Xiaoyi Tian

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Research Interests

CS and AI Education, Education Technology, Human-Computer Interaction, Computational Linguistics, Computer-Supported Collaborative Learning

Education

Ph.D. in Human-Centered Computing 2024
University of Florida Gainesville, FL

Dissertation title: *Designing for Children to Create Conversational Agents and Learn about Artificial Intelligence*

Committee: Kristy Elizabeth Boyer (advisor), Eric Ragan, Jaime Ruiz, Maya Israel

M.S. in Information Science 2020
University of Pittsburgh Pittsburgh, PA

B.Mgmt. in Management Science 2018
Anhui University Hefei, China

Experience

Research Scientist, North Carolina State University 09/2024 - present
Supervisor: Tiffany Barnes Raleigh, NC

- Design and create new materials and tools for K12 and undergraduate STEM and computing education and educators
- Design, develop, deploy, and maintain software tools to support educators, students, and research
- Oversee day-to-day operations of research projects
- Prepare and monitor IRB protocols and assure compliance
- Provide guidance on the research direction of graduate student and staff efforts across a large projects

Graduate Research Assistant, University of Florida 08/2020 - 08/2024
Supervisor: Kristy Boyer Gainesville, FL

- Managed an NSF ITEST project (DIALOGS: Fostering Computer Science and AI Learning through Youth-Led Conversational App Development Experiences; $1.5M; DRL-2048480; 03/15/21—03/15/25), overseeing all aspects of the project, including research design, learning tool development, curriculum and assessment development, data collection and analysis, professional development for undergraduates, middle school summer camp, classroom studies, project report writing and research dissemination
- Designed and developed a novel learning tool, AMBY, for children to create conversational agents. In AMBY, users can create a chatbot, input training data, formulate responses and deploy the chatbot on a website or phone
- Conducted contextual inquiry and usability studies with 46 children (aged 12-13) and 11 adults to understand user experiences and challenges while using AMBY. The analysis contributes design implications for conversational AI authoring tools that empower AI learning for children
- Conducted research under an NSF IUSE project (PRIME: Engaging STEM Undergraduate Students in Computer Science with Intelligent Tutoring Systems; $2M; DUE-1626235, DUE-1625908; 08/25/2016—08/15/21), clustered affective states and problem-solving behaviors of 86 undergraduate students in an adaptive block-based programming environment for novice learners. This study provided insight into how frustration trajectory models can guide system adaptivity during problem-solving episodes

Research Intern, Carnegie Mellon University 10/2019 - 07/2020
Supervisors: Amy Ogan, Michael Madaio Pittsburgh, PA

- Automated data collection for a child literacy system used by 500+ participants in Côte d'Ivoire over 8 months
- Visualized user phonological awareness curriculum progression of 8 units and 1,000+ weekly logs of learning actions

Research Assistant, University of Pittsburgh 04/2019 - 05/2020
Supervisor: Erin Walker Pittsburgh, PA

- Conducted qualitative research on multi-sessions rapport management of middle school learners with a social robot
- Utilized Independent Component Analysis (ICA) to model linguistic rapport components extracted from human coding and automated LIWC measurements

Awards and Honors

Three Minute Thesis Award (second place), University of Florida 2023

Best Short Paper Award, International Learning Analytics and Knowledge Conference (LAK'23) 2023

Best Paper Award, ACM Technical Symposium on Computer Science Education (SIGCSE'23) 2023

Gartner Group Graduate Fellowship, University of Florida 2022, 2023

Outstanding Undergraduate Thesis (Top 1% in the Class), Anhui University 2018

Academic Excellence Scholarship, Anhui University 2015 & 2016 & 2017

"Merit Student", Anhui University 2015 & 2017

Publications (Google Scholar Page)

Peer-Reviewed Journal Articles

[**J5**] **Tian, X**, Griffith, A. E., Price, Z., Boyer, K. E., & Tang, K. (2024). Investigating linguistic alignment in collaborative dialogue: A study of syntactic and lexical patterns in middle school students. *Language and Speech*, *0*(0), 1–24. https://doi.org/10.1177/00238309241234565

[**J4**] Song, Y., Weisberg, L. R., Zhang, S., **Tian, X**, Boyer, K. E., & Israel, M. (2024). A framework for inclusive AI learning design for diverse learners. *Computers and Education: Artificial Intelligence*, *6*, 100212. https://doi.org/10.1016/j.caeai.2024.100212

[**J3**] Song, Y., Xing, W., Li, C., **Tian, X**, & Ma, Y. (2024). Investigating the relationship between math literacy and linguistic synchrony in online mathematical discussions through large scale data analytics. *British Journal of Educational Technology*, *00*, 1–31. https://doi.org/10.1111/bjet.13444

[**J2**] **Tian, X**, Kumar, A., Solomon, C. E., Calder, K. D., Katuka, G. A., Song, Y., Celepkolu, M., Pezzullo, L., Barrett, J., Boyer, K. E., & Israel, M. (2023). AMBY: A development environment for youth to create conversational agents. *International Journal of Child-Computer Interaction*, *38*, 100618. https://doi.org/10.1016/j.ijcci.2023.100618

[**J1**] **Tian, X**, Risha, Z., Ahmed, I., Lekshmi Narayanan, A. B., & Biehl, J. (2021). Let's talk it out: A chatbot for effective study habit behavioral change. *Proceedings of the ACM on Human-Computer Interaction*, *5*(CSCW1), 1–32. https://doi.org/10.1145/3449171

Peer-Reviewed Conference Proceedings

[C11] **Tian, X**, Mannekote, A., Solomon, C. E., Song, Y., Wise, C. F., Mcklin, T., Barrett, J., Boyer, K. E., & Israel, M. (2024). Examining LLM prompting strategies for automatic evaluation of learner-created computational artifacts. *Proceedings of the 17th International Conference on Educational Data Mining (EDM)*, 1–4. In press.

[C10] Song, Y., **Tian, X**, Barrett, J., Israel, M., & Boyer, K. E. (2023). Guide, safety net, project tester, and more: Investigating the roles of facilitators in an ai summer camp. *Proceedings of the 17th International Conference of the Learning Sciences-ICLS 2023*, 2013–2014. https://doi.org/10.22318/icls2023.548176

[C9] Song, Y., **Tian, X**, Regatti, N., Katuka, G. A., Israel, M., & Boyer, K. E. (2024). Artificial intelligence unplugged: Designing unplugged activities for a conversational AI summer camp. *Proceedings of the 55th ACM Technical Symposium on Computer Science Education V. 1*, 1272–1278. https://doi.org/10.1145/3626252.3630783

[C8] Song, Y., Xing, W., **Tian, X**, & Li, C. (2023). Are we on the same page? Modeling linguistic synchrony and math literacy in mathematical discussions. *LAK23: 13th International Learning Analytics and Knowledge Conference*, 599–605. **[Best Short Paper Award]**. https://doi.org/10.1145/3576050.3576082

[C7] Katuka, G. A., Auguste, Y., Song, Y., **Tian, X**, Kumar, A., Celepkolu, M., Boyer, K. E., Barrett, J., Israel, M., & McKlin, T. (2023). A summer camp experience to engage middle school learners in AI through conversational app development. *Proceedings of the 54th ACM Technical Symposium on Computer Science Education V. 1*, 813–819. **[Best Paper Award]**. https://doi.org/10.1145/3545945.3569864

[C6] Song, Y., Katuka, G. A., Barrett, J., **Tian, X**, Kumar, A., McKlin, T., Celepkolu, M., Boyer, K. E., & Israel, M. (2023). AI made by youth: A conversational AI curriculum for middle school summer camps. *Proceedings of the Thirty-Seventh AAAI Conference on Artificial Intelligence and Thirty-Fifth Innovative Applications of Artificial Intelligence Conference and Thirteenth AAAI Symposium on Educational Advances in Artificial Intelligence*. https://doi.org/10.1609/aaai.v37i13.26882

[C5] Kumar, A., **Tian, X**, Celepkolu, M., Israel, M., & Boyer, K. E. (2022). Early design of a conversational ai development platform for middle schoolers. *2022 IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC)*, 1–3. https://doi.org/10.1109/VL/HCC53370.2022.9833129

[C4] Bounajim, D., Rachmatullah, A., Hinckle, M., Mott, B., Lester, J., Smith, A., Emerson, A., Morshed Fahid, F., **Tian, X**, Wiggins, J. B., et al. (2021). Applying cognitive load theory to examine stem undergraduate students' experiences in an adaptive learning environment: A mixed-methods study. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *65*(1), 556–560. https://doi.org/10.1177/1071181321651249

[C3] **Tian, X**, Wiggins, J. B., Fahid, F. M., Emerson, A., Bounajim, D., Smith, A., Boyer, K. E., Wiebe, E., Mott, B., & Lester, J. (2021). Modeling frustration trajectories and problem-solving behaviors in adaptive learning environments for introductory computer science. *Proceedings of International Conference on Artificial Intelligence in Education*, 355–360. https://doi.org/10.1007/978-3-030-78270-2_63

[C2] Morshed Fahid, F., **Tian, X**, Emerson, A., B. Wiggins, J., Bounajim, D., Smith, A., Wiebe, E., Mott, B., Elizabeth Boyer, K., & Lester, J. (2021). Progression trajectory-based student modeling for novice block-based programming. *Proceedings of the 29th ACM Conference on User Modeling, Adaptation and Personalization*, 189–200. https://doi.org/10.1145/3450613.3456833

[C1] **Tian, X**, Lubold, N., Friedman, L., & Walker, E. (2020). Understanding rapport over multiple sessions with a social, teachable robot. *Proceedings of International Conference on Artificial Intelligence in Education*, 318–323. https://doi.org/10.1007/978-3-030-52240-7_58

Posters and Workshop Papers

[W1] Buddemeyer, A., **Tian, X**, & Walker, E. (2022). Dominance as an indicator of rapport and learning in human-agent communication. *Student Research Workshop in Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics (ACL).* https://doi.org/10.48550/arXiv.2212.02361

Selected Projects

Automated Assessment of Computational Artifacts using LLMs 08/2023 - present

Developing a large language model (LLM)-based evaluation module to enhance open-ended project evaluation methods and reduce teacher workloads

- Developed a rubric for assessing learner-created conversational AI artifacts, encompassing four dimensions: project ideation, AI development, conversational design and end-user satisfaction
- Examined GPT-4's ability to assess learner-created artifacts, highlighting its effectiveness and limitations across different artifact dimensions
- Investigated the trade-offs between rubric-based and example-based prompting strategies, showing that few-shot learning with contextual examples improves LLMs' grading accuracy

Linguistic Alignment in Collaborative Learning Dialogues 01/2021 - 08/2023

Investigating on the role of linguistic alignment in middle school students collaborative problem solving dialogues

- Parsed the syntactic structure and extracted lexical types for both task-relevant and non-task words
- Calculated linguistic alignment on both syntax level and lexicon level for each dialogue exchange
- Performed Beyasian mixed-effect modeling on linguistic alignment and students' satisfaction toward their partner

StudyBuddy: A Chatbot for Effective Study Habits 09/2019 - 10/2020

Designing a chatbot prototype to induce and sustain study behavioral change for university first-year students

- Utilized mix-method to investigate the feasibility of chatbots for study behavioral change of college students
- Developed a chatbot prototype in Slack using DialogFlow and Slack API
- Conducted in-depth interviews with 8 students, 5 faculty and a usability survey with 118 students
- Offered design recommendations for chatbots on building trust with users, incorporating gender and individual differences, importance of context, balancing between immediate help and long-term support

Grant Writing Experience

Scaling, Expanding, and Iterating Innovations (SEI): Scaling AI Learning through Youth-Led Conversational App Development Experiences ($3,000,000 proposal submitted to *National Science Foundation-ITEST Program*, under review). In this proposal, we will address the growing need for AI literacy among K-12 students by scaling a successful DTI project to 20 times the original population size and expanding into formal middle school computer science (CS) instruction. **My contribution:** Writing the original draft for project description and project timeline.

AMBY - AI Made By You ($150,000 proposal submitted to *The Tools Competition*, entered phase 2, declined in phase 3). In this educational tool competition, we propose an LLM-based software architectural development for our existing learning tool, AMBY, to support diverse learners in creating conversational apps at scale. **My contribution:** Ideating the proposed system's development and learning engineering approaches, managing writing tasks for all contributors, writing the original draft, obtaining support letters from external researchers, coordinating with department staff to create the budget plan, and making the pitch video for the proposal.

Academic and Community Services

Microsoft TEALS volunteer, teacher for high school computer science (CS1, Python), Fall 2022
Reviewer of ACM Conference on International Computing Education Research (ICER) 2024
Reviewer of Workshop on Innovative Use of NLP for Building Educational Applications (BEA) 2024
Reviewer of Applied Computing and Informatics
Reviewer of ACM Transactions on Computing Education (TOCE)
Reviewer of ACM Technical Symposium on Computer Science Education (SIGCSE TS) 2024
Reviewer of International Society of the Learning Sciences (ISLS) 2023
Reviewer of ACM CHI Conference on Human Factors in Computing Systems (CHI) 2023, 2024
Reviewer of International Conference on Educational Data Mining (EDM) 2022
Reviewer of ACM Conference on Computer-Supported Cooperative Work (CSCW) 2020, 2023

Students Mentored (*denotes co-authored publications)

Omar Maslamani, B.S. Computer Science, University of Florida
Yvonika Auguste*, B.S. Health Education and Behavior, University of Florida
Carly Solomon*, B.S. Computer Science, University of Florida
Kaceja Calder*, B.S. Computer Science, University of Florida
Chandler Wiggins, B.S. Computer Science, University of Florida
Alex Johnson, B.S. Computer Science, University of Florida
David Vallejo-Lozano, B.S. Computer Science, University of Florida
Madison Edward, B.S. Computer Science, University of Florida
Nandika Regatti*, B.S. Computer Science, University of Florida
Shiyi Qiu, B.S. Computer Science, University of Florida

Invited Talks and Presentations

Invited Speaker, CAST AI Quarterly Convening 06/2024
How Can We Make AI Learning More Inclusive: A New Framework

Speaker, Child-Centered AI Design Workshop, ACM Conference on Human Factors in Computing Systems (CHI) 05/2024
Designing for Children to Create Conversational Agents and Learn about Artificial Intelligence

Speaker, AI in K-12 education seminar, University of Florida 11/2023
Empowering Youth in AI Learning: DIALOGS curriculum and AMBY interface

Guest speaker, PAWS research seminar, University of Pittsburgh 04/2023
Learner Modeling and Design of CS & AI Learning Environments

Guest speaker, AI workshop for Florida middle school teachers, University of Florida 07/2022
Camp DIALOGS: Teaching Conversational AI in Middle School Summer Camps

Guest speaker, undergraduate HCI course, University of Florida 03/2021
Let's Talk It Out: A Chatbot for Effective Study Behavioral Change

Skills

User-Centered Research: Contextual inquiry, interview, survey, storyboard, usability testing, persona, qualitative coding, dialogue act tagging, thematic analysis, ethnography, case study

Computational Toolkit: Python (spaCy, NLTK, Scikit-Learn, Pandas, NumPy, Matplotlib), R (lme4, brms, dplyr, tidyverse, ggplot2), OpenAI, LangChain, SPSS, JMP, Stata

Statistical Methods: ANOVA, regression analysis, mixed-effect models, Bayesian modeling

Last updated: September 5, 2024