

Workshop: Promoting Technology Adoption Among Engineering Faculty

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Abstract—This Workshop will present the results from a study exploring the facilitating conditions which support the adoption of new engineering technologies among engineering faculty. Suggested interventions to promote greater technology adoption among faculty will be reviewed. Participants will discuss ways to build upon these suggested interventions and leave with concrete ideas about how to promote faculty technology adoption on their campuses.

Keywords—technology adoption model (TAM), engineering faculty, Unified Theory of Acceptance and Use of Technology (UTAUT), faculty development.

I. BACKGROUND

During the 4th industrial revolution, the fast-paced changes of technology in all aspects of our lives present engineering faculty with the grand challenge of keeping the technologies we teach to students current and up to date. Many faculty struggle to find the time and resources to adopt new engineering technologies unless they hold a direct significance for their research. Technologies used by professors in their research are often complicated lab instruments, software, and programming languages, which may not necessarily be relevant for engineers within industry. As a result, new technologies that may be important for practicing engineers may be overlooked in university engineering programs.

Technology adoption has been widely studied within information systems, and several models of technology adoption have been developed. The most

often used models within education settings are the Technology Acceptance Model (TAM) [1] and its revision to the TAM2 [2]. TAM2 predicts the intention to use a technology based on its Perceived Usefulness and Perceived Ease of Use [2]. The TAM does not predict all variability within intention to use a technology [3-7], but still remains the most applied model for predicting the use of instructional technologies among teachers [8]. Constructs from the TAM2 were combined with other behavioral models [9-10] to create the Unified Theory of Acceptance and Use of Technology (UTAUT) [11], later revised to the UTAUT2 [12], which added additional constructs, including facilitating conditions, or users' perceptions of the supports available for adopting the technology. In this study, constructs from TAM2 [2] and UTAUT2 [12], along with other potentially relevant constructs identified in the literature, including time [13-14], were used as a framework for the qualitative analysis of transcripts from interviews of 21 engineering faculty at a Midwestern, USA, technologically-focused university.

Engineering faculty were interviewed about technology adoption via Zoom during the 2020/21 academic year. Analysis of the transcript data was based on analytic induction to allow for the codes to be grounded in prior theory while still allowing new observations and theory to emerge from the data [15, 16]. The analytic induction method includes a

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convergent-coding multi-pass process, combining both deductive and inductive coding [16]. As noted above, preliminary (deductive) codes were based upon the TAM2 [2], the UTAUT2 [12], additional codes drawn from the literature, as well as prior, as yet unpublished, work with student focus groups on the researchers' campus. The inductive coding that followed allowed new codes to emerge from the data [16].

II. WORKSHOP GOALS

Participants in this Workshop will view the results for the facilitating conditions that affect engineering faculties' technology adoption (digital resources, non-digital resources, time, formal training, and other people) as well as the faculty members' suggested interventions to promote technology adoption among them.

Workshop participants will be divided into groups to discuss the research results and actively brainstorm ways in which intervention solutions could be implemented on their own campuses. Based on preliminary results, we anticipate that break out rooms may include topics such as:

- Methods for promoting the use of peers, mentors, and students to learn technologies
- Methods for reducing the time constraints on faculty
- Methods for making more training and classes available to faculty to support learning of new technologies
- Methods for increasing access to and awareness of digital learning resources
- Methods for addressing cost and access to technologies

Within each breakout discussion, participants will be provided with a shared Google doc for note taking in response to discussion prompts. Participants will spend 25 minutes discussing one topic of their choice, brainstorming and recording ideas for implementation on their own campuses. Each breakout discussion cycle will be followed by a 20 minute reporting session, where a spokesperson for the breakout discussion will provide a summary of discussion points to the other Workshop participants. Then, participants will be asked to pick a second discussion topic, and complete a second discussion

and reporting cycle, building upon the documented ideas provided in the Google doc during the first breakout. As results from this Workshop may be added to the existing project data, an Institutional Review Board (IRB) request for human subjects research will be submitted at our university prior to the Workshop.

III. OUTLINE

A. *Explanation of Workshop and consent to participate (15 Minutes):*

Overall Workshop goals and purpose will be introduced to the participants in the context of background literature. Participants will be read an informed consent statement approved by the university's IRB, informing them of the intent to use the Workshop results for future publications and giving them the chance to withdraw from the Workshop if they do not want to participate. Thus, informed consent will be assumed of all who participate. (Note - this may be adapted to written consent if our IRB board requires it.)

B. *Presentation of research methods (5 Minutes):*

This study involved interviewing 21 engineering faculty at a STEM-focused Midwestern US university about the barriers and supports for their engineering technology adoption. The focus was on engineering technologies (software, programming languages, and instruments), not classroom instructional technologies (such as learning management systems, document cameras, or wikis), although some faculty did discuss these technologies after the initial interview questions were answered. An explanation of the analytic induction based data analysis methods will be provided, along with a rationale for selecting this method - providing for the discovery of new theories while grounding the work in prior theories and literature [15-16]. Preliminary codes deduced from the TAM2 [2], the UTAUT2 [12], other literature, as well as prior, as yet unpublished, work with focus groups on the researchers' campus.

C. *Presentation of research results: (30 Minutes):*

Results from the qualitative analysis of the faculty interviews will be presented to Workshop participants. An explanation of the codes with example quotes from the data for facilitating conditions—digital resources, non-digital resources,

time, other people, and classes—will be provided to the participants.

Digital Resources: Digital resources are those found within digital technology, such as those built in documentation centers, as well as those found online, such as wikis, blogs, and forums.

Non-digital Resources: Non-digital resources include books, journal articles, or printed manuals.

Time: Time resources included the class time tradeoffs involved in teaching a technology, time involved in learning a technology, and general faculty time restrictions and pressures.

Other People: Peers, mentors, and students are the people that faculty members leverage when learning new technologies. This category includes former professors, current colleagues in industry and academics, as well as students.

Formal Training: Faculty often used formal training and classes for learning new technologies. Many had learned technologies within classes during their graduate school experiences.

A summary of the interventions suggested by interviewees will also be provided. Overall, faculty interviewees suggested interventions that involved fostering relationships with other people to support faculty technology adoption. Additionally, a majority of faculty suggested efforts to relieve their time limitations and pressures, and suggested offering formal training to aid faculty in learning new technologies. Other interventions included providing digital resources, making efforts to address technology costs, and providing better access to technologies.

D. Breakout discussion 1 (30 Minutes - including 5 min transition time into groups):

Attendees will be asked to select a breakout topic about a possible intervention method for discussion based on their interest. All participants will be provided a Google doc to take notes from their breakout discussion. Participants will be asked to record their own ideas in the document as well as add and build onto others' ideas. Each group will be asked to designate a reporter who will provide a summary to the main group. The following discussion prompts will be provided to guide group discussions about a given intervention method: How might [this method] for promoting faculty technology adoption work on

your campus? What new systems or policies might need to be put into place? What resources might be needed to implement it? What barriers might need to be addressed?

E. Break out discussion 1 reporting: (20 Minutes):

Each group will provide a 2-minute summary of their results to the main group.

F. Break: (15 minutes)

G. Breakout discussion 2, “yes and”: (30 Minutes - including 5 min transition time into groups):

Participants will be asked to select a second topic area and read through the previous groups' notes. The groups will then use a “yes and” improvisational approach to build on the ideas provided by the prior group for implementing technology adoption interventions and removing barriers to implementing them on their campuses.

H. Break out discussion 2 reporting: (20 Minutes):

Each group will provide a 2-minute summary of their results to the main group.

I. Summary wrap up: (15 Minutes):

A summary of the visions for implementing each of the methods for promoting faculty technology adoption at a campus level will be provided. Participants will be provided with permanent links to the summary documents from the Workshop and offered the opportunity to share contact information for follow up discussions and post-Workshop collaborations.

Total time: 3 hours

IV. ANTICIPATED AUDIENCE

Although the research was targeted towards engineering faculty, it may be broadly applicable to any STEM faculty and university administrators. In order to ensure that the Workshop is conducted effectively, the number of participants shall be limited to 50.

V. TAKE-A-WAYS

At the end of this Workshop, attendees will be able to:

- Describe what resources facilitate faculty members' adoption of new technologies

- Describe strategies and interventions that will enhance the adoption of new technologies
- Propose steps that they will take to implement interventions that may enhance the adoption of new technologies within the context of their home institutions

VI. WORKSHOP EQUIPMENT

Attendees are encouraged to bring laptop computers able to access a stable internet connection during the Workshop. One laptop per breakout discussion (8 laptops), one moderator desk/laptop, a projector, and a projection screen will be required. If the conference cannot provide a laptop for each breakout discussion, then 8 easels with flipboard paper pads (post-it easels) can be utilized and discussion prompts will be provided by paper handout to each group.

VII. WORKSHOP COST

There is no additional anticipated fee for attendees to cover materials and supplies.

VIII. WORKSHOP FACILITATORS & QUALIFICATIONS

Facilitator 1 Michelle Jarvie-Eggart is currently researching technology adoption among engineering faculty under a project funded by the National Science Foundation (NSF) through the Directorate for Engineering, Engineering Education and Centers titled (Blinded for Review). The main project goal is to develop an understanding of the factors that support or inhibit engineering faculty technology acceptance. The project also aims to propose a revised model for engineering faculty technology adoption, and suggest interventions to promote and support such adoption. Facilitator 1 has previously published a WIP paper on the preliminary results of this research at FIE [17] and a poster session at ASEE [18].

Facilitator 2 Alfred Owusu-Ansah was a graduate research assistant on the project, and a co-author on all project publications to date.

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