Designing the TEACHActive Feedback Dashboard: A Human Centered Approach

Dana AlZoubi, Jameel Kelley, Evrim Baran, Stephen B. Gilbert, Shan Jiang, Aliye Karabulut-Ilgu
Iowa State University
{dalzoubi, jkelley, ebaran, gilbert, sjiang1, aliye} @iastate.edu

ABSTRACT: Effective facilitation of active learning is key to enhancing student engagement in engineering classrooms. Instructors need opportunities for frequent observation, feedback, and reflection on the use of their active learning strategies, yet there are no validated automated approaches available. We address this need by designing a feedback dashboard, TEACHActive, that leverages classroom analytics from an automated sensing observation system. The TEACHActive dashboard provides feedback on the in-class implementation of various active learning strategies in engineering classrooms. In this poster, we present the initial phases of a human-centered dashboard design process. The human-centered design (HCD) approach includes techniques such as, creating personas, conducting user interviews, and implementing user walk-through sessions. To confirm the practicability of TEACHActive dashboard for further revisions before the actual larger scale (*n*=30) implementation, a small sample of engineering instructors (*n*=5) participated in the prototype design process to identify meaningful attributes associated with the TEACHActive dashboard and shared perspectives and expectations towards its use in their classrooms.
Keywords: feedback dashboard, active learning, classroom analytics, human-centered design.

1 Background

Effective facilitation of active learning in engineering classrooms is key to promoting student engagement (Shekar et al., 2015). The use of automated systems for classroom observation and feedback is growing, yet few studies have integrated a specific classroom pedagogy (Lockyer et al., 2013), and none have addressed it in the context of active learning use in engineering classrooms. There is a critical need for research that links pedagogical theories with in-class practices to determine ways to improve instructors' implementation and facilitation of effective teaching practices (Bodily et al., 2018). We designed the TEACHActive feedback dashboard by leveraging classroom analytics from automated observation to provide feedback on the in-class implementation of various active learning strategies in engineering classrooms. TEACHActive communicates with an existing camera-based automated classroom sensing system, EduSense (Ahuja et al., 2019), which tracks faculty and student proximities and behaviors in a classroom. TEACHActive is designed to transform raw classroom data into meaningful metrics and then further into practical feedback for instructors. TEACHActive dashboard visualizations provide automated feedback for instructors about their facilitation strategies in correspondence with the captured features of interest, including sit vs. stand, hand raises, body position, instructor movement, student vs. instructor speech, and speech acts.

2 TEACHActive Feedback Dashboard Design

Our design approach follows the human-centered design (HCD) principles (Arbas, Maloney-Krichmar, & Preece, 2004). taking into account various human factors of why and how the system and the interface are used. We initiated our HCD approach by first identifying the context for implementation and the instructors as potential users. We then employed various HCD techniques to generate an understanding about instructors' needs, goals, barriers, frustrations, expected outcomes, and experiences.

2.1 Needs Analysis and Persona Development

Our first phase in the TEACHActive dashboard prototype design was creating data-driven user personas. We first built an understanding of potential users through looking at patterns from the findings of a needs analysis that was conducted with engineering faculty. The needs analysis included data collected through a survey (*n*=53) and follow-up semi-structured interviews (*n*=4). Survey questions aimed to gather instructors' perspectives, knowledge, use of active learning strategies in engineering classrooms. The follow-up interviews helped collect data about instructors' teaching experiences, courses taught, specific examples and reasons for active learning implementation in classrooms, classroom management strategies, challenges, support, and desired outcomes. Our thematic analysis of survey and interview data revealed four personas: (a) The Agile, (b) The Seeker, (c) The Planner, and (d) The Feeler (Table 1). All personas share at least one common goal, which is implementing effective active learning strategies to better engage students. Each user persona developed will be shared in the poster session.

Table 1: User Personas

User Persona	Goals	Characteristics (Important factors)	Needs/Support Factors	Frustrations/ Barriers	Expected Outcomes
The Agile	Moving around in class	-Classroom climate -Class size, room structure, seating	-More space -Better technology	-Staying in one spot -Lecturing too much	-More engagement and interaction
The Seeker	-Seeks recognition for good teaching -tracking improvement	-Mobilizing support from faculty & administration -Flexible in changes	-Faculty/peers/administration -Feedback on teaching	-Engaging students -Feedback on teaching	-Progress report -Constructive feedback on ways to improve
The Planner	-Planning good fit activities -Making lectures more interactive	-Balance between lectures and activities -Evidence AL is not a waste of time	-Structured times to integrate activities -Building routine	-Time constraints -Choosing between lectures & activities -Changing plans & class routine	- Proof of progress from one session to another
The Feeler	-Excited about change -More engaging lectures	-Motivated internally by interaction and feedback -Emotionally charged -Fearful & excited	-Reactions from students -Positive reinforcement -Motivation & creativity	-Fearful & nervous about change -Not receiving good feedback	-Proof of progress from one session to another

2.2 Initial Dashboard Prototype Development

Our second design phase was to develop the TEACHActive dashboard prototype iteratively based on the personas created and the features captured by the classroom sensing system. The initial dashboard prototype was designed with Adobe XD and included two main displays: (a) session and (b) progress. The session display included the following metrics: total number of hand raises and their frequency as a function of time, duration of instructor speech, duration of student speech, frequency of instructor vs.

student speech as a function of time, instructor movement patterns, sit vs stand. The progress display included comparison statistics between the session display metrics through bar graphs.

2.3 User Interviews and Walk-Throughs

The user interviews and walk-throughs were carried out on a small scale (*n*=5) to confirm the practicability of TEACHActive dashboard for further revisions before the larger scale (*n*=30) implementation. We conducted thirty-minute semi-structured user interviews with five engineering instructors to understand their perspectives and expectations of the initial dashboard prototype features. In the user walk-throughs, we discussed each of the dashboard metrics and visualizations in terms of their perceived usefulness to identify meaningful attributes associated with the TEACHActive dashboard. Based on the instructor recommendations, we modified the initial TEACHActive dashboard prototype. We will share different versions of the dashboard prototypes in the poster session.

3 Conclusion

The TEACHActive dashboard aims to support instructors' implementation and facilitation of active learning strategies in engineering classrooms using the analytics of classroom sensing data. In this poster, we present our HCD approach for developing the initial dashboard prototype. Next, we will develop further prototypes using the React framework, pilot those with actual classroom video recordings, and create revisions with further instructor walk-throughs.

Acknowledgement

This material is based upon work supported by the National Science Foundation under Grant No. 2021118. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of National Science Foundation.

REFERENCES

Ahuja, K., Kim, D., Xhakaj, F., Varga, V., Xie, A., Zhang, S., Townsend, J., Harrison, C., Ogan, A. & Agarwal, Y. (2019). EduSense: Practical classroom sensing at Scale. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, 3*(3), 1-26. doi.10.1145/3351229

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-centered design. *Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications*, *37*(4), 445-456.

Bodily, R., Kay, J., Aleven, V., Jivet, I., Davis, D., Xhakaj, F., & Verbert, K. (2018, March). Open learner models and learning analytics dashboards: a systematic review. *In Proceedings of the 8th international conference on learning analytics and knowledge* (pp. 41-50).

Lockyer, L., Heathcote, E., & Dawson, S. (2013). Informing pedagogical action: Aligning learning analytics with learning design. *American Behavioral Scientist, 57*(10), 1439-1459. doi.10.1177/0002764213479367

Shekhar, P., Demonbrun, M., Borrego, M., Finelli, C., Prince, M., Henderson, C., & Waters, C. (2015). Development of an observation protocol to study undergraduate engineering student resistance to active learning. *International Journal of Engineering Education, 31*(2),597-609.