also ask' and keywords being highlighted, and some

perceived it as being the most reliable search tool. In addition, Google Scholar has been identified as 'the most comprehensive academic search engine' (Gusenbauer, 2019, p.199), and a recent study by JISC (2024a) identified it amongst the top ten most useful digital tools, which may explain the preference for Google searches in the present study.

Avdic and Eklund (2010) reported that students expect sources to be of higher quality when using library databases and that students believed this could lead to higher grades. This may partly explain why a quarter of participants in the present study chose to start their searches with library/subject specific databases and why five students commented that they were choosing sources/databases based on familiar and lecturer-recommended resources. However, students have also noted that using library databases to locate materials can be more challenging and time-consuming, whilst Google Scholar is convenient and easy to use (Avdic and Eklund, 2010; Wu and Chen, 2012). A participant in the present study noted that the library search was not as useful for finding journal articles, suggesting another possible reason for the heavy use of Google Scholar. Interestingly, students in the study by Avdic and Eklund (2010) reported that it is easy to learn how to search and that teachers do not always fully explain the benefits of using databases. Lack of awareness of important databases has also been reported in other work (Kai-Wah Chu and Law, 2005). In addition, Avdic and Eklund (2010, p.229) observed that the 'least experienced students found it more time consuming to search' than experienced students, and more internet experience also correlated with ease of searching the internet for sources. These factors may have contributed to the results in the present study, for example referring to GAI to find sources rather than an appropriate database or library search.

The majority of students searched using keywords and many demonstrated an ability to use alternative words. However, several poorer strategies were observed. Of the students who took part, 26.7% searched for the whole essay question and it was noted that this often led to search results which included study aid sites selling whole assignments. Furthermore, only 36.7% of students used filters in their search and a limited number used Boolean techniques. Research from others has also found students overestimate their ability to perform searches and that their ability to use Boolean or truncation techniques correctly was limited, which in turn can lead to wasting more time (Jacobsen and Andenæs, 2011).

Referencing

Most participants kept track of their sources while making their plan, and just under half consistently matched the information with the source clearly in their plan. However, no student in the study referenced the use of GAI at the planning stage. It is unknown if they would have declared this in the final version or whether they were aware of how to reference GAI, but failing to reference literature is a common mistake students make when writing essays (West et al., 2019).

Wu and Chen (2012) described how students may choose not to use referencing management software such as EndNote because they do not have a large number of sources to keep track of or because they fail to understand its functions. This may partly explain why so few students in the present study chose to use any referencing management software and when they did, they used software such as MyBib rather than EndNote. MyBib is a free online tool which is quick and intuitive to use and requires little training.

Recommendations

Learning developers have a key role to play in educating students about the benefits and drawbacks of using GAI for different purposes. When developing tutorials or sessions around the use of GAI, it will be essential to raise awareness of the benefits of tools beyond ChatGPT, which many students opted to use. Clear guidance is needed on the limitations of GAI tools and how to evaluate their outputs to ensure they follow up on sources and fact check the information provided. As the research indicated that experience and confidence in GAI appeared to correlate with multiple uses of GAI, students should be given the opportunity to explore GAI for themselves to identify its strengths and weaknesses. Learning developers and librarians should also consider incorporating more Google and Google Scholar searches in their teaching and recognise that referencing management software such as MyBib may be the most widely used by students.

As some students appeared to overestimate their abilities to use GAI appropriately, they may benefit from a quiz or self-analysis tool which allows them to test their knowledge.

The JISC Discovery Tool (JISC, 2024b) now contains an AI question set, which if implemented alongside university guidance, can provide some clarity around how GAI can be used appropriately in relation to their studies.

Limitations of the study

The present study has a relatively small sample size and a higher proportion of students towards the end of their degree or PGT. Kelly et al. (2023) found postgraduates were more confident than undergraduates in GAI; however, this was compensated for, to some extent, by selecting students from a range of GAI confidence levels. Demographic information was not recorded, including whether English was a first language. Some differences in gender and age were observed for searching abilities in students from Sweden (Avdic and Eklund, 2010). Although degree subject was recorded, there were insufficient numbers in each area to make strong conclusions, and future studies may benefit from focusing on particular groups of students. Prompt literacy was not an aim of this study but future research should explore this further. As GAI is a constantly changing tool, there are imminent developments that could impact on user behaviour, and future studies could benefit from exploring these in more detail. As well as the standalone tools such as ChatGPT being updated, there is also the integration of AI into technologies such as search engines and Microsoft Office products, which could change the way students choose to search and write their assignments in the near future.

The current study provides a small window into the assignment writing experience and it is unknown what the final essays would have consisted of. It is possible that students who volunteered to take part may be more studious and less likely to commit academic malpractice whether intentionally or by mistake, although previous research showed students who were more confident in their writing were less likely to use GAI at all (Johnston et al., 2024). Finally, students were ultimately being recorded and, despite reassurances about confidentiality, may not have behaved exactly as they would have for a typical assignment. In addition, this was a mock assignment and there was no element of stress, time pressure, or competing deadlines, which are all factors which could impact student behaviour and potentially change the findings here.

Conclusion

GAI was embraced by 70% of students in the study, with ChatGPT 3.5 (Open AI) the most popular choice, suggesting that university staff should aim to increase awareness of the benefits of other tools, such as CoPilot. Overall, the majority of students who used GAI at the planning stage used the technologies to assist with understanding concepts and generating essay plans, but still relied on academic or subject appropriate sources to support their conclusions. Furthermore, students generally kept good records of their sources, apart from citing GAI itself, although it is unclear if this would have been the case for the final essay. Self-reported confidence in using GAI was related to frequency of use in this study, but there was no correlation between student confidence level and their awareness of GAI limitations, suggesting some students may overestimate their understanding of GAI. Therefore, it may be useful to introduce self-analysis tools so that students can better gauge their abilities with GAI.

Google and Google Scholar were by far the most widely used search tools, which should be considered when delivering sessions to students on search techniques. Although the majority of students used keywords and alternative terms to find relevant content, students seemed less confident in using Boolean or filtering information and would benefit from additional training in developing effective search strategies.

In conclusion, although students are already using GAI tools in a variety of ways to assist with the searching and planning process, the role of the learning developer is essential in raising awareness of the different tools on offer, enabling students to maximise the benefits of these tools, ensuring effective prompt literacy, and clearly conveying the limitations***.***

Acknowledgements

The authors did not use generative AI technologies in the creation of this manuscript.

References

Attewell, S. (2024) *Student perceptions of generative AI.* Available at: https://www.jisc.ac.uk/reports/student-perceptions-of-generative-ai (Accessed: 5 November 2024).

Avdic, A. and Eklund, A. (2010) 'Searching reference databases: what students experience and what teachers believe that students experience', *Journal of Librarianship and Information Science*, 42(4), pp.224-235. Available at: https://doi.org/10.1177/0961000610380119

Baek, C., Tate, T. and Warschauer, M. (2024) '"ChatGPT seems too good to be true": college students' use and perceptions of generative AI', *Computers and Education: Artificial Intelligence*, 7, article number 100294. Available at: https://doi.org/10.1016/j.caeai.2024.100294

Bobula, M. (2024) 'Generative artificial intelligence (AI) in higher education: a comprehensive review of challenges, opportunities and implications', *Journal of Learning Development in Higher Education*, 30. Available at: https://doi.org/10.47408/jldhe.vi30.1137

Chan, C.K.Y. and Hu, W. (2023) 'Students' voices on generative AI: perceptions, benefits, and challenges in higher education', *International Journal of Educational Technology in Higher Education,* 20, article number 43. Available at: https://doi.org/10.1186/s41239-023-00411-8

Crawford, J., Cowling, M. and Allen, K.-A. (2023) 'Leadership is needed for ethical ChatGPT: character, assessment, and learning using artificial intelligence (AI)', *Journal of University Teaching and Learning Practice*, 20(3). Available at: https://doi.org/10.53761/1.20.3.02

Dalalah, D., and Dalalah, O.M.A. (2023) 'The false positives and false negatives of generative AI detection tools in education and academic research: the case of ChatGPT', *The International Journal of Management Education*, 21(2). Available at: https://doi.org/10.1016/j.ijme.2023.100822

Dahl, B.M., Vasset, F. and Frilund, M. (2023) 'Students' approaches to scientific essay writing as an educational method in higher education: a mixed methods study', *Social Sciences and Humanities Open*, 7(1). Available at: https://doi.org/10.1016/j.ssaho.2022.100389

Dao, X.Q. (2023) 'Performance comparison of large language models on VNHSGE English dataset: openAI ChatGPT, Microsoft Bing Chat, and Google Bard'. *arXiv preprint arXiv:2307.02288.* Available at: https://doi.org/10.48550/arXiv.2307.02288

Diaz, M. (2024) 'ChatGPT vs. Microsoft Copilot vs. Gemini: which is the best AI chatbot?', *ZDNET,* 13 August. Available at https://www.zdnet.com/article/chatgpt-vs-microsoft-copilot-vs-gemini-which-is-the-best-ai-chatbot/ (Accessed: 24 Dec 2024).

Dwivedi, Y.K., Kshetri, N., Hughes, L., Slade, E.L., Jeyaraj, A., Kar, A.K., Baabdullah, A.M., Koohang, A. et al. (2023) 'Opinion paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy', *International Journal of Information Management*, 71. Available at: https://www.sciencedirect.com/science/article/pii/S0268401223000233?via%3Dihub (Accessed: 24 May 2024).

Gusenbauer, M. (2019) 'Google Scholar to overshadow them all? Comparing the sizes of 12 academic search engines and bibliographic databases', *Scientometrics*, 118, pp.177-214. Available at: https://doi.org/10.1007/s11192-018-2958-5

Hamerman, E., Aggarwal, A. and Martins, C. (2024) 'An investigation of generative AI in the classroom and its implications for university policy', *Quality Assurance in Education,* 33(2). Available at: http://dx.doi.org/10.1108/QAE-08-2024-0149

IBM (2024) *Statistical Package for Social Sciences*. Available at: https://www.ibm.com/products/spss-statistics (Accessed: 16 March 2024).

Instructure (2024) *Canvas*. Available at: https://www.instructure.com/canvas (Accessed: 4 March 2024).

Jacobsen, H.E. and Andenæs, R. (2011) 'Third year nursing students' understanding of how to find and evaluate information from bibliographic databases and Internet sites', *Nurse Education Today*, 31(8), pp.898-903. Available at: https://doi.org/10.1016/j.nedt.2011.01.003

JISC (2024a) *2023/24 UK higher education students digital experience insights survey findings.* Available at: https://digitalinsights.jisc.ac.uk/reports-and-briefings/our-reports/2023-24-uk-higher-education-students-digital-experience-insights-survey-findings/ (Accessed: 5 November 2024).

JISC (2024b) *Discovery Tool*. Available at: https://digitalcapability.jisc.ac.uk/our-service/discovery-tool/ (Accessed: 21 January 2025).

Johnston, H., Wells, R.F., Shanks, E.M., Boey, T. and Parsons, B.N (2024) 'Student perspectives on the use of generative artificial intelligence technologies in higher education', *International Journal for Educational Integrity,* 20, article number 2. Available at: https://doi.org/10.1007/s40979-024-00149-4

Kai-Wah Chu, S. and Law, N. (2005). 'Development of information search expertise: research students' knowledge of databases', *Online Information Review*, 29(6), pp.621-642. Available at: https://doi.org/10.1108/14684520510638070

Kasneci, E., Sessler, K., Kuchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G. et al. (2023) 'ChatGPT for good? On opportunities and challenges of large language models for education', *Learning and Individual Differences*, 103. Available at: https://doi.org/10.1016/j.lindif.2023.102274

Kazley, A.S., Andresen, C., Mund, A., Blankenship, C. and Segal, R. (2024) 'Is use of ChatGPT cheating? Students of health professions perceptions', *Medical Teacher,* pp.1-5. Available at: https://doi.org/10.1080/0142159X.2024.2385667

Kelly, A., Sullivan, M. and Strampel, K. (2023) 'Generative artificial intelligence: university student awareness, experience, and confidence in use across disciplines', *Journal*

of University Teaching and Learning Practice, 20(6). Available at: https://doi.org/10.53761/1.20.6.12

Lim, W.M., Gunasekara, A., Pallant, J.L., Pallant, J.I. and Pechenkina, E. (2023) 'Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators', *International Journal of Management Educatio*n, 21(2). Available at: https://doi.org/10.1016/j.ijme.2023.100790

McCune, V. (2004) 'Development of first-year students' conceptions of essay writing', *Higher Education*, 47, pp. 257-282. Available at: https://doi.org/10.1023/B:HIGH.0000016419.61481.f9

Obenza, B.N., Salvahan, A., Rios, A.N., Solo, A., Alburo, R.A. and Gabila, R.J. (2024) 'University students' perception and use of ChatGPT: generative artificial intelligence (AI) in higher education', *International Journal of Human Computing Studies*, 5(12), pp.5-18. Available at: https://ssrn.com/abstract=4724968 (Accessed: 24 May 2024).

Stokel-Walker, C. (2022) 'AI bot ChatGPT writes smart essays – should professors worry?' *Nature,* 9 December. Available at: https://www.nature.com/articles/d41586-022-04397-7 (Accessed: 24 May 2024).

West, H., Malcolm, G., Keywood, S. and Hill, J. (2019) 'Writing a successful essay', *Journal of Geography in Higher Education*, 43(4), pp.609-617. Available at: https://doi.org/10.1080/03098265.2019.1655720

Wu, M.-D. and Chen, S.-C. (2012) 'How graduate students perceive, use, and manage electronic resources'., *Aslib Proceedings,* 64(6), pp.641-652. Available at: https://doi.org/10.1108/00012531211281779

Author details

Heather Johnston works as a Learning Developer in Libraries, Museums and Galleries at The University of Liverpool where she teaches academic skills.

Maria Eaton was employed as a student partner in The Library at The University of Liverpool.

Isabel Henry was employed as a student partner in The Library at The University of Liverpool.

Eva-Marie Deeley was employed as a student partner in The Library at The University of Liverpool.

Bryony Parsons works as a Learning Developer in Libraries, Museums and Galleries at The University of Liverpool where she teaches academic skills.

Licence