american physiological society

ADVANCES IN PHYSIOLOGY EDUCATION

Adv Physiol Educ 49: 517–525, 2025.
First published March 25, 2025; doi:10.1152/advan.00181.2024

EDUCATION RESEARCH

Teaching in an Era of Generative Artificial Intelligence

The use of AI large language models by university students for assignment preparation

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Abstract

Using an opportunity where students were explicitly permitted to use artificial intelligence (AI) applications to prepare an assignment, we compared the practices and beliefs of two distinct student cohorts: second-year science students at a large metropolitan university in Australia and students at a partner institution in the People's Republic of China (PRC). Data from an anonymous survey revealed that over 50% of students employed AI tools, primarily for idea generation and initial drafting, instead of using these tools as a source of text they would use in the assignments without editing or attribution. Reasons for use showed differences between native English speakers, their nonnative speaking classmates, and their classmates attending the PRC campus. Across the cohorts, there was a measured engagement with AI tools when preparing assignments. Notably, all cohorts declared a greater willingness to use such tools if institutional licenses were made available. Most students believed that they would use AI in their future professional roles and that their institutions should be providing guidance on the proper use of AI tools. At the Australian campus, sanctioning the use of AI in preparing the class assignment was not associated with any change in the average assignment marks from those gained by a cohort from the previous year where no sanction was in place. At the same time, there was a significant improvement in the average mark for the PRC students, which was associated with the same sanction.

NEW & NOTEWORTHY We compared second-year science students at an Australian university and a partner institution in China on their use of AI tools for assignments. Over 50% used AI for idea generation and drafting. Notably, PRC students showed improved grades when AI was permitted, while Australian students saw no change. Most students expressed a willingness to use AI in their future careers and called for institutional guidance on AI use, especially if official licenses were provided.

artificial intelligence; assessment; international education; physiology education; undergraduate

INTRODUCTION

The release of the Chat Generative Pre-Trained Transformer (ChatGPT) large language model in late 2022 vastly increased global awareness of the uses of artificial intelligence (AI). For example, its release has led to heightened competition among major technology companies creating similar natural language processing models (1–3). ChatGPT has been trained on a diverse range of internet texts, allowing it to exercise a capacity to work with and within a broad range of languages and contexts. The enthusiasm of most users for this and similar large language models is largely driven by its ability to engage in interactive conversations and provide coherent and contextually relevant responses to user inputs (2). Unlike web-based search engines such as Google and Bing, which provide relevant web links based on the search terms or phrases, these large language models provide textual answers to users' inquiries. Even though the answer(s) provided are not always correct and or relevant, these models are still frequently used by people from all backgrounds and all levels of prior and current learning (4–6).

The advent of ChatGPT needs to be considered a recent event in the lengthy history of students' use of language processing and assistive technologies. Well-known examples include Grammarly for grammar checks and style guidance (7) and Turnitin for checking and feedback on the originality of writing (8). As well as this, language translation services, such as Google Translate, have been frequently used by nonnative English-speaking students for comprehension and writing (9). In preparing assignments, students use AI tools to automatically summarize large volumes of text to extract critical information from research publications quickly. Examples of this latter AI tool are Bidirectional Encoder Representations from Transformers (BERT) and SMMRY (10). Students and

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Submitted 16 September 2024 / Revised 26 November 2024 / Accepted 17 March 2025

professionals have used programming languages like R and Python for data analysis and visualization (11–13).

The development of AI is principally aimed toward the creation of devices, machines, or systems capable of performing tasks that would otherwise require human intelligence and, in this way, acting as helpful problem-solving assistants and time savers (14). As stated earlier, the advent of ChatGPT significantly raised the awareness of the potential for AI in work and leisure (14, 15). In the publication field, researchers have already engaged ChatGPT in writing scientific papers (16). Copilot, a large language model embedded in Microsoft Word, can draft a manuscript based on proffered data and figures (17). In the higher education sector, using ChatGPT or other language processing systems for assignments has been a growing trend for students, raising concerns among educators about the originality of submitted work and the potential as a means to avoid plagiarism detection. There have been ongoing discussions in many forums on assessment design and marking that have considered and continue considering how to cope with, but potentially manage, and ideally incorporate students' use of large language models when preparing assignments (18–28).

The use of AI in education and other professions is an evolving field, and new technologies and systems keep emerging. Therefore, we encouraged students to use AI tools to complete an assignment on the future of AI as part of a subject taught at a large metropolitan university in Sydney, Australia. It is delivered to second-year medical science students as a core unit (a "subject" at this campus). However, students from other majors who meet the pre-requisite requirements can enroll in the subject as an elective. The assignment was an oral presentation in which the students were to explore the role of AI in the context of this subject's content and learning objectives. The students were allowed to use any AI tools to prepare for this assignment.

Students were surveyed about their beliefs about and engagement with AI tools when preparing this and other assignments. Students were also surveyed on their perspectives on using AI in their future jobs. In addition to teaching campus-enrolled students, the University has a 4-year undergraduate pathway program with a campus in the People's Republic of China (PRC). In this program, lecturers from the Australian university deliver face-to-face tutorials to China-based students. These students are all Mandarin speakers but must complete the subject in English. While the presentation needs to be in English, English as a nonnative language can affect how students compose their opinions in English (29, 30). Therefore, we hypothesized that the use of AI tools, particularly those designed for language processing, may benefit nonnative English speakers more than native English speakers. This arrangement gave the investigators a unique opportunity to compare the use of, and attitudes toward, AI tools between students enrolled at the Australian campus and those attending the campus in the PRC.

METHOD

Participants

The students from the Australian campus came from a mixture of overlapping majors, including medical science, biomedical science, biotechnology, biomedical physics, and biomedical engineering. They were a mix of domestic and international students who were mostly halfway through their respective courses. The other cohort was the students enrolled in the pathway program mentioned above as biotechnology majors. Both cohorts studied the same unit during the Australian campus's Spring Session (September to December 2023). They were taught by the same staff involved with the students when preparing their assignments.

Assessment Requirements

The assessment was a group-created short presentation with a maximum length of 8 min, contributing to 25% of the final mark for the subject. In designing and delivering the presentation, the students were to imagine presenting to an audience with no science or medical background, that is, "lay people" of any age and employment status. Some examples were a housewife/househusband, school students in a coding club, or administrative staff in a social service center. Groups of four to five students prepared an oral presentation on their investigations of the role of AI in medicine, public health, and health education. There needed to be an emphasis on presenting the pros and cons of embracing AI to equip themselves for future careers in the health and medical industry and the capacity to make positive contributions to population health outcomes.

This was an audiovisual presentation that could be in any format, and examples ranged from the familiar PowerPoint slide presentation to more sophisticated multimedia formats. The assignments were presented at the end of the teaching session in their individual workshop sessions, and they were marked by the class tutors. At the beginning of the semester, the marking rubric (Supplemental Table S1) for the assignment was provided to all students. Briefly, the presentation was marked by seven criteria: *1*) relevancy of content (4 points); *2*) clarity and easy to understand (4 points); *3*) critical analysis of opposing information (4 points); *4*) referencing: sufficient use of literature sources to support the statements (5 points); *5*) structure, organization, and presentation (2 points); *6*) within the 6- to 8-min time limit (2 points); and *7*) innovation in the presentation format (4 points).

Study Design

For this study, a mixed-method approach was adopted that relied on a survey comprising demographics, Likert scale-type and open-ended questions. Although AI has been a part of university education for many years, a validated survey gauging students' use of and attitudes toward AI tools in the assignments aligned with our study's research objectives was unavailable. Instead, a bespoke survey was designed drawing on the investigators' extant experience. Completing the survey was voluntary, and participation was anonymous. Students were not surveyed regarding nationality or study major to prevent any means of identifying a student, especially in cases where a cohort comprised of very few students. They were invited to declare whether they were native English speakers or not. The survey items asked about students' uses of and attitudes toward using AI in preparing their assignment in this subject, their willingness to use AI for other assignments, and their evaluation of and predictions about using AI tools in their future jobs. Included in the survey were linked

open-ended questions to solicit students' explanations regarding their choices or opinions.

The investigators also wanted to evaluate the ability of AI tools to develop a survey. ChatGPT-3.5 was used to generate survey questions. Some questions were directly deployed from ChatGPT-generated texts due to their alignment with the topic of interest (*questions 3*, *4*, *5*, *6*, and *16*). One survey question was a combination of the author's version and the version generated by ChatGPT (*question 7*). In total, 23% of the total questions had some or complete AI input. At the end of the survey, participants were asked to estimate the percentage of the total number of questions written using AI.

A paper-based version of the survey was deployed in the second last week of the semester during the sessions when attending student groups gave their presentations to the rest of their class. Of 350 students enrolled in the subject at the Australian campus, 168 (48%) participated in the survey. Two weeks after the due date of the assignment, an online form of the survey was provided for the students at the PRC campus. Eighteen of the 60 students enrolled at PRC Campus filled in the form (30%).

Data Analysis

The values obtained were expressed as a percentage of total number of respondents for two cohorts separately. For participants from the Australian campus, responses were subdivided based on any participant's declaration of being a native or nonnative English speaker. The average marks for the group presentation between the 2023 and 2022 cohorts were extracted from results archives and were expressed as the mean ± standard error. The marks were analyzed by two-way ANOVA with the Tukey post hoc tests. $P < 0.05$ was considered statistically significant.

RESULTS

Demographics

As shown in Table 1, at the Australian campus, most participants were younger than 30 yr old (98%) and identified as female (72%). While most (88%) considered themselves native English speakers, for nearly all participants (97%), English was the language of instruction at high school. Only a handful of participants (2%) indicated they were undertaking postgraduate study.

The demographics of the pathway students at the Chinese campus were comparable in some instances. All eighteen participants were less than 30 yr of age and enrolled as undergraduates. However, only half the participants declared themselves as females. They were all Mandarin speakers, and this was their first experience of English as the language of instruction.

The Use of AI during the Preparation of the Group Presentation in Human Pathophysiology

The Australian campus has an Academic English support unit that can provide one-to-one assistance and free workshops about preparing assignments. Among the participants, 6 out of the 20 nonnative English-speaking respondents, but only 8 of the 143 native English-speaking respondents, claimed to have used this service to prepare their group presentation.

Table 1. *Demographic information of the participants enrolled at the Australian campus*

Demographics	*n*
Age	
<20	71
20–29	94
30–39	1
40–49	1
>50	1
Gender	
Female	120
Male	43
Trans	1
Nonbinary	2
No disclosure	2
Education using English in high school	
Yes	163
No	5
Native speaker	
Yes	147
No	20
No disclosure	1
Second language for native English speaker	
Yes	63
No	81
No disclosure	1
Enrollment	
UG	161
PG	4
No disclosure	3

PG, postgraduate; UG, undergraduate.

What is not accounted for in the survey data is the composition of any survey participant's group is the number of native English-speaking members, which is likely to be a consideration in the decision by any member to seek academic help (31). However, given that only 3% of the Australian participants had not received English instruction at high school, the low engagement with the Academic English support unit is explicable.

Trends regarding the usage of AI were similar across different groups. For example, across both campuses, more than half of the participants indicated that they had used an "AI language process system" for the assignment in this subject (52% for the Australian campus, 56% for the campus in the PRC). At the Australian campus, the proportion of native speakers who made this claim was lower than that of nonnative speakers (52 vs. 60%, respectively). Australian students commonly cited Grammarly (44%) and ChatGTP (46%). Among the 18 participating students enrolled at the PRC campus, 2 cited the Bing search application, 3 used ChatGPT, and individual students nominated different AI programs developed by local Chinese companies that were only available in Chinese characters.

Details about students' opinions about using and how they used AI for preparing the assignment are summarized in Table 2. Views on how AI can be used in their assignment preparation showed similar trends across both campuses and language groups at the Australian campus. Specifically, opinions were generally either supportive or undecided regarding using AI to start writing and paraphrasing. Notably, a greater proportion of the participating native English speakers at the Australian campus held negative opinions. Across the cohorts, more than half of students used AI for grammar checking. Using AI tools to avoid plagiarism was twice as commonly

Table 2. *Opinions on the use of AI language process systems for the group presentation in the subject*

	Number of Respondents (%Cohort)		
	Australia		PRC
	Native Speaker	Nonnative Speaker	
Useful for initiating the assignment writing			
Yes	44.8% (39)	5.7% (5)	66.7% (12)
No	23.0% (20)	1.1% (1)	11.1% (2)
Neutral	20.7% (18)	6.9% (6)	22.2% (4)
Useful for paraphrasing your own or other's writing?			
Yes	36.4% (23)	6.9% (6)	50.0% (9)
No	35.6% (31)	1.1% (1)	22.2% (4)
Neutral	25.3% (22)	6.9% (6)	27.8 (28%)
Helped to identify and correct any grammatical errors?			
Yes	62.1% (54)	9.2% (8)	61.1% (11)
No	10.3% (9)	3.4% (3)	5.6% (1)
N/A	14.9% (13)	2.3% (2)	33.3% (6)
Helped to identify and avoid plagiarism?			
Yes	31.1% (28)	5.6% (5)	66.7% (12)
No	25.6% (23)	5.6% (5)	5.6% (1)
N/A	28.9% (26)	3.33% (3)	27.8% (5)
Think using AI to write an assignment saves time			
Yes	58.1% (50)	9.3% (8)	69.2% (9)
No	26.7% (23)	5.8% (5)	30.8% (4)
Think using AI to write an assignment affects the quality of their work?			
Yes	68.2% (58)	12.9% (11)	61.1% (11)
No	16.5% (14)	2.4% (2)	3.89% (7)
Use of the AI-generated text			
Inserted it as is.	5.1% (5)	0	11.1% (2)
Inserted after a small amount of editing.	17.2% (17)	4.0% (4)	38.9% (7)
Inserted after a lot of editing.	52.5% (52)	7.1% (7)	27.8% (5)
Couldn't use the AI generated text at all.	13.1% (13)	1% (1)	22.2% (4)

AI, artificial intelligence; PRC, People's Republic of China.

used among the students at the PRC campus. While most of the students across the cohorts considered using AI as a time-saving device, the proportion of support was higher for the native speakers at the Australian campus (68%) than either their colleagues (61%) or students at the PRC campus (50%). Nearly all respondents from the Australian campus and a majority from the PRC campus believed the use of AI had an impact on the quality of their assignments.

Encouragingly, respondents who used AI did not commonly use the generated text without edits (5 vs. 11% for the Australian vs. PRC respondents, respectively). Notably, 14% and 22% of students at the Australian and PRC campuses did not use the AI-generated text at all. Among the students' explanations for the reluctance to use unedited text: "the intention to avoid plagiarism"; "to make the work sound authentic"; "the need to elaborate and expand"; and "the unfavourable wording style and American spelling."

Indeed, students often exercised critical judgment as to their use of AI. Students noted, for example, "AI can't represent my thoughts"; "[AI written work] is not my work it does not contain my thoughts, I think it does not belong to me"; "text edited by AI is not as vivid as human language"; "it may produce some repetitive statements"; and "I only took the ideas, not the text."

Rather, students may be using AI to help them understand concepts to support their research or move their ideas along. One student noted, "What artificial intelligence provides can only be used as a reference, and it is still up to people themselves to reorganise the language, further improve it, and use the way of thinking of the people around them to complete the homework."

When students evaluated the helpfulness of AI-powered tools in writing their assignment using a 10-score scale: 1 (not helpful at all) to 5 (somewhat helpful) to 10 (extremely helpful), the average score was around 6, somewhat useful, regardless of the cohort (Fig. 1).

The Use of AI for Academic Work and the Workplace

General opinions about the use of AI on campus and in the workplace are collated in Table 3. Across the three cohorts surveyed, most students believed using AI in assignment preparation could help a student achieve a higher mark. There was a wide belief that such use of AI did not, or did not always, constitute cheating. Among the respondents, roughly half of the two language cohorts on the Australian campus and three-quarters of the PRC cohort would either not, or were not sure that they would, use AI tools for future assignment preparation, and only 51% and 40% of the respective cohorts would recommend using AI to prepare an assignment. However, if their respective campuses were to provide a licensed copy of an AI tool, only 5% or 11% of students from the Australian and PRC campuses, respectively, would definitely not use the tool. Depending on the cohort, few to none of the respondents believed that AI would not be an essential tool in their future job, and in all cohorts, the majority of students agreed that they should be taught about the proper uses of AI in preparing assignments.

Assignment Marks

Marks for the audiovisual presentation were compared between the 2022 and 2023 cohorts (Fig. 2). For the students enrolled at the Australian campus, encouraging the use of AI

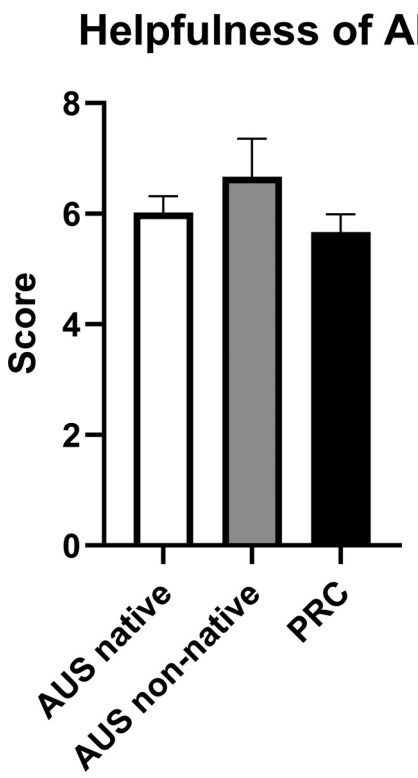

Figure 1. Participants' rating of the helpfulness of artificial intelligence (AI) tools in preparing assignments. Students used a numerical scale from 1 (not helpful at all) to 10 (extremely helpful). The results are expressed as the mean ± standard deviation. AUS-native, declared native English speakers at the Australian campus; AUS-nonnative, declared nonnative English speakers at the Australian campus; PRC, students at the campus in the People's Republic of China.

has no impact on average marks for the assignment. In 2022, the average mark for the PRC student submissions was significantly lower ($P < 0.0001$) than their Australian classmates. In 2023, the average mark of the PRC-based students significantly increased ($P < 0.0001$) and was on par with the mark of the Australian of the same year.

Student's Judgement on the Involvement of AI in Writing the Current Survey

Twenty-three percent of the questions in this survey were directly taken from or derived from templates created by ChatGPT. Less than 20% of students at each campus chose an amount close to this value, while similar or smaller percentages opted for all AI-generated questions (Fig. 3). Estimates of heavy use of AI were based on impressions about the format and language of the questions (simple, generic, nonpersonal, formal, repetitive, and scripted), the low number of grammatical and typographical errors, or because this was a survey on AI use. Conversely, lower estimations were linked to comments that the questions were human appearing enough and personalized.

DISCUSSION

In 2023, the group oral presentation routinely assessed in a second-year undergraduate medical science subject was modified such that, first, the use of artificial intelligence (AI) in preparing the assignment was sanctioned, and, second, the topic incorporated consideration of the use of AI in the health industry and medical research. This modification provided an opportunity to investigate the students enrolled in the subject regarding their uses and evaluation of using artificial intelligence to prepare assignments. The expectation is that these students would be particularly aware of AI reliant upon large language models such as ChatGPT and Grammarly. These two tools were the most commonly used among the survey participants.

Australia is a multiethnic country (32), with an education sector providing tuition for a substantial number of international students (33) where such tuition encompasses both on-shore and off-shore delivery. This allows for comparisons of academic help and, in particular, help with academic English between native and nonnative English-speaking cohorts with varying prior experience of English as the medium of instruction. In the current study, there was the opportunity to compare the responses between students enrolled in a large metropolitan Australian campus with those from overseas, such as the PRC campus, where all the students were enrolled in the same subject.

As to the general usage of AI for assignment preparation, regardless of the campus a student attended, or whether they were native English speakers or not, AI was used by over 50% of the survey participants. A substantial proportion of students (36 to 68%) judged that AI was helpful for proofreading, getting started on a task, avoiding plagiarism, and paraphrasing. Notably, when students used AI, 95% of the students on the Australian campus and 89% on the PRC campus either edited in some way or did not use the text created by the tool or tools they used. Indeed, native English-speaking students at the Australian campus stated that they used AI to inspire them with new ideas and performed extensive editing of AI-generated text before use. This may reflect their confidence in their own writing skills, which may lead native English speakers to underutilize available academic support services. It also needs to be noted that the assignment was an oral presentation using lay language, which relies not just on writing skills but also on speaking and multimedia integration. Therefore, native English-speaking students would feel more comfortable doing the writing instead of fully relying on AI for the task. Further evidence of a measured approach to using AI to prepare assignments was indicated by the high proportions of students who were either unsure about or against the use of AI in any future assignments and that 36%–50% of the participants indicated that they would not recommend using an AI-powered tool for writing an assignment. Yet, it was widely held that AI could improve academic performance in assignments. What was also notable is that most participants did not consider using AI for assignment preparation as cheating, or as cheating in all cases, and agreed that using AI tools saved time in preparing assignments and could lead to higher marks. Nonnative English-speaking students were more likely to use AI tools to paraphrase others' writing on both campuses, and those on the PRC campus were more consciously using AI tools to avoid plagiarism. This is most likely to be driven by the limitation of expressing their thoughts in formal English. Also, there was a broad willingness to use, or at the very least consider using, AI for assignment preparation if

Table 3. *Use of AI tools in academic work and the workplace*

	Number of Respondents (%Cohort)		
	Australia		PRC
	Native Speaker	Nonnative Speaker	
Do you think using AI in preparing an assignment can help you achieve a higher mark?			
Yes, in all cases	10.6% (17)	1.9% (3)	0
Yes, in some cases	52.8% (85)	6.8% (11)	44.4% (8)
Yes, only in a few cases	20.5% (33)	3.1% (5)	27.8% (5)
Never	4.3% (7)	0	27.8% (5)
Do you think using AI to prepare an assignment is cheating?			
Yes always	3.1% (5)	1.3% (2)	27.8% (5)
Yes sometimes	51.9% (83)	6.3% (10)	55.6% (10)
No	33.8% (54)	3.8% (6)	16.7% (3)
Do you intend to use AI to prepare future assignments?			
Yes, because I use it already	19.0% (30)	2.5% (4)	0
Yes, I am intending to use it	24.7% (39)	2.5% (4)	22.2% (4)
Not sure	36.1% (57)	5.1% (8)	55.6% (10)
No	9.5% (15)	0.6% (1)	22.2% (4)
If the University provided all students with a licensed copy of an AI application, would you use AI to prepare assignments?			
Yes, definitely	34.1% (54)	5.7% (9)	0
Yes, possibly	49.4% (78)	5.7% (9)	88.9% (16)
No	5.1% (8)	0	11.1% (2)
Do you think AI will be an essential tool in your future job?			
Yes	47.4% (74)	5.8% (9)	66.7% (12)
No	6.4% (10)	1.3% (2)	0
Not sure	35.3% (55)	3.8% (6)	33.3% (6)
Do you agree with this statement: "Since AI is widely used by different professions, we should learn how to effectively use it for our assignments."			
Strongly agree	24.0% (37)	3.2% (5)	11.1% (2)
Agree	37.7% (58)	6.5% (10)	55.6% (10)
Neither agree nor disagree	20.1% (31)	1.9% (3)	27.8% (5)
Disagree	5.2% (8)	0	5.6% (1)
Strongly disagree	1.3% (2)	0	0
Would you recommend using an AI-powered tool to write an assignment to other students?			
Yes	52.1% (76)	6.8% (10)	44.4% (8)
No	35.6% (52)	5.5% (8)	55.6% (10)

AI, artificial intelligence; PRC, People's Republic of China.

their campuses issued licensed copies and provided support toward formal training on how best to use AI in assignment preparation. However, students on the Australian campus seemed to be more certain (40% definitely, 55% possibly) than those at the PRC campus (0% definitely, 88.9% possibly). This attitude toward future perspectives may be due to several factors, including differences in educational systems, cultural attitudes toward technology, and the availability of resources and support for AI tools. Australian students might have more exposure to and familiarity with AI technologies, as well as greater institutional support, which could contribute to their confidence in using AI in their future careers. In contrast, PRC students might be more cautious due to less exposure or different educational priorities.

Since anonymity is expected to support honesty and openness among survey participants (34), some broad conclusions can be drawn from the survey. These include the fact that university students are widely aware of what academic help they can obtain from using AI tools and recognize that it is a source of help rather than a replacement for academic effort and that their uptake would be increasing with institutional sanction and guidance. Recognizing AI as a helper rather than a substitute helps maintain academic integrity. Students are less likely to make attempts at plagiarism or submit AI-generated content without proper attribution, as they see the value in their own contributions to their work. It also needs to be noted that students critically analyzed the content generated by AI, as some indicated in the survey that not all content was relevant or useful for their assignment. Also, learning environments in which the use of AI for assignment preparation is sanctioned and supported (e.g., the institute provides licensed AI tools) could enhance student success, particularly for those new to English as the medium of instruction. When institutions provide clear guidelines on how to use AI tools ethically and effectively, students can integrate these technologies into their learning processes without fear of violating academic policies. This structured approach ensures that AI is used to complement, not compromise, academic standards. Institutional support often includes providing access to licensed AI tools and training on their use. This can level the playing field, ensuring all students, regardless of their background or resources, can benefit from these technologies. With institutional endorsement, students are more likely to feel confident in using AI tools. Training sessions and workshops can enhance their competence, enabling them to use AI more effectively and creatively in their assignments. As to this last conclusion, there is an acknowledgment that it would be unacceptable to draw any causation between the redesign of the oral presentation and the use of AI and the academic performances of the 2023 PRC campus students. Many factors could contribute to any difference in the academic performances between different sessional cohorts of students. Students may perceive AI

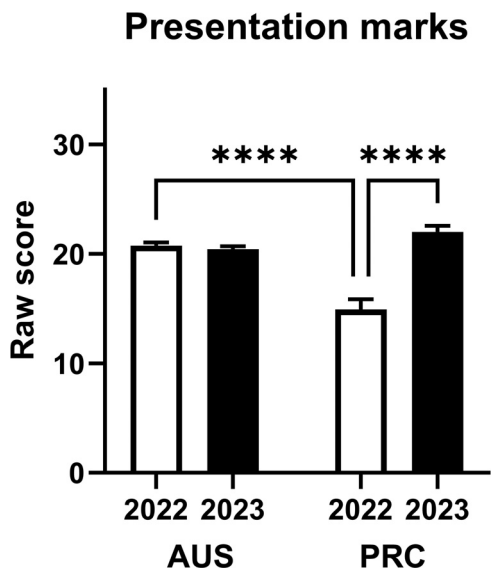

Figure 2. Comparing the average marks for the oral presentation assignment between 2022 and 2023. In 2023, the instructions provided to the students included encouragement to use artificial intelligence (AI) to prepare the assignment and consider using AI in the health and medical sector. The number of group marks for the Australian (AUS) campus was 61 and 73 for 2022 and 2023, respectively. For the same 2 respective years at the People's Republic of China (PRC) campus, the numbers were 12 and 13 group marks. The results are expressed as mean ± standard error. ****$P < 0.0001$.

tools as helpful because they streamline certain tasks, such as grammar checking and idea generation. However, this perceived utility may not translate into higher quality work if students did not know how to be creative with the content and style. In addition, the Australian cohort already had a high baseline competence in English and academic skills (average 80% as distinction), reducing the relative impact of AI tools on their performance. In contrast, the PRC cohort, with less experience in English, may benefit more noticeably from AI assistance, as AI tools can provide crucial language support, helping them overcome barriers to English proficiency. This led to a more noticeable improvement in their assignment quality. Furthermore, the type of assignment (oral presentation) might not fully leverage the strengths of AI tools, which are often more suited to written tasks. The skills required for a compelling presentation, such as public speaking and multimedia integration, might not be significantly enhanced by AI. Mindful of all this, what remains is that modifications to the design of the assignment supportive of the use of AI were concomitant with a significant improvement in students' academic performance at the PRC campus in 2023.

With the welcome engagement with teaching practices underpinned by work-integrated learning, it was notable that while most students in each of the three cohorts believed that AI was an essential tool for future careers, uncertainty about this was also prevalent. With a wide acknowledgment of the inevitable and substantial impacts that AI does and will have on work (35), the results from the current survey further underpin the onus upon the higher education sector to embed AI competencies in any graduate attribute, or capability, framework used in curricular design.

Limitations to the salience of the findings from this survey must be acknowledged. First, the response rates were under 50% for paper-based delivery at the Australian campus and were predictably lower (30%) for online delivery at the PRC campuses. However, the response rate for the Australian campus substantially exceeded those for institutional imposed online evaluations of subjects by students. A second limitation was that this was a group task; the particular mix of academic capacities and competency with AI tools among members of any group will determine the degree of use of AI by any individual member. A further limitation is that an oral presentation draws on a broader and distinctive range of academic and creative skills than would be expected for a written submission. An example that comes to mind for an oral presentation would be the collation and sequencing of the research and interpretation across the duration of the presentation and the use of informative and relevant images to support the narrative. However, in the survey, there was a narrow focus on tasks more aligned to the preparation of an individually prepared written assignment, and it did not capture how much students were using AI to assist them with skills more attuned to multimedia presentations. Furthermore, when we asked the question on if using AI to write an assignment can affect the quality of their work, we did not ask if it was positively or negatively affected. Given the general perception of how AI can save time and effort, we can only speculate that the students may take it as a positive impact. However, interpretations of "quality" that students might consider may vary, which can include clarity and coherence of the arguments; grammar, spelling, and punctuation; logical structure and organization; originality and creativity; accuracy and relevance of content. While they are important to understand, it is

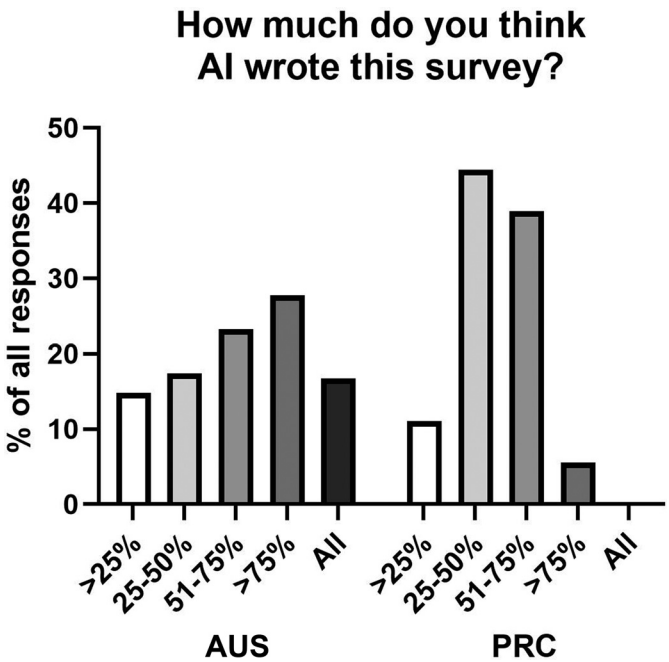

Figure 3. Students' estimation of the percentage of survey questions written by artificial intelligence (AI). The actual proportion of questions derived from ChatGPT was 23%. The results are present in a percentage of all responses on both the Australian (AUS) campus and the People's Republic of China (PRC) campus.

difficult to use a survey to gauge such information. Future studies can include focus groups to better understand the students' perception of this aspect.

Conclusions

AI is becoming an integral tool across diverse industries. It is imperative for the higher education sector to address, embrace, and build on the burgeoning use of AI tools by its students when designing assignments. In higher education, educational institutes must ensure equitable access to such tools and the capacity to use them among their students. In addition to supporting greater academic success, the purposeful embedding of AI in student assignments will enhance student preparedness for the workplace.

DATA AVAILABILITY

Data will be made available upon reasonable request.

SUPPLEMENTAL MATERIAL

Supplemental Table S1: http://doi.org/10.6084/m9.figshare.27978807.

ACKNOWLEDGMENTS

We thank the assistance of the tutors in Human Pathophysiology to distribute and collect the survey papers.

DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS

H.C., D.V.R., and B.G.O. conceived and designed research; H.C. performed experiments; H.C. and B.G.O. analyzed data; H.C., D.V.R., and B.G.O. interpreted results of experiments; H.C. prepared figures, H.C. and D.V.R. drafted manuscript; H.C., D.V.R., and B.G.O. edited and revised manuscript; H.C., D.V.R., and B.G.O. approved final version of manuscript.

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