DEPARTMENT OF CHEMISTRY
FACULTY OF MATHEMATICAL & PHYSICAL SCIENCES

# Use of Artificial Intelligence in Higher Education Chemistry: Student and Staff Perceptions

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Image generated using Microsoft Copilot (21/05/24).
“AI: artificial intelligence or academic integrity? Can it be both?”

UCL Chemistry Education Research

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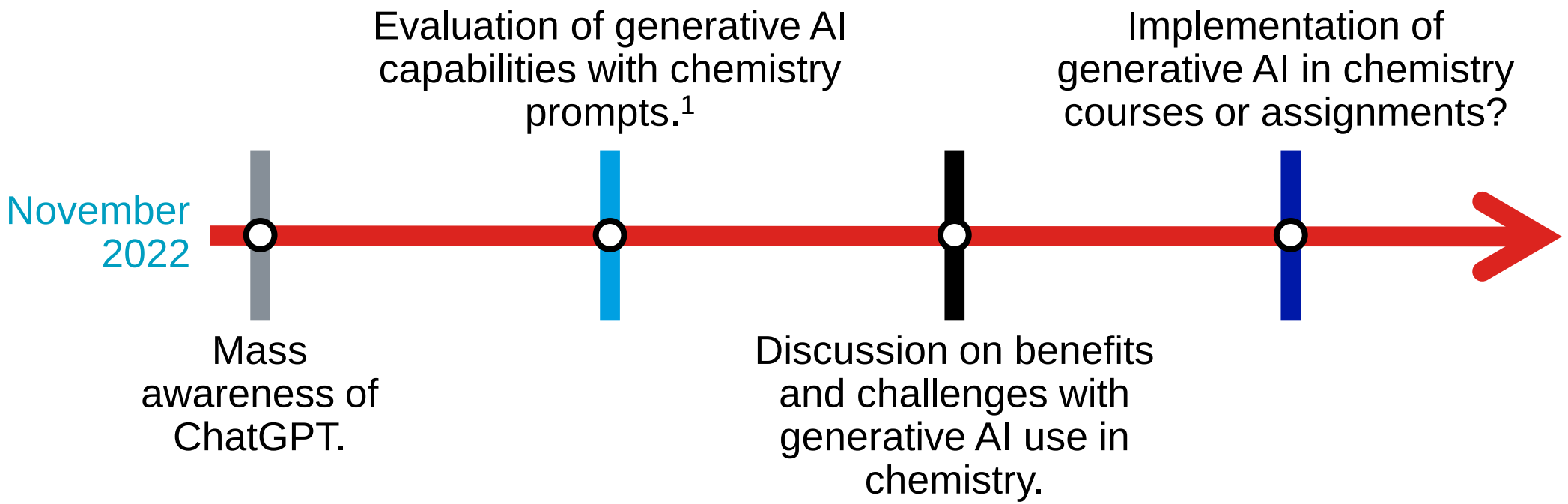
# Generative AI in Chemical Education




To date, there has been limited investigation on chemistry students' and staff's perception and use of generative AI.



1. e.g., (a) C. M. Castro Nascimento and A. S. Pimentel (2023). *J. Chem. Inf. Model.*, **63**, 1649–1655. (b) A. J. Leon and D. Vidhani (2023). *J. Chem. Educ.*, **100**, 3859–3865. (c) T. M. Clark (2023). *J. Chem. Educ.*, **100**, 1905–1916. (d) S. Fergus *et al.* (2023). *J. Chem. Educ.*, **100**, 1672–1675.

# Chemical Education Research Project

Carried out by **Chloe Chan**, MSci research project 2023/24.

UCL ethics approval 11925/010.

## Research Questions

1. **How and why** do chemistry students use generative AI in a higher education setting?
2. **How does a student's background influence** their perception and use of generative AI?
   - gender,
   - year of study,
   - ethnicity,
   - English as their native language.
3. **How do chemistry staff perceive students' use** of generative AI in a higher education setting?

# Mixed-Methods Approach: Current Use and Perception of AI



## Surveys

- N = **105**:
  - 85 of 987 students invited (9%).
  - 20 of 65 staff (31%).
- Closed- and open-ended questions.[2]
- Data analysis:
  - Thematic analysis (free-text data),
  - Kruskal-Wallis one-way ANOVA,
  - Mann-Whitney U,
  - Chi-squared (yes/no),
  - Statistically significant, **$p \leq 0.05$**.

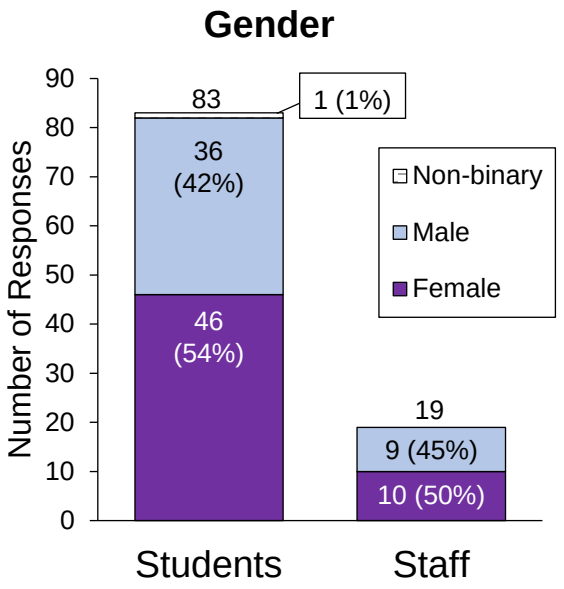
## Interviews

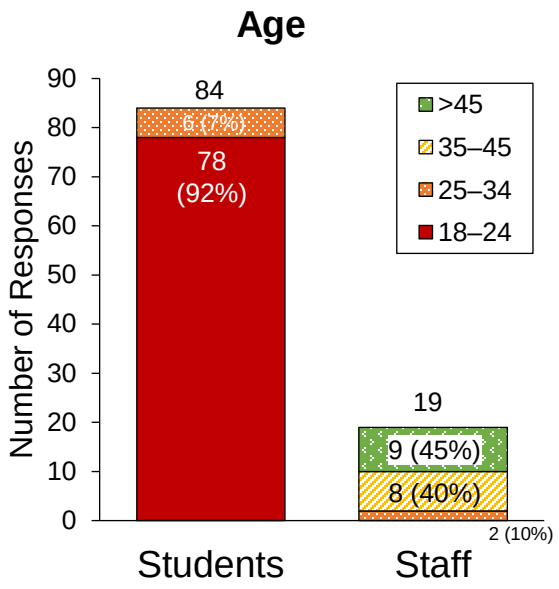
- N = **6** (1 student and 5 staff).
- Deeper insight towards use and opinions of AI.
- Seeking clarity on survey data.

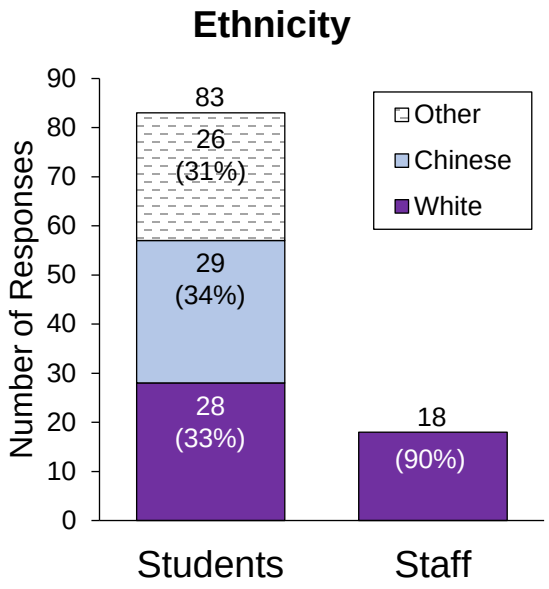
2. H. Ibrahim *et al*. (2023). "Perception, Performance, and Detectability of Conversational Artificial Intelligence across 32 University Courses", *Sci. Rep.*, **13**, 12187.

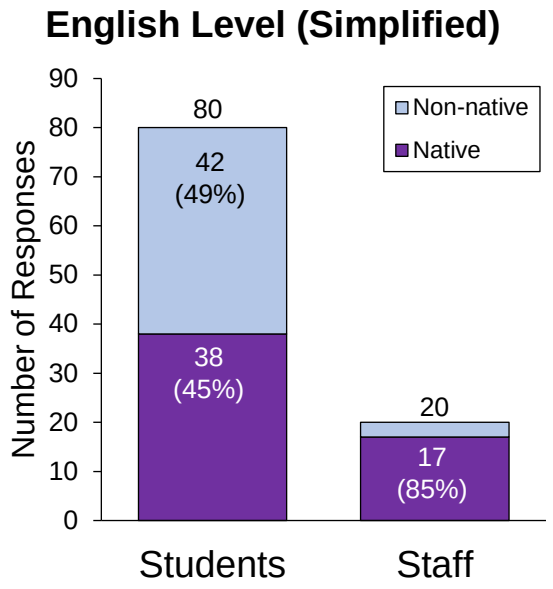
# Demographics

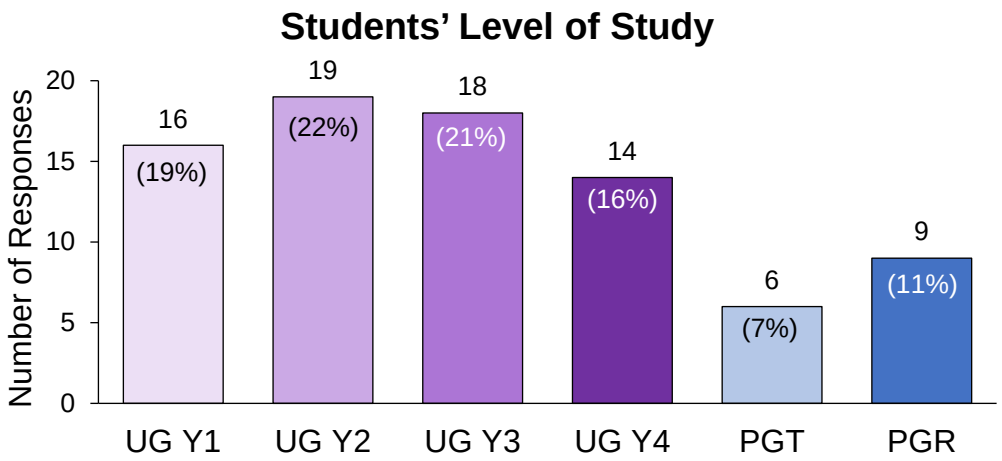
Students, *n* = 85. Staff, *n* = 20. “Prefer not to say” excluded below.

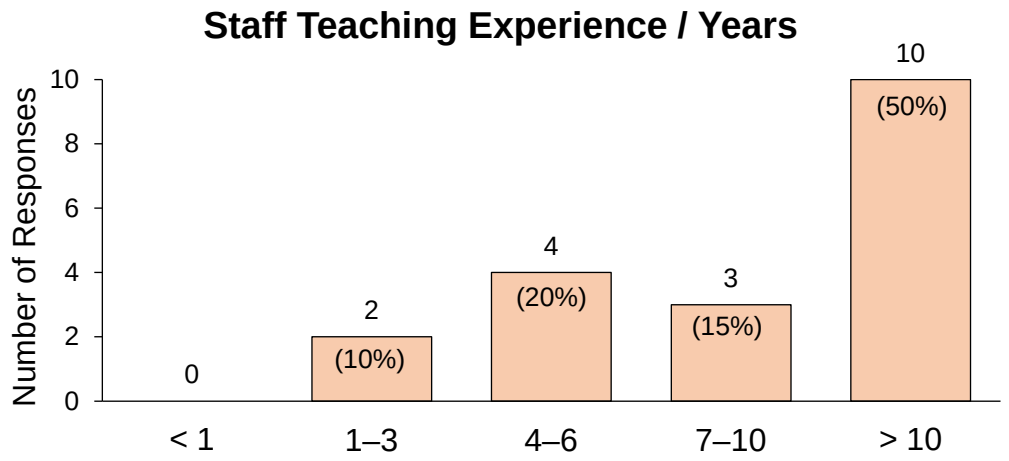


# 1. Students' Use of AI

"Yes" or "no" to statements from a list of options provided.

**Students said they use AI for:**

**62%** **Daily-life tasks** such as travel plans and non-academic queries.

**59%** **Administrative tasks**, *e.g.*, writing emails and career applications.

**55%** General **queries on lecture content**.

**Reasons students gave for using AI:**

**64%** General **curiosity** about generative AI technology.

**59%** **Improve their writing**.

**57%** Checking **how to approach an assignment** when not sure.

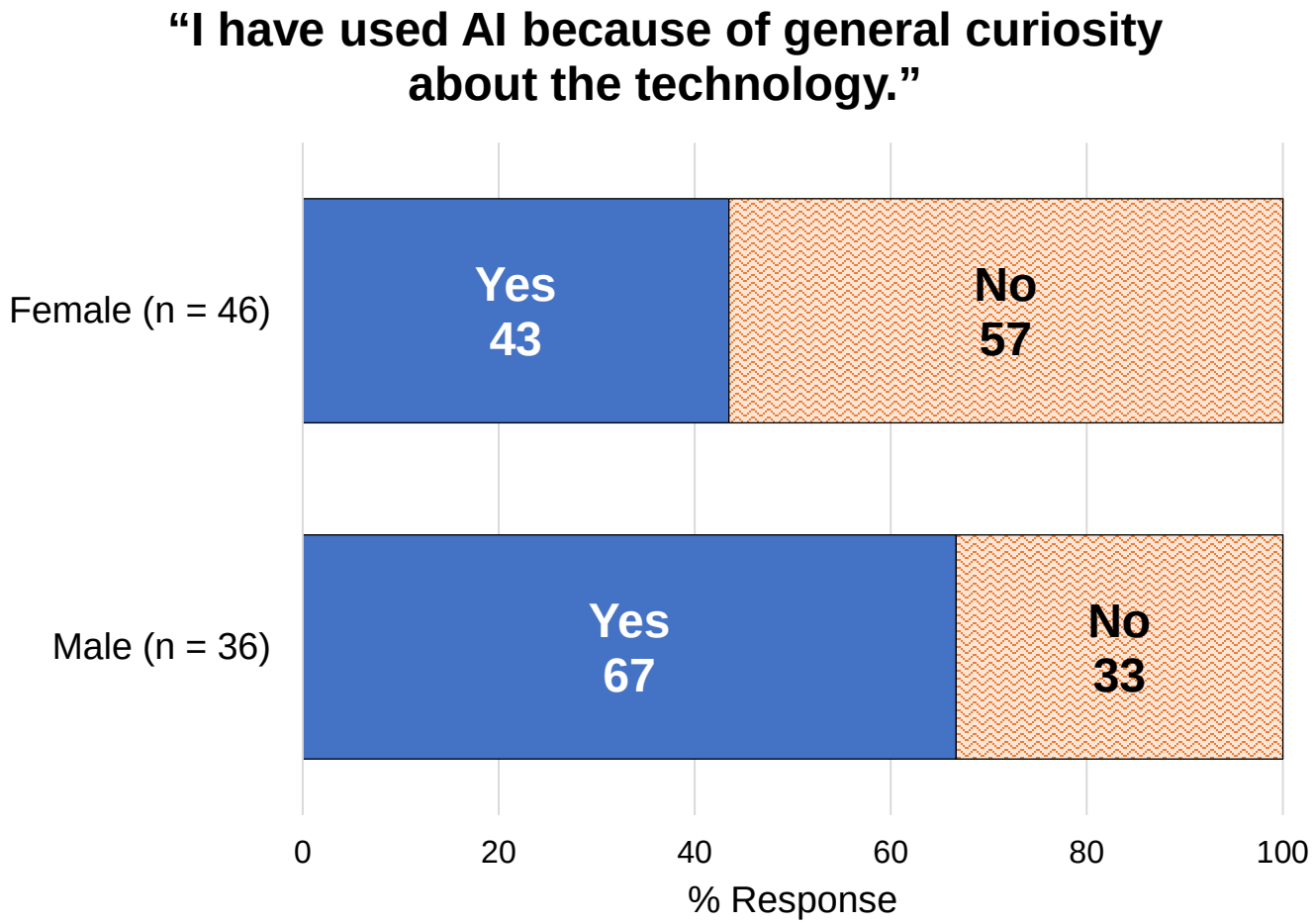
# 1.1. Students' Gender

**Male students were more likely than females to use AI** due to general curiosity about generative AI technology [p = 0.037].

Males tend to

- exhibit less "computer anxiety"
- react more positively towards new media

than females.[3]







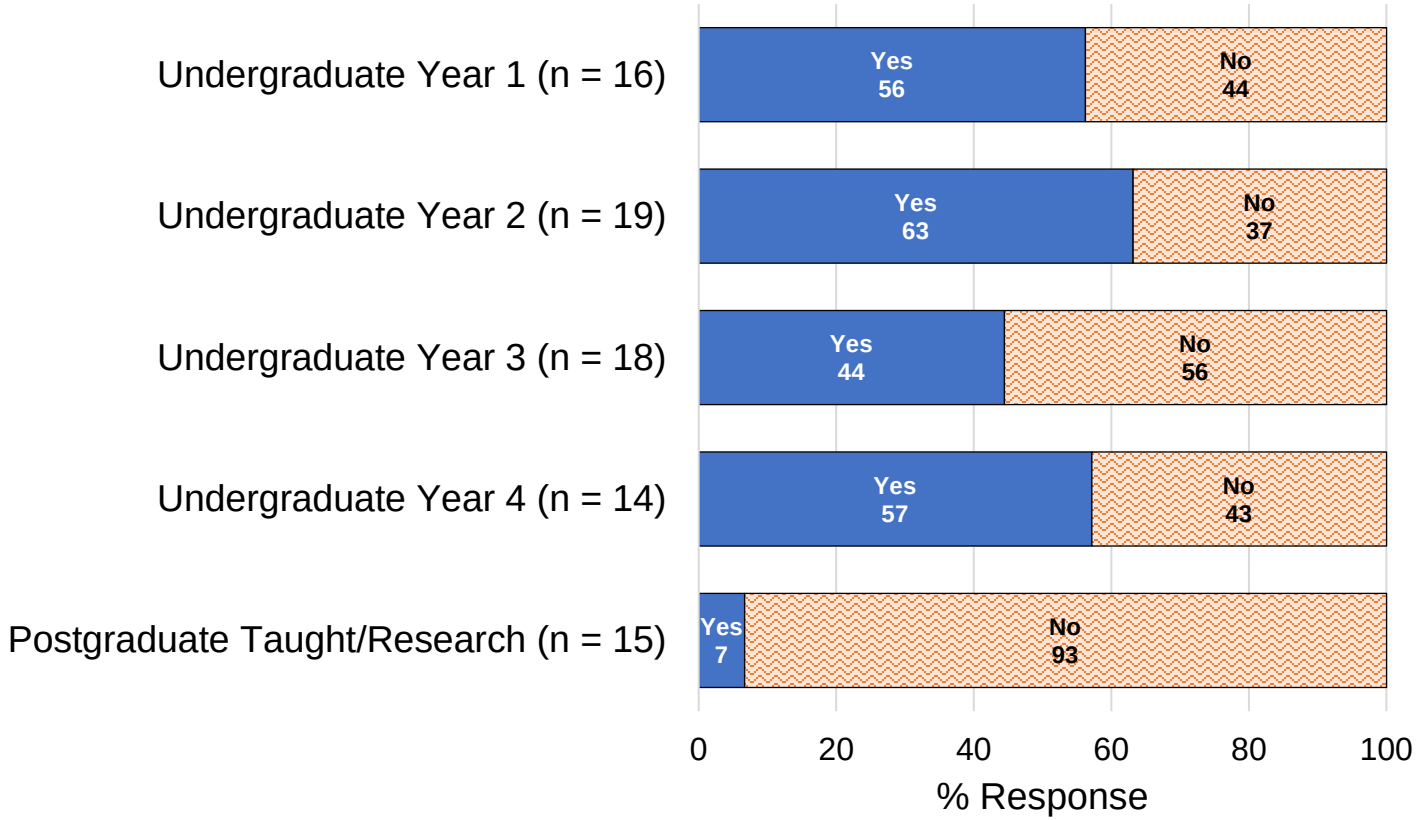

3. A. Broos (2005). "Gender and Information and Communication Technologies (ICT) Anxiety: Male Self-Assurance and Female Hesitation", *Cyberpsychol. Behav.*, **8**, 21–31.

# 1.2. Year of Study

**Undergraduates** were more likely to use AI due to **uncertainty of how to approach assignments** [p = 0.011].

- More experienced students perform tasks too complex for AI.
- AI less incorporated into lives of postgraduate students.
- Lower years generally less sure of what is expected from university assignments.[4]

**"I used generative AI because I was unsure of how to approach an assignment."**



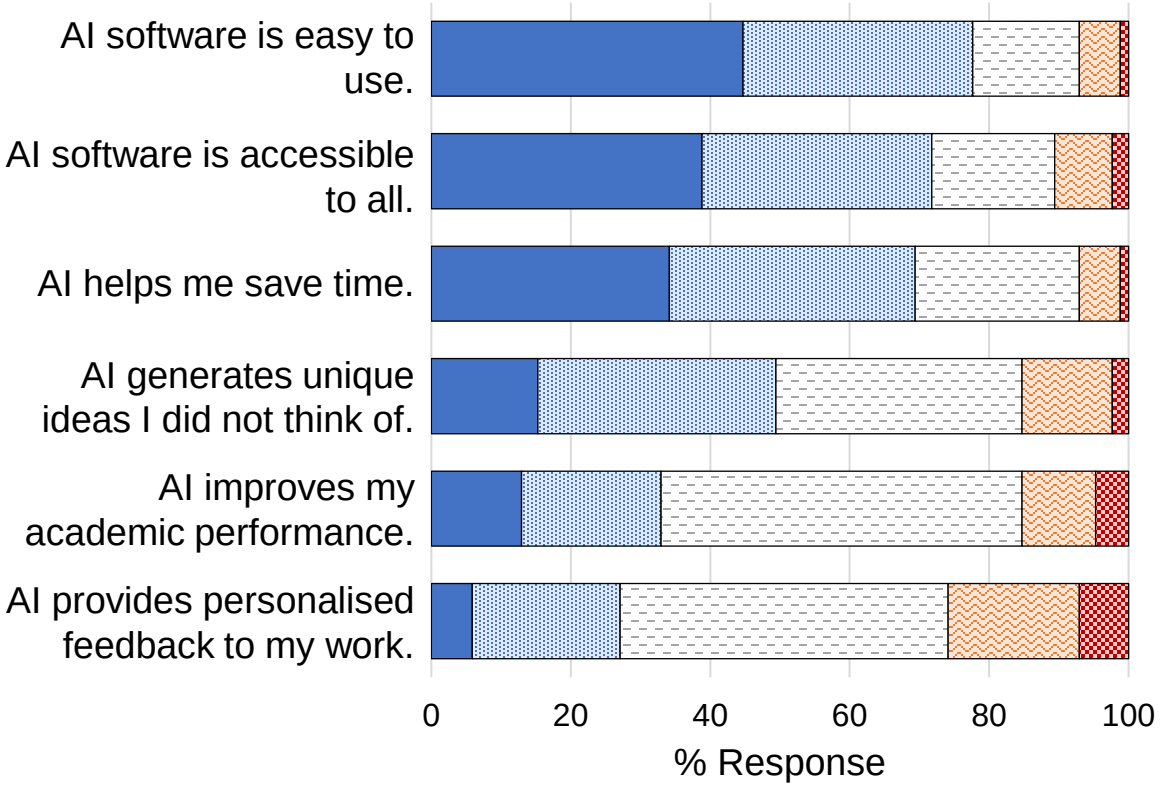




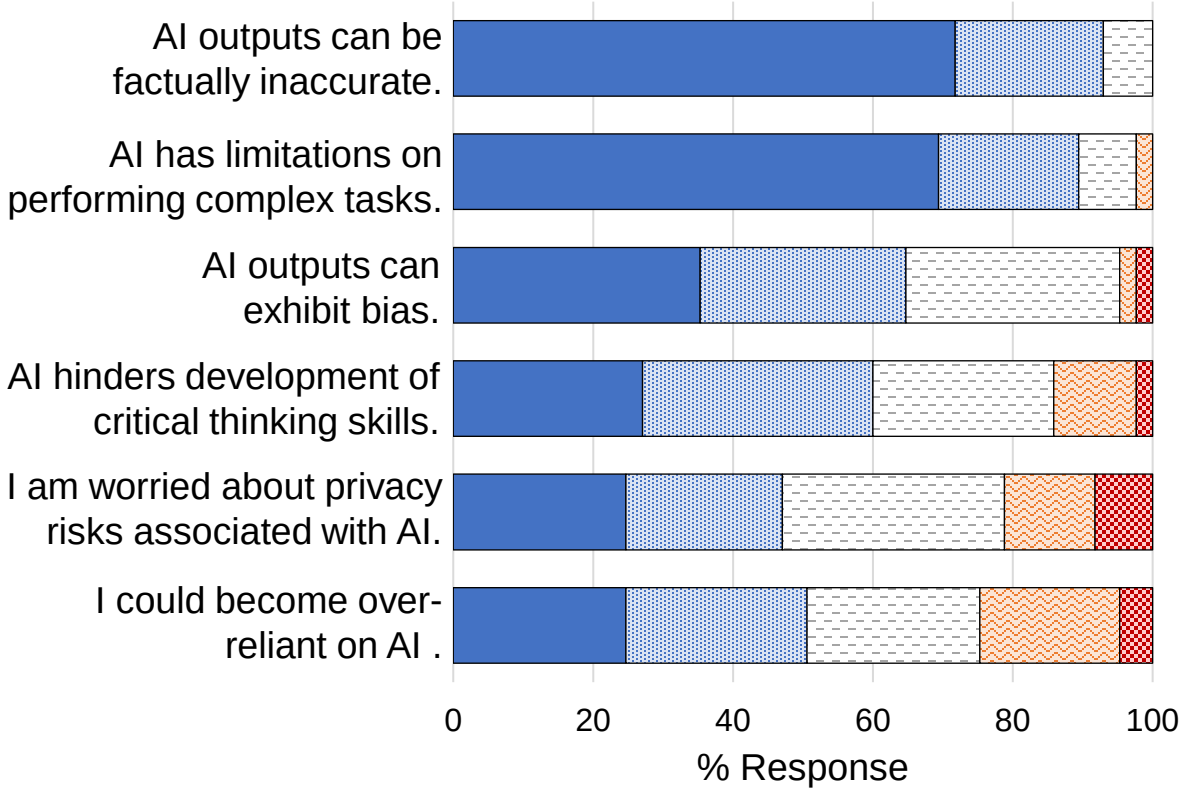

4. A. Blair (2017). "Understanding First-Year Students' Transition to University: A Pilot study with Implications for Student Engagement, Assessment, and Feedback", *Politics*, **37**, 215–228.

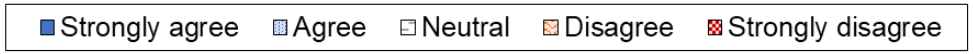
# 2. Students' Attitudes towards the Perceived Benefits and Challenges of AI

## Perceived Benefits of AI




## Perceived Challenges of AI

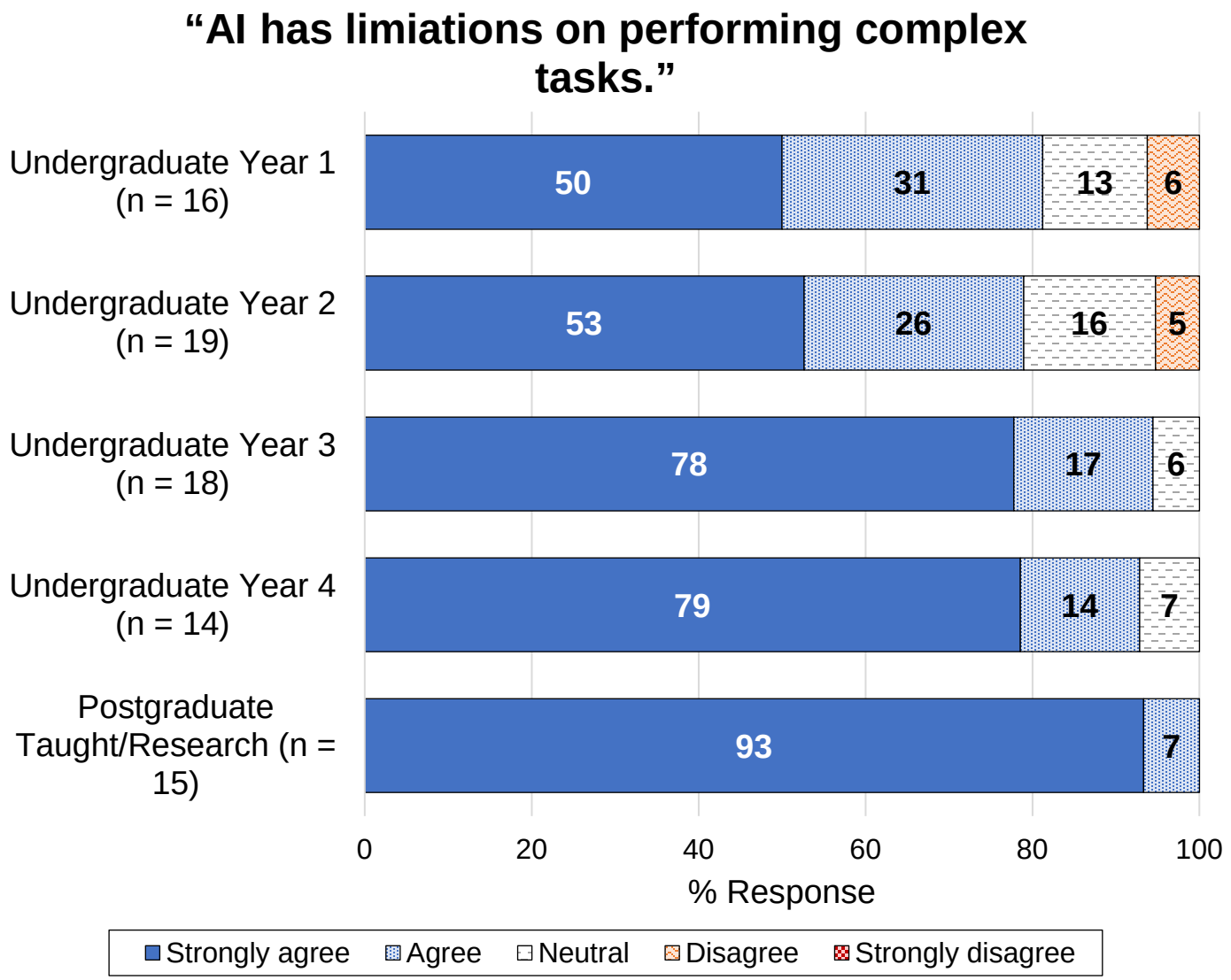


# 2.1. Year of Study

**Higher years of study more likely to agree** that AI has limitations on performing complex tasks [p = 0.026].

- MSci, PGT and PGR students explore novel research areas beyond the scope of AI.
- AI performs poorly at higher-level tasks.
- More student experience means stronger critical thinking skills.[5]

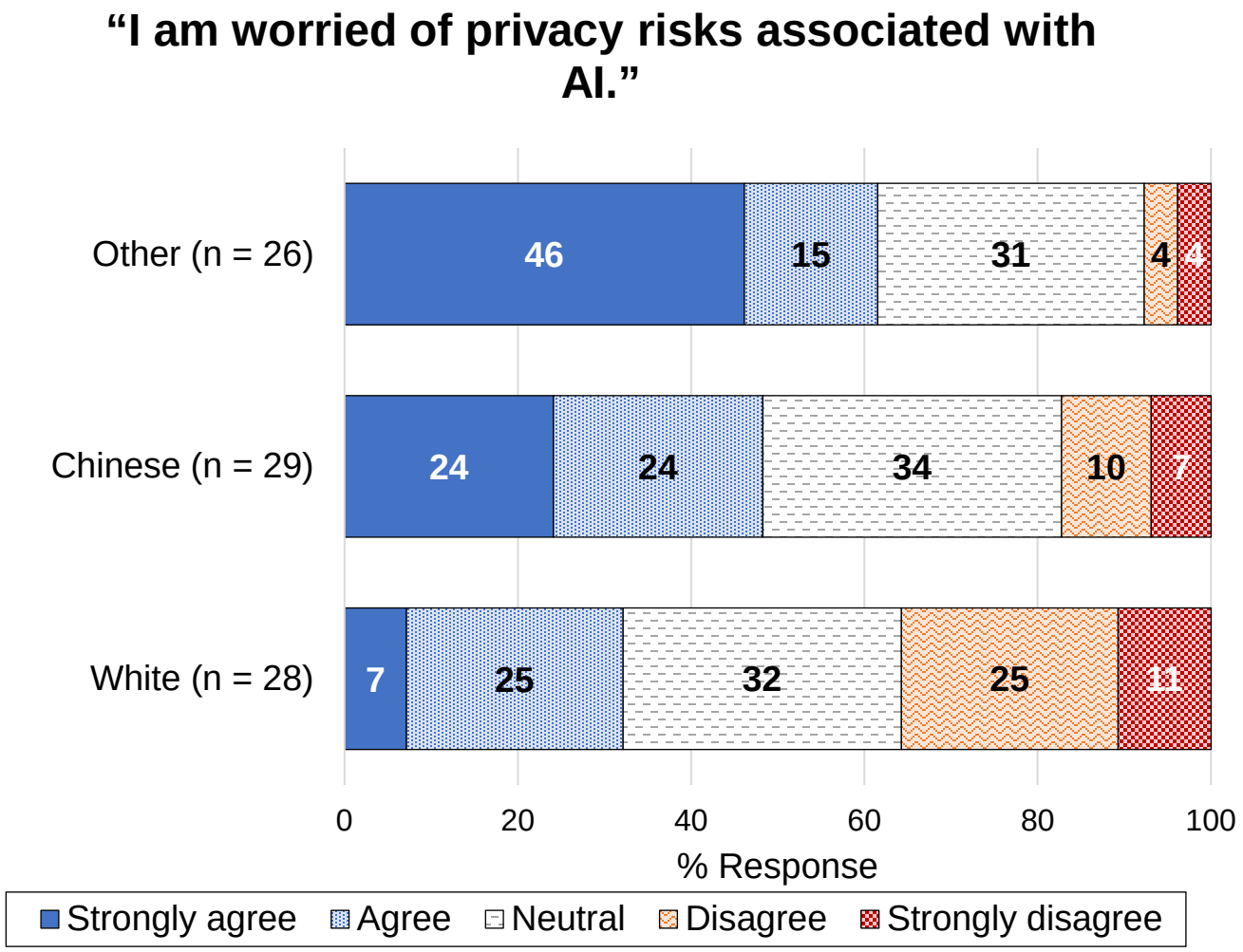



5. K. Roohr *et al*. (2019). "A Multi-Level Modeling Approach to Investigating Students' Critical thinking at Higher Education Institutions", *Assess. Eval. High. Educ.*, **44**, 946–960.

# 2.2. Ethnicity

**White students** were less concerned with **privacy** risks [p = 0.006].

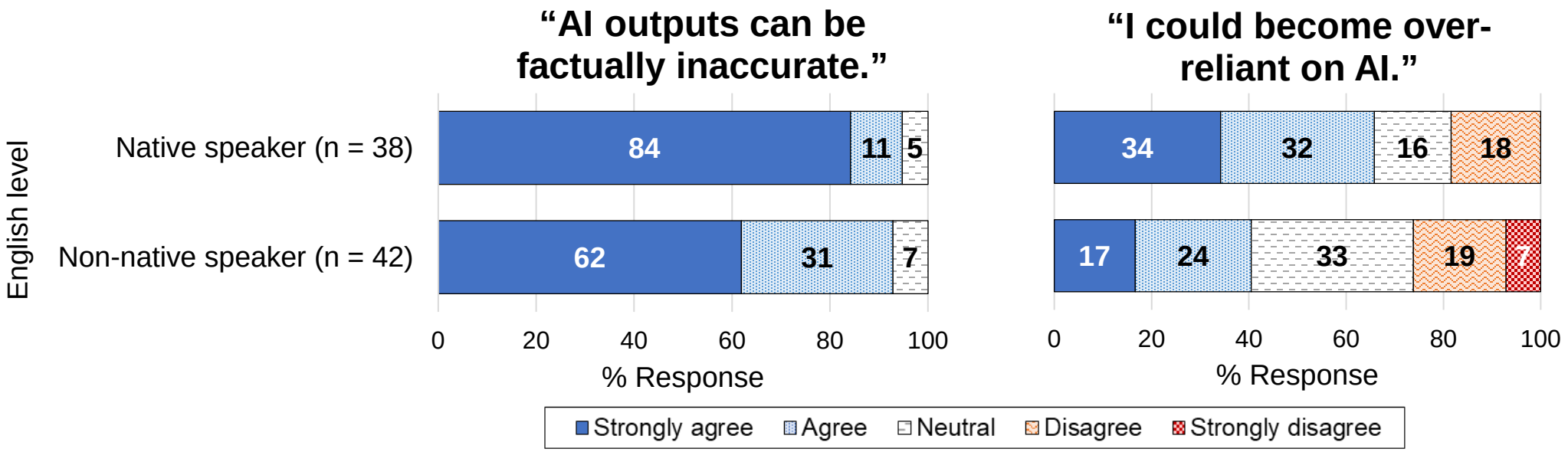
- Difference in cultural values regarding autonomy and confidentiality.[6]
- Cautious of possible identification from information such as names and email address.[7]




6. S. G. Lee *et al.* (2013). "The Impact of Cultural Differences on Technology Adoption", *J. World Bus.*, **48**, 20–29.
7. X. Li *et al.* (2023). "Undergraduates' Knowledge, Attitude and Behavior (KAB) Towards the Disclosure of Personal Data Online in China", *Front. Artif. Intell. Appl.*, 370 ,46–63.

# 2.3. Level of English

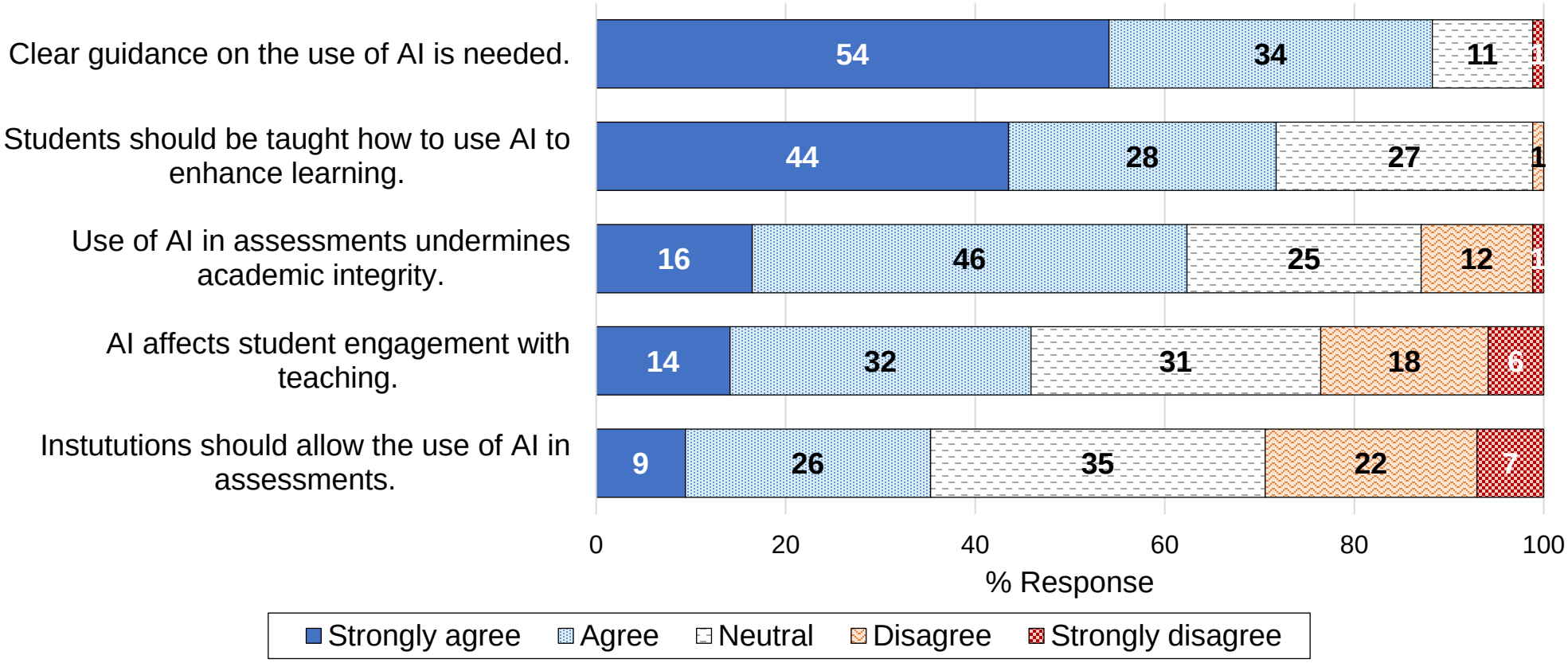
**Native English speakers** more likely to think AI can be **inaccurate** [p = 0.035], but also that they **could become over-reliant** on it [p = 0.029].




- Native speakers may better comprehend AI outputs in English and hence determine its accuracy.
- Non-native English speakers may have a poorer user experience with AI tools.[8]

8. S. Han *et al*. (2022). "Making FAQ Chatbots More Inclusive: An Examination of Non-Native English Users' Interactions with New Technology in Massive Open Online Courses", *Int. J. Artif. Intell. Educ.*, **33**, 752–780.

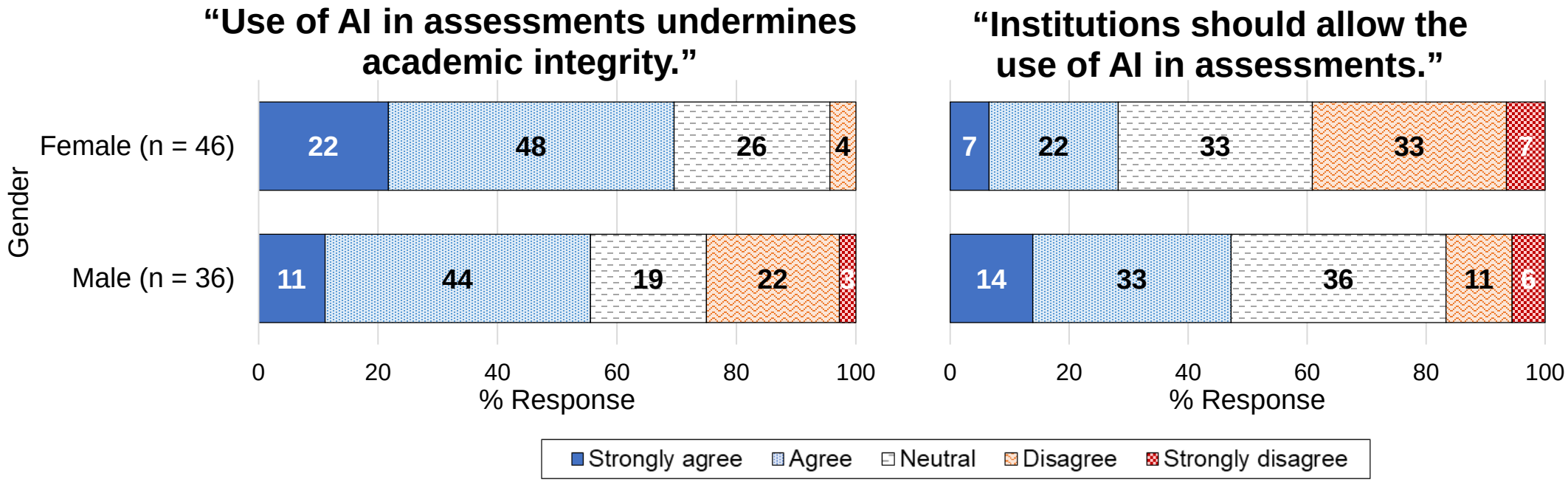
# 3. Students' Perceptions towards AI Integration (*n* = 85)




- Students want guidance!
- They're less certain about AI's adoption in education.

# 3.1 Gender

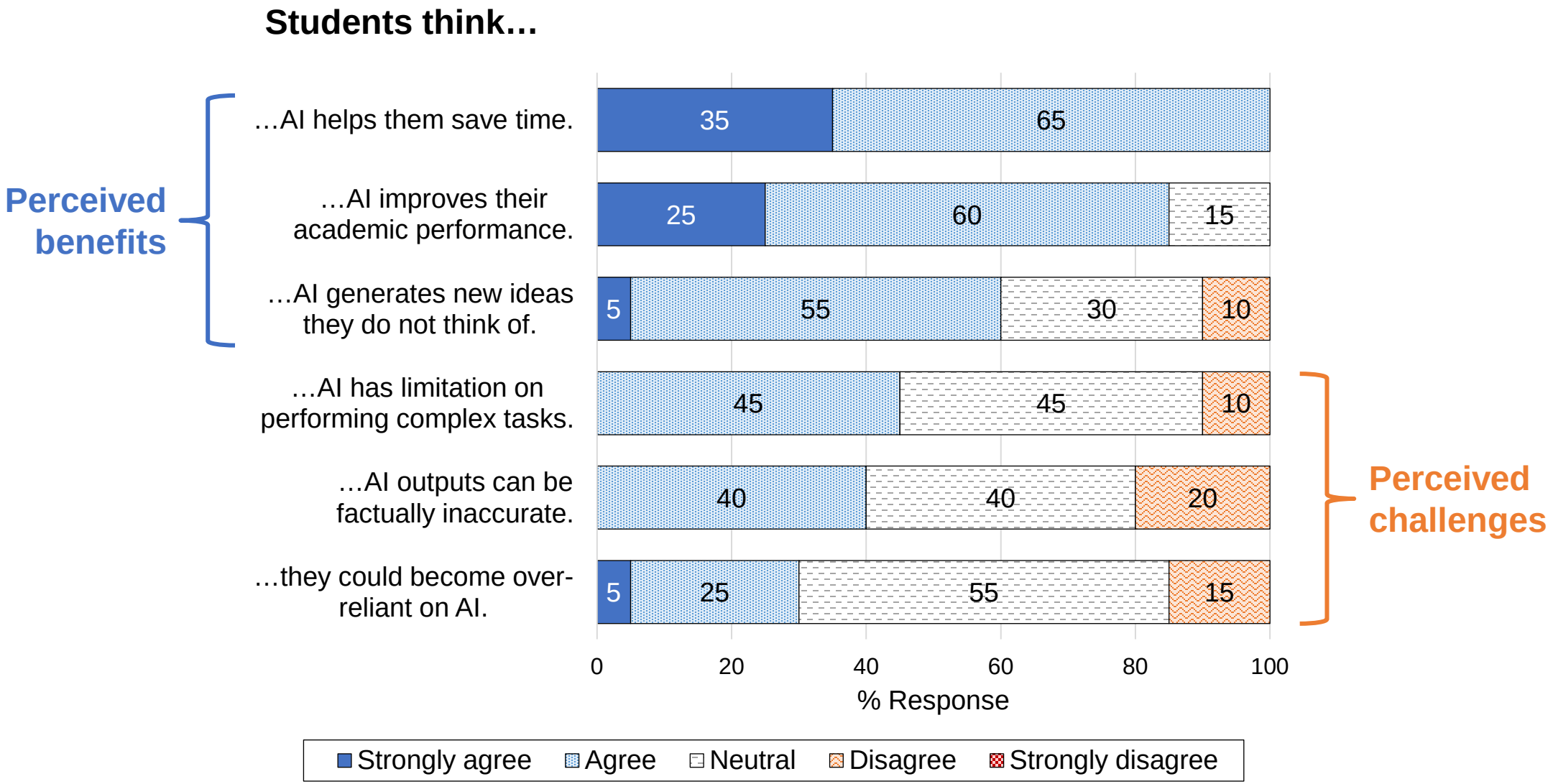
**Male** students were more **open towards the integration** of AI in education than females.




- Female students more likely to feel AI undermines academic integrity [$p = 0.047$] as they are generally more strongly against academic misconduct.[9,10]
- Male students were more likely to welcome AI use in assessments [$p = 0.028$].

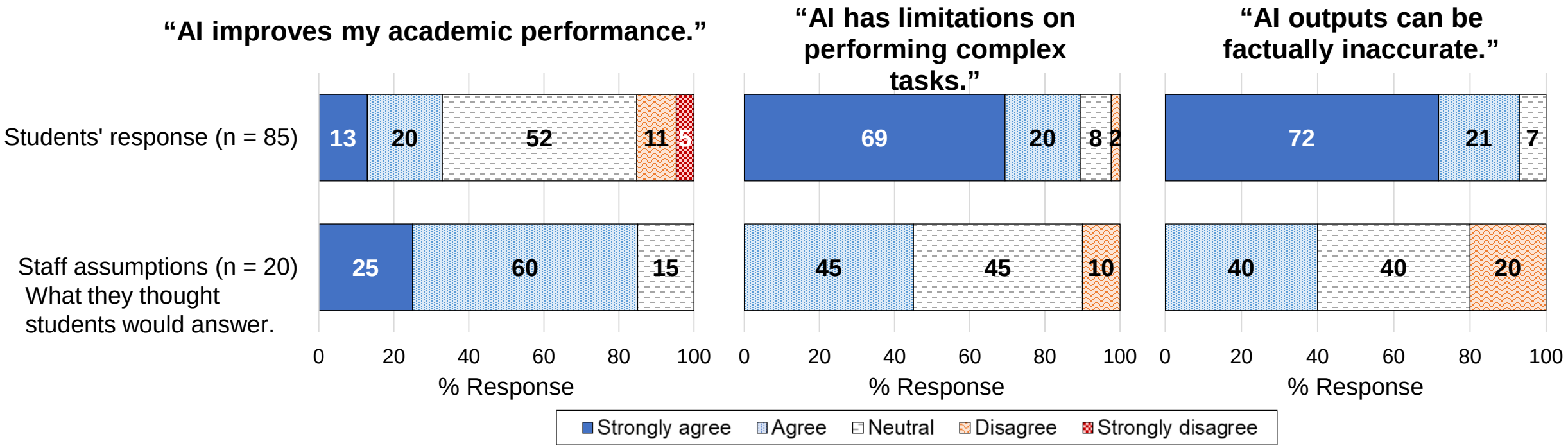
9. Y. Zhang *et al*. (2018). "Investigating Academic Dishonesty among Chinese Undergraduate Students: Does Gender Matter?", *Assess. Eval. High. Educ.*, **43**, 812–826.
10. M. C. Ossai *et al.* (2023). "Academic Integrity during Examinations, Age and Gender as Predictors of Academic Performance among High School Students", *Int. J. Educ. Dev.*, **100**, 102811.

# 4. Staff Assumptions about Students' Views (*n* = 20)



# 4.1. Students' Opinions vs. Staff Assumptions

Disparity was observed between staff assumptions and students' actual opinions towards AI [$p < 0.01$ in all three cases].

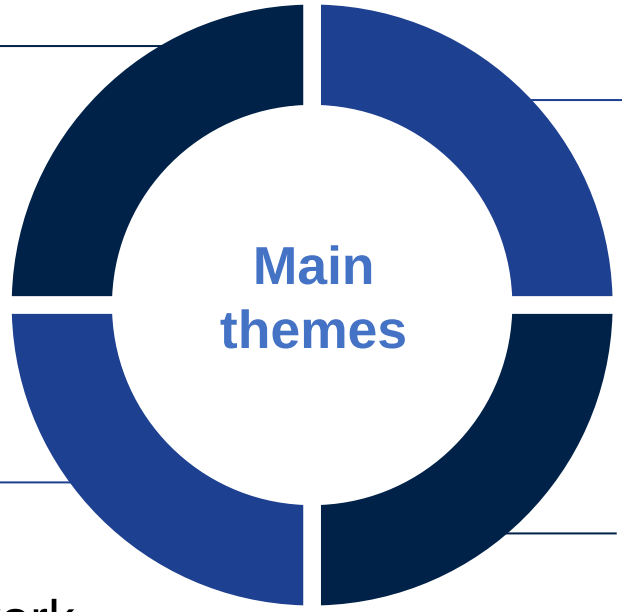



- Highlights differing understanding of students' views towards AI.
- Staff interview:

"[We] haven't spent […] much time talking about the trustworthiness of AI, so [colleagues might] infer that students don't understand that very much."

# 5. Thematic Analysis

From free-text comments in questionnaires (students and staff).




### How students use AI

- Clarifying concepts.
- Improve writing.
- Summarising articles.
- Others (non-degree).

### Suggestions for implementation

- Develop critical thinking skills.
- Tool to assist with assignments.
- Allowing / accepting AI use.
- Curriculum modifications.

### Positive aspects

- Create initial plans/drafts of work.

### Negative aspects

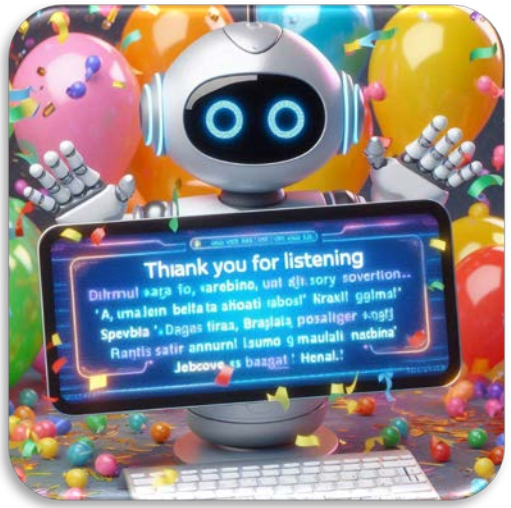
- Limitation with output reliability.
- Academic misconduct.
- Over-reliance on AI.

# Conclusions

| | |
|---|---|
| 1 Students' current AI usage. | Generative AI was more **commonly used for non-academic** purposes. |
| 2 Students' attitudes and perceptions towards AI use. | Students do **understand strengths and limitations** of generative AI, and their **background can influence their views/experience** with it. |
| 3 Students' perception towards integration of AI in academia. | There is a **need for clear(er) guidance** on the use of generative AI. |
| 4 How staff assume students view AI. | There is **disparity between staff perception and students' actual opinions** towards generative AI. **We actually think similarly!** |

## Recommendations

- **Teach** students and staff how to best use generative AI and provide **formal guidance** on its use in HE.
- **Modify assessment design** to include/account for AI use.
- Use AI to **develop students' critical thinking** skills.
- **Understand** how students' **backgrounds** can affect their AI experience – work with them.



# Detailed Ethnicity & English Language Levels