PeerConnect: Co-designing a Peer-Mentoring Support System with Computing Transfer Students

Nisha Anthraper*
Prachee Javiya*
wm01531@umbc.edu
pjaviya1@umbc.edu
University of Maryland, Baltimore County
Baltimore, Maryland, USA

Sai Iluru
venkati1@umbc.edu
University of Maryland, Baltimore County
Baltimore, Maryland, USA

Lujie Karen Chen
lujiec@umbc.edu
University of Maryland, Baltimore County
Baltimore, Maryland, USA

Andrea Kleinsmith
andreak@umbc.edu
University of Maryland, Baltimore County
Baltimore, Maryland, USA

ABSTRACT

In the US, nearly half of the STEM undergraduates begin their academic careers at community colleges. Transferring to four-year institutions can be challenging. Evidence suggests that mentoring can help by increasing a sense of belonging and retention. We engaged mentors and mentees from a pilot mentoring program for new transfer students in computing majors at a minority-serving institution in the Northeastern US in a co-design workshop to understand their needs and requirements for a peer-mentoring system, PeerConnect. PeerConnect aims to foster transfer students' academic and social engagement, increase self-efficacy and belonging, and develop students' self-regulated learning skills. Preliminary results show that students want features that push the system beyond merely measuring engagement to actively promoting it. This study contributes to HCI and CSCW work in designing support systems for mentoring and peer support programs in educational settings and to the emerging literature on student-centered learning analytics systems.

CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**; *Empirical studies in HCI*;

KEYWORDS

co-design, peer mentoring, sense of belonging, learning analytics

ACM Reference Format:
Nisha Anthraper, Prachee Javiya, Sai Iluru, Lujie Karen Chen, and Andrea Kleinsmith. 2024. PeerConnect: Co-designing a Peer-Mentoring Support System with Computing Transfer Students. In *Extended Abstracts of the CHI Conference on Human Factors in Computing Systems (CHI EA '24), May 11–16, 2024, Honolulu, HI, USA.* ACM, New York, NY, USA, 7 pages. https://doi.org/10.1145/3613905.3650936

*Both authors contributed equally to this research.

CHI EA '24, May 11–16, 2024, Honolulu, HI, USA

ACM ISBN 979-8-4007-0331-7/24/05
https://doi.org/10.1145/3613905.3650936

1 INTRODUCTION

A diverse STEM workforce is essential for a nation's competitiveness in science and technology. In the United States, women and members of ethnic/racial minority groups continue to be underrepresented in computing majors at two- and four-year institutions [24]. Nationally, nearly half of the STEM undergraduates begin their academic careers at community colleges [15, 20]. Students from underrepresented groups often choose to begin their education at community colleges due to their affordability, convenient locations, and flexible class schedules and delivery formats [14, 15, 20]. Transferring to four-year institutions is a challenging milestone for community college students as they must adapt to new academic and social environments while tackling the increasing difficulty of upper-level coursework. There is increasing evidence that mentoring can serve as a protective factor and increase confidence, sense of belonging, and retention rates in STEM majors among underrepresented groups [21, 30, 41].

Situated in a four-year, mid-sized minority-serving institution (MSI) in the Northeastern US, the context of this study is a pilot mentoring program for new transfer students in computing majors. This program explores a novel mentoring structure that leverages near-peer mentoring and horizontal peer support [34]. A triad of transfer students forms a small cohort, which includes a near-peer mentor who is a transfer student who has completed at least one semester post-transfer and two new transfer students in their first semester. In addition, students are supported by instructional and program staff throughout the program. The success of a mentoring program like this relies on a robust infrastructure that supports students' social and academic engagement in their new environment. Inspired by the work in student-centered learning analytics dashboard (LAD) systems, we envision **PeerConnect**, a mentoring support system that integrates the features of a LAD with the social structure afforded by the mentoring program, aiming for a data-driven, information-rich support system connecting multiple stakeholders (mentees, mentors, instructors, and program staff).

This paper reports on a co-design study with mentors and mentees. As one of the first attempts to deliberately incorporate students' voices, aiming for a system designed by students for students, this participatory design-based study surfaced desired features from both mentors' and mentees' perspectives. The preliminary results show that while students appreciated the initial concepts of LADs, they demanded features that push the system beyond merely measuring engagement to actively promoting it. This study contributes to the emerging literature on student-centered learning analytics systems using a human-centered approach [4] and the broader HCI and CSCW (Computer-Supported Cooperative Work) work in designing support systems for mentoring and peer support programs in educational settings.

2 THEORETICAL FRAMEWORKS

PeerConnect aims to foster transfer students' academic and social engagement, increase self-efficacy and sense of belonging, and develop students' self-regulated learning skills. The design is informed by frameworks in *Self-Regulated Learning* (SRL, [42]) and *Social-Determination Theory* (SDT, [9]). SRL model comprises stages of planning, performance, and self-reflection [42]. Data in the LAD play a critical role in supporting reflection and positive behavior change. Research in student-facing learning analytics suggests no one-size-fits-all solution [35] due to variability in individuals' motivation, cognitive, and metacognitive profiles. Moreover, if the support is not well-adapted, there is a risk of undermining students' agency [3]. SDT [9] provides a useful framework to address the agency issue. This theory posits that individuals have three innate psychological needs: competency, connection, and autonomy, which can be satisfied in an autonomy-supportive environment, thus enhancing intrinsic motivation for SRL activities.

Guided by those frameworks, PeerConnect has the promise to address the current limitations of LAD by building an autonomy-supportive environment where near-peer mentors provide scaffolding for enacting the critical SRL steps of reflection and behavior change. The goal-setting and tracking functions enabled by the platform allow mentees to exercise autonomy. Providing a peer mentor as a "personal assistant" who adapts to individual students' complex learner profiles opens avenues for highly customizable support. Moreover, mentors' social support or encouragement will directly address students' basic needs for connection.

3 RELATED WORKS

3.1 Technology-mediated mentoring and peer support

Technology-mediated mentoring, or e-mentoring, utilizes tools like social media, email, video, and online forums for remote, synchronous, or asynchronous communication [36]. Evolving from standalone designs, it now offers flexible models letting participants choose their communication tools, a trend in education [2], business [18], and career development [31]. The "village model" [10] is explored in the context of community-based mentoring using an integrated infrastructural approach. Extensive research in technology-mediated peer support, especially in healthcare and mental health, explores infrastructure [11] and design implications for effective systems [25]. In education, systems like Pears address student loneliness, while others use creative formats like story sharing [6] and stress source hashtagging [5]. These approaches also extend to specific groups like home-care [27] and gig workers [40].

Despite these developments, there appears to be a limited representation of technology-mediated mentoring and peer support in educational settings, particularly in systems beyond basic communication facilitation, as seen in traditional e-mentoring models. The field could benefit from more innovative approaches that extend the functionalities of these systems to meet various educational needs to support the increasingly popular peer-mentoring program with computing students in higher education.

3.2 SRL-Oriented Learning Analytics and Student-Centered Design

Our work aligns with existing research in Student-Centered Learning Analytics [23], particularly those with a strong focus on promoting Self-Regulated Learning [22]. Although there is a growing interest in student-centered LA, especially those aimed at enhancing SRL, its adoption remains limited. This limitation is due to several factors, including the challenges of customizing to individual student needs [35], a lack of student participation and voice, which can lead to misinterpretations of LA as a "black box" [19] or surveillance analytics [26]. The overlooking of students' agentic power [3]. To gain a deeper understanding of students' perspectives and empower them to design systems that cater to their needs, a human-centered approach to LA design [4] is essential.

In this study, we piloted a student-centered design approach that adheres to the principles of human-centered design for LA. While most current SRL-oriented LA systems target individual students, our work explores learning analytics in a social context, involving peer mentors and other stakeholders such as instructors and program staff. As such, this study holds potential for advancing Learning Analytics research and the broader field of CSCW.

4 INITIAL DEVELOPMENT OF PEERCONNECT

The primary objective in developing PeerConnect is to empower mentees to monitor their academic progress and strengthen the mentor-mentee relationship through goal-setting and social engagement activities. Thus, we focused the development on academic, social, and peer mentoring program objectives to ensure that the dashboard combined performance feedback with elements of self-regulated learning to offer personalized learning experiences and motivational tools [38]. We developed the first iteration of PeerConnect through discussion with mentoring program staff who have a good understanding of mentor and mentee needs through working closely with them and by drawing insight from prior work [7, 32]. We developed the initial mentor (Fig. 1) and mentee (Fig. 2) displays ahead of the co-design session to give participants a concrete artifact to explore and iterate on in the session.

While each dashboard view is tailored to the student's role, i.e., mentee or mentor, most features are shared between the two views. The majority of the center section of both views is for setting, tracking, and viewing the mentee's academic, social, and mentoring program goals. These different areas can be accessed through menu links on the left-hand side of PeerConnect. The primary differences between the two views are that the mentee's view includes progress bars at the top as a visual indicator shown to aid motivation [37],

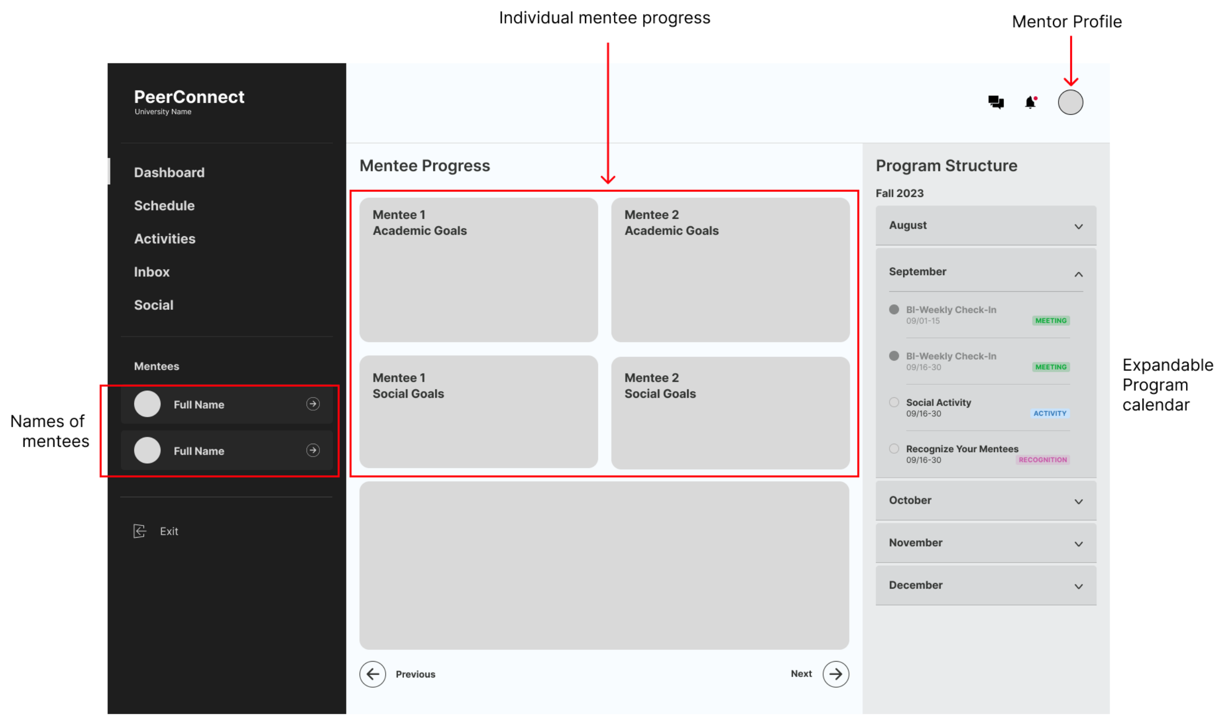


Figure 1: Initial draft view of mentor page

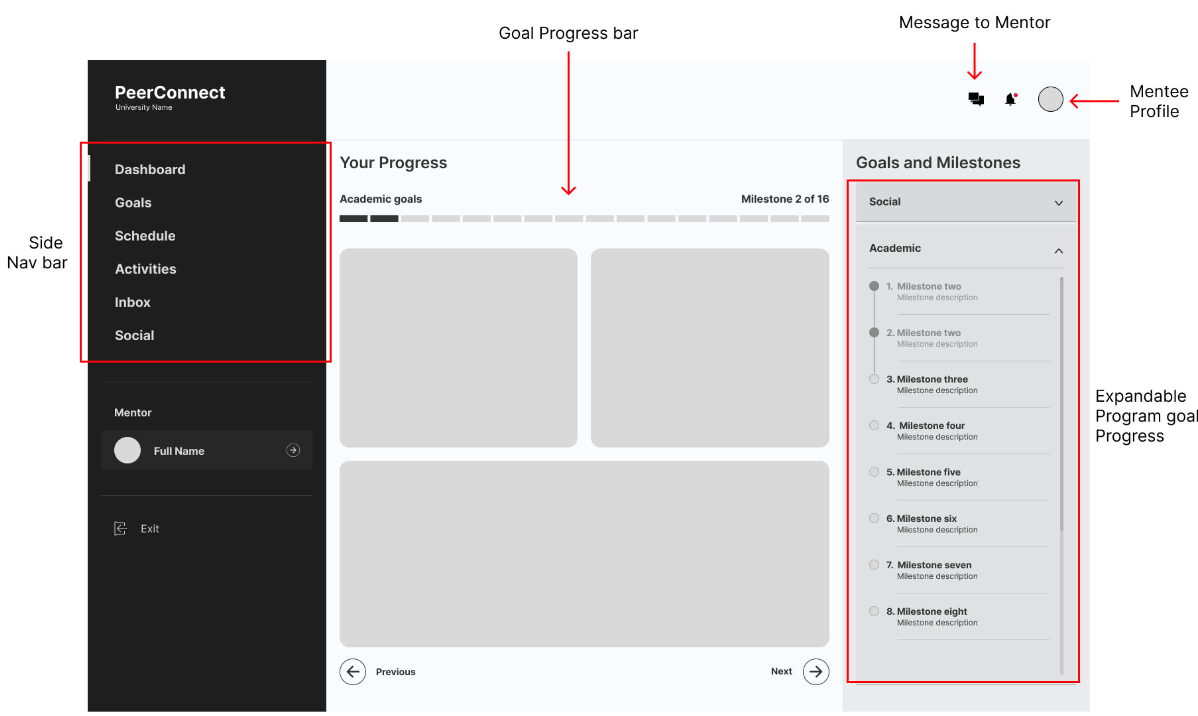
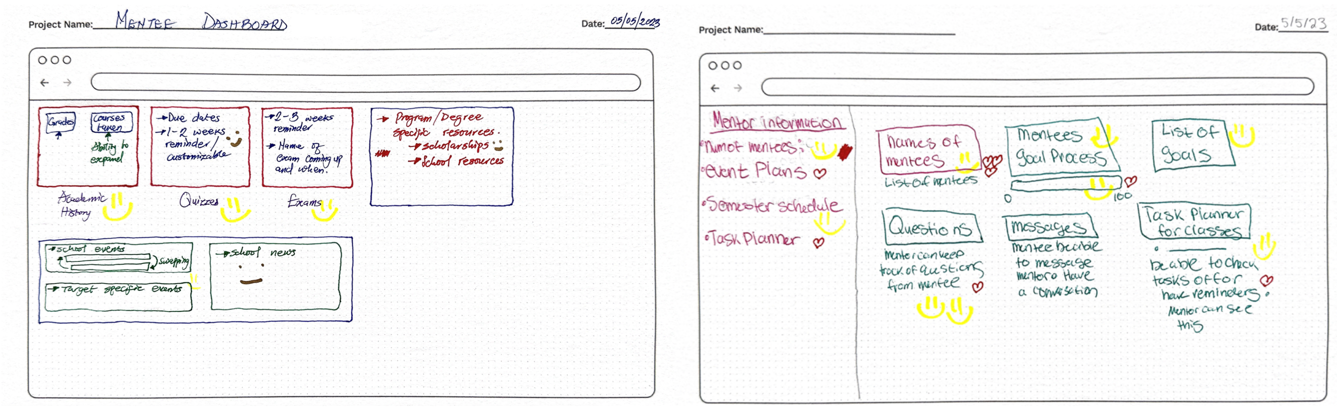


Figure 2: Initial draft view of mentee page



Co-design of the mentee's dashboard **Co-design of the mentor's dashboard**

Figure 3: PeerConnect designs from the co-design activity

and the mentor's view contains separate goal and activity sections for each of the mentor's two mentees.

Both views include access to a calendar view of the mentee's upcoming events, deadlines, and meetings. This enables mentees and their mentors to maintain an up-to-date view of the mentee's schedule; allowing mentors, for example, to provide encouragement for an upcoming exam.

The right-hand side of the mentee and mentor views differ. In the mentor view, a timeline has been implemented that illustrates the structure of the mentoring program across the academic year with collapsible sections for each month. It is also the location for the mentor to review a list of scheduled activities and events with their mentees, such as bi-weekly check-ins, social activities, and mentoring program events. The mentee's goals and milestones are listed on the right-hand side of the mentee's view. This provides the mentee and their mentor with a detailed breakdown of the mentee's current goals and objectives.

5 METHODOLOGY

We conducted a participatory design workshop consisting of three phases: concept testing [28], co-design, and dotmocracy [33] to better understand transfer students' specific needs and concerns with PeerConnect [32].

Participants. Participants were recruited from a transfer student peer mentoring program at a mid-sized MSI in the Northeastern US. Inclusion criteria required both mentors and mentees to be undergraduate students, 18 years of age or older, who transferred to the University from a 2-year institution. Additionally, mentors were required to have been in a computing major for at least one semester, in good academic standing, and at least 2 semesters from graduation. Mentees were required to have either newly transferred to the University or newly switched to a different computing major. Two mentors (one identified as he/him and one identified as she/her) and one mentee (he/him) were recruited for the study due to the small population in this new mentoring program. They were thanked for their participation with lunch and beverages at the end of the workshop. The study was approved by the university's Institutional Review Board.

Study Procedure. After participants signed informed consent forms, the session began with introductions, followed by an explanation of the study. Participants then engaged in concept testing PeerConnect in which they completed a concept testing survey tailored to evaluate the initial wireframe. Participants then engaged in a co-design activity to uncover and explore additional mentee- and mentor-specific system requirements for further promoting academic, social and program engagement. They were provided with design worksheets to create paper sketches of their ideal system after which participants voted on the preferred features in their paper sketches.

6 DATA COLLECTION

Concept Testing. A concept test survey was administered to evaluate the wireframes. This approach aligns with the conventional concept testing methodology [28]. The survey contained a Likert scale and related open-ended questions to assess participants' reactions to PeerConnect (*poor* to *excellent*) and their interest in using it (*not at all* to *extremely*, while what they liked most and least about it were open-ended only. We opted for an in-person paper survey format to foster a more interactive and detailed exploration of participant reactions and ensure that everyone had access to the same visual and contextual information during the evaluation.

Co-design. Participants actively engaged in a co-design process [29] through the creation of paper sketches to visually communicate their design ideas, preferences, and suggestions for the PeerConnect dashboard (illustrated in Fig. 3).

Dotmocracy. We employed dotmocracy, also referred to as 'dot-voting', for collaborative decision-making amongst participants. In this approach, participants use dot stickers to vote on their preferred priorities [17] which facilitates brainstorming and consensus building. Each participant was allocated 15 votes (or dots) to distribute among the three paper sketches generated from the co-design session.

7 RESULTS AND PEERCONNECT REDESIGN

We conducted a basic inductive qualitative analysis to answer our research question: *what are the specific needs and requirements of*

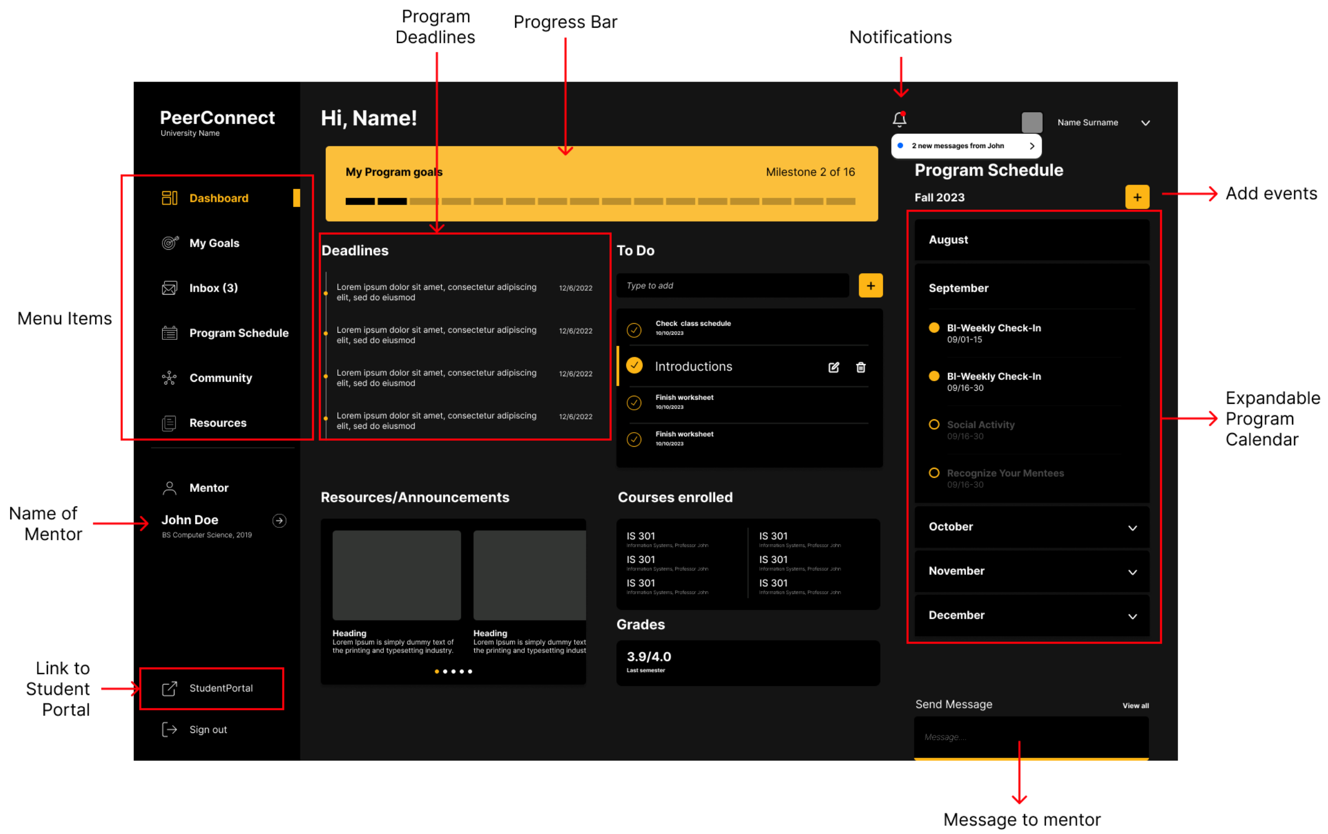


Figure 4: Redesigned view of the mentee's page

mentors and mentees in a mentoring support system targeting new transfer students? We employed affinity diagramming [16] to organize and analyze the responses from the concept testing survey and the co-design sketches. The first two authors developed separate diagrams for each view. Discrepancies were addressed through consensus-building discussions. In the second phase of analysis, PeerConnect features, both existing and participant-defined, were ranked and prioritized according to the number of dot votes received. Mentee details received the highest number of votes with 9; mentee-mentor-chat feature, to do list, and mentee's list of goals all received 4 votes; and mentee goal progress and mentoring program events schedule each received two votes.

All participants' initial reactions to the design were *"very good."* Mentor1 elaborated that *"it provides a great overview of status at a glance."* The Mentee and Mentor1 rated their interest in using the prospective system as *"extremely interested."* Although Mentor2 indicated only *"somewhat interested"*, they felt PeerConnect *"would help keep track of things better"*. Mentee explained, *"I like the dashboard. It looks easy to use and understand. Also, it will allow me to reach my mentor in a timely manner."* The ability to reach out to a mentor from within the system suggests that an important role for PeerConnect is to facilitate communication and support. The mentee elaborated, PeerConnect *"would help making sure the peer mentor and mentee keep communication open. Also, it would help mentor to monitor the performance of the mentee,"* suggesting that mentees are open to sharing academic and other information with their mentor. These snippets demonstrate how the system promotes continuous engagement through providing interaction means that differ from traditional LADs. To address the communication need, in the second iteration of PeerConnect (Fig. 4 and Fig. 5), we added a messaging feature at the bottom right of the user interface to allow for immediate, direct communication between mentors and mentees without requiring a separate application.

Originally, the mentee's progress bar was only included in the mentee's view. However, mentors felt that replicating their mentee's progress bars in the mentor's view would provide them with an immediate snapshot of their mentees' progress toward their academic, social, and mentoring program goals. We added this in the second iteration (Fig. 5). This will enable them to more quickly identify the need to check in, if, for instance, the mentor sees that their mentee is falling behind. To emphasize this and further support quick and effective communication, we included a "Message" button allowing mentors to directly message their mentee without navigating to a different area.

Participants provided positive feedback regarding several aspects of the initial PeerConnect design, such as *"the dashboard columns for goals on the homepage and the project bar"* (Mentor1). These are highlighted in their paper sketches along with new features

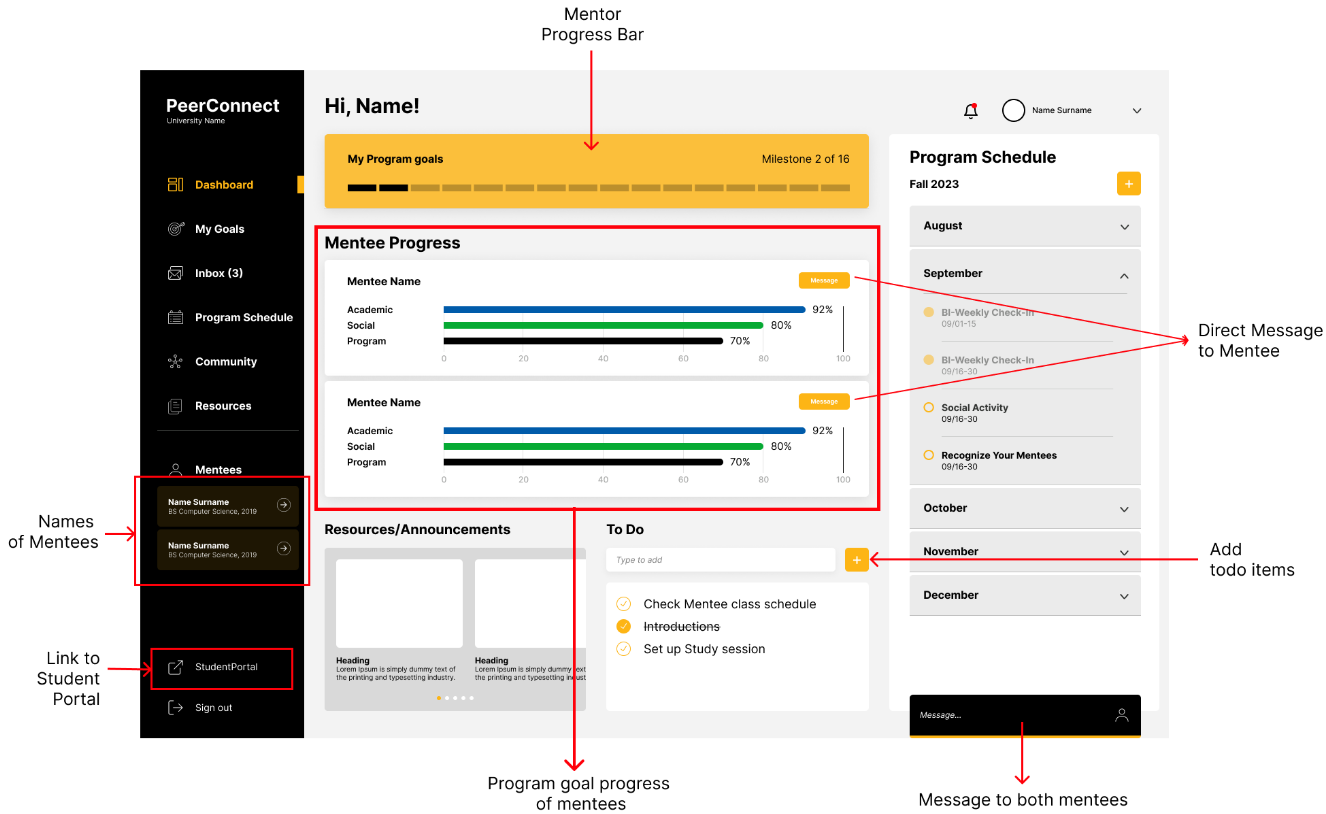


Figure 5: Redesigned view of the mentor's view

and capabilities (Fig. 3). They appreciated that the navigation made access to mentor and mentee information, mentees' list of goals and their progress, and details about the mentoring program activities easy. Mentor2 most liked *"how you can check off tasks/objectives"* which we emphasized more in the second iteration by providing a larger area for this functionality. We also added a notification panel and icon in the top right of both views.

8 DISCUSSION AND CONCLUSION

To design PeerConnect, we drew inspiration from co-creation and participatory design principles to understand the needs and dynamics of mentor-mentee relationships [1, 12]. Our emphasis was on creating a student-centered platform that facilitates communication and fosters a sense of community and connection among its users. This approach represents a paradigm shift in educational technology as it emphasizes technological aspects while also taking into account the social and collaborative dynamics of learning [13]. As such, PeerConnect is more than a learning analytics tool, it is designed to be a dynamic space where mentors and mentees can track and reflect on their progress and goals to promote students' SRL and agency. Using the redesigned iteration of PeerConnect, we will hold a second co-design workshop focusing on usability, self-reflection, and the interaction dynamics between mentors and mentees as they engage with the prototype. We will then conduct a focus group with all stakeholders to finalize PeerConnect.

Integrating tools that support real-time communication, group activities, and shared resource access in PeerConnect enables students to communicate more effectively and promotes engagement. For instance, features like group discussion forums, collaborative goal setting, and shared progress tracking can foster a sense of collective responsibility among students [39]. Ideally, doing so will enhance the mentor-mentee relationship which is crucial for student engagement and well-being in a learning environment. While we have been exploring near-peer mentoring between mentors and mentees up to this point, one of our next steps is to investigate: (i) horizontal mentoring between the two mentees and (ii) the reciprocal learning effect of mentors, i.e., the prótege effect [8]. This was not feasible in this first phase of the project due to the small number of participants enrolled in the recently launched mentoring program to recruit from.

Currently, PeerConnect facilitates self-reflection through visualizations of students' academic progress and social engagement. These features encourage students to think critically about their learning strategies, identify areas for improvement, and set personalized goals. We imagine future iterations of PeerConnect guiding students' reflective practice by incorporating reflective prompts and personalized feedback for data-driven/evidence-based reflections for both mentors and mentees.

ACKNOWLEDGMENTS

This material is based upon work supported by the National Science Foundation under Grant No. 2216633.

REFERENCES

[1] June Ahn, Fabio Campos, Maria Hays, and Daniela K. DiGiacomo. 2019. Designing in Context: Reaching beyond usability in learning analytics dashboard design. *Journal of Learning Analytics* 6, 2 (July 2019). https://doi.org/10.18608/jla.2019.62.5

[2] Aseel Alhadlaq, Ahmed Kharrufa, and Patrick Olivier. 2019. Exploring e-mentoring: Co-designing & un-platforming. *Behaviour & Information Technology* 38, 11 (2019), 1122–1142.

[3] Roger Azevedo, François Bouchet, Melissa Duffy, Jason Harley, Michelle Taub, Gregory Trevors, Elizabeth Cloude, Daryn Dever, Megan Wiedbusch, Franz Wortha, et al. 2022. Lessons learned and future directions of metatutor: Leveraging multichannel data to scaffold self-regulated learning with an intelligent tutoring system. *Frontiers in Psychology* 13 (2022), 813632.

[4] Simon Buckingham Shum, Rebecca Ferguson, and Roberto Martinez-Maldonado. 2019. Human-centred learning analytics. *Journal of Learning Analytics* 6, 2 (2019), 1–9.

[5] Ryuhaerang Choi, Chanwoo Yun, Hyunsung Cho, Hwajung Hong, Uichin Lee, and Sung-Ju Lee. 2022. Facilitating instant interactions for stressful experiences sharing and peer support. In *Proceedings of the 20th Annual International Conference on Mobile Systems, Applications and Services*. 636–637.

[6] Christopher Collins, Simone Arbour, Nathan Beals, Shawn Yama, Jennifer Laffier, and Zixin Zhao. 2022. Covid Connect: Chat-Driven Anonymous Story-Sharing for Peer Support. In *Designing Interactive Systems Conference*. 301–318.

[7] Ed de Quincey, Chris Briggs, Theocharis Kyriacou, and Richard Waller. 2019. Student centred design of a learning analytics system. In *Proceedings of the 9th international conference on learning analytics & knowledge*. 353–362.

[8] Lillian Turner de Tormes Eby, B Lindsay Brown, and Kerrin George. 2014. Mentoring as a strategy for facilitating learning: Protégé and mentor perspectives. *International handbook of research in professional and practice-based learning* (2014), 1071–1097.

[9] Edward L Deci and Richard M Ryan. 2012. Self-determination theory. *Handbook of theories of social psychology* 1, 20 (2012), 416–436.

[10] Tawanna R Dillahunt, Alex Jiahong Lu, Aarti Israni, Ruchita Lodha, Savana Brewer, Tiera S Robinson, Angela Brown Wilson, and Earnest Wheeler. 2022. The Village: Infrastructuring Community-based Mentoring to Support Adults Experiencing Poverty. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. 1–17.

[11] Xianghua Ding, Linda Tran, Yanling Liu, Conor O'Neill, and Stephen Lindsay. 2023. Infrastructural Work Behind The Scene: A Study of Formalized Peer-support Practices for Mental Health. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. 1–14.

[12] Mollie Dollinger and Jason M Lodge. 2018. Co-creation strategies for learning analytics. In *Proceedings of the 8th international conference on learning analytics and knowledge*. 97–101.

[13] Qingwen Dong and Christine M Collaco. 2009. Overcome ethnocentrism and increase intercultural collaboration by developing social intelligence. In *Proceedings of the 2009 international workshop on Intercultural collaboration*. 215–218.

[14] Scott Freeman, Pamela Pape-Lindstrom, Anne Casper, and Sarah Eddy. 2020. Community College Students Rise to the Challenge—Meeting the Time Demands of Highly Structured Courses. *Journal of College Science Teaching* 49, 5 (2020), 7–16.

[15] Stephen J Handel. 2011. Improving Student Transfer from Community Colleges to Four-Year Institutions: The Perspectives of Leaders from Baccalaureate-Granting Institutions.

[16] Gunnar Harboe and Elaine M Huang. 2015. Real-world affinity diagramming practices: Bridging the paper-digital gap. In *Proceedings of the 33rd annual ACM conference on human factors in computing systems*. 95–104.

[17] Enric Senabre Hidalgo. 2018. Dotmocracy and planning Poker for uncertainty management in Collaborative research: two examples of co-creation techniques derived from digital culture. In *Proceedings of the sixth international conference on technological ecosystems for enhancing multiculturality*. 833–839.

[18] Julie Hui, Nefer Ra Barber, Wendy Casey, Suzanne Cleage, Danny C Dolley, Frances Worthy, Kentaro Toyama, and Tawanna R Dillahunt. 2020. Community collectives: Low-tech social support for digitally-engaged entrepreneurship. In *Proceedings of the 2020 CHI conference on human factors in computing systems*. 1–15.

[19] Kirsty Kitto, Mandy Lupton, Kate Davis, and Zak Waters. 2017. Designing for student-facing learning analytics. *Australasian Journal of Educational Technology* 33, 5 (Oct. 2017). https://doi.org/10.14742/ajet.3607

[20] Jay B Labov. 2012. Changing and evolving relationships between two-and four-year colleges and universities: They're not your parents' community colleges anymore. *CBE—Life Sciences Education* 11, 2 (2012), 121–128.

[21] Bonita London, Lisa Rosenthal, Sheri R Levy, and Marci Lobel. 2011. The influences of perceived identity compatibility and social support on women in nontraditional fields during the college transition. , 304–321 pages.

[22] Wannisa Matcha, Dragan Gašević, Abelardo Pardo, et al. 2019. A systematic review of empirical studies on learning analytics dashboards: A self-regulated learning perspective. *IEEE transactions on learning technologies* 13, 2 (2019), 226–245.

[23] Xavier Ochôa and Alyssa Friend Wise. 2020. Supporting the shift to digital with student-centered learning analytics. *Educational Technology Research and Development* 69, 1 (Nov. 2020), 357–361. https://doi.org/10.1007/s11423-020-09882-2

[24] President's Council of Advisors on Science and Technology. 2012. Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics.

[25] Kathleen O'Leary, Arpita Bhattacharya, Sean A Munson, Jacob O Wobbrock, and Wanda Pratt. 2017. Design opportunities for mental health peer support technologies. In *Proceedings of the 2017 ACM conference on computer supported cooperative work and social computing*. 1470–1484.

[26] Abelardo Pardo and George Siemens. 2014. Ethical and privacy principles for learning analytics. *British Journal of Educational Technology* 45, 3 (April 2014), 438–450. https://doi.org/10.1111/bjet.12152

[27] Anthony Poon, Matthew Luebke, Julia Loughman, Ann Lee, Lourdes Guerrero, Madeline Sterling, and Nicola Dell. 2023. Computer-Mediated Sharing Circles for Intersectional Peer Support with Home Care Workers. *Proceedings of the ACM on Human-Computer Interaction* 7, CSCW1 (2023), 1–35.

[28] Fritzie Primananda Adi Praja, Royana Afwani, Edi Sutoyo, Embun Suryani, and Diswandi Diswandi. 2023. Enhancing Website Design: The Implementation of Sequential Monadic Concept Testing on User Interface and User Experience Design. In *2023 International Conference on Advancement in Data Science, E-learning and Information System (ICADEIS)*. IEEE, 1–6.

[29] Carlos G Prieto-Alvarez, Roberto Martinez-Maldonado, and Theresa Dirndorfer Anderson. 2018. Co-designing learning analytics tools with learners. In *Learning analytics in the classroom*. Routledge, 93–110.

[30] R Robnett. 2013. The role of peer support for girls and women in STEM: Implications for identity and anticipated retention. , 232-253 pages.

[31] Niloufar Salehi and Michael S Bernstein. 2018. Ink: Increasing worker agency to reduce friction in hiring crowd workers. *ACM Transactions on Computer-Human Interaction (TOCHI)* 25, 2 (2018), 1–17.

[32] Juan Pablo Sarmiento, Fabio Campos, and Alyssa Wise. 2020. Engaging students as co-designers of learning analytics. In *Companion proceedings of the 10th international learning analytics and knowledge conference*. SoLAR Frankfurt, 29–32.

[33] Enric Senabre. 2018. Dotmocracy and Planning Poker for Uncertainty Management in Collaborative Research: Two Examples of Co-creation Techniques Derived from Digital Culture. *TEEM'18: Proceedings of the Sixth International Conference on Technological Ecosystems for Enhancing Multiculturality*, 833–839. https://doi.org/10.1145/3284179.3284325

[34] Elena Spiridon, Linda K Kaye, Rod I Nicolson, Heather J Ransom, Angel JY Tan, and Bryan WX Tang. 2020. Integrated learning communities as a peer support initiative for first year university students. *Journal of Applied Social Psychology* 50, 7 (2020), 394–405.

[35] Stephanie D Teasley. 2017. Student facing dashboards: One size fits all? *Technology, Knowledge and Learning* 22, 3 (2017), 377–384.

[36] Harold Tinoco-Giraldo, Eva Maria Torrecilla Sanchez, and Francisco José García-Peñalvo. 2020. E-mentoring in higher education: A structured literature review and implications for future research. *Sustainability* 12, 11 (2020), 4344.

[37] Andika Y Utomo and Harry B Santoso. 2015. Development of gamification-enriched pedagogical agent for e-learning system based on community of inquiry. In *Proceedings of the International HCI and UX Conference in Indonesia*. 1–9.

[38] Anouschka Van Leeuwen, Stephanie D. Teasley, and Alyssa Friend Wise. 2022. *Teacher and student facing learning analytics*. 130–140. https://doi.org/10.18608/hla22.013

[39] Alyssa Friend Wise, Yuting Zhao, and Simone Nicole Hausknecht. 2013. Learning analytics for online discussions: A pedagogical model for intervention with embedded and extracted analytics. In *Proceedings of the third international conference on learning analytics and knowledge*. 48–56.

[40] Zheng Yao, Silas Weden, Lea Emerlyn, Haiyi Zhu, and Robert E Kraut. 2021. Together but alone: Atomization and peer support among gig workers. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW2 (2021), 1–29.

[41] Anna M Zaniewski and Daniel Reinholz. 2016. Increasing STEM success: a near-peer mentoring program in the physical sciences. *International Journal of STEM Education* 3, 1 (2016), 1–12.

[42] Barry J Zimmerman. 1990. Self-regulated learning and academic achievement: An overview. *Educational psychologist* 25, 1 (1990), 3–17.