INTELLIGENT LEARNING IN STUDYING AND PLANNING COURSES – NEW OPPORTUNITIES AND CHALLENGES FOR OFFICERS

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Abstract

There were two projects at the National Defence University of Finland (NDU), which both ended by the end of 2022. One of them tried to find the answers to the main question: How artificial intelligence (AI) could be used to improve learning, teaching, and planning? The other tried to find the answer to the main question: What new skills do officers need when artificial intelligence is coming?

We did literature reviews and found out that intelligent technology combined with data analytics can offer several improvements to traditional classroom teaching. From literature reviews, we also found some new skills that officers might need to be able to handle AI- based technologies. This is a position paper presenting the arguable opinions of the writers.

We have found lots of benefits that the use of intelligent learning technology can bring, mainly by supporting individual learning paths. There is also an obvious need for AI officers who should have a deeper understanding of the AI-supported technology than normal officers.

This project and some other similar projects have raised a lot of discussions, one seminar series about artificial intelligence and we do have some trained AI officers as well.

Keywords: *artificial intelligence, intelligent learning, supported studying, intelligent planning, characteristics of war*

Introduction

Artificial intelligence (AI) forms the basis for intelligent learning and AI is possible by machine learning and reinforcement learning. New smart learning environments enhance the learning process, making it independent of time and place. The use of mobile devices as part of learning literally enables continuous learning through mobility and device independence. On the other hand, there are new requirements for learning, because new information is immediately available to everyone, in which case understanding and utilization of information become key competitive assets in terms of career development.

In the Finnish Defense Forces, we understand that artificial intelligence will bring changes and set new requirements for officers' skills. Learning becomes independent of place and time; lifelong learning becomes a permanent phenomenon. Officers must have sufficient knowledge to implement methods and tools utilizing artificial intelligence, as well as the wisdom to combine pedagogy and new intelligent systems. This study investigates the possibilities of using artificial intelligence in the training of officers from

a technical point of view. The focus is on the officers' technical competence requirements. The key skill requirement is technological literacy; the ability to review new technology; the ability to understand the technological process and communicate about it; the ability to detect and solve technological problems with support. All officers must have sufficient ability to understand intelligent technology as a part of military operations and sufficient ability to examine the impact of intelligent technologies on military operations as a whole.

This study provides grounds for revisions of officer training curricula at different course levels. Based on this, it is possible to identify the basic phenomena, concepts and technologies related to artificial intelligence, which should be taught at different course levels, so that the graduating officers have the skills to understand the impact of new phenomena emerging using artificial intelligence.

In this study, it is considered the following questions: What is intelligent learning? How will it change learning and how will it exchange course planning? What skill requirements do officers need to work in an AI operating environment and prepare for it? How the large-scale implementation of artificial intelligence will change the image of future war and combat, national defence and leadership?

Intelligent Learning

The term "intelligent learning" can refer as an example to the process of learning itself, where it would simply mean that an individual is learning in an intelligent way. One could also ask; "What is intelligence?" and this would lead to the philosophical study of intelligence itself. However, here intelligent learning is understood to be a discipline that follows from the use of intelligent technology in teaching and studying. Intelligent technology was at an early age called "Teaching Machines" (Smallwood, 1963). Nowadays the use of AI-powered tools and technologies are able to enhance the learning experience. Artificial intelligence (AI) powered with machine learning (ML) techniques are able to optimize and personalize the learning experience for individual students. In other words, technology can create a more efficient, effective, and engaging learning experience that can help individual learners to achieve their educational goals.

In order to provide individual learning experiences, the system has to identify the strengths and weaknesses of each student, to be able to track their progress. The system also has to be able to provide customized recommendations and feedback. Furthermore, the system can adapt to the learning style, preferences, and pace of each student, providing them with tailored resources, activities, and assessments. This can all be possible by the use of appropriate data with tailored algorithms.

The system can use multiple data sources like learning management systems, social media, and online interactions. The more data the learning system has, the more personal and targeted actions it can offer to the individual learner. They can also identify patterns and insights that can be used to inform the teacher or the teaching administrator to change instructional design in order to improve learning outcomes.

Mainly these systems are online and in blended learning environments, where students have access to digital resources and tools. These technologies are also present in traditional classroom settings, where teachers can leverage AI and ML to enhance their teaching and assessment practices. Intelligent learning has the potential to revolutionize

the way we teach and learn, making education more personalized, engaging, and effective. New intelligent learning technology represents a significant shift away from traditional one-size-fits-all approaches to education, towards a more personalized and adaptive model that is better suited to the needs of individual learners (Chaudhri, 2013; Essa, 2016; Mousavinasab, 2021; Zeide, 2019). A review article published online in 2018, based on inclusion criteria on 53 papers by Elham Mousavinasab, Nahid Zarifsanaiey, Sharareh R. Niakan Kalhori, Mahnaz Rakhshan, Leila Keikha & Marjan Ghazi Saeedi (Mousavinasab, 2021) provides a list of typical characteristics of the techniques used for Intelligent Tutoring systems (ITSs) in years 2007 to 2017. This list should be updated since it does not include for example reinforcement learning and neural networks (Fenza, 2017). From the literature about intelligent learning technology, we can pick the following expectations:

Identify learning objectives: Before designing a course, it's important to identify clear learning objectives. Intelligent learning systems can help to analyze learning data and identify meaningful objectives based on the knowledge and skills that students have (Castro, 2021).

Analyze learner data: Collect and analyze data on student performance, engagement, and progress to identify areas where students are struggling or where they are excelling. This information is to inform course content and pacing, as well as to design assessments and interventions that target individual learning needs (Ouyang, 2022). After this use adaptive learning technologies, which use algorithms that personalize the learning experience. By adapting course content and activities to each student's strengths, weaknesses, and learning style, we help learners to use the material more efficiently (Peng, 2019).

Provide personalized feedback and recommendations: Intelligent learning systems should provide targeted feedback and recommendations to help students improve their performance. By identifying areas for improvement system, one can deliver customized feedback and guidance that is tailored to each student's needs (Peng, 2019). Facilitation of collaboration and peer-to-peer learning by identifying opportunities for students to work together and provide tools (Al-Samarraie, 2018).

Incorporate gamification and interactive elements: Gamification and interactive elements make learning more engaging and enjoyable for students. Game-like features such as points, badges, and leaderboards, as well as interactive activities such as simulations and virtual labs, can create a more immersive and interactive learning experience for everybody (Kapp, 2012).

Officers' Skill Requirements for Operating with AI

Many skills may help officers to excel in an AI operating environment and to be effective in their roles to be models to their conscripts. Superficial knowledge about machine learning algorithms connected to some analytical skills is likely enough for most officers to understand if the AI systems are working as they should, and how reliable are the results they give in general. Likely, there is a need for AI officers who are comfortable working with programming languages, software tools, and other technical resources. Analytical skills that are enough for most officers are that they are able to interpret and make decisions based on visual analytics created by AI systems. AI officers,

on the other hand, should be able to analyze large amounts of data, identify patterns and be able to make the best possible tactical decisions and perform strategic planning.

AI officers need to have data communication fluency because they have to be the ones that translate complex technical information to the other officers and other team members who are likely to have a worse technical background. This means that they have to be able to explain AI and other technical concepts and outcomes in clear, concise language, and be able to work collaboratively with others to achieve common goals.

AI environments at least nowadays are evolving rapidly, so AI officers need to have a solid background of technical principles so they can distinguish valuable new technology from the hoax. They have to be able to work in an environment of uncertainty and ambiguity and be able to adapt their strategies and approaches as needed.

Ethical questions are crucial and can be in many ways confusing in the war zone. This means that all the officers need to have a solid understanding of ethical philosophy and understand the implications of the possible wrongdoings of the machines using AI. A minimal requirement is that they are aware of the ethical principles and legal requirements of the military actions performed with AI.

Changing the Image of Future War and Combat, National Defense and Leadership

Artificial intelligence (AI) will surely have a significant effect on the image of war and combat, national defence, and leadership (Allen, 2017; Cummings, 2017; Yu, 2021). AI is advancing and there does not seem to be any game where finally, it would not beat the human (Campbell, 2002; Moyer, 2016; Ontanón, 2013). What is war but a game with very high stakes? Of course, in war, there are many elements, which will likely be very hard for the intelligent machine to tackle like human factors, and ethical issues and to distinguish "the fog of war" from reality (Wallace, 2018). There are some fields where AI seems to fit naturally. One of these is surely autonomous weapons and autonomous weapon systems. These kinds of machines would ideally identify and engage targets without any human interaction. However, they are still actually quite easily misguided and therefore raise serious ethical and legal issues.

Cyber, in case it is understood as something that is related to computers, information technology and virtual reality can easily benefit from the use of AI in general and of course in cyber warfare. For example, online security, counter-terrorism and cyber-attacks are potential usages for AI.

Supportive decision-making and predictive analytics are also very original usages of AI, and their usage will increase in the future. For example, it is used to analyze data to identify patterns where future events can be predicted. This helps to anticipate and prevent threats before they occur. Decision-making can be enhanced by the provision of accurate and timely information for the leaders. This could lead to more efficient and effective decision-making processes in the context of national defence.

Overall, the implementation of AI is expected to have a significant impact on the image of future war and combat, national defence, and leadership. While AI has the potential to enhance capabilities and improve decision-making processes, it also raises important ethical, legal, and security concerns that must be addressed. As such, careful consideration and regulation will be necessary to ensure that the development and use of AI in these contexts is responsible and beneficial to society.

Final Remarks

In Finland, the public administration has outlined that we should be among the leading countries in the application of artificial intelligence since 2017. The goal is meaningful and according to some statements by successfully applying AI, Finland has the potential to double its economic growth rate by 2035. The Finnish government has launched several initiatives, including the Finnish Center for Artificial Intelligence (FCAI), FCAI comprises 60 professors and 300 researchers and has a EUR 250 million budget for the flagship term of 2019–2026. It is a community of experts from Aalto University, the University of Helsinki and VTT. According to Coursera's Global Skills Report 2022, Finland is the world's top data science nation. In a country of 5.5 million people, major universities offer more than 250 individual AI courses, 40 master-level programs, 19 bachelor-level programs and 3 doctoral programs. The universities of applied sciences provide an additional 26 study programs on the subject. The role of intelligent learning is to be learning with intelligent tools that enhance the learning process will become standard in teaching in Finland. Especially the role of analytics and real-time conclusions leading to system suggestions will increase rapidly. This will lead to more personal and better learning experiences.

The defence administration of Finland has outlined that it will develop its artificial intelligence expertise through research, training, and international networking. Officers will learn new skills that they need to be able to effectively use AI-based war technologies. In practice, most officers will learn the skills that they need to understand how systems work. The Defence Forces have to invest in additional training for officers, especially in the fields of science that support operational decision-making. In addition, it is worth investing in the utilization of practical and theoretical knowledge of AI decision processes from universities and industry by increasing cooperation and hiring. In artificial intelligence, reinforcement learning and its connection to already existing systems will be studied even more in the future. Artificial intelligence systems become even smarter when the systems really start to learn, and they are not built just relying on large amounts of data.

These results clearly point out that the use of intelligent technologies has a possibility to greatly change the characteristics of learning, teaching, and war. The change in the characteristics of war should also change the officers' curriculum for military technology majors. This project and some other similar projects have raised a lot of discussions, one seminar series about artificial intelligence and we do have some trained AI officers as well nowadays.

Declaration of Interest

The authors declare no competing interest.

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