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Board 359: Potential Interventions to Promote Engineering Technology Adoption among Faculty

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Potential Interventions to Promote Engineering Technology Adoption Among Faculty

During the current 4th industrial revolution, technology is changing at an ever increasing pace [1]. Thus, it is essential that engineering educators continually adopt and teach new engineering technologies to both keep the technologies used in engineering coursework relevant for graduates entering industry, as well as to model lifelong learning for their students. In fact, ABET requires faculty to teach relevant tools for modern engineering, as well as equip students with life-long learning skills [2]. However, the time restrictions on faculty are well documented [3 - 4] and can make learning new technologies challenging.

This poster summarizes the preliminary results of an NSF project funded through the Directorate for Engineering, Engineering Education and Centers. It builds on prior research that used faculty interviews to identify factors that support or inhibit technology adoption and potential interventions to promote faculty adoption of new engineering technologies [5-6]. Participants at a workshop at the IEEE Frontiers in Education Conference were presented with those preliminary results and asked to brainstorm ways the interventions could be implemented on their campuses, barriers to their implementation, and methods to overcome those barriers. The workshop was designed to provide peer review of the research results to determine if they would be considered relevant for institutions beyond the original research focus. An additional workshop goal was to expand on the existing set of proposed interventions by gathering ideas from faculty at other institutions. In this manner, the workshop both confirmed and expanded our data. The poster and this accompanying paper will present results of the brainstorming at that workshop and will include proposed methods for reducing time constraints on faculty, as well as providing supporting structures and human resources to support learning of new technologies.

Background

Facilitating conditions for technology adoption are the resources that users perceive as supporting their ability to learn and use technologies [7]. Previous work has revealed the facilitating conditions for faculty adoption of engineering technologies, such as programming languages, software, and instrumentation, to include:

- Other people - such as mentors, peers, and students [5, 8]
- Digital learning resources - like YouTube and stack exchange [5]
- Time - for both learning and teaching the technologies [3 - 5]
- Non-digital resources - primarily print media like journals and texts [5]
- Formal training - including classes, short courses, and trainings [5, 9]

The facilitating conditions for faculty adoption of engineering technologies identified previously in this project were based on 21 interviews with engineering faculty at Midwestern US University [5], and member-checked through focus groups of the participants. The faculty interviewees also suggested potential interventions to promote faculty engineering technology adoption. These interventions were grouped into categories for peer discussion at a workshop on

faculty engineering technology adoption at the 2022 Institute of Electrical and Electronics Engineers (IEEE) Frontiers in Education Conference (FIE), where faculty were asked to consider barriers to their implementation and strategies to overcome these barriers [6].

Methods

This paper and poster present the results from the peer-review and discussion at the 2022 IEEE FIE workshop. The participants in the FIE workshop were an international group of 14 engineering faculty. Informed consent of the participants was obtained for the use of the results of those workshop discussions in accordance with an approved human subjects research protocol.

Workshop attendees were presented with project results detailing the facilitating conditions for faculty engineering technology adoption, after which they were provided the following five topics as options for breakout discussions: 1) methods for reducing the time constraints on faculty, 2) incentive structures for faculty technology adoption, 3) human resources to support learning of new technologies (through other people), 4) digital learning resources to support learning of new technologies, and 5) methods for addressing cost and access to technologies. Faculty participants were encouraged to participate in the discussions of most interest to them. The participants selected topics one, two, and four for discussion during the workshop. Topics three and five were not addressed further within the workshop.

Each breakout group was provided with a handout to guide their discussion that summarized the suggestions made by faculty interviewees previously in the project and asked them to provide additional suggestions. Workshop participants were then asked to identify barriers for implementing the expanded list of suggested interventions, as well as suggest methods for overcoming those barriers.

Workshop Results

Within the workshop, faculty discussed how universities might relieve faculty time constraints, incentivize technology adoption among faculty, and provide digital learning resources to support technology adoption. Overall, workshop participants confirmed that the interventions suggested by the original faculty interviewees would also be relevant for implementation at their institutions, providing essential peer confirmation of project results being applicable beyond the initial research institution. Workshop participants also expanded upon these suggestions with further ideas to promote faculty technology adoption.

Methods for reducing the time constraints on faculty

Prior to the workshop, the faculty interviewees suggested the following methods for reducing their time constraints: reducing faculty teaching loads; setting time aside for instruction on new

technologies; and providing faculty assistance with developing the materials to teach technologies, such as utilizing vendor supplied tutorials for software taught in classes.

Faculty within the workshop expanded on this list by suggesting faculty be provided with TAs or leverage automatic grading in learning management systems to reduce their time spent grading. Workshop participants also recommended faculty be provided with training on time management and optimization, delegation, and that faculty perform time tracking exercises. Peer support for time management and work-life balance was also encouraged by the workshop participants. Finally, workshop participants pointed out that all faculty should have a mentor by which they should run any decisions about service before committing to new service assignments.

Incentive structures for faculty technology adoption

Prior to the workshop, the faculty interviewees suggested the following incentive structures for faculty technology adoption: providing financial support for training/classes or to attend conferences and meet external experts, offering financial incentives for experimentation with new technologies (such as a bonus), and including key performance indicators (KPIs) around technology adoption within annual reviews. Interviewees also suggested identifying commonly used software or programming languages to be promoted for university-wide use and supported through training. This university-wide adoption model is often currently used for instructional and communication technologies (ICT) within universities, such as course learning management systems supported through centers for teaching and learning. Additionally, faculty interviewees suggested offering faculty a "free pass" for a semester's bad teaching reviews when experimenting with or introducing a new technology into their courses.

Workshop participants added to these recommendations by proposing that faculty adopting new technologies within the classroom might be offered priority room selection for teaching, so that they can be assured of a learning environment that supports the new technology use. Participants also suggested that student testimonials supporting technology use might motivate faculty to adopt more technologies. Highlighting and showcasing success stories of faculty who were exceptional at adopting technologies was proffered as a means to provide motivation by increasing visibility and peer recognition within an institution.

Digital learning resources to support learning of new technologies

Prior to the workshop, the faculty interviewees suggested the following methods for promoting technology adoption via digital learning resources: providing context relevant examples, supplying good documentation as a learning resource for faculty new to a technology, and maintaining a curated list of learning resources available for faculty for certain technologies.

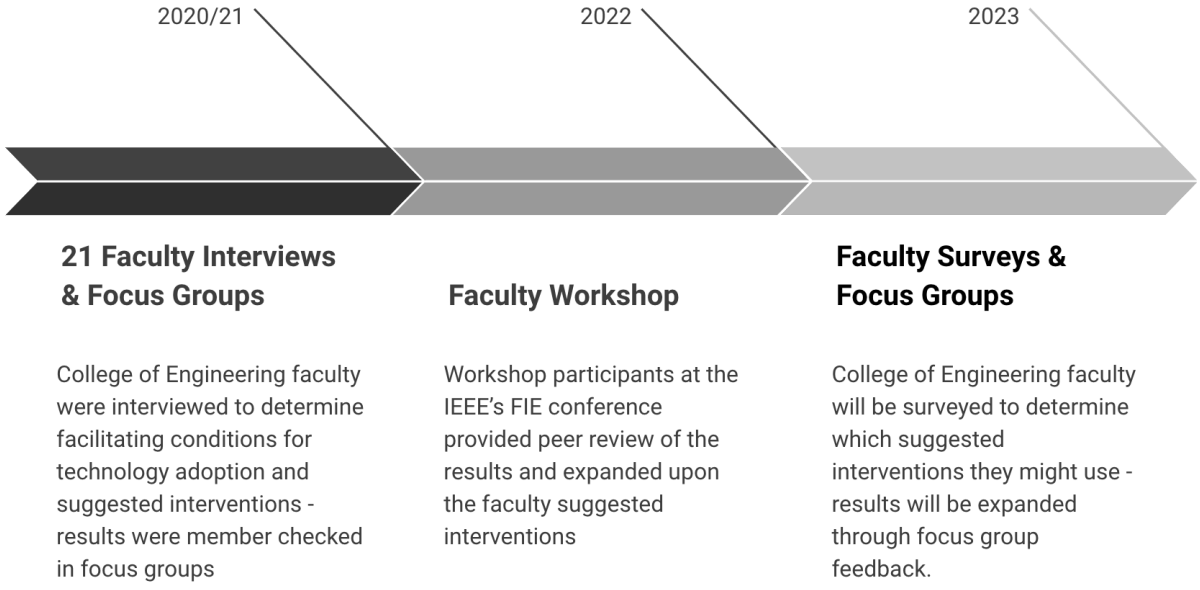
Workshop participants expanded on these suggestions by offering that faculty be encouraged to utilize massive online open courses (MOOCs) for their own learning. Workshop participants also

suggested that faculty leverage LinkedIn learning resources, if they were available through their organizations. Workshop participants also indicated that universities should consider adding staff to support faculty's engineering technology adoption, especially for common programming languages, much as they currently do with ICT technologies. Finally, e-books and gamified learning experiences were suggested as digital learning resources which students might find appealing when learning new technologies.

Conclusion & Future Work

Potential interventions to promote faculty adoption of engineering technologies were disseminated and expanded upon through a workshop at IEEE's FIE conference in the Fall of 2022 [6]. These expanded results show how peer review of research can enrich data gathered within a study. In this case, perspective was provided by faculty from additional institutions, increasing the generalizability of the results to an international context.

Currently, additional faculty are being surveyed as to which of these suggested interventions to promote engineering technology adoption would be most appealing and most likely to be utilized by them. The results of these surveys will inform focus groups that will flesh out more details and structures of chosen interventions. Work is also underway to expand the survey to include engineering faculty at another university.



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