

PAID: A Participatory Design Method to Co-Ideate AI-Based Solutions

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Over time, we have learned that designing new technologies with users is a reliable way to deliver useful products and achieve user acceptance. Research has contributed techniques that support co-design, enable rapid prototyping, and offer a more hands-on user experience in the co-development process. Meanwhile, Artificial Intelligence (AI) technologies are rapidly advancing. Since they present both opportunities and risks to society, it is essential not only to develop human-centric AI solutions but also to co-create them with the people who will be affected by them. Enhancing AI literacy and developing techniques and tools to support it is crucial to enabling users to co-design AI technologies. Therefore, this study developed a participatory design (PD) method called the PAID method, which was implemented and evaluated.

CCS Concepts: • **Human-centered computing** → **Human computer interaction (HCI)**.

Additional Key Words and Phrases: Artificial Intelligence, AI, Participatory Design, PD, Co-design, AI literacy

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1 Introduction

AI is a computer science field aimed at developing machines that perform tasks requiring human intelligence [1]. AI technologies can transform industries, streamline processes, and enhance efficiency, but they also pose risks like bias, opaque decision-making, and misinformation [23]. The concept of "Human-centered AI" focuses on developing systems that align with human needs and values [20]. Addressing both the opportunities and risks of AI requires not only creating human-centric solutions but also co-designing these solutions with those impacted by them.

PD emphasizes involving those affected by new technologies in the design process, empowering users through active participation [4, 22]. This makes PD relevant for the responsible and ethical development of AI artifacts. To enable individuals to actively participate in co-designing future AI artifacts, it's essential to enhance their AI literacy.

Thus, this study introduces the Participatory AI Design (PAID) method, aimed at enhancing AI literacy and empowering individuals to co-design AI technologies that reflect their needs and values. I developed this method through a systematic literature review and interviews with AI experts and then applied it in two specific contexts—healthcare and the digitalization of societies.

2 Literature Review

The reviewed studies cover various AI applications. Seven papers focus on AI in education, the most studied context [3, 9, 11, 13, 19, 21, 22]. Four focus on general AI tools [2, 12, 15, 17], and four on AI in healthcare [5–7, 18]. Only one paper covers entertainment [16] and one focuses on social

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contexts [10]. Conversational AI is the most studied, appearing in six studies [3, 6, 9, 11, 21, 22]. Other studies include PD for ambient assistive living [18], AI-driven language learning [13], a value-sensitive design for a mental healthcare tracker [5], a K-12 education system with learning analytics [19], Game AI [16], and a proactive auto-response agent [10]. One study explores a sound-based digital pain companion for chronic pain [7]. The studies employed various methodologies, including the Wizard of Oz technique, brainstorming, storytelling, interviews, role-playing, and more. Two studies [10, 22] provided initial models like chatbots and messaging agents for hands-on experiences. Only one study [3] explained AI concepts but did not provide explicit details. This gap suggests a potential area for future research to explore the most effective approaches for informing about AI and co-designing future AI technologies, which this study addresses.

3 Method

3.1 Systematic Literature Review and Interview

To develop an effective method for raising AI literacy and co-designing AI artifacts, I conducted a systematic literature review (SLR) using the search string "*participatory design*" AND "*AI*" OR "*artificial intelligence*" in the ACM Digital Library and Springer databases. After applying inclusion and exclusion criteria and using the snowball technique, I identified and analyzed 17 relevant studies. Additionally, I interviewed seven AI experts and thematically analyzed. Using the insights from the SLR and interviews, I developed a PD method called the PAID method.

3.2 Workshops

Two workshops were conducted using the PAID method. The first focused on healthcare, while the second focused on digital society for internationals in Østfold, Norway. The first workshop included four women aged 20-50, and the second had two women aged 30-50, all were non-technical. The workshops were analyzed using Schön's theories on reflection in action [14].

4 Findings

4.1 Interview Findings

The thematic analysis of the interview transcriptions identified eight themes: *Constructed Intelligence*, *Data is King*, *Domain-Specific Intelligence*, *Ethical Dilemmas*, *Capabilities of AI*, *Limitations of AI*, *Building AI Literacy*, and *AI Everyday Applications*.

4.2 Participatory AI Design (PAID) Method

Understanding AI; This workshop segment aims to provide participants with a basic understanding of AI through two distinct approaches: a meta-level overview of AI and an in-depth exploration of a specific AI technology.

Problem Definition; Participants reflect on real-life challenges where AI solutions could be impactful, thereby facilitating their later engagement in co-designing AI solutions.

Co-designing AI-Enabled Artifacts; The goal of this segment is to generate new ideas and reflect on responsible, explainable, and ethical AI, rather than creating advanced prototypes.

4.3 PAID Method Implementation

The first focuses on understanding AI through two activities: Participants were asked to draw a flower based on provided photos and reflect on their thought processes. Basic AI concepts were then explained in relation to this activity. Finally, participants were asked to draw the next flower from a new set of images and compare it with their previous drawing to discuss data reliability, accuracy, and issues with incorrect data. In the second set of activities, participants were asked to

identify spam emails from four examples and discuss their choices. They were then shown how emails can be relabeled to correct classifications, showing AI's ability to improve through feedback. This activity was compared with the flower imagery task to understand AI's domain-specific nature.

In the second section of the first workshop, participants were asked to define problems for co-designing AI solutions in healthcare and create cartographic maps. In the third section, they were asked to reflect on the previous sections, envision AI solutions, and create storyboards to illustrate user interactions with the proposed technology.

In the second section of the second workshop, participants were asked to share their views on digital society. Then asked to list positive and negative aspects of living as expatriates and to vote on the most prominent negative aspects to focus on further. In the third section, participants were asked to reflect on previous sections and envision life in 2050 with advanced AI. Then asked to consider how these AI capabilities could address identified challenges and to create storyboards.

4.4 Reflection on Workshop Outcomes

In both workshops, participants drew the next flower, considering factors such as petal shape, color, size, background, leaves, etc. They also correctly identified spam emails and distinguished this task from drawing flowers. In the first workshop, participants created cartographic maps. Group 1 proposed AIDoc, a virtual doctor app for diagnosis and treatment recommendations, while Group 2 suggested a chip to monitor a dog's behavior. Both groups created storyboards.

In the second workshop, participants identified language barriers and food prices as key challenges for expats. Participant 1 designed an AI hospital app for better communication and appointment scheduling. Participant 2 proposed Foodie, an app optimizing food selection by balancing cost and quality across stores.

5 Discussion and Conclusion

As AI technologies become an integral part of our daily lives [8], it is important to co-design responsible and ethical AI systems. Raising AI literacy is essential for effective co-design, and selecting the right PD method is vital. Therefore, I proposed, implemented, and evaluated the PAID method. The artifacts designed during the two workshops demonstrated participants' understanding of AI by using data to make informed decisions and avoid impractical technologies. This result highlights the effectiveness of the PAID method in raising AI literacy and enabling end-users to co-design AI technologies. Since this is an initial workshop, participants can't fully articulate all aspects of AI technologies. Further refinement and deeper AI knowledge are needed.

In the first workshop, Group 1 preferred symptom-based diagnosis, while Group 2 chose real-time data analysis for early detection. This highlights that users' preferences can vary even in similar scenarios, emphasizing the need for user involvement in design process to address specific needs.

References

- [1] [n. d.]. Artificial Intelligence (AI): What Is AI and How Does It Work? | Built In. <https://builtin.com/artificial-intelligence>
- [2] Tone Bratteteig and Guri Verne. 2018. Does AI make PD obsolete? exploring challenges from artificial intelligence to participatory design. In *Proceedings of the 15th Participatory Design Conference: Short Papers, Situated Actions, Workshops and Tutorial - Volume 2 (PDC '18)*. Association for Computing Machinery, New York, NY, USA, 1–5. <https://doi.org/10.1145/3210604.3210646>
- [3] Amanda Buddemeyer, Jennifer Nwogu, Jaemarie Solyst, Erin Walker, Tara Nkrumah, Amy Ogan, Leshell Hatley, and Angela Stewart. 2022. Unwritten Magic: Participatory Design of AI Dialogue to Empower Marginalized Voices. In *Proceedings of the 2022 ACM Conference on Information Technology for Social Good*. ACM, Limassol Cyprus, 366–372. <https://doi.org/10.1145/3524458.3547119>
- [4] Klaudia Carcani and Christina Mörberg. 2018. Enhancing engagement and participation of seniors in society with the use of social media - the case of a reflective participatory design method story. *Interaction Design and Architecture(s)* 36 (March 2018), 58–74. <https://doi.org/10.55612/s-5002-036-004>

- [5] Alessandra Cenci, Susanne Jakobsen Ilskov, Nicklas Sindlev Andersen, and Marco Chiarandini. 2023. The participatory value-sensitive design (VSD) of a mHealth app targeting citizens with dementia in a Danish municipality. *AI and Ethics* (April 2023). <https://doi.org/10.1007/s43681-023-00274-9>
- [6] Morena Danieli, Tommaso Ciulli, Seyed Mahed Mousavi, and Giuseppe Riccardi. 2021. A Conversational Artificial Intelligence Agent for a Mental Health Care App: Evaluation Study of Its Participatory Design. *JMIR Formative Research* 5, 12 (Dec. 2021), e30053. <https://doi.org/10.2196/30053>
- [7] Bleiz Macsen Del Sette, Dawn Carnes, and Charalampos Saitis. 2023. Sound of Care: Towards a Co-Operative AI Digital Pain Companion to Support People with Chronic Primary Pain. In *Computer Supported Cooperative Work and Social Computing*. ACM, Minneapolis MN USA, 283–288. <https://doi.org/10.1145/3584931.3606971>
- [8] Mohammad Ilyas. 2022. Emerging Role of Artificial Intelligence. *Journal of Systemics, Cybernetics and Informatics* 20, 6 (Dec. 2022), 58–65. <https://doi.org/10.54808/JSCI.20.06.58>
- [9] Francisco Iniesto, Tim Coughlan, Kate Lister, and Wayne Holmes. 2020. Designing an Assistant for the Disclosure and Management of Information about Needs and Support: the ADMINS project. In *Proceedings of the 22nd International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '20)*. Association for Computing Machinery, New York, NY, USA, 1–4. <https://doi.org/10.1145/3373625.3418017>
- [10] Pranut Jain, Rosta Farzan, and Adam J. Lee. 2023. Co-Designing with Users the Explanations for a Proactive Auto-Response Messaging Agent. *Proceedings of the ACM on Human-Computer Interaction* 7, MHCI (Sept. 2023), 201:1–201:23. <https://doi.org/10.1145/3604248>
- [11] Jeonghyun Lee, Vrinda Nandan, Harshvardhan Sikka, Spencer Rugaber, and Ashok Goel. 2023. Designing a Communication Bridge between Communities: Participatory Design for a Question-Answering AI Agent. (2023).
- [12] Q Vera Liao and Michael Muller. 2019. Enabling Value Sensitive AI Systems through Participatory Design Fictions. (2019).
- [13] Amna Liaqat, Cosmin Munteanu, and Carrie Demmans Epp. 2021. Collaborating with Mature English Language Learners to Combine Peer and Automated Feedback: a User-Centered Approach to Designing Writing Support. *International Journal of Artificial Intelligence in Education* 31, 4 (Dec. 2021), 638–679. <https://doi.org/10.1007/s40593-020-00204-4>
- [14] Hugh Munby. 1989. Reflection-In-Action and Reflection-On-Action. *Current Issues in Education* 9, 1 (Sept. 1989), 31–42. <https://doi.org/10.1353/eac.1989.a592219>
- [15] John W. Murphy and Carlos Largacha-Martínez. 2022. Decolonization of AI: a Crucial Blind Spot. *Philosophy & Technology* 35, 4 (Dec. 2022), 102. <https://doi.org/10.1007/s13347-022-00588-2>
- [16] Nathan Partlan, Erica Kleinman, Jim Howe, Sabbir Ahmad, Stacy Marsella, and Magy Seif El-Nasr. 2021. Design-Driven Requirements for Computationally Co-Creative Game AI Design Tools. In *The 16th International Conference on the Foundations of Digital Games (FDG) 2021*. ACM, Montreal QC Canada, 1–12. <https://doi.org/10.1145/3472538.3472573>
- [17] Soaad Qahha and Syed Ishtiaque Ahmed. 2021. Towards a New Participatory Approach for Designing Artificial Intelligence and Data-Driven Technologies. (2021).
- [18] Katherine-Marie Robinson, Rachana Devkota, and Jason Millar. 2022. A Participatory Design Methodology to Elicit Aging- in-Place Stakeholder Concerns with Ambient Assistive Living (AAL) Devices During COVID-19. In *2022 IEEE 30th International Requirements Engineering Conference Workshops (REW)*. IEEE, Melbourne, Australia, 38–47. <https://doi.org/10.1109/REW56159.2022.00016>
- [19] Katarina Sperling, Linnéa Stenliden, Jörgen Nissen, and Fredrik Heintz. 2023. Behind the Scenes of Co-designing AI and LA in K-12 Education. *Postdigital Science and Education* (Sept. 2023). <https://doi.org/10.1007/s42438-023-00417-5>
- [20] Jiao Sun, Q. Vera Liao, Michael Muller, Mayank Agarwal, Stephanie Houde, Kartik Talamadupula, and Justin D. Weisz. 2022. Investigating Explainability of Generative AI for Code through Scenario-based Design. In *27th International Conference on Intelligent User Interfaces*. ACM, Helsinki Finland, 212–228. <https://doi.org/10.1145/3490099.3511119>
- [21] Zheng Zhang, Ying Xu, Yanhao Wang, Bingsheng Yao, Daniel Ritchie, Tongshuang Wu, Mo Yu, Dakuo Wang, and Toby Jia-Jun Li. 2022. StoryBuddy: A Human-AI Collaborative Chatbot for Parent-Child Interactive Storytelling with Flexible Parental Involvement. In *CHI Conference on Human Factors in Computing Systems*. 1–21. <https://doi.org/10.1145/3491102.3517479> arXiv:2202.06205 [cs].
- [22] Qingxiao Zheng and Yun Huang. 2023. "Begin with the End in Mind": Incorporating UX Evaluation Metrics into Design Materials of Participatory Design. In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems*. ACM, Hamburg Germany, 1–7. <https://doi.org/10.1145/3544549.3585664>
- [23] Douglas Zytko, Pamela J. Wisniewski, Shion Guha, Eric P. S. Baumer, and Min Kyung Lee. 2022. Participatory Design of AI Systems: Opportunities and Challenges Across Diverse Users, Relationships, and Application Domains. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts*. ACM, New Orleans LA USA, 1–4. <https://doi.org/10.1145/3491101.3516506>