

Pioneer Research Program Evaluation Form

Scholar Information

Scholar's Full Name:	Xingyang (Chris) He
Scholar's Research Concentration:	Designing and Creating Human Centered Technologies
Title of Scholar's Research Paper:	Enhancing Learning with Student Teacher Augmented Response (STAR): A Multi-Agent Collaborative System for Nontraditional Education Settings

Grading and Academic Oversight Section

Program grade conferred by professor: A

**Full grading rubric approved by Pioneer Academics and Oberlin College*

The Pioneer Research Program's college accreditation and academic oversight are conducted collaboratively with Oberlin College:

Listing on Common Application:	"Summer Program, Credit Awarded Directly by Oberlin College"
Course Title on Coalition Application:	"099" "Pioneer Research Course"
College Course ID on UC Application:	"INST 099" "Pioneer Research Course"

Comprehensive Evaluation Section

Evaluator Name & Full Title:	Dr. Franceska Xhakaj
College/University & Department:	Carnegie Mellon University, Computer Science Department and Human-Computer Interaction Institute, School of Computer Science
Full Educational Background of Evaluator:	2021-Present: Assistant Teaching Professor, Computer Science Department (CSD) and Human-Computer Interaction Institute (HCII) at the School of Computer Science (SCS), Carnegie Mellon University 2015-2021: Ph.D. Human-Computer Interaction, School of Computer Science, Carnegie Mellon University 2015-2017: M.S. Human-Computer Interaction, School of Computer Science, Carnegie Mellon University 2011-2015: B.S. Computer Science, Minor in Mathematics, Lafayette College

Please rate the scholar in the following areas:

	Excellent	Good	Average	Below Average	Poor
Ability to form original ideas and concepts	X				
Ability to communicate thoughts in an effective and articulate manner	X				
Ability to synthesize and organize information from disparate sources	X				
Level of scholar's curiosity, aptitude, and industriousness	X				

Based on the scholar's performance through Pioneer, how would you **rate this scholar's potential** for undergraduate-level academic work at a top college/university, relative to other undergraduate students whose academic work you have mentored?

One of the best I have encountered, top 5% <u>X</u>	Excellent, top 10% ____
Very Good, top 25% ____	Good, top 50% ____
Below Average ____	

Describe some of the scholar's strengths:

Chris demonstrated an exceptional ability to read and comprehend scientific literature, synthesize findings, and identify gaps in previous work. Furthermore, he excelled in understanding user needs, developing a solution both in prototype and implemented form, and subsequently testing it with real users. Chris's research paper provides a comprehensive end-to-end example of user-centered research. His writing surpassed the expectations for high school or undergraduate students. Moreover, I was particularly impressed by Chris's initiative to independently learn how to work with a Language Model (LLM) and build his system based on it, despite having no prior experience in this area. **It was a pleasure to work with Chris.**

Describe some areas in which the scholar can improve:

Chris was always prepared, with all the assignments submitted by the deadline. I can't identify any areas where improvement is needed.

While the second half of the research work was one-to-one with the professor, the first half involved a small research cohort of 3-6 scholars. Describe the contribution that the scholar made to the research group discussion and learning:

Chris consistently came prepared to every session, offering thoughtful insights on the assigned papers. He always asked questions that demonstrated a genuine desire to understand the material presented in class more deeply. Additionally, Chris was helpful to his peers, posing questions about their proposed research ideas and providing feedback on their approaches. He was always well-prepared, professional, and supportive of his peers.

Would you recommend this scholar to a college admissions officer at a top college or university? Why or why not?

I would strongly recommend Chris to a top university/college. This is where he belongs. The skills he showed this semester in conducting research, in addition to his meta skills in learning and managing a research paper (independent and self-directed learning) show that he will thrive and excel in the rigorous environment of any high-quality university.

Evaluator's Signature:	<i>Dr. Franceska Xhakaj</i>
Evaluator's Printed Name:	Franceska Xhakaj
Date of Evaluation:	07/28/2024
Evaluator's email & phone:	xhakajf@gmail.com, 7029343574

Pioneer Academics affirms that the scholar whose research paper is attached has followed Pioneer Academics' protocols for developing original research and that their paper has met Pioneer Academics' standards for authenticity. The grading and evaluation have met the standards collaboratively defined by Pioneer Academics and Oberlin College & Conservatory. If there are any questions regarding the work's academic integrity, please contact us at academic.integrity@pioneeracademics.com or by calling (855) 572-8863. We will conduct an immediate review and respond to your questions promptly.

Please briefly explain the nature and requirements of the research paper and your interaction with the scholar:

At the beginning of the “Designing and Creating Human-Centered Technologies” I delivered four sessions with some amount of time dedicated to discussions and hands-on activities per each session.

- In the first session, we introduced human-centered design, discussed its core principles and history and analyzed case studies of good and bad designs from the real world. We also focused on brainstorming research project ideas per student.
- In the second session, we had an in-depth exploration of a variety of user research methodologies including primary and secondary research via qualitative, quantitative or a mixed methods approach. We practiced with hands-on exercises on how to apply some of those methods.
- In the third session we explored prototyping and its importance in the human-centered design process. We introduced fidelity levels of prototyping and demonstrated basic prototyping techniques. We practiced with hands-on exercises on how to apply some of those methods.
- In the fourth session, we discussed other forms of high-fidelity. We also discussed how to conduct usability testing via common user testing methods. At the end of the session, we brainstormed one more time on the research project ideas per each student.

As part of the program, students were required to write a final research paper which would be evaluated on:

- Research (were the research goals clearly defined and appropriately ambitious? Were the research methods soundly executed? Were the findings clearly articulated, Interesting and supported by evidence?)
- Clarity (were the ideas clearly described and communicated in written form?)
- Demonstrated effort (does the paper seem the result of careful work?)

After the group sessions, Chris and I had five individual, one-on-one meetings. In our first session, Chris came prepared with the broad idea of wanting to support learning in nontraditional educational settings via educational technologies. This is a particularly important research area as the majority of research in education focuses on traditional settings, neglecting the unique needs of nontraditional environments. Chris was motivated in conducting this research by his peers' struggles with nontraditional learning and had also conducted a thorough literature review on how educational technologies are used to support nontraditional learning settings and what are current gaps in research. His goal was to enhance educational accessibility and alleviate educational inequality outside the traditional classroom.

During the first few sessions, Chris and I worked to narrow down the specific type of educational technology he wanted to focus on. After reviewing literature on various educational technologies, Chris showed a keen interest in Large Language Models (LLMs). LLMs, such as the ChatGPT chatbot introduced by OpenAI in 2022, have shown great potential in supporting student learning in traditional classroom settings.

As the first stage of his research project, Chris proposed interviewing users to better understand their motivations for engaging in nontraditional learning and the limitations of current technologies (particularly ChatGPT) in facilitating these learning processes. He used contextual inquiry and affinity diagramming to collect and synthesize this data, uncovering insights such as current LLMs' inability to delve too deeply into a topic, wasting users' time with multiple iterations of question asking, and having a short memory that would not retain user preferences. Based on these insights, Chris began designing an LLM chatbot that would serve as a virtual tutor, bridging the gap between current chatbots and his findings from user studies, to support learners' self-directed learning in nontraditional educational settings.

Midway through our sessions, Chris started thinking about how to implement this new chatbot. Despite having limited programming knowledge, he thoroughly reviewed LLM tutorials and various APIs and decided to use Microsoft's AutoGen, which facilitates the development of multi-agent workflows. Although he encountered multiple bugs and difficulties during development, he resolved all issues independently, demonstrating a strong will and perseverance in getting his technology working. In his final research paper, Chris developed a multi-agent collaborative system called STAR (Student Teacher Augmented Response), proposing a novel multi-agent interaction framework to align generated responses with student demands to better support student learning in nontraditional education settings.

While I already considered Chris's progress in research up to this point a significant achievement, Chris also wanted to conduct a preliminary evaluation of STAR. He performed a controlled experiment comparing ChatGPT and STAR in supporting student learning in nontraditional settings. His findings showed that STAR helped students gain a deeper understanding of content, improved learning efficiency by reducing time and effort students put into talking to the chatbot, and alleviated demotivating factors associated with learning through technology, such as repetitive prompting. Overall, I was very impressed by the quality of Chris's research work as well as his ability to communicate his findings clearly and concisely in his research paper and the research presentation session in front of his peers at our last group session.