Student Preconceptions of Artificial Intelligence: Results from Single Institution Survey

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ABSTRACT

Artificial intelligence (AI) has become an increasingly critical component of not only the computing workforce but also society. It is essential for a diverse group of young people to contribute to this field. However, even within computing, AI is not taught to all post-secondary students. Students often must self-select into AI courses, meaning their reasons for choosing AI may be based on preconceptions of the discipline that may or may not be accurate. We extend the work of a small-n interview study of primarily Asian/Asian American undergraduate students, many of whom expressed perceptions of AI that paralleled identified computing stereotypes. Many of these stereotypes have the potential to discourage undergraduate computing students to take classes or specialize in AI, particularly those from underrepresented groups. Here we present a larger scale validation of those findings in the form of survey data conducted at a large public research institution in the USA. The survey largely confirmed the findings of the interview study at a larger scale, and we also found that gender did not significantly influence the results. Finally, we discuss strategies for AI integration into non-AI computing courses based on those previously used in responsible computing contexts, the goal being to counter harmful preconceptions before students specialize into computing subareas.

AI has already made a great impact on a variety of computing and non-computing related disciplines, and is poised to play an increasing role across various areas in industry and society [1, 6, 7, 12, 13]. It is essential to educate young people to contribute to this field to ensure the development of a high-qualified workforce. This requires post-secondary computing students to sign on to learn about the discipline. However, within university computing departments AI is not always a part of the required undergraduate or graduate curriculum, meaning computing students must choose whether to take courses and further their education in AI based on their already existing opinions on the subject.

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One recent SIGCSE paper, "Computing Specializations: Perceptions of AI and Cybersecurity among CS Students" used interview methods to identify a variety of preconceptions related to AI: that AI is very difficult and time consuming "intimidating" "rigorous"; AI requires advance meth skills "I think all of AI/ML is essentially just math."; AI is "trending" and "cool"; AI requires an inherent brilliance "they're really smart."; AI will have a large societal impact (although not always for the better); and AI is a "male-dominated" discipline [11]. Many of these preconceptions were noted as matching preconceptions of computing disciplines more generally [9] and potentially having a discouraging impact on marginalized or historically excluded groups in computing environments, particularly women [8]. In this poster, we aim to validate the findings of Ojha et al. with quantitative data from a single institution survey of post-secondary computing students in the USA. To this end, we ask the following research questions.

1.) To what degree are the preconceptions of AI identified in Ojha et al. (2023) confirmed by a larger sample of post-secondary computing students at a large public US university?
2.) To what extent are there difference in preconceptions of AI based on gender?[1]

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1 METHODS

All data was collected from a single survey fielded during May and June 2023. In total, 106 responses were recorded from 24 information and computer science courses.

Sample Development: To gather our sample, we sent an email asking all instructors currently teaching computer science and information science courses at our university to field the survey to their students. Students were not offered an incentive to take the survey. The sample is not random, and students who had more positive opinions of their instructors may have been more likely to take the survey.

Major: Most respondents majored in computer (49.6%) or information science (42.1%). Small numbers were computational math/physics majors (3%) and engineering (5.3%) majors.

[1]Our sample size did not allow for comparisons based on other demographic features such as race or ethnicity.

Year of School: First year computing students made up 6.3% of our sample, Sophomores made up 11.3%, Juniors made up 26.3%, Seniors made up 31.3%, 5th/6th year undergraduates made up 10%, and graduate students made up 10%.

Gender: Men made up 67.1% of our sample, women made up 30.4%, and 2.5% preferred not to answer. No participants reported being non-binary or gender queer.

Race: White people made up 72.5% of our sample, South Asian/Indian people 10%, Hispanic people 7.5%, East Asian people 5%, Black people 5%, prefer not to answer 2.5%, American Indian people 1.3%, and 1.3% not listed.

Survey Items. One initial survey question asked students to choose the three subjects they thought were most and least important to becoming a professional in computing and information technology. Twelve subjects were presented to participants, adapted from the ACM computing classification system [3] with some modifications to improve accessibility and increase construct validity. The other eight survey questions were directly informed by the themes identified in Ojha et al. and were presented as four option Likert scales, with a "don't know" option to avoid midpoint ambiguity [10].

Analysis. Fisher's exact hypothesis tests were used to compare group differences between men and women. All other statistics were analyzed descriptively.

2 RESULTS AND DISCUSSION

In terms of topic importance, AI was considered a top three most important computing topic by 28.2% of participants, with only 14.8% of participants reporting it a top three least important topic out of the twelve topics asked about. Most participants (57%) did not consider AI a top three most or least important computing topic.

Table 1: Student Preconceptions of AI

Survey Item	N	$\bar{x}$	σ	p-value (gender)
Work in AI is difficult.	106	3.5	.67	.08
Work in AI is time-consuming.	106	3.6	.53	.60
To do work in AI, it is important to have advanced math skills.	106	3.3	.71	.16
AI is accessible to anyone who wishes to learn about it.	106	2.9	.86	.57
To do work in AI, it is important to have a brilliant mind.	106	2.6	.92	.93
AI is cool.	106	3.5	.69	.40
AI is a male-dominated discipline.	106	3.4	.81	.29
Work in AI will have a large societal impact.	105	3.9	.35	.99

4-point scales from 1-Strongly Disagree to 4-Strongly Agree

Many of the preconceptions of cybersecurity noted by Ojha et al. were affirmed by participants in our survey (Table 1). Some negative preconceptions (difficult/time consuming/requires advanced math skills/male dominated) were widely agreed with, with a few more positive preconceptions (AI is cool/will have a large societal impact) also affirmed. That AI is "accessible to anybody who wishes to learn about it" found tepid agreement, with a mean slightly above the midpoint of 2.5, indicating that there is work to be done in making AI seem accessible to new students. Responses to the negative misconception that AI requires a "brilliant mind" were mixed. No preconception was significantly more prevalent among women or men. However, this doesn't mean that widely reported preconceptions impact men and women's motivation to study AI in the same way.

One potential method of combating negative preconceptions of AI prior to self-selection into sub-specializations, is by incorporating AI education into non-AI computing courses. A model of this is already present in responsible computing, which has been integrated into introductory programming courses with some degree of success [4, 5]. The can be an increasingly salient option as universities are struggling to hire faculty and offer coursework in AI as part of a recent AI "gold rush" described in Inside Higher-Ed's July 2023 report [2]. We recommend that instructors consider a variety of holistic ways to introduce AI into their courses and curriculum.

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