How does <u>AI</u> support military
Education, Training, Exercises and Evaluation

This info paper was developed by the PfPC ADL WG as part of its "ETEE Emerging Capabilities Quick-Looks" series to inform next-generation Education, Training, Exercises, and Evaluation among security partners.

> This info paper is intended to give military leaders involved with training and education (e.g., commandants, deans, department directors, faculty, and staff) a quick and pragmatic overview of **AI** within the context of military learning and development. It is a 9-minute read.

What is AI and how can it support military ETEE?

<u>**Artificial Intelligence (AI)**</u> is a broad class of software that performs human-like functions such as problem-solving, predicting, and learning. AI that "learns" is called <u>**Machine Learning (ML)**</u>. Today, when most people refer to "AI," they are really talking about ML. Specifically, ML is a subset of AI that develops its functionally by looking for patterns in data. For example, an ML algorithm can "learn" to predict which students are most likely to need help in class by looking at historical data on the characteristics of successful and unsuccessful students. To "train" an AI algorithm, it needs to analyze thousands (or millions or billions) of real-world examples. Then it can look for probabilistic correlations from the data set.

More recently, a subset of ML called <u>**Deep Learning**</u> has been invented. Unlike shallow ML, which requires carefully labeled ("simpler") data, Deep Learning can find patterns in complex, unstructured data, such as images, videos, books, geographical data, and more. When trained on a very large set of data, such as books and pictures, a Deep Learning algorithm can learn to create derivatives of those texts and images. These algorithms are called <u>**Generative AI**</u>. It is the underlying technology behind popular tools like ChatGPT (text) and DALL-E (images).

AI can support many different Education, Training, Exercises and Evaluation (ETEE) activities. It can be used across the ETEE lifecycle to support learning content design and development, delivery, management, and evaluation. AI tools can also support diverse stakeholders, including trainees and students, faculty and staff, and organizations. The professional discipline of using AI, data, and human-centered engineering approaches in conjunction with learning science is referred to as "<u>**Learning Engineering**</u>."

What are some common mistakes (risks) made around AI for ETEE?

(1) Waiting until your program is "ready" for AI (at some future date)
The (digital) world is changing rapidly, and AI tools are growing more mature each day. If ETEE leaders do not invest in AI pilot projects now, then their personnel will fall behind and struggle to catch-up in the future. Although any new technology carries challenges and risks, do not let that complexity create a state of paralysis. Find a way to say "yes" to AI pilot projects, and do so

sooner versus later. Start today, even with small projects or basic exposure—for faculty, staff, students, and trainees at various levels, and for both civilians and uniformed personnel.

(2) Not considering the entire system, especially the people and processes

Advanced technologies, such as AI, require a holistic approach. Specifically, technology must be supported by both skilled personnel and efficient processes. Avoid the mistake of investing in a new AI product without making the corresponding investments in upskilling personnel and updating internal processes to accommodate the new AI capability.

(3) Buying expensive technology first

Although it is tempting to buy a high-end (expensive) product, under the assumption that it will be superior, this can be a mistake. Often, it is best to start with a free or low-cost version of an AI-enabled system (even if it has limited functionality) to give you an opportunity to experiment and to mature your people and processes before committing to the purchase of a more expensive technology. Plus, you might find that the lower-cost version satisfies all of your needs; after all, many useful AI applications are free or are integrated into software you already own.

(4) Not accounting for total lifecycle costs

When purchasing a new technology, particularly one that relies on advanced software, make sure to account for the **total lifecycle cost**. Modern software is not a "one and done" product; rather, it requires ongoing management and maintenance. New capabilities also require investments in upskilling personnel, developing policies and processes, and potentially also the implementation of supplementary systems such as new databases or security software. So, consider the breadth of any new system across all of its technical and nontechnical components and across its total lifecycle, including development, implementation, and long-term maintenance.

(5) Not having a data strategy (for management, security, and use)

If you plan to use ML, then you may need data, such as trainee performance data or **metadata** (that is, descriptive information) about your courses. It is essential to have policies for secure data storage, access control, validation, ethical use, privacy, and governance. Example data strategies can be found online, but each organization will need to build their internal capabilities and processes. Find an appropriate data strategy to begin with (or ask a Generative AI chatbot for help) and then begin to apply it across your digital applications, so that faculty and staff grow accustomed to it and are able to personalize it to your organization.

What benefits does AI offer military ETEE?

(1) AI can improve ETEE effectiveness

AI can support **adaptive learning** (also called personalized learning) where AI monitors a person (or team) and then offers recommendations based on their characteristics and behaviors. Adaptive learning can improve various outcomes, such as increasing performance, reducing

student drop-outs, and accelerating attainment of expertise.[1] For example, a recent meta-analysis (which is an aggregate of other scientific studies, making it a more reliable analysis) found that, on average, adaptive learning systems produce an effect size of 1.48 (mean).[2] For reference, any effect size over 0.8 is considered a "large effect" that can be seen with the naked eye.

(2) AI can improve ETEE efficiency and scalability

AI can perform some tasks for faculty and staff (e.g., automated instruction and testing), and it can make their jobs more efficient. For example, Generative AI can substantially accelerate the creation of tests, syllabi, and instructional materials. It can generate e-learning courseware from reference files, and it can recommend feedback and student grades based on teacher-provided rubrics. For military training, Generative AI can also create countless simulation scenarios, letting personnel better experience the range of situations they might encounter in operations.

(3) AI can give organizations more insights into personnel readiness

By analyzing data from individual learners, teams, and larger collective units, AI can give military leaders greater insights into personnel readiness. For example, AI can take evidence from test scores, physical behaviors (e.g., captured via a video camera during an exercise), and instructor observations and then statistically predict how ready a person or team is to perform defined tasks. AI and data from learning ecosystems can support **learning analytics**.[3] These analyses can, for example, help uncover root causes of capability gaps, predict which teams are likely to perform well, and contribute to estimates of force readiness.

Actions for ETEE military leaders about AI

(1) Yes, you should be investing in AI pilot projects—now

There will never be a future time when there is *less* AI in military ETEE. The world is advancing quickly. Although there seems to be a lot of hype about AI, it is not all misplaced. ETEE leaders should invest in AI pilot projects now or risk being left behind in 3–5 years. Use an incremental approach (i.e., start with small experiments), mature your personnel and processes along with new technologies, and account for total lifecycle costs.

(2) "AI" is a general term; be specific when asking for a capability

Nearly all software we use today could (technically speaking) be called "AI," so if you ask for "AI" to be added to some system, that could mean nearly anything. If you are not confident in

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[1] See a review of adaptive learning outcomes see Muñoz, J. L. R., Ojeda, F. M., et al. (2022). Systematic review of adaptive learning technology for learning in higher education. *Eurasian Journal of Educational Research, 98*(98), 221-233. https://ejer.com.tr/manuscript/index.php/journal/article/view/707. And for a catalog, see Fadieieva, L.O. (2023). Adaptive learning: A cluster-based literature review (2011-2022). *Educational Technology Quarterly, 2023*(3), pp. 319–366. https://doi.org/10.55056/etq.613

[2] Gao, Y. (2023). *The Potential of Adaptive Learning Systems to Enhance Learning Outcomes: A Meta-Analysis.* (Doctoral dissertation, University of Alberta). https://doi.org/10.7939/r3-a6xd-m403

[3] Lang, C., Siemens, G., Wise, A. F., Gašević, D., Merceron, A. (Eds.). (2022). *Handbook of Learning Analytics* (2nd. ed.). SoLAR: Vancouver, BC. https://www.solaresearch.org/publications/hla-22

your ability to use technology jargon, then rather than asking for "AI" or "ML," define the capabilities you want. For example, do not request an "AI system that adapts to students," instead, try asking for a "digital learning platform that produces the same quality of results in half the time." Similarly, be cautious of vendors selling "AI systems." They might be advanced, or they might merely be standard software sold under the new, shiny title of "AI."

(3) Security and data protection are important, but be specific in your risk management

While all software, and especially data-centric software like ML, poses a cybersecurity risk, be careful to avoid letting a general sense of risk prevent your exploration of AI. ("Fear, Uncertainty, and Doubt," or FUD, is a well-known tactic that hackers and cybersecurity salespeople use to exaggerate the risks of online threats.) Do not give into FUD. Instead, be specific in risk analyses and the management of risk. If

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you hear someone make an overly general statement, such as "we cannot do AI because of cybersecurity," this is a warning sign that they have not done due diligence to catalog and address *reasonable* risks. AI, in its many forms, can be implemented in defense and security ETEE safely, if done correctly. Take the time to do realistic and specific risk analyses.

(4) Be aware of (and engage with) international activities that are already happening

The PfPC ADL working group, various NATO and EU organizations, and the Institute of Electrical and Electronics Engineers (IEEE) are all working on "AI and learning" topics. You or your team members should be participating in at least one (if not more) of these groups. Participation not only helps you stay aware of current policies and technologies, but it also helps you influence the groups' directions. You can contact the PfPC ADL working group for help identifying points of contact among the international groups.

Next steps: Specific actions recommended for the next 6-12 months

(1) Identify 1 to 3 AI pilot projects that your faculty and staff can pursue. Also, participate in that pilot project yourself.

(2) Begin building your team's Learning Engineering expertise. Designate at least one person to learn about Learning Engineering and ask them to teach the rest of the faculty and staff. Then consider building a small Learning Engineering team to handle the AI pilot projects.

(3) Implement a professional development program for your faculty, staff, students, and other stakeholders, so they can learn about AI and its uses, benefits, and risks. Consider assigning your team members to each teach short sessions on key AI topics.

(4) Join one or more of the international groups that are working on AI in military learning.