Lessons Learned from Integrating a Computational Cognitive Model for Personalized Linguist Training

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ISSUES

The Department of the Air Force (DAF) is tasked with delivering high-quality warfighter training to develop and sustain warfighter mission-critical knowledge, skills, and abilities to maintain technological and human capital advantages over adversaries. It is both challenging and costly to provide the breadth of training required to develop competencies across a wide variety of occupations in a manner that targets the needs of individual warfighters.

Adaptive training methods have the potential to provide a scalable and economical means to deliver effective training. In previous work, RAND researchers assessed the utility of cognitive models to deliver personalized training in the applied setting of language learning, with a focus on vocabulary memorization and recall. They surveyed the landscape of state-of-the-art adaptive training technologies and examined machine learning, artificial intelligence (AI), and cognitive scientific techniques and determined that computational cognitive models hold promise for delivering personalized training in multiple domains, such as new-language acquisition, that require memorization and recall. However, the researchers faced data quality, data capture, and implementation challenges.

APPROACH

To help communities across the DAF avoid common pitfalls as they move toward adopting personalized training methods, we present lessons learned and describe technical requirements to validly implement and use a computational cognitive model. We document methods to address data capture and data quality issues, including both exposure and performance data, in a cognitive model that leverages existing Arabic language data. These techniques will allow for higher-quality data capture across curricula to support the application of cognitive modeling to adaptive training.


KEY FINDINGS

- Adaptive training utilization requires objective and quantifiable performance metrics, explicitly defined competencies, and clearly defined policies so that relevant data can be collected and leveraged over time and across individual careers.
- Training planners must consider data collection requirements when making investments in learning management systems. This will aid in the organizational ability to adequately collect, integrate, and share data to create a continuum of learning across careers.
- Training planners must thoughtfully consider integration requirements when incorporating adaptive technologies into existing training processes. Simulation methods can help ensure that content is delivered to trainees in a manner that optimizes alignment with current learning objectives and goals.
- Adaptive learning technology developers and stakeholders need to continually engage one another to align training content with learning objectives. It is critical to acquire buy-in and trust from users of the intended population and to bolster utilization and adoption of adaptive learning technologies through education regarding how the technology will function when it is effectively used.
- Emerging large language model capabilities hold promise for automating data validation and assessments, for providing more-efficient training experiences, and for increasing customization of learning experiences. These capabilities possess the ability to parse learning activities, determine and extract the underlying competencies being trained, help overcome data quality deficiencies, and efficiently generate content tailored to the unique needs of individual learners and within the constraints of existing curricula.

RECOMMENDATIONS

- Clearly define competencies and policies for collecting data on those competencies across a person’s career in the DAF. These elements should be established collectively among the DAF training and personnel management communities: The training community would likely collect the data, and the personnel management community would likely be responsible for managing the data across a person’s career.
- Account for integration and data collection requirements across training and learning platforms when making technology investments. High-level guidance can help drive requirements that make integration and data sharing easier when communities move to adopt adaptive training methods. Integrators and those responsible for collecting and managing the data, such as the training and personnel communities, should agree on these requirements. The requirements should cover what data to collect, how often to collect them, and how to protect them.
- Avoid disruption of existing training processes when integrating adaptive technologies. Simulation methods can be used to ensure that those involved in the integration effort deliver content to trainees in a manner that does not disrupt ongoing learning goals while providing the necessary data to aid the integration of adaptive content delivery. This requires close and continual collaboration between instructors and trainers and the integrators.
- Continual collaboration with stakeholders across the student community, instructors, infrastructure (i.e., database) maintainers, and application developers is important to define what the available resources are and to design the integration with minimal disruptions to student learning objectives based on the complexity of the learning workflows, the existing student-facing technology, and the expected frequency and types of interactions.