

Each device consists of 4 ultra-high sensitivity electroencephalography electrodes adhered to a learner's scalp without the need for hair removal and connects to a small transmitter that clips to the learner's lapel or collar. The electrodes sense individual neuron action potentials, which are converted to computer code and transmitted in real time to a HIPAA-compliant cloud server.

We recruited 16 internal medicine interns for a 1-month pilot study. Each participant underwent a 6-hour session in which they wore the devices during conversations, reading, and cognitive exercises to "train" AI algorithms to convert the transmitted computer code into verbal output. AI algorithms were also "trained" to filter out neuronal activity for thoughts unrelated to professional activities (personal thoughts) and remove them from the output stream.

Outcomes to Date

Participants wore the devices daily for 1 month during their general internal medicine ward rotations, with no reported physical side effects. Captured neuronal data were translated into thought narrative transcripts, along with quantitative data of multiple cognitive variables, including the number of diagnoses considered, decision-making time, and quantitative rating of decision confidence. Overall, 93% of filtered and transcribed data were related to professional activities, while 7% were related to personal thoughts. Personal thought data were immediately deleted by the study team. Debriefing with residents showed that transcribed thoughts matched their recalled thought processes with high fidelity.

Our study demonstrates the feasibility of using wearable BCI technology to gather unprecedented data on resident cognition in real time. However, many challenges and questions remain before widespread implementation. First, AI was not perfect in differentiating professional from personal thoughts, raising issues of confidentiality and ethical dilemmas. What if problematic thoughts (eg, unprofessional thoughts or thoughts of self-harm) are detected? Should program leaders intervene on thoughts or on behaviors only? Higher specificity AI algorithms and input from learners and ethics experts are needed. Second, we did not assess the effects of this approach on the learner or the program. Does cognition truly equal competence? Do resulting data help learners? Will clinical competency committees be able to review such vast data in a meaningful way? Finally, this pilot focused on cognition, not emotion, so use of BCI to measure

wellness and burnout requires further investigation. Future studies should address ethical and emotional implications, in addition to further refinement and validation of the approach.

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NEW IDEAS

An Adaptive, Open Source, Faculty Development Platform for Medical Educators in 2030

Setting and Problem

There is a widening gap between traditionally delivered faculty development resources and

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programming, and how chronically overloaded medical educators in the year 2030 will access, engage with, and document completion of such materials. One-hour lunch-and-learn sessions are no longer sufficient or sustainable; similarly, traditional topics such as assessment, feedback, and mentorship are increasingly supplemented with lessons on unconscious bias, learner distress, digital literacy, organic learning environments, and a revolving door of education technologies and online tools. Legacy and apprenticeship learning models are being replaced by student-centered and personalized learning systems. The diversity of pedagogical knowledge and methodologies requires an agile, integrated, and innovative approach to faculty development for medical educators.

Intervention

Medicine is in the midst of a radical transformation as it incorporates and leverages artificial intelligence into the health care environment. Academic medicine increasingly utilizes adaptive learning strategies and data visualization to create individualized learning plans and outcome dashboards for learners. These adaptive learning strategies and web-based content delivery platforms will reform the one-size-fits-all faculty development landscape to that of a customized learning experience tailored to the immediate and future needs of each unique educator.

An adaptive learning system platform for faculty development will be designed to prioritize individual needs, harvest engagement data, and employ algorithms to guide faculty to the most relevant content and resources when and where it can be best reviewed and applied. A multi-institution randomized control trial will be implemented to assess digital competence, impact on clinical and learning environments, and outcomes of faculty engaged with the adaptive learning platform, versus those of faculty engaged in traditional methods.

The creation of an international catalog of trusted e-learning faculty development materials and resources delivered through a novel web-based delivery and reporting system will provide faculty immediate access to differentiated experiences and automatic documentation of the completion of high-quality, customized, relevant, and evidence-based faculty development materials. As content is consumed and validation of quality and efficacy is gathered, the programmatic algorithms will ensure the best and most relevant content is disseminated and retrievable through intuitive pathways, digital

solutions, and networked communication channels.

Outcomes to Date

Faculty time is the most valuable of commodities. The evolution from in-person, administratively burdensome, and time-consuming faculty development programming to easily accessible, microlearning, multimodal, individualized faculty development resources and career pathways is feasible and may prove to be cost neutral. An open source, adaptive delivery, reporting platform will yield necessary faculty development data for the purpose of accreditation documentation, as well as recognizing and rewarding faculty commitment to education and its effect on the learning environment.

This data-driven faculty development platform will transform how resources are accessed, engaged with, and documented at the micro, meso, and macro levels. The feasibility of this innovative system is high, because the technology currently exists, the demand among medical educators is growing, and high-quality resources are readily available. Barriers to implementation may include initial reluctance to share faculty data across institutions and strict policies for governance and maintenance of validated content.

As a result of implementing an adaptive learning platform for faculty development, learners, institutions, and the public will be reassured that health care providers in the digital era are also well prepared to educate the next generation of physicians and health care providers.

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