2023-2024 Duke AHEAD Grant Proposal
Due by January 26th (5:00 pm)

Title: STICKing PHM: Making Graduate Medical Education "Stick" Using Microlearning in Pediatric Hospital Medicine

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Focused question: What are best practices in the use of microlearning content for Graduate Medical Education (GME) trainees? · Are GME trainees receptive to ML content use during training? · What modalities are most preferred/useful? · What frequency of content engagement is most effective? · What is the optimal timing for content review?

Background: As healthcare education training programs contend with the integration of required competencies and skill sets into curricula, alongside exponential growth of scientific knowledge bases and technology, it has long been clear that the traditional lecture-based model of medical education training requires disruptive innovation. Despite data demonstrating a 5% knowledge retention rate for adult learners and multiple calls for alternative strategies that are more learner-centric and interactive, passive lecture-based formats continue to serve as the foundation of medical education, particularly at graduate levels.(1-4) Medical educators have struggled to transition to potentially more effective teaching methods due to lack of time, funding, guiding data, familiarity with alternatives, and technological knowledge/skill; competing demands/priorities; and the ability to reach large audiences with consistent content in a lecture format.(5) While effective active teaching methods have been described, such as simulation and flipped classroom models, the merits of each method are still in dispute and best practices have not been established.(6,7)

Similarly, trainee factors significantly impact the effectiveness of graduate medical education (GME) curricula. Trainees are expected to balance patient care demands with education, comply with mandated work-hour restrictions, and maintain work-life integration to minimize burnout. As a result, trainee attendance of synchronous educational activities is often variable throughout training, leading to the potential for uneven exposure to key topics.(8) The shift from time-based to competency-based graduate medical training also underscores the impetus to create more efficient teaching methods and tools to prevent unnecessarily prolonged training time and thus,

avoid the inherent consequences of increased training costs and delayed entry into the shortage-laden healthcare workforce. Clearly, graduate-level trainees require a more individualized, flexible, and tailored educational approach.

Microlearning (ML) has become recognized in health professions education as a valuable method of overcoming many of these obstacles.(9) ML is the acquisition of knowledge that is broken down into small segmented, targeted units. Knowledge retention is facilitated through delivery of high-yield manageable content that streamlines learning by decreasing superfluous information, thereby minimizing learner cognitive load. In line with Mayer's cognitive theory of multimedia learning, ML content should include 1-2 learning objectives, require <15 minutes to complete, and employ dual channel (visual and auditory) and active learning techniques.(10) Examples of ML content include infographics, podcasts, visual abstracts, and mobile gaming. ML offers easily accessible and adaptable content for use in various learning environments in a learner-centric, learner-paced format. Particularly important in health professions education, ML-based curricula scaffold development of clinical reasoning skills by encouraging learners to make connections between small units of content and build upon prior learning, thus supporting heutagogy, or self-determined learning.(11) Furthermore, incorporation of ML-based curricula into GME training offers the potential to standardize core content exposure for workplace-based learners who are otherwise dependent on individual patient case mix and thus subject to learning gaps.

While the use of ML in classroom-based settings has been fairly well characterized(12), little is known about the effectiveness of microlearning in GME settings, where workplace-based learning predominates. Many medical and surgical specialties offer board preparation curricula and programs, primarily consisting of board-type question banks and procedural-based video tutorials. While these programs can improve knowledge acquisition and performance on standardized tests, included materials often do not adhere to the construct of microlearning or are presented in less engaging text-only formats.(12-14) Similarly, just-in-time interventions have shown improvements in primary measures when compared to traditional instructional methods but do not intentionally or consistently incorporate ML principles.(12,15,16) Although published studies focused on GME trainees are few, rates of feasibility, acceptability, and perceived satisfaction of ML-based interventions have been positive, and small studies have demonstrated the ability of ML-based interventions to impact resident physician behavior.(17-21) In light of the dearth of evidence, myriad unknowns exist, including optimal delivery approaches and content formats.

Specific aims: Phase 1 (Year 1)

1. Perform a survey-based needs assessment of Duke pediatric and combined medicine-pediatric resident physicians
2. Create a ML-based educational curriculum tailored to local learner (pediatric medical resident physicians) needs and preferences

Phase 2 (Year 1-2)

3. Examine the feasibility and acceptability of a ML-based curriculum for teaching core PHM content

Phase 3 (Year 2-3)

4. Examine the effectiveness of a ML-based curriculum for promoting trainee incorporation of core PHM content knowledge into patient care

Methods: Global Aims

Create and prospectively evaluate a novel longitudinal ML-based curriculum for graduate-level trainees in experiential-based pediatric clinical care settings to promote understanding of core content in PHM. The curriculum is entitled STICKing PHM: Spaced, Time-limited, Interactive Core Knowledge in PHM. The goals of the curriculum are to:

1. Standardize trainee exposure to core content in PHM
2. Facilitate knowledge retention and understanding through the use of evidence-based strategies

based on the theories of constructivism and adult learning. Along with microlearning principles,

strategies will include learner pacing, spaced/distributive learning, scheduled repetition, gamification, short messaging service (SMS) use, interaction, and socialization.(10,12,22-26)

3. Broaden the evidence base for using ML in GME curricula

Components

1. Perform needs assessment of Duke pediatric and combined medicine-pediatric resident physicians (Phase 1) to explore:
   a. Content relevance
   b. Learning preferences (styles, formats, modalities)
   c. Time constraints
   d. Technology readiness
   e. Current curriculum effectiveness
   f. Barriers to participation
   g. Perspectives of shift from time-based to competency-based training
2. Assemble and/or develop enduring ML content covering 12 topics included in the American Board

of Pediatrics PHM Content Outline.(27) (Phase 1)

a. Use of a commercially available, secure ML platform (edapp). Edapp offers comprehensive

curriculum development and management, as well as data management:

1. Ability to build and import interactive content elements; integration with Canva graphic design

software

2. Integrated creation, storage, access, and evaluation of ML content
3. Learner assessment capability, including scheduled repetition
4. Advanced analytics: lesson access rate, individual lesson completion percentage, total lesson

completion rate, learner time spent on lesson, learner performance tracking

5. SMS capability: schedule and send notifications to individuals and groups
6. Gamification: leaderboards, competitions, certificates
7. Socialization: supports live chat, group discussion, peer learning

8. Course management capability

*A prototype of a two-lesson course that we have built using edapp can be found here: https://trainingpreview.edapp.com/p/ud4RxgKiIyrjopzMGeeE1Pqo

3. Implement and evaluate curriculum feasibility and acceptability (Phase 2)
   a. Convergent parallel mixed-methods design with measures stratified by PGY level and rotation at the time of lesson completion
      1. Quantitative measures
      - lesson access rate
      - lesson completion rate
      - time spent on lesson
      - learner self-rating on topic understanding before/after lesson completion
      - survey data, administered via platform and/or Qualtrics
      2. Qualitative measures
      - learner formative feedback via open-ended questions within content (preferences on content, format, and structure)
      - semi-structured learner interviews with approximately 12-15 trainees conducted by a trained qualitative analyst via recorded Zoom sessions to accommodate variable trainee schedules/locations
      - thematic analysis of data from open-ended questions within content and recorded interviews will be performed using NVivo to identify and group related codes; qualitative analyst will assure validity and reliability of findings and the iterative generation of codes by working closely with the research team
4. Refine curriculum iteratively using quality improvement methodology (Phase 2)
   a. Re-evaluating and adjusting features every 3-4 months based on above measures
   b. Goal: We anticipate a goal of 75% lesson completion rate by 50% of learners by 12 months, but will adjust ultimate goal based on preliminary data after first review cycle

IRB Status: Plan to submit

Challenges: We anticipate several challenges:
1. Trainee use of platform: The platform incorporates multiple strategies to promote engagement. The use of rapid-cycle adjustments affords the opportunity to readily adapt components.
2. Completion rate limited by trainee time/effort: We plan to negotiate with education leadership to allow trainees to receive credit towards required board preparation.

3. Generalizability/scalability/sustainability: Use of a subscription-based platform may be a barrier for internally sustaining this curriculum. However, we anticipate that the content created and insights obtained will be easily transferrable to other platforms/contexts.
4. Impact of other topics/learning modalities: In Phase 2 of this project, we plan to evaluate the effectiveness of the curriculum in promoting trainee behavioral change. However, we recognize the inherent difficulty in determining the effect of a single intervention in the context of a structured training program.

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Resource needs and budget:
Funding will be available for a 12-month period. Please fill in the table below and provide justification/description for each item below. Also, where requested, please provide an estimate of the time/effort you will expend on this project. PI support may not total more than 25% of the requested funds. Administrative support is available through "consultant costs."

	Description	Estimated Cost:
Software subscriptions		$3392
Consultant costs		$4930
Participant financial incentives		$960
Statistical analysis		$718
Total Costs for proposed project:		$10,000

Software Subscription: edapp platform at $3/user/month, estimated 72 users for 12 months

Canva graphic design software, 5 users for 12 months

Consultant costs: qualitative data collection and analysis by INTERACT qualitative analyst from the Department of Population Health Sciennces, 10% effort for 6 months

Participant financial incentives: $30/month in gift cards, $50/participant for 12 interviews

Statistician effort: Statistician effort for analysis of quantitative data