



ADVANCED DISTRIBUTED LEARNING IN EXERCISES

Annex to NATO ADL Handbook

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1 Executive Summary

Training is vital to mission success, yet it is difficult to quantify the impact of any particular training event or exercise. Advanced Distributed Learning (ADL) enables exercise planners to provide cost-effective, easily accessible, highly learnable courses and materials that can be tailored to address specific knowledge gaps, training objectives, and exercise scenarios. Equally important, ADL return-on-investment (ROI) analysis empowers training commanders and exercise management to maximise and justify the expenditure of limited resources.

ADL makes the work of exercise planners and managers easier, more efficient, and more effective. This Annex provides a practical, validated set of guidelines that both the military exercise community and the ADL community can relate to and act upon. It presents methods and best practices for developing and integrating ADL into all types and levels of training exercises, experimentation, mission rehearsals, and war gaming.

The most obvious advantage of using ADL is for Training Audience (TA) pre-exercise preparation. Far too often, valuable time at an event is spent instructing the TA on information they should learn before arrival. ADL courses and microlearning modules provide the pre-training solution for this problem. Moreover, members of the Exercise Planning Group (EPG) and Core Planning Team (CPT) require training and preparation at the outset of the exercise planning process, and Observer Trainer Mentors (OTM) need instruction to assure uniform standards for TA performance scores. ADL is well-suited to each of these important tasks.

Beyond early learning, ADL can play an important part in exercise event execution, shifting from an educational to a supportive function. The ADL dashboard can give management real-time visualisations of training progress and data analysis, and the ADL platform can supply learning at the point of need during the exercise execution, with templates, checklists, and standard operating procedures for activities such as conducting a briefing or interacting with the media.

ADL's value and utility continue in the post-event evaluation process. ADL resources can help inform Post-Exercise Discussions (PXD), provide data and analysis for documents such as the First Impressions Report (FIR) and Final Exercise Report (FER), and aid the development of lessons learned and recommendations. And in the necessary financial review, the ADL ROI Dashboard can quantify and illustrate the training gains made in the exercise.

This Annex concludes with case studies of VIKING 18 and two other exercises, detailing the successes, shortcomings, and lessons learned from the integration of ADL into these training events:

- Integrate ADL into all exercise phases (e.g., pre-training, execution, evaluation, post-exercise discussions).
- Tailor key learning content to the exercise and align it with the training objectives and exercise themes.
- Support anywhere/anytime ADL access for just-in-time learning.
- Emphasise content quality over content quantity.

2 Introduction

2.1 General

This Annex provides pragmatic guidance on introducing, developing, and integrating Advanced Distributed Learning (ADL) into all types and levels of training exercises and similar events, such as test experimentation, mission rehearsal, and war gaming.

Relevant actors around the world face comparable training and education challenges to building readiness capacity. Operations are increasingly multinational and multi-domain; supporting systems are ever more complex; and most organisations are suffering from a performance gap. Military and civilian personnel facing unpredictable, complicated, and evolving security environments require an expanding range of competencies at higher levels of proficiency. The quick acquisition of knowledge and skills is essential to confronting novel multi-domain challenges. In many NATO and national exercises, augmentees are introduced to the exercise at the last minute, requiring them to “get up to speed” in hours or days. The introduction of distributed learning can assist in preparing the Training Audience (TA) and the Exercise Control (EXCON) staff.

However, resource-constrained systems must meet these training and education needs without significantly raising expenditures. Operational integration of ADL assets into multinational exercises is one step toward achieving this goal. ADL enables exercise planners to provide cost-effective, easily accessible, highly learnable courses and materials that can be tailored to address particular knowledge gaps, training objectives, and exercise scenarios. As the number and scope of distributed computer assisted exercises (CAX) increase, and educational systems go online, the ability to deliver ADL training and education becomes a critical capability.



*Figure 2-1. VIKING Exercise Control, Joint Exercise Centre.
Photo by: Swedish Command and Control Regiment*

VIKING – a regularly scheduled, multinational, civil-military CAX – is one of several similar events that aspire to full operational integration of ADL as an essential part of exercise training and preparation, and ADL has been a supportive learning concept in the VIKING events since 2003. This includes utilising Experience Application Programming Interface (xAPI), an eLearning software specification that allows learning content and learning systems to speak to each other in a manner that records and tracks all types of learning activities. The VIKING 2018 exercise expanded the scope and scale of ADL resources to include assets of both pre-training and operational value. The event also highlighted analytics on a common dashboard with data from both the learning management system (LMS) and the command-and-control (C2) system. This enabled the comparison of pre-training data with exercise execution data, including data from the designated evaluation team and exit interviews with participants.

2.2 Purpose

The purpose of this Annex is to enhance military training and education by synthesising the best practices of integrating ADL capabilities into joint and coalition training exercises. This use of ADL resources can yield concrete benefits: quantified measurement of training effectiveness; improved learning outcomes; increased learning efficiency by easing access to instructional materials and making them more convenient to use; and expanded readiness reporting through learning analytics and their associated visualisations.

2.3 Scope

This Annex is intended to serve as a practical, usable set of guidelines that both the ADL and exercise communities can relate to and act upon. It covers event planning, execution, and evaluation; and it offers insights and topics for consideration when implementing and maturing ADL in support of a training exercise.

2.4 Initial Steps

No “one-size-fits-all” process exists for integrating and maturing ADL in training exercises. There are too many different types of exercises, too-varied exercise and training objectives and learning content, and too wide a range of particular constraints. Developing an exercise’s ADL components also depends upon the level of the organisers’ existing eLearning material: Will they create new courses from scratch? Update previously used ADL courses? Convert established classroom courseware into ADL? Likely, it will be some combination of the three. (And the latter two cases would provide some already well-defined learning objectives, media, quizzes, etc.)

In all circumstances, the initial step to creating an ADL solution for an exercise should be conducting an analysis of the gap between the desired state of performance and the current state of performance. When leaders discover a performance gap, the automatic recommendation often is to improve the training. However, a best practice is to verify first that the root cause (or causes) of the performance gap actually can be addressed through education and training. Mature organisations assess the

source of the performance discrepancy and generate a list of possible causes that have resulted in, or may yet lead to, the performance shortfall.

When enhanced or wider-scope training is identified as the means to close a performance gap, this Annex – with its best practices and recommendations – can help organisers recognize key concerns to guide this effort and the subsequent planning and execution. To maximise the value of incorporating ADL into exercises, it must be considered in each of the exercise life cycle’s main stages: strategic guidance, design, preparation, execution, evaluation, and analysis.

Cross-cutting themes that we address in this Annex include:

- *Early engagement and training for planners and management*
- *Learning to support information, introduction, and instructions*
- *Hosted learning platform*
- *Standards and technical requirements*
- *Content responsibility – Subject Matter Experts*
- *Content and information ownership*
- *Academia and curriculum*
- *Pre-training (some mandatory) for TA and EXCON*
- *Repository (even during execution)*
- *Microlearning (even during execution)*
- *Capturing performance data*
- *Assessment*
- *Analytics*
- *Evaluation (support to the Exercise Evaluation and Final Exercise Report)*
- *Dashboard (summarising and visualising results)*
- *Continuity, reuse, and content sharing (after and between exercises)*

2.5 Return on Investment

Experimental research demonstrates that integrating ADL content and automated learning analytics into military exercise technologies improves learning outcomes and operations effectiveness while advancing business intelligence for readiness reporting.

- *Aim & Purpose: Build readiness; enhance efficiency and effectiveness*
- *Objectives: Improved learning, training, and exercises*
- *Performance Gaps: Identified and assessed by leadership*
- *Requirements: Operational (Task List) and technical capabilities*

2.6 Research and Development

The modernisation of learning remains a concept in development, and operational integration of ADL into exercises offers near-real environments both to conduct essential R&D of solutions our war fighters depend upon and to provide learning at the point of need. Using ADL in exercises offers a variety of benefits, including:

- *Enhanced demand signal by feedback from uniformed soldiers*

- Innovative solutions validated in an operational context
- Increased visibility to help win new stakeholders
- Improved capture of lessons identified

2.7 Use Case Studies

Case studies of ADL use in these exercises are presented in Chapter 4:

- VIKING CPX/CAX
- NATO Standards Ukraine
- Bold Quest Interoperability experiment



*Figure 2-2. Computer Assisted Simulation Control, VIKING Exercise Centre.
Photo by: Swedish Command and Control Regiment*

2.8 References

- **NATO Bi-SC 75-7 E&ITD (Education & Individual Training Directive)** The latest version is available through NATO Transnet:
<https://www.act.nato.int/images/stories/structure/jft/ptecs/etd-075-007.pdf>
- **NATO Bi-SC 75-3 CT&ED (Collective Training & Exercise Directive)** The latest version is available through NATO Transnet:
<https://www.act.nato.int/images/stories/structure/jft/ptecs/cted-075-003.pdf>
- **NATO AMSP-05 (Allied Modelling & Simulation Publication), Handbook (Best Practice) for Computer Assisted Exercises (CAX).**
- **Guidelines to Methods in Computer Assisted Exercises (CAX),** Partnership Simulation Network and VIKING 22.
- **Computer Assisted Exercises and Training, A Reference Guide,** Prof. Erdal Cayirci and Dr. Dusan Marincic.

- **The NATO Advanced Distributed Learning Handbook**, NATO Training Group Task Group for Individual Training & Education Developments (IT & ED).
- **VIKING 18 FIR, First Impression Report**, Swedish Armed Forces.
- **I/ITSEC 2018 Paper 18152, Integrating Advanced Distributed Learning into Multinational Exercises**, Mj Niclas Ljung, Mj Tohmas Ax, Dr. Aaron Presnall, Dr. Sae Schatz.
- **I/ITSEC 2018 Paper 18196, Learning Analytics with xAPI in a Multinational Military Exercise**, Ms. Vesna Radivojević, Dr. Aaron Presnall
- **ADL Initiative MADLx Protocol Report (DI-MISC-807ip11A) NATO Standards Exercise Ukraine**, Ms. Biljana Presnall
- **I/ITSEC 2021 Paper 21222, Enhancing Military Exercise Team Performance with Diversified xAPI Instrumented eLearning**, MG Serhii Salkutsan, Col Andrii Golovanov, Col Andrii Shyhyda, Lt Col Maksym Tyshchenko, and Ms. Biljana Presnall

2.9 Contributors

This Annex is a compilation of initiated nations working together under the umbrella of the NATO Training Group (NTG) Individual Training & Education Development (IT&ED). We want to specifically thank the following people for their efforts in drafting this Annex.

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3 Exercise Framework

3.1 Planning and Execution Process

The exercise planning and execution process follows six steps: strategic guidance, design, prepare, execute, evaluate, and analyse. ADL uses a similar framework of production, which is called ADDIE: analysis, design, development, implementation, and evaluation. The two processes are complementary, as illustrated in Figure 3-1.



Figure 3-1. Exercise and ADDIE processes.

The six-step exercise planning and execution process is based on twenty years' experience and was developed from NATO directive Bi-SC CT-ED 75-3 for use in major multinational distributed exercises. It is detailed in *Guidelines to Methods in CAX* (Swedish Armed Forces – VIKING edition). The ADDIE process for developing eLearning content is detailed in the *NATO Advanced Distributed Learning Handbook* (2019), and the eLearning course “Kickstart to ADL” (NORDEFECO) provides interactive instruction on how to create ADL material.

3.2 Exercise Planning Cycle and Products

Each of the six steps in the planning and execution cycle is driven by particular considerations, which in turn inform the subsequent step, as illustrated in Figure 3-2. Subsections 3.4 to 3.10 in this Annex will explain in detail how ADL can support each phase of the process.



Figure 3-2. Planning and execution cycle considerations.

3.3 Timeline for ADL in Exercises

To maximise its value, ADL must be a central part of the exercise process from beginning to end. Figure 3-3 illustrates the ideal timeline for the ADL deployment phases. It includes some of the most important applications of ADL resources for each step, including two critical elements of effective ADL support for the exercise: early access and delivery of the ADL platform and courses. This ADL timeline is intended to be aligned with that of the exercise planning, execution, and evaluation process, and the two always should be coordinated as the process actually unfolds.¹

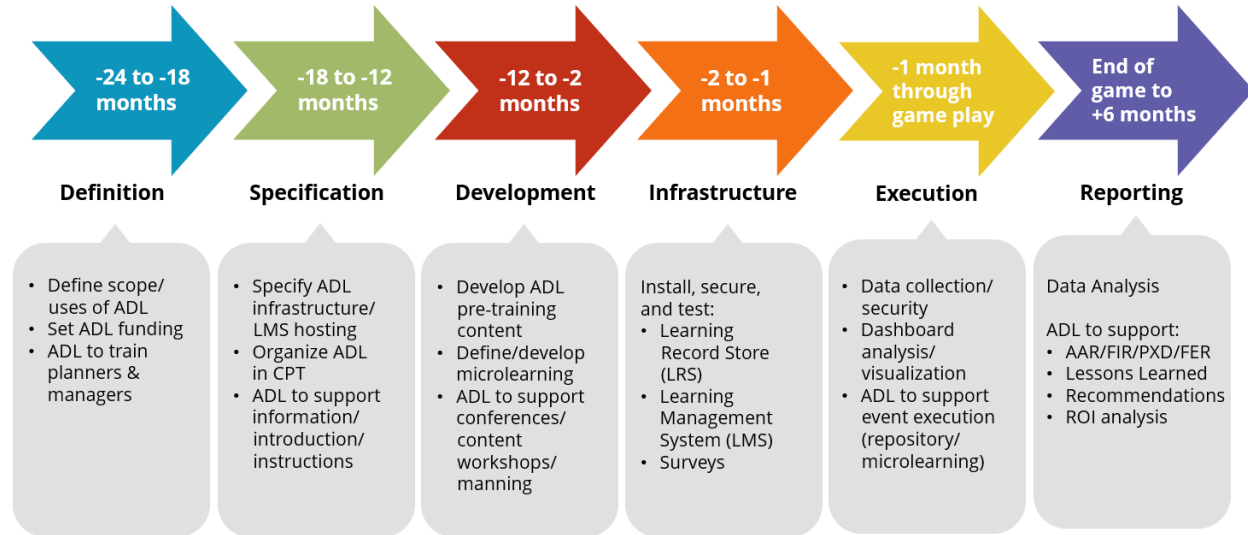


Figure 3-3. ADL production and execution timeline.

¹ In Figure 3-3, Reporting phase: AAR=After Action Review; FIR=First Impressions Report; PXD=Post-Exercise Discussions; FER=Final Exercise Report.

ADL in Exercises: Step by Step

The diagram in Figure 3-4 shows the relationship between the six steps in the exercise process and the corresponding uses of ADL assets for each step. The lists of ADL resources are not exhaustive, but they illustrate the specific ways that ADL can aid and support each step of the exercise process. ADL makes the work of exercise planners and managers easier, more efficient, and more effective.

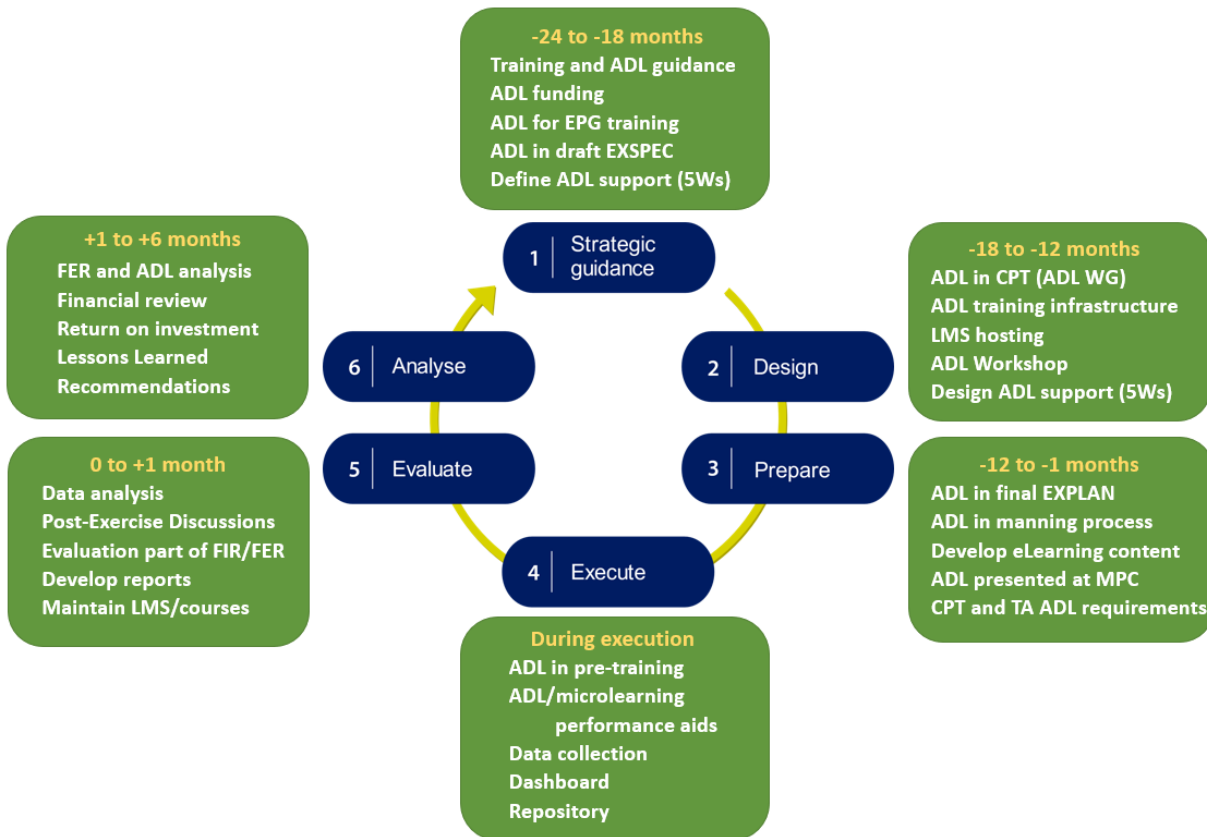


Figure 3-4. Specific ADL assets for each step of the exercise process.

One resource to familiarise exercise planners with the process of successful ADL integration is the eLearning course “CAX Method with ADL” (MADLx Project). The course can be accessed at this site: <https://nordicadl.com/course-catalog>.

3.4 Step One: Strategic Guidance



Scope

Strategic Guidance is the initial step in the exercise process, from 24 to 18 months before execution of the exercise event. The aim for ADL is to establish it as a central element of the entire exercise process. The Officer Scheduling the Exercise (OSE) staffs the Exercise Planning Group (EPG), which comprises the OSE staff, invited partners, and representatives of the Training Audience (TA), participating organisations, and the exercise centres.

The OSE tasks the EPG with various activities and responsibilities to support the early exercise process. The EPG prepares the first draft of the Exercise Specification (EXSPEC), and it plans and conducts the Exercise Specification Conference (ESC) to revise and finalise the EXSPEC draft.

Establishing ADL integration into the overall exercise guidelines and mandates begins with raising the awareness of the OSE, OSE staff, and EPG. One practical way to demonstrate the value of ADL is using it for training the EPG members when the group is first staffed. In the Strategic Guidance step, it is crucial that the ADL training ambitions and guidance are included in the EXSPEC outline and placed on the ESC agenda. The OSE should appoint ADL representatives to the EPG, and the EPG should create an ADL Working Group (WG) within the Core Planning Team (CPT). ADL resources, support, and funding should be addressed according to the “Five Ws and How” (Who, What, Where, When, Why, and How) and be the baseline for the exercise design.

Best Practice

- Establish early management attention to ADL, leveraging success case studies.
- Have management provide clear guidance on ADL use, stated in EXSPEC.
- Do not wait for requirements from management; take the initiative and adjust along the way.
- Base ADL effort and road map on lessons identified in prior exercises and previous experience.
- Be open and strive for ADL concept development.
- Ensure that ADL representatives are part of the Exercise Evaluation (EXEVAL) team to provide recommendations for future ADL in exercises.

3.5 Step Two: Design

Scope

Design is the second step in the exercise process, from 18 to 12 months before execution of the exercise event. The aims for ADL are to design the ADL concept and infrastructure and set the main requirements for exercise event pre-training, complying with the overall planning design and timeline. In this second step, the EPG designs the exercise concept (method and technique) based on the OSE's strategic directions and guidance. The EPG's exercise concept is established in the EXSPEC. Also in this step, the CPT is activated under the control of the Officer Conducting the Exercise Officer Primary Responsible (OCE OPR).



ADL resources should be used in the training of the planners, including the CPT members. ADL should be formally represented on the CPT, as noted above, preferably as one of the members responsible for training and education planning. The design of ADL support and infrastructure should be structured and clearly defined in a plan (remember the “Five Ws and How”) that is included in the EXSPEC Training Annex.



Some ADL and microlearning courses should be mandatory for all exercise participants, but the number of required courses must be limited if participants realistically are expected to complete them. Learning content aimed directly at meeting the exercise, training, and learning objectives should be mandatory, while other useful materials should be presented as recommended or supplementary. One course that should be mandatory is an overview of the exercise scenario. All participants, especially the TA, should be required to complete it to prepare for STARTEX. Some courses addressing exercise-specific information should be mandatory only for particular groups of participants. For example, the EXCON staff, but not the TA, should be required to complete courses on EXCON organisation/functions and implementing/conducting exercise procedures and methods. Similarly, Observer Trainer Mentors should be required to complete a “how to” course on their duties.

Best Practice

- Include the deadline to decide ADL course/content production early in the draft exercise timeline.
- Identify where ADL should be situated in the Exercise Management Organisation.
- Conduct a Training and ADL Workshop early in the process (to develop the “Five Ws and How” and set the plan and standards for ADL in the exercise process).
- Involve necessary actors in an ADL WG (preferably formed at the ADL Workshop).

- Define the Learning Management System (LMS)/Learning Record Store (LRS) hosting agency/agencies early (to set the standards and make ADL available for planner training/aid).
- Define how data will be extracted from exercise management and exercise support systems for analysis.
- Use microlearning for wider reach than the partly restricted exercise platform.
- Identify the availability and owner(s) of the information used in ADL/microlearning resources.
- Monitor and advocate for ADL and training involvement in drafting the EXSPEC.
- Consider early action items in network security, personal integrity, information security, accounts, etc.

3.6 Step Three: Prepare

Scope

Prepare is the third step in the exercise process, from 12 months to one month before execution of the exercise event. The ADL aims are to set the ADL plan, produce the course materials, establish the infrastructure configuration, and make the ADL platform available for participants – including planners – well ahead of event execution. Overall in this step, the planning begun in the Design phase broadens, deepens, and intensifies. When the Prepare step ends, all pre-event components and products are fully developed and ready for execution, including deliverables such as the exercise planning directives and Standing Operating Procedure (SOP).



The results of this step are delivered primarily through the Exercise Plan (EXPLAN), which builds and expands upon the EXSPEC. The EXPLAN is completed by the CPT, and it guides the work of all subgroups and organisations responsible for planning, executing, and evaluating the exercise. The EXPLAN is organised in four main parts (followed by annexes and sub-annexes):

- Part I: Exercise Concept
- Part II: Exercise Planning and Development
- Part III: Exercise Implementation
- Part IV: Exercise Evaluation

The general details and guidelines of ADL and training should be integrated into all four parts of the EXPLAN, with specific instructions and information in the annexes. The CPT Training OPR and the ADL WG should present the ADL and training concept at the planning conferences. Ideally, the ADL platform is launched and demonstrated at the Main Planning Conference (MPC), and it is operational and available thereafter to all participants (including the planners). In addition, the ADL WG should support and prepare the exercise leadership to emphasise the importance of ADL pre-training, preferably during the leadership closing remarks at the MPC.

Best Practice

- Bring ADL competence into the manning process as early as possible for an active planning presence, linking directly with the staff assigned as training officers.
- Do not expect exercise planners to have experience with ADL in exercises.
- Provide planners with early advice and monitor and give support throughout the planning process.
- Put strong professional effort into ADL's inclusion in the EXPLAN; it establishes the pre-training norms and is the main mechanism for outreach, especially to distributed sites.
- Be sure that the EXPLAN includes analytics standards (xAPI).
- Encourage partners and the ADL community to contribute early to the ADL concept.
- Encourage distributed site nations to provide specific ADL products addressing their

particular pre-training needs.

- Ensure ADL experts are part of the Exercise Evaluation (EXEVAL) team throughout the process.
- Use microlearning for brief, focused training modules.

3.7 Step Four: Execute

Scope

Execute is the fourth step in the exercise process, from one month before STARTEX through the end of the event. The ADL aims are to provide courses for job training and Work-Up Staff Training (WUST) in the few days prior to STARTEX, resources for use during the exercise event, and analytics before, during, and after the exercise event. ADL and microlearning are of equally high value during the exercise event execution as during pre-event training.



Overall, this step comprises three main activities: adapted job training prior to the game start, implementation of the scenario-driven game from start to stop, and the initial evaluation primarily to determine whether the training objectives have been fulfilled.

Job training follows the guidelines presented in the EXPLAN, and the use of ADL in this training is crucial. ADL both improves the quality of learning and reduces the expenditure of training time and resources. A participant's exercise assignment determines the type and topics of the pre-training they need. Job training generally takes one of three forms, all of which can be conducted or supported with ADL.

- **Academic seminars/formal education.** The purpose is to prepare commanders and key personnel in trained units to meet the challenges of specific operations exercises by giving them the opportunity to study and analyse strategic and operational conditions.
- **Method Training.** Specific training on the gaming method, exercise management, and exercise support system.
- **Operator Training.** Simulation systems and other systems training for operators, such as SitaWare HQ, Sword, OneSAF, VBS, ITC, and Actor.

These forms of job training apply when standing units/staffs/headquarters are to be trained, and they are expected to conduct the training with their own resources. Exercise-related training is planned and implemented according to the Exercise Director (EXDIR) and the CPT. The WUST is based on exercise-related information and the exercise scenario, focusing on practical development of participant abilities. It includes information and management systems training. In other exercise types, where the goal is to train individuals, the CPT is responsible for planning and executing customised training for those individuals.

In addition to pre-event training, ADL offers a variety of other benefits during the execution phase, when it can shift from an educational to a supportive role. During exercise, the ADL platform can provide participants with learning content as performance aids. It can generate checklists, SOPs, templates, or other reference material for immediate use, such as conducting a briefing or interacting with the media. The LMS also can serve as a general document repository, making diverse information readily available for the creation of reports, presentations, and spreadsheets utilising the platform's built-in functionality.

The final activity in this step, after game play has concluded, is to create the First Impression Report (FIR). It documents the main initial results and analytics of the exercise event. During event execution, the OTMs create a collection of observations detailing TA capabilities and training objective fulfilment. This observation data is used to produce activity/function and/or unit reports that are given to the TA as appendices to the FIR. The FIR, staff reports, and Staff Instructors' activity reports are presented to the participants before their departure from the exercise.

Best Practice

- Establish a plan for efficient data collection.
- Make ADL management modules available as courses and hands-on training.
- Provide ADL and microlearning solutions to support the exercise event during game play.
- Provide internet access as close to the participants' working areas as possible.
- Consider setting up an ADL lab with internet workstations and ADL support.
- Use ADL information as a repository for identifying knowledge gaps.
- Use a dashboard to give management visualisations of data analysis, ideally with the results available on-demand.
- Make relevant exercise documentation and checklists available to the TA on the LMS and mobile solutions.

3.8 Step Five: Evaluate

Scope

Evaluate is the fifth step in the exercise process, from execution to one month after the event. The ADL aim is to integrate the ADL dashboard, analytics, and survey capabilities into the evaluation process. In general, the purpose of this step is to evaluate how and whether the planning, implementation, and execution phases led to fulfilment of the exercise aim, exercise objectives, and training objectives. The evaluation process is based on the collection of information and data for analytics that has occurred throughout the entire exercise cycle.



The Final Exercise Report (FER) and other functional reports are the primary vehicles for delivering the results and the main outcome of this step. The FER assesses whether the exercise achieved its stated aims and objectives, including how the design and implementation of the exercise supported TA performance, and it incorporates participant evaluations of the exercise. The FER draws conclusions, makes recommendations, and identifies lessons for future activities (action proposals). The Director of EXEVAL is responsible for completing this step and delivering the FER to the OCE, with the OTMs and EXEVAL following a detailed SOP to support their operations.

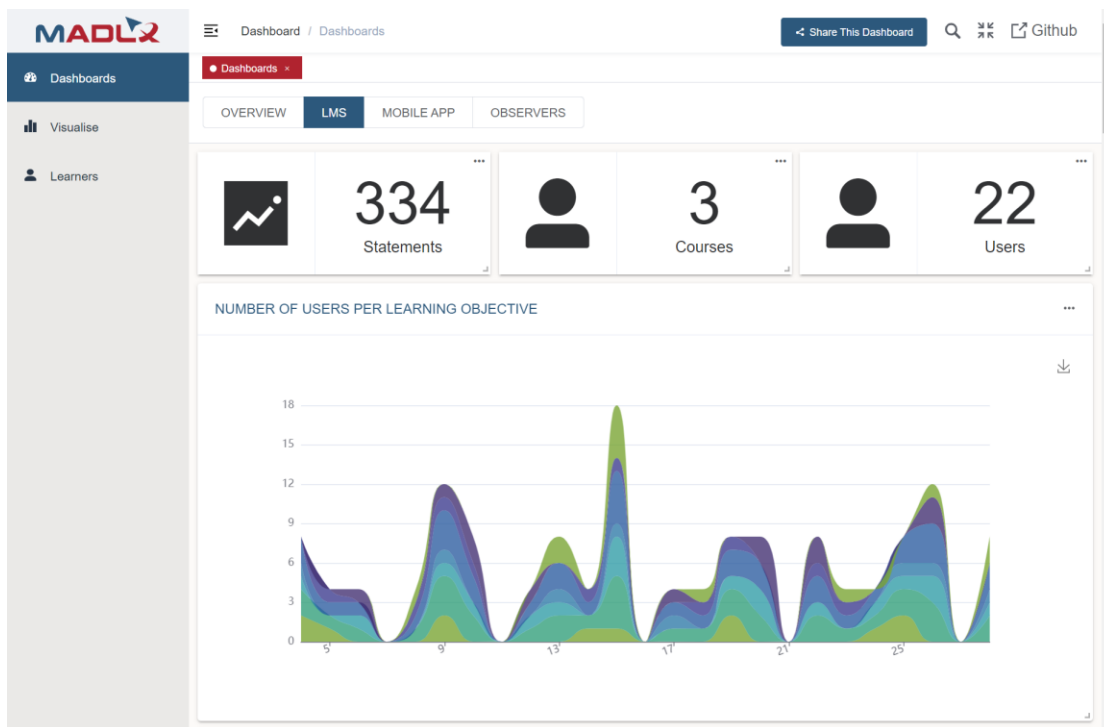


Figure 3-5. Analytics dashboard presenting xAPI outcomes.

Best Practice

- Ensure ADL representation in the Post-Exercise Discussions (PXD).
- Ensure ADL and training lessons identified are included in the FER.
- Establish a Training and ADL Annex to the FER.
- Use ADL to help develop reports.
- Maintain post-exercise event hosting of LMS and ADL courses.

3.9 Step Six: Analyse

Scope

Analyse is the final step in the exercise process, from one month to six months after execution of the exercise event. The ADL aims are to analyse the exercise learning data; support analysis of the FER; and provide analytics to support the exercise financial review, lessons identified and lessons learned, and recommendations for future exercises. Overall, this step contributes to the strategic development and enhancement of future training and exercise design by identifying successes, challenges, best practices, limitations, problems, and areas for improvement.



To this end, it is important that all functions involved in the CPT document their experiences and identify lessons learned. This information, along with the exercise reports and participant evaluations, helps future planners and managers both reduce the repetition of mistakes and learn positive lessons from good and productive examples.

The analysis step is conducted by headquarters planners, exercise planners, and staff from the hosting platform (e.g., a Joint Training Centre). The OSE staff is responsible for coordinating this foundation for future training operations, and they should conduct a workshop within one month after the exercise ends to initiate this step. Full engagement in the exercise does not end until staff follow up on all measures, reports, and data to confirm that the intent and guidance of evaluation and analysis have been effectively communicated. Ideally, recommendations should describe how a change should be implemented and by whom, with the exercise's conclusions and recommendations addressed through either direct adaptation or controlled implementation (institutionalisation). Both will lead to changes in technology, methodology, organisation, and/or personnel.

Best Practice

- Use CPT experience documentation to help inform analysis.
- Define how data will be extracted from exercise management and support systems for analysis.
- Clarify the potential consequences related to GDPR (if any) and how to address them.
- Define which ADL material is needed for the analysis.
- Define who will support the development of ADL content and ensure ADL quality control.
- Define how other relevant external ADL material can be used.
- Define how ADL analytics can be integrated into the EXEVAL function.

3.10 Checklist

STEP	1. STRATEGIC GUIDANCE (-24 to -18 months)	ADL/EDUCATION/TRAINING
Activity	<ul style="list-style-type: none"> Organise EPG Draft Exercise Guidance/Terms of Reference (EG/TOR) 	<ul style="list-style-type: none"> Training and ADL guidance ADL funding
Product	<ul style="list-style-type: none"> Strategic decision Exercise EG/TOR Exercise Objectives 	EXSPEC <ul style="list-style-type: none"> ADL in EPG ADL support to make STARTEX available ADL support to EXEVAL (data + analysis) ADL support in language training to remote sites Plans for ADL experimentation, demonstration, and concept development Key themes that ADL should support
Responsible	Officer Scheduling the Exercise (OSE), Exercise Planning Group (EPG)	EPG
STEP	2. DESIGN (-18 to -12 months)	ADL/EDUCATION/TRAINING
Activity	<ul style="list-style-type: none"> Design Workshops (Ops, Tech) BiL Concept Development Conference Exercise Specification Conference (ESC) 	<ul style="list-style-type: none"> ADL tech infrastructure (internet/internal systems) ADL LMS hosting ADL organisation Design workshop Concept of Training ADL support to make the scenario available ADL support to disseminate exercise documentation
Product	<ul style="list-style-type: none"> Officer Conducting the Exercise (OCE) Planning Guidance Exercise Specification (EXSPEC) Main Training Objectives 	<ul style="list-style-type: none"> ADL must be a function or position in the CPT (e.g., ADL WG) ADL-related interdependencies in timing/planning schedule ADL on what is a CPX/CAX ADL on planning process
Responsible	EPG, OCE Officer with Primary Responsibility (OPR)/Core Planning Team (CPT)	CPT
STEP	3. PREPARE (-12 months to -1 month)	ADL/EDUCATION/TRAINING
Activity	<ul style="list-style-type: none"> Initial Planning Conference (IPC) Workshops (Tech, IM, OPS, MEL/MIL) Main Planning Conference (MPC) Final Coordination Conference (FCC) 	<ul style="list-style-type: none"> ADL requirements concerning the manning process ADL to support evaluation, analysis, and reports
Product	<ul style="list-style-type: none"> Exercise Plan (EXPLAN) Scenario Modules Main Events List/Main Incidents List (MEL/MIL) 	<ul style="list-style-type: none"> Present pre-training/training/ADL concept at MPC ADL clear part of final EXPLAN Develop eLearning content
Responsible	OCE OPR/CPT	OCE OPR/CPT

STEP	4. EXECUTE (-1 month through event)	ADL/EDUCATION/TRAINING
Activity	<ul style="list-style-type: none"> • Pre-Training • CPX/CAX execution performance aids • Follow-up Training Objectives • After Action Review • ENDEX Review 	<ul style="list-style-type: none"> • Clarify ADL support in job training section <ul style="list-style-type: none"> ○ Blended Learning ○ Microlearning ○ Documentation ○ AR/VR/XR possibilities ○ Data collection ○ Dashboard(s)
Product	<ul style="list-style-type: none"> • Observer Trainer Mentors (OTM) report • Commanders reports • First Impression Report (FIR) 	<ul style="list-style-type: none"> • ADL support for data/analysis and reporting
Responsible	Exercise Director (EXDIR), Exercise Control (EXCON)	EXDIR, EXCON
STEP	5. EVALUATE (0 to +1 month)	ADL/EDUCATION/TRAINING
Activity	<ul style="list-style-type: none"> • Post-Exercise Discussions (PXD) 	<ul style="list-style-type: none"> • ADL evaluation • xAPI data and analysis
Product	<ul style="list-style-type: none"> • Final Exercise Report (FER) 	<ul style="list-style-type: none"> • ADL separate headline
Responsible	Exercise Evaluation (EXEVAL)	EXEVAL
STEP	6. ANALYSE (+1 to +6 months)	ADL/EDUCATION/TRAINING
Activity	<ul style="list-style-type: none"> • Economy review • FER analysis 	<ul style="list-style-type: none"> • xAPI data and analysis • ADL ROI
Product	<ul style="list-style-type: none"> • Lessons Learned • Recommendations 	<ul style="list-style-type: none"> • ADL LL and recommendations
Responsible	OSE	OSE

4 Case Studies: ADL Use in Exercises

4.1 VIKING 18



Background

VIKING is the world's largest multinational civil-military training exercise. This unique concept was initiated by the U.S. and Sweden in 1999. A total of nine VIKING events have been conducted, successfully bringing together more than 25,000 participants and more than 100 nations and organisations over this time.

The aim of the event is to train and educate participants – civilian, military and police – to operate together for multidimensional crisis responses and peace operations. The VIKING 18 exercise, conducted 16-26 April 2018 with 2,500 participants, was created for individual and team training and learning at the tactical and operational levels. The staffs consisted of several simulated HQs at different locations in Sweden and other countries.



Figure 4-1. Response Cell Air workplace in Uppsala
Photo: blogg.forsvarsmakten.se/viking/

ADL Content

The VIKING 18 Core Planning Team (CPT) formed a multinational ADL Working Group (WG) to manage eLearning integration, provide existing national/NATO ADL assets, and to produce a limited quantity of new, exercise-specific ADL content. VIKING 18 also had a designated ADL evaluator within the Exercise Evaluation (EXEVAL) team, who was tasked specifically with observing how the ADL effort influenced exercise performance and outcomes.

Six nations contributed a total of 29 eLearning courses to the exercise: 27 legacy courses that met different VIKING 18 themes and learning objectives, and two purpose-built courses. The only mandatory course (*Introduction to VIKING*) was developed especially for VIKING 18 and provided an overview of the exercise organisation, the basic scenario, and a description of the road to crisis. The courses were divided into three levels of importance: Level 1 (Mandatory); Level 2 (Recommended for specific parts of exercise); and Level 3 (Repository available to all participants). Exercise participants had access to all the courses for one month prior to the exercise and could refer to them during the execution for just-in-time learning. The courses remained available through the end of 2018 for further use and reference. An ADL lab at the main site in Enköping, Sweden, also was open to the participants during exercise execution. Courses were delivered through a separate instance of the existing SAF Learning Management System (LMS), enabling the eLearning team to separate the VIKING participants from the existing users on the LMS, which supported better cyber security and information assurance.

Learning Analytics

The Experience Application Programming Interface (xAPI) played an important role in VIKING 18. xAPI is a technical specification that lets learning technologies better record, aggregate, and analyse learning performance data, particularly across diverse learning experiences. Given that the legacy courses generally did not use the xAPI specification, the eLearning team devised technical solutions to collect and aggregate the relevant data regardless of the technical specification used. The eLearning developers created a web-based data visualisation dashboard that analysed both xAPI and non-xAPI data from the exercise's management system. With the dashboard, exercise organisers and other stakeholders could trace trainee performance across different times and technologies, correlating eLearning activities with performance in the exercise scenario and unlocking the potential for deeper insights into the exercise training outcomes.

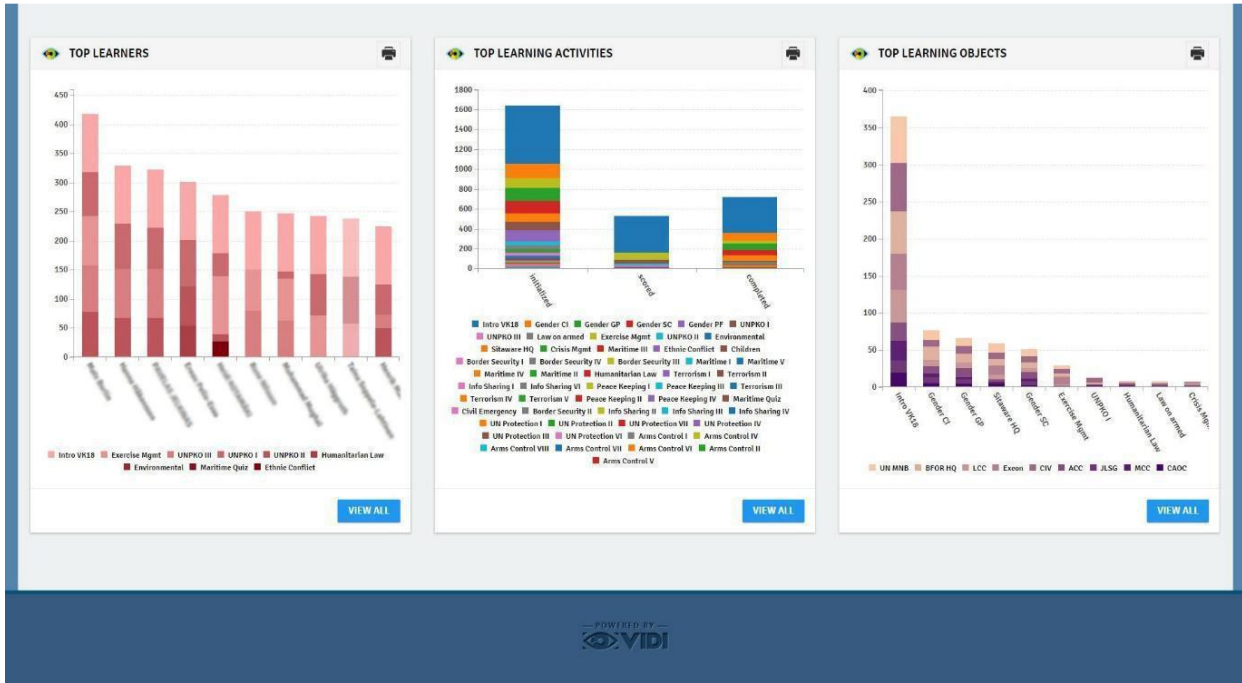


Figure 4-2. VIKING 18 eLearning visualisation dashboard.

Participant Feedback

At the end of the exercise, participants completed a digital survey which included two questions related to eLearning. The first asked, “Were the eLearning courses you took relevant and useful?” It used a scale from 1 (No, not at all) to 6 (Very useful). It included an option of indicating that they had not taken any eLearning courses, and 32.7% of respondents said they had not. Of those who used eLearning, 59% responded that it was useful (rating it a 4, 5, or 6). The second question asked, “Did you receive information about the mandatory eLearning courses?” and 38% of respondents said they had not. Participants who used the ADL content said that dividing it into levels of importance helped them prioritise their pre-training time.

In addition to the digital surveys of all participants, the eLearning team conducted short interviews with 30 participants at the exercise. Half of them said they had not received information about the eLearning options. Among those who did access the ADL material, most said that they found the courses relevant and useful, though it varied by the respondent’s role in the exercise. For example, more of the content was relevant for participants with EXCON functions than for participants representing the UN mission in the exercise. In addition, some said that they chose not to take courses that were overly long and contained too much different information. Interviewees also reported some ADL access problems because they were required to have separate accounts for the PLANEX portal and the VIKING LMS.

Conclusions

In total, over 700 course completions were registered, and an additional 1,000 courses were initiated but not completed. The *Introduction to VIKING* course was by far the most popular, with 588 initiations, 369 completions overall, and 342 completions before the exercise began. Given the participation level and positive user assessments, the exercise's eLearning component was a success.

Still, using ADL in VIKING 18 was in part an afterthought. The ADL WG was formed after the initial planning conferences and meetings. Not being part of the planning in the early stages had several consequences, including difficulty in securing sufficient funds for ADL, problems with producing and updating courses, and complications with automating the LMS system due to manning list shortcomings that would have been discovered earlier had the ADL WG been part of the process from the beginning. Failure to adequately inform participants about eLearning throughout the entire planning and pre-training process led to a lower-than-expected use of ADL resources. The EXEVAL team concluded in the First Impressions Report:

The lack of clearly understood minimum requirements of the pre-training and WUST also led to some elements of the pre-training material being developed explicitly for the exercise not being used to its full potential. For example, the use of the e-learning modules was very low.

Because the ADL courses used in VIKING 18 were mostly legacy courses from multiple sources, they covered only part of the specific exercise themes and training objectives. ADL courses are more useful if their content is tailored to match an exercise's particular training objectives, and their scope and length are limited to focus on information clearly of interest and value to the learners in the exercise.

Recommendations

Formalisation:

- Integrate ADL into all exercise phases (pre-training, WUST, execution, evaluation, POSTEX).
- Make ADL part of the CPT.
- Form a CPT-mandated ADL WG in the planning process.

Communication:

- Improve strategic communication about ADL to leaders, trainers, and trainees.
- Make sure Exercise Guidance, calling messages, and the Exercise Plan (EXPLAN) clearly state that participants are required to do mandatory eLearning content before the exercise.
- Plan how to reach out to partner heads and their participants, and make sure partners are properly mandated to do pre-training.

Learning resources:

- Tailor key content to the exercise and align it with the training objectives and exercise themes.
- Recommend content for different elements in the exercise.

- Make ADL courses modular and as short as possible. (Content quality is more important than content quantity.)

Access:

- Provide internet access as close to the participants' workstations as possible.
- Use microlearning to support anywhere/anytime ADL access (e.g., at home, travelling to the exercise, in the exercise site hotel room or barracks, within the exercise execution area) and to promote just-in-time learning during the exercise.
- Ensure ADL system usability.

Evaluation:

- Make sure ADL is a part of the EXEVAL effort.
- Give the EXEVAL team full and immediate access to the exercise learning analytics dashboard.

4.2 NATO Standards Exercise, Ukraine



Background

Even as the field of learning analytics becomes increasingly sophisticated, many nations/partners currently lack the capability to produce high-fidelity determinations of how military exercises have specifically improved personnel readiness. This challenge is magnified in multinational environments, due to a lack of standardised measures. The NATO Standards exercise in Ukraine was conducted 17-22 June 2020 with 81 participants at the National Defence University of Ukraine (NDUU).

The exercise aim was to develop Military Staff Officers' professional competencies in planning and conducting combat actions of military units and inter-service operations of troops according to NATO standards.

The exercise was supported by the U.S. ADL Initiative's Maturing ADL in Exercises (MADLx) project. MADLx aims to build the foundations for measuring learning effectiveness in mission rehearsals to help management make better decisions about the best ways to use different learning approaches in multinational exercises. The goal of this research study is to develop and field test measurement standards with analytics-enhanced learning content in exercises, and to visually represent those analytics in a dashboard.

ADL Content

The ADL pre-training component covered the theoretical foundations of the operational planning procedures and work of a joint headquarters. ADL pre-training also addressed the development of operational documents in accordance with NATO standard STANAG 2014. The NDUU randomly assigned 11 participants to serve as a control group and the remaining 70 participants to two treatment groups. The treatment groups had access to the ADL content, while the control group was provided the same material in traditional paper form. Data on the participants' relative success at meeting the mission rehearsal objectives was anonymously collected from student learning on the online platform and within the exercise itself. The xAPI-compliant ADL performance data fed the exercise dashboard in real time. The observer data remained non-standardized and was presented to MADLx during the exercise. This was the first time that NDUU had used native xAPI standardised courses.

Participant Feedback

All participants completed a post-event survey, which included a question on how they felt the ADL pre-training courses had affected their exercise performance. Nearly all noted some kind of positive effect, with 63% saying the ADL content provided them with new interesting knowledge. (Figure 4-3)

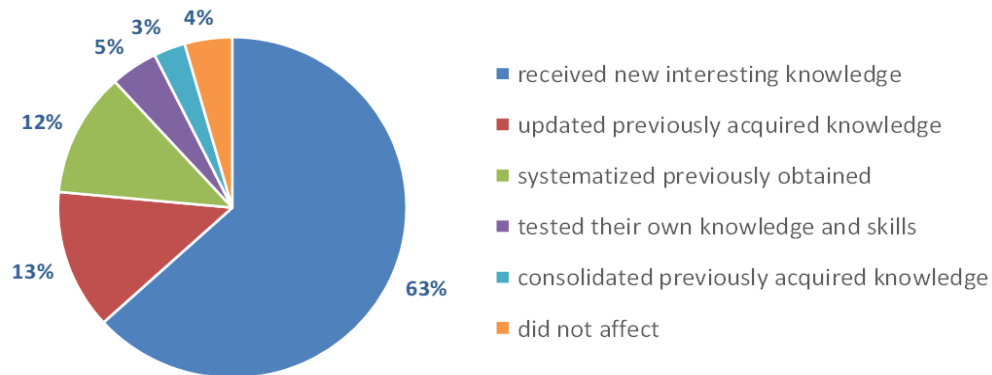


Figure 4-3. NATO Standards participant survey on ADL content.

ADL and Performance

The two treatment groups were provided with the ADL materials as recommended pre-training and an integral part of the exercise, and their results dominated overall performance results (Figure 4-4). The treatment groups achieved an average of 8.11% higher results for all exercise objectives and team averages over the control group, which had received traditional paper-based pre-training.

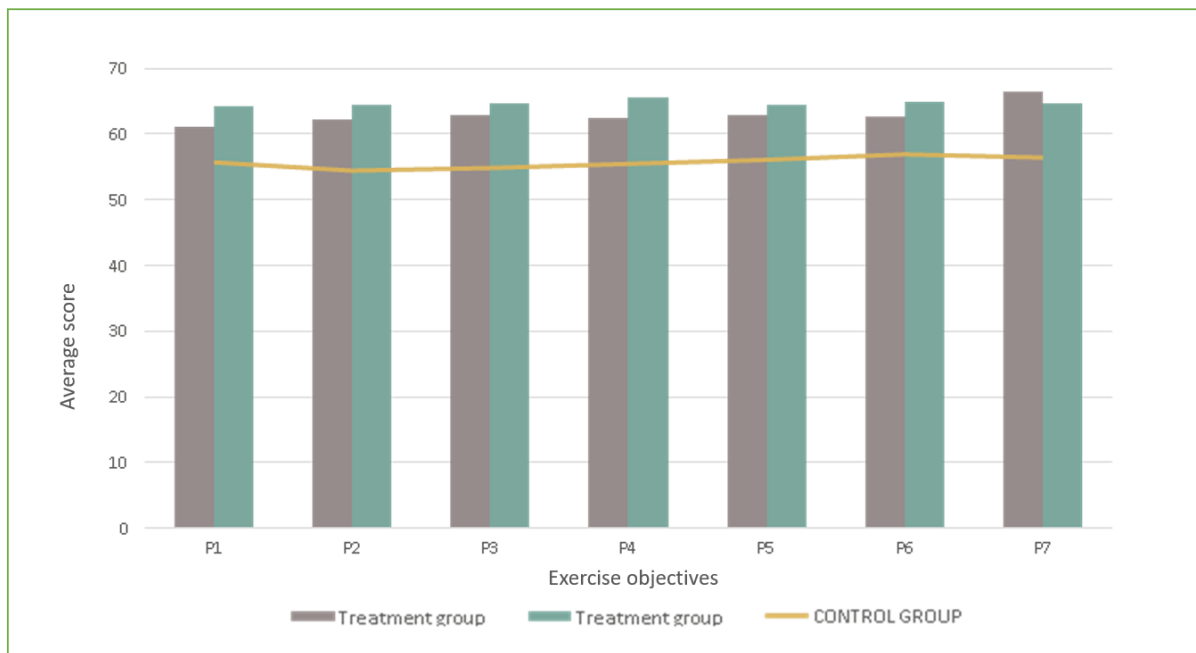


Figure 4-4. NATO Standards exercise performance by objective.

Conclusions

The exercise successfully measured and visualised improved operations effectiveness by participants who utilised ADL content. The MADLx project/exercise executed a solution that was fully integrated into the planning and operations environment of the existing exercise. The exercise learning analytics revealed gaps in participant readiness and highlighted the need for improved pre-training in the next iteration of the event. The xAPI-compliant ADL solution sustained no intrusions into the Learning Management System (LMS), Learning Record Store (LRS), or Learning Analytics Dashboard (LAD) in an active hostile security environment. The exercise met all standards, measured a meaningful, actionable result relative to the training objectives, and represented this measurement in an intelligible real-time dashboard.

Recommendations

- Integrating ADL early into exercise planning can achieve an exceptional match between the learning objectives of eLearning courses and the exercise training objectives.
- ADL performance can be monitored live during pre-training on a dashboard with more than 15 data visualisations showing performance, comparisons, and behaviour of the training audience.
- Exercise stakeholders should receive basic xAPI implementation training.
- Analytics can inform and enable midstream corrections to pre-training.

4.3 Bold Quest

Background

The Coalition Capability Demonstration and Assessment series, known as Bold Quest, fosters Joint and Coalition resource pooling, collaborative data collection, and data analysis to inform capability development on a Joint and Coalition scale. The purpose of the Bold Quest series of events is to improve interoperability across systems, services and nations. It fosters rapid and accurate information exchange, providing the warfighter with battlefield situational awareness to support decision making against modern and traditional opponents and increasing lethality among joint and coalition operations.



Bold Quest was originally conceived in 2001 as an Advanced Concept Technology Demonstration (ACTD), with the first operational demonstration in 2003. The ACTD was extended twice at the request of the participant nations and services to accommodate an expanding scope of work. Bold Quest then transitioned from an ACTD to a recurring cycle of collaborative capability demonstrations and analysis.

The Bold Quest 20:2 live exercise was held from 24-30 October 2020 at Camp Atterbury, Indiana, with 54 participants (down from the initially planned 108, due to pandemic-related cancellations).

ADL Content

The planning process included the preparation of an ADL online pre-training course on the use of the Android Team Awareness Kit (ATAK) system. This was the first time that the exercise organiser used an alternative xAPI standardised course. MADLx created a native xAPI course and enrolled all participants in an independent Learning Management System (LMS) for access. However, only 12 international (Belgian) participants and U.S. Subject Matter Experts (SMEs) attended the virtual learning environment for pre-training. Their interaction was modest and collected 4,164 xAPI statements. The LMS was the only source of xAPI data. With the Belgian participants' withdrawal from the exercise because of the pandemic, their statements could not be compared to the live exercise data.

Data Collection

Unlike many other exercises, data collection activities represented an integral part of the Bold Quest exercise, albeit with essentially no usable data from the ADL content. The collection methods included the following data procedures at the live exercise:

- A designated Learning Record Store (LRS) collected data on participants who attended the online pre-training.

- Participants were asked upon arrival to complete informed consent, demographics, and additional knowledge and self-assessments, if designated.
- Participants completed a mission-related survey upon commencement of training activities.
- Researchers observed participant performance on meaningful activities tied to the training curriculum.
- System instrumentation and audio collections occurred during virtual or live scenario performance.
- Upon completion of each day's activities, participants completed the Mission Awareness Rating Scale (MARS), a reaction survey, and additional self-assessments.
- Participants completed an overall reactions survey and additional self-assessments at the end of the exercise.
- Researchers asked individual participants a series of questions in the form of semi-structured interviews.

Based on the self-assessments of the participants, MADLx reconstructed their opinions on exercise performance and overall mission success. Opinions were organised into Squad (SQUAD) group, Leaders (LDR), Anonymous (ANON), and Exercise Control (EXCON). Participants rated both the mission's success from their perspective and their own performance, ranked on a scale of 1 (Not at all Successful) to 10 (Very Successful). The aggregated average results showed that EXCON performance matched the mission achievements at a very high rate. SQUAD average opinions were rated lower for both their performance and mission achievements. Similarly, the LDR group rated the achievements lower, but with less of a difference between the mission success and their performance. The ANON group (those participants might belong to any said group) rated the mission success highly but noted discrepancies with performance.

Conclusions

We were not able to measure and visualise improved operations effectiveness by participants who utilise ADL content because the pandemic undermined the ADL effort by eliminating international participation. We also were not able to utilise the ROI dashboard or give actionable analytics on the training environment to maximise performance success and improve the learning environment. Furthermore, last-minute shifts in participants and support personnel resulted in U.S. exercise participants failing to utilise the online training assets, and institutional inertia behind a heavy reliance on paper reporting resulted in limited use of the online self-evaluation survey instrument. Targeted sensor data from the exercise ultimately was unavailable to MADLx for analysis, demonstrating that data which can land in the Secret Internet Protocol Router (SIPR) is highly vulnerable to breakdown in coordination.

However, ADL demonstrated the capability to be integrated into and support even a highly disrupted exercise event. We executed a solution that was fully integrated within the planning and operations environment of the existing exercise with a continuous supporting role. With early integration of ADL into exercise planning, we matched the eLearning courses to the training objectives. Processing and delivery of analytics with useful visualisations was accelerated, especially for legacy analog paper-based reporting, and multiple data streams on exercise participant performance offered resilience to

analytics delivery, even as the primary performance data was made unavailable. In addition, there were no security issues for the LMS, LRS, or Learning Analytics Dashboard (LAD).

Recommendations

- Assure ADL involvement in planning from an early stage, and directly link ADL with shortening the preparation time at the live event and consequent savings. (For example, make online preparation mandatory, and dedicate in-person time for other elements of mission preparation.)
- Establish protocols for U.S. military personnel to access online resources which reside internationally.
- Establish protocols for live-streaming non-classified data into the MADLx ROI dashboard, instead of relying on a totally paper-based collecting process, with its subsequent wait for the data. (For example, establish the role of the ROI dashboard in expansive analytical research done by other researchers in the Bold Quest exercise series.)