THE NATO ADVANCED DISTRIBUTED LEARNING HANDBOOK

Guidelines for the development, implementation and evaluation of Technology Enhanced Learning

NATO Learning and
Technology Interoperability
Group (NL&TIG)

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1. Forword

Rear Admiral

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Deputy Chief of Staff Joint Force Development

Welcome to the NATO ADL Handbook, this document, published by the NATO Training Group Individual Training and Education Developments Task Group, provides information and guidance on using and developing online learning.

Since Allied Command Transformation was created in 2003, we have been tasked by the Military Committee to transform NATO's Education & Training (E&T) policies, capabilities and delivery, bringing in transformational ways of ensuring our NATO and national command and force structures are fully prepared for the mission ahead. One of these ways which has matured and grown substantially both in NATO and in the nations is e-Learning or Advanced Distributed Learning (ADL). This technological approach to delivering education and training has added capabilities to our E&T "toolbox" and continues to offer new ways to reach and educate our dispersed audience. I expect to see in the near future expanded changes in our mind-set towards residential traditional, online and blended Learning, utilising the best features of all methods and ensuring we offer the best solutions to NATO's E&T requirements.

This handbook, created and maintained by many contributing nations within the NATO Training Group, provides guidance for the procurement, implementation and evaluation of ADL

I hope this document will provide useful information to you, and you will join in our efforts to improve education and training development for our forces.

NATO ADL HANDBOOK

2. Background

2.1 Purpose of this handbook

This handbook provides practical guidance to organizations for the creation and/or the procurement, implementation, and evaluation of Advanced Distributed Learning (ADL). This handbook is not meant to be all-encompassing. It is an overarching look at ADL concepts and some of the tools used to develop ADL. Nations are intended to use this handbook as a starting point and supplement it with additional guidance that is applicable to their own policies and procedures.

2.2 How to use this handbook

This document is intended to be used for practical, pragmatic guidance and as a source of examples for the creation, use and implementation of ADL. This handbook can be read from beginning to end to gain a general understanding, or it can serve as an "on demand" reference manual to answer specific questions that may arise in the process of working with ADL. The document includes specific advice for Instructional System Designers (ISDs), Subject Matter Experts (SMEs), programmers and/or developers, and managers.

2.3 What is "Advanced Distributed Learning"?

ADL describes methods of teaching that do not require the learners' physical presence at a specific site. ADL also infers that the instruction uses some form of electronic and/or information technology. The NATO Bi-Strategic Command (Bi-SC) 75-7 Education and Individual Training Directive (E&ITD)[1] defines ADL as "an interactive, outcomes-focused approach to education, training, and performance-aiding that blends standards-based Distributed Learning." Bi-SC 75-7 also stipulates the delivery of instruction as electronic combined with other methods of instruction that do not require the student to be present at a specific site.

Distributed learning began as correspondence study offered by institutions and individuals. In the past century, "advanced" distributed learning was enriched by new technologies such as telephone, radio, audio, television, and video. The large-scale introduction of multimedia-capable computers to businesses and homes, followed by the widespread adoption of the Internet and mobile communication technologies, added tremendous new potential to technology-supported distributed learning.

It is important to note that electronic learning **(**commonly referred to as **e-Learning)** refers to "instruction delivered on a digital device (such as a…computer, tablet, or smart phone) that is intended to support learning." Although the definitions of e-Learning and ADL are very similar, often organizations and communities prefer one term over the other. For the purposes of this handbook, the Nations agree to the wider definition of ADL which includes Instructional

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Multimedia Instruction (IMI), Computer-Based Instruction (CBI), Computer-Based Training (CBT), Web-Based Training (WBT), e-Learning, and other terms associated with technology-based or online instruction. (We also recognize that ADL and e-Learning can be used synonymously.)

2.4 About this handbook

This handbook supports **NATO** and **partner countries** in producing effective ADL content for specific or shared training and education needs.

The handbook uses the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) framework for the ADL development process (Figure 2-1). ADDIE is a common chain of processes to describe the creation, use, and evaluation of training materials. ADDIE presents the steps in a sequence, but the steps often run concurrently in practice. The concurrence of steps (and their sub-steps) are sometimes referred to as “agile design and development” or “successive approximation.”

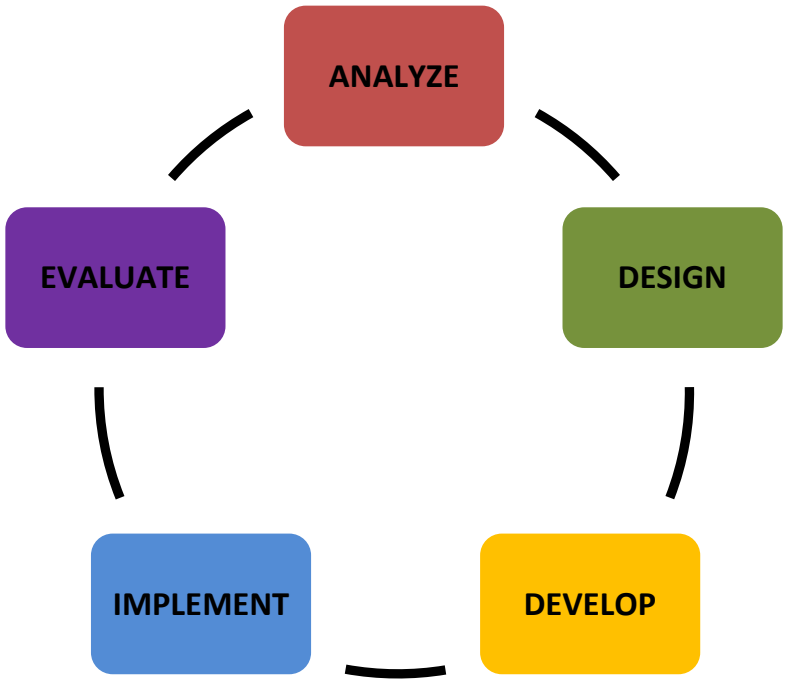

Figure 2-1. ADDIE Process

Some of the information found in this handbook is based on the **ADL Content Production Kit**[2]. The kit was created by the Partnership for Peace Consortium’s (PfPC) ADL Working Group (WG), comprising NATO and non-NATO professionals in the field of ADL. We recommend these documents, which include “how-to” instructions as well as worksheets/checklists for day-to-day work.

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The **NATO Bi-SC 75-7 E&ITD** is an important reference document for comprehensive training and education solutions, and also includes information on the Training Needs Analysis (TNA) required for any strategic NATO project. The latest version was endorsed on 10 September 2015, and it is available through NATO Transnet.

2.5 There is more than one way to succeed!

Please keep in mind that due to the many types of ADL projects, the wide range of possible goals and content, and the widely differing project constraints, there is no “one-size-fits-all” process. However, by using this document and its recommendations, you may identify critical issues to help you improve your project.

2.6 Contributors

This handbook is a compilation of numerous nations working together under the umbrella of the NATO Training Group (NTG) Individual Training & Education Developments (IT&ED) working group.

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3. Analysis

3.1 Scope

This chapter provides an overview of considerations that should be the basis for all instructional planning and development of ADL. There are many differing opinions on the “correct” way to conduct analysis and the order in which steps should be taken. There are also many different types of initial development efforts (e.g., starting from scratch, updating “old” courses, and conversions to ADL from established classroom courseware). Artificial Intelligence (AI) or a

Large Language Model (LLM) could help with the analysis. In the latter two cases, there may already be well-defined learning objectives, media, quizzes, etc. Whatever the situation, before we create an ADL solution, it is important to confirm that an initial gap analysis has been completed.

3.2 Introduction

Education and Individual Training (E&IT) is often the first recommendation put forward when we have a "problem" or a gap between the desired state of performance and the current state of performance. It is a good practice to verify that the root cause (or causes) of the performance gap can be addressed through education and training. You may have heard the adage, "An ounce of prevention is worth a pound of cure." Mature organizations will assess the cause of the performance discrepancy and generate a list of possible causes that have resulted in, or may yet cause, the performance shortfall. Some common reasons for a performance gap arising are illustrated in the figure below. Within the NATO context, this analysis takes place during the development of the Strategic Training Plan (STP) and the follow-on Training Requirements Analysis (TRA).

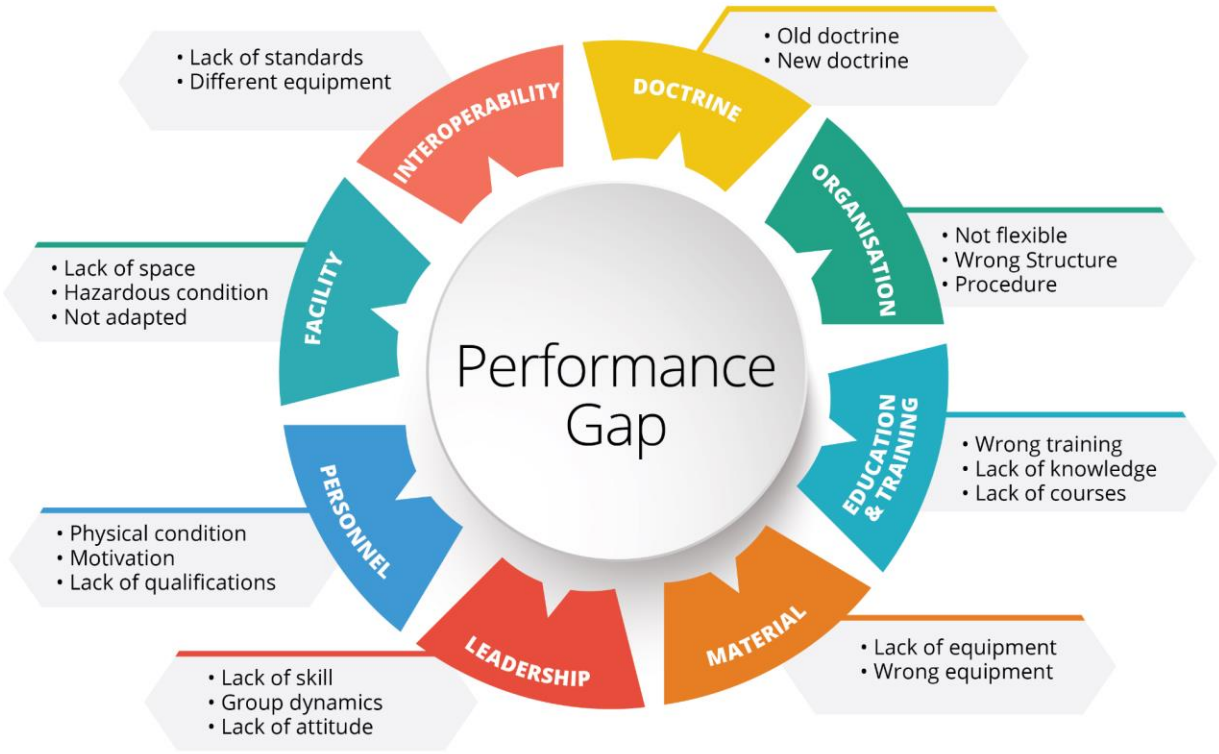


Figure 3-1. Performance gap causes and considerations

Once the root cause(s) of the performance gap are confirmed, and E&IT is identified as a viable solution to close this gap, the NATO Systems Approach to Training (SAT) is used. The NATO SAT is an iterative and interactive sequence of activity, which leads from identifying a need for E&IT training to defining, developing, and implementing effective and efficient learning solutions

to satisfy the need. It is important to note that the NATO SAT is an Instructional Systems Design (ISD) model, and it is often synonymous with the ADDIE model. The NATO SAT consists of five distinct phases and includes a feedback loop at the conclusion of each phase. (See figures below).

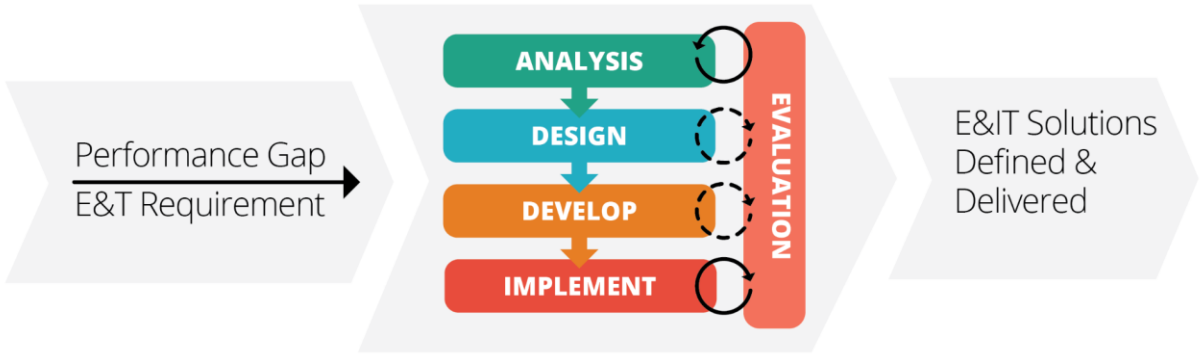


Figure 3-2. Performance gap to E&IT solutions

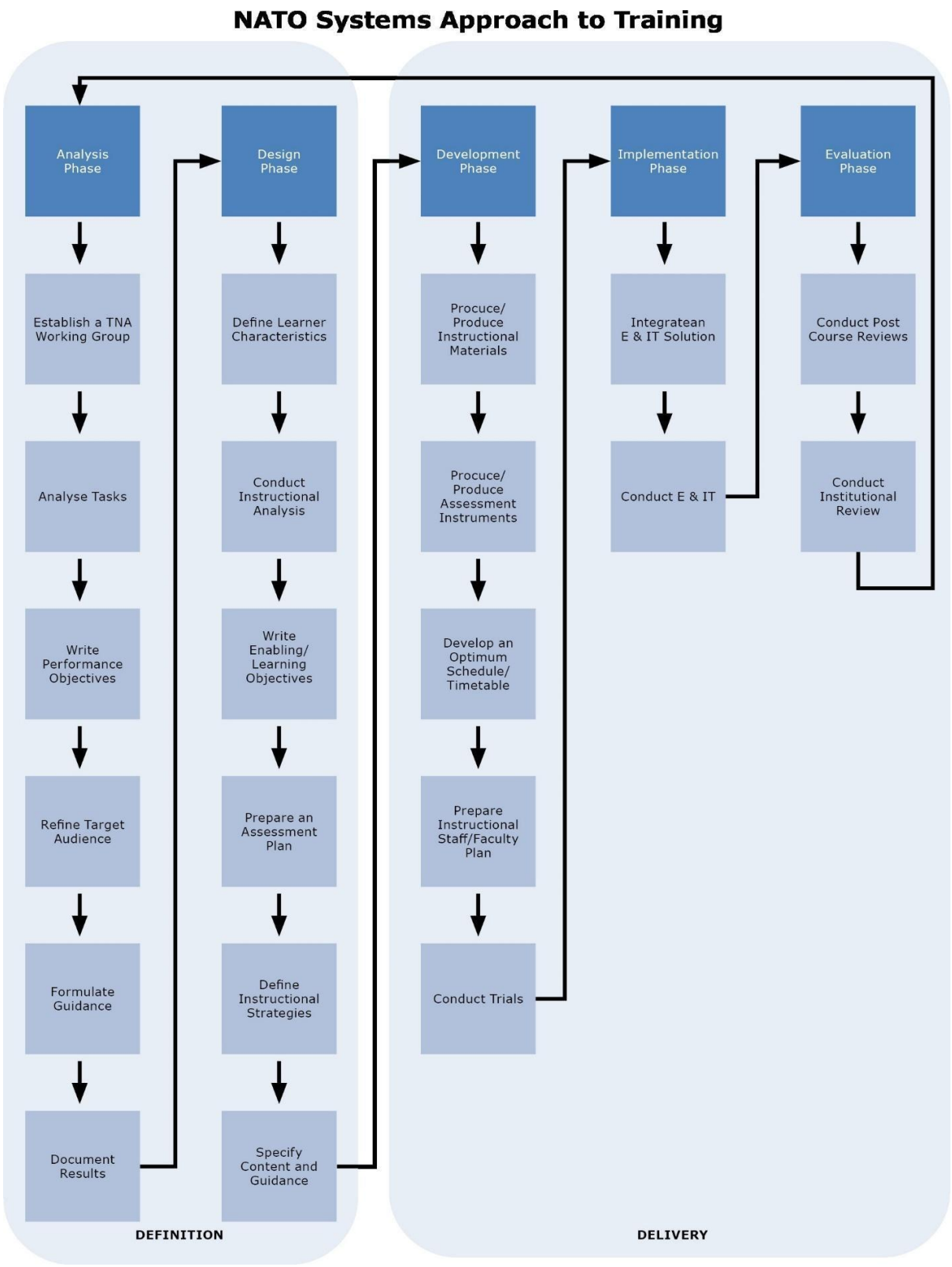


Figure 3-3. NATO Systems Approach to Training

3.3 NATO SAT: Analysis Phase

The purpose of the Analysis Phase is to generate clear and precise **Performance Objectives** (POs). POs are designed to address a performance gap and identify the intended outcome. POs are expressed in terms of the required job performance proficiency to be achieved. During this process we attempt to answer the following key questions:

a. Why train?

b. Who must be trained?

c. What must be trained, to what level, and under what conditions?

The Analysis Phase often relies on a Working Group (WG) to systematically analyze, select and organize the specific tasks that require E&IT. The WG requires inputs from a community of interests including command staffs, the originators of the training requirement, end-users, Subject Matter Experts (SMEs), and E&T specialists. The success of the WG relies upon the discretion, experience, and expertise of the assembled members and their respective abilities to make reasoned judgments throughout the Analysis Phase. If the problem or performance gap is not clearly understood, the likelihood of designing an effective E&IT solution is diminished. Having the right people involved in the WG is essential to providing the required guidance to design an E&IT solution during the following phases of the NATO SAT.

The following steps are undertaken during the Analysis Phase:

Step 1: Establish a Training Needs Analysis (TNA) WG

Step 2: Analyze tasks

Step 3: Write performance objectives

Step 4: Refine target audience

Step 5: Formulate guidance

Step 6: Document the results

3.3.1 Analyze tasks

The task analysis for the target audience identifies all tasks, sub-tasks, and task elements carried out correctly and efficiently. With current performance problems, it identifies the gaps between current and intended performance, and it identifies other factors that might affect

performance (e.g., incompatibility of technologies, tools and procedures).

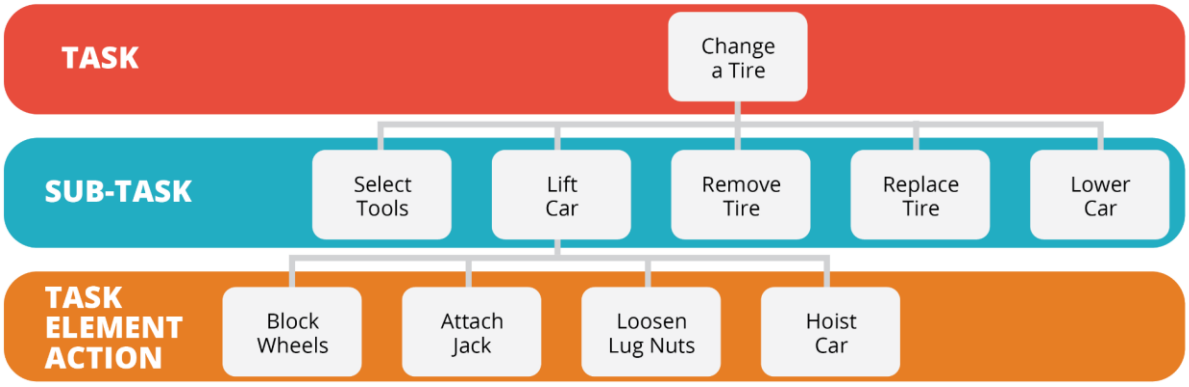


Figure 3-4. Simplified task analysis

Example: With new equipment, the task analysis might lead to the following top-level items: Unload the equipment from ships or trucks, install the equipment, start the equipment, safely operate the equipment, perform the typical activities A, B … P, perform standard maintenance activities Q … W, know when and where to get support for non-standard maintenance and repairs. Each of these items needs to be broken down into more detail. (e.g., Unloading equipment by crane or forklift might include tasks such as knowing the weight, correctly hooking up, and knowing where to support the equipment.)

Note: In the case of performance problems, a broad look at all causes is essential, as some causes may require more than another training course! If, for example, certain equipment shows unexpectedly high downtimes, the reason is not always incorrect operation or maintenance. It could be that the equipment was never meant to be used in a given environment at the given intensity. In other cases, such as not observing safety rules, the reason does not need to be lack of training. Perhaps there were just some signs missing on the equipment to remind operators of what they had learned long before.

3.3.2 Write Performance Objectives (POs)

POs (also called Behavioural Objectives or Learning Objectives in some national systems) specify, in precise terms, what an individual must be able to do in terms of job performance. A well-crafted Performance Objective includes clear performance statements, the conditions under which the performance is to be carried out, and a standard that defines the proficiency level which individuals are expected to achieve. Not all tasks, sub-tasks, and task elements identified during the previous step will necessarily appear in the POs, but they can help formulate the conditions and standards statements. The elements of a PO are as follows:

a. **Performance Statement.** A concise statement representing a logical and complete part of the job function that is observable and measurable. The performance statement forms the first element of the PO. Performance statements are derived from the task statements identified during task analysis. A PO performance statement often represents a group of related tasks and activities. For example, “write a memorandum,” “write a

military letter," and "document minutes of a meeting" are all tasks that can be combined as "prepare military correspondence." Tasks are grouped or combined based on a) similarity and b) complexity of the skills required to perform each task. A hierarchy of objectives can also be used. Higher-level objectives are called "terminal objectives," and the objectives that enable accomplishment of the terminal objective are called "enabling objectives."

b. **Conditions.** Conditions provide context and describe the situation under which the performance must be completed. Conditions affect how the job or function is done. These are based on the actual workplace or other presumed area of operation. This answers the "when, where, and with what" of the tasks being performed.

c. **Standards.** Standards describe how – and how well – the performance must be completed. The greater the specificity provided, the more valuable the contribution to the development of E&IT solutions. Clear, detailed, and specific standard statements provide the scope and focus for E&IT; they also facilitate accurate assessment. In all instances, the proficiency level required is based on actual job performance requirements. Standards generally specify a product, a process, or a combination of the two; and standards include measures of completeness, soundness of judgment, accuracy, and/or speed.

3.3.3 Refine the target audience

The learners in a particular training project often are not required to master the same exact tasks within the context of that project. For example, the participants in a training for new equipment may include both primary users of the equipment and maintenance personnel. They would all share some training needs, but there also would be some needs unique to each group. Primary users, for instance, would not be expected to master all skills to maintain the equipment, and maintenance workers would not be expected to operate the equipment in combat conditions. Thus, the different groups within a training project's audience must be identified and characterized early to effectively analyze their relevant tasks; and such cases will require a modular training solution, with modules addressing particular training gaps.

For any training project, it is equally important to know the characteristics of the target audience. These include current job experience, prior background, education, and training and experience with computers and ADL. A good understanding of the target audience helps avoid typical mistakes such as using the wrong level and style of language, or trying to build on knowledge and skills that the participants do not possess. Whenever style and content do not align with the needs of the target audience, the content will not be effective.

3.3.4 Formulate guidance

With a clear picture of what an E&IT solution is expected to achieve and the intended audience, it is then possible to provide additional guidance for the Design Phase activities. During this step, the WG will review training strategy options and provide a preliminary estimate of how the E&IT requirement will likely be met.

For most situations, the learning environment falls into one of three delivery options:

a. **Residential Delivery:** This is mainly instructor-led training and education. The students are brought to a centralized location.

b. **Distributed Delivery:** The course is taken to the students. Distributed delivery is usually accomplished by the following means:

    i. **E-Learning/Advanced Distributed Learning (ADL**). These E&IT solutions can use an array of communications and collaboration tools as well as virtual/online environments. They may be self-directed (individual) programmed instructional packages, or they may utilize real-time instructor collaboration and support.

    ii. **Mobile Education and Training Teams (METT**). This E&IT solution usually involves delivering courses in the workplace or at specific locations.

c. **Blended Learning:** A combination of residential and distributed instruction options. It has the potential to reach large numbers of students anytime and anywhere while still leveraging the benefits of residential delivery, making it a particularly attractive approach.

3.3.5 Document the results

This step is used to capture the results of the Analysis Phase. A record of proceedings (sometimes called a **record of decisions**) is recommended to document the WG's decisions, assumptions, and methodologies. The record of decisions is an important document for e-Learning designers and developers because it provides insight into the intent of the E&IT solution and what outcomes need to be achieved. A well-rounded analysis will provide the following:

a. **Requirements for a course.** The rationale for a specific E&IT solution, with the background and history serving as the basis for developing the course.

b. **Aim.** The overall reason(s) for the E&IT.

c. **Performance Objectives.** The details of the outcomes to be addressed through an E&IT solution. Each PO includes a performance statement and the conditions and standard to be achieved. POs also specify the proficiency level, and they may include additional details to support the design of E&IT solutions.

3.4 Summary

The Analysis Phase concludes with a clear definition of the E&IT requirements and provides guidance for designing E&IT solutions. If the Analysis Phase is properly conducted, e-Learning designers and developers will be presented with a solid rationale and requirements for the remaining SAT phases. They then will have to decide which of the four development options best fits their circumstances: developing the content in-house; reusing or repurposing content that is available to be shared by other organizations (information available from national NATO Training Group representatives); buying commercial off-the-shelf (COTS) content; or contracting with a vendor for custom development. The topics discussed in this chapter apply to whichever option is selected.

4. Design

4.1 Scope

This chapter focuses on designing a course or training that includes ADL content. It highlights methods and media selection, applying pedagogy, and appropriate instructional designs. The adoption or inclusion of technology adds a critical element to consider when designing ADL content.

4.2 Pedagogy

4.2.1 Introduction: Generalities about pedagogy

Although it is possible for a single person to be responsible for creating a course, ADL course design usually requires teamwork in which pedagogy must be considered from the beginning of the process.

What does the term mean?

- Pedagogy is the art of teaching. It refers to strategies, methods, and styles of instruction, usually in the context of teaching children. In general, pedagogy is more focused on teachers presenting knowledge for students to acquire.

Before considering content design, the pedagogical team – in close coordination with instructors/teachers – must choose the appropriate combination of face-to-face education and ADL. Various types of training methods offer differing balances between the two, as well as the inclusion (or not) of dedicated coaching. The following are among the possible training methods:

- **Enriched face-to-face learning:** The students are physically present in a training center with the teacher but have access to additional ADL content to reinforce what they have studied.

  Enrichment may be created with technology such as smart phone or holographics.
- **Blended learning:** Traditional face-to-face classroom methods are combined with ADL courses articulated in a complementary way. The ADL can be presented prior to, during, and/or following the face-to-face instruction. For the ADL courses, the student may benefit from coaching, ideally by the face-to-face course instructors. For certification courses, blended learning is an effective means of providing practical application exercises.
- **Remote face-to-face learning:** Rather than being physically present in a training room, the students are connected to the teacher and peers via live video, chat sessions, help desks, and/or virtual classrooms.
- **Distance learning:** The students participate in a distance educational program in a virtual learning environment. Though not physically present in a training room, the students also receive coaching related to the material.
- **Self-learning:** Self-directed learning in which the content is placed online for the students to access but without any additional assistance.

The following chart illustrates these concepts in relation to four parameters:

- **Co-located versus Remote** (whether students are all physically present in the same place, or in different locations)
- **Asynchronous versus Synchronous** (whether students individually choose when to perform learning activities, or perform learning activities at a designated time)

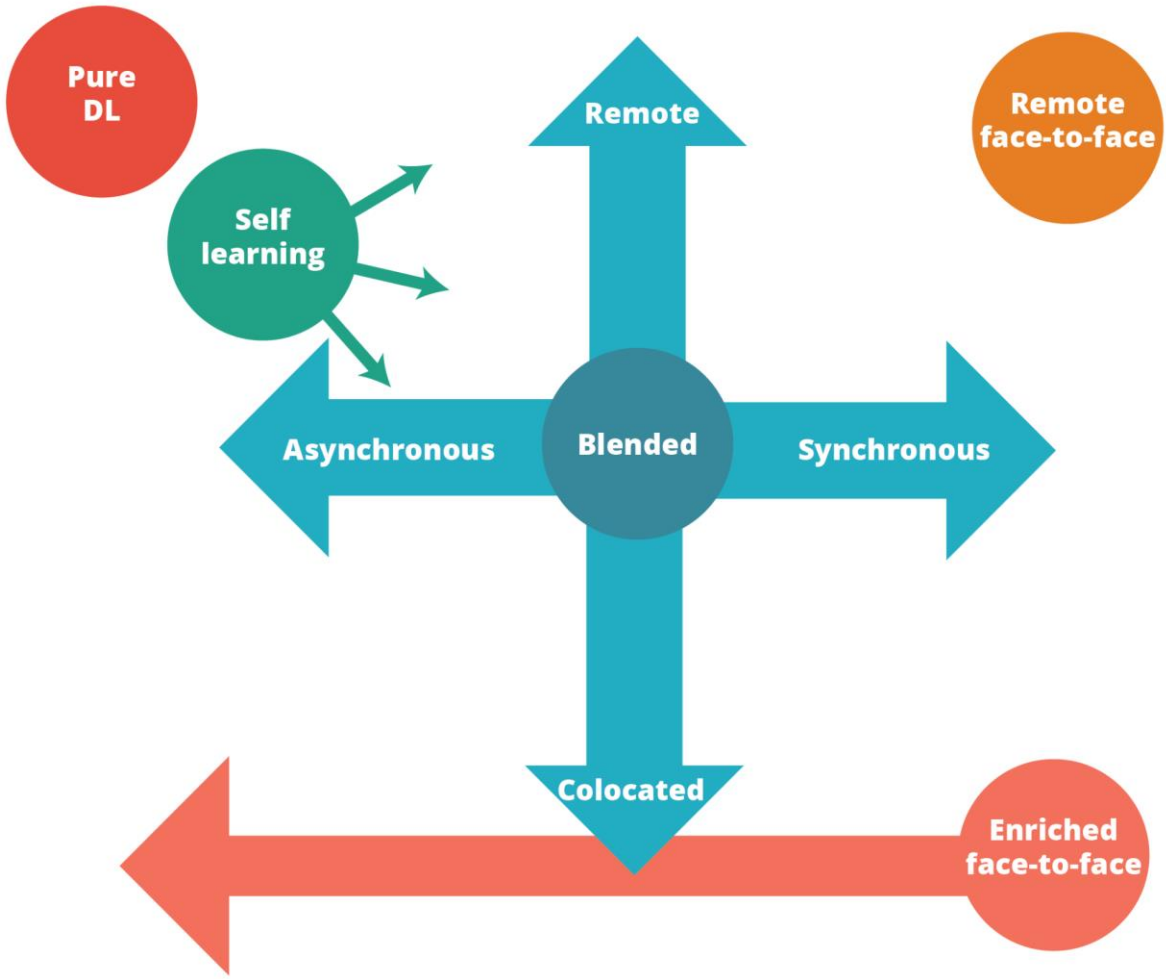


Figure 4-1. Remote vs. Co-located & Asynchronous vs. Synchronous

Before developing training content, it is essential to decide what type of training method to apply in order to implement the appropriate learning structure.

Producing effective ADL instruction requires an understanding of the processes by which students learn and interact with technology. The basic principles of pedagogy used for conventional courses also apply to ADL courses, but from the pedagogical point of view, the development of ADL courses must take into account the following considerations:

- The learning process happens at a distance and regularly without the physical presence of the teacher. The ADL courses and their technical environment (Learning Management System) must include all the necessary self-educational learning material needed for effective understanding of the content in order to achieve the learning objectives (LOs).
- The interactive communication between the different participants in the learning process will also happen virtually and without physical contact. The instructor should periodically check the students' comprehension and provide feedback.
- .If the ADL course is web-based, the interaction with technology can be an obstacle for both the learners and the teachers.

The target group for developing military ADL courses is the adult learner. Therefore, six principles have to be taken into consideration

- they know the reason for learning or doing something;
- learning is experiential (including error);
- they fully have control over their learning and are responsible for their decisions on education (timing, planning, evaluation, etc.);
- the subject matter has immediate relevance to their work and/or personal lives;
- the learning is http://en.wikipedia.org/wiki/Problem problem-based rather than content-oriented; and
- the process is positive and encouraging. Adults respond better to internal versus external motivators.

Adult learning with technology involves a cycle of **conceptualization** (students given information); **construction** (students perform tasks); and **dialogue** (students given feedback). ADL modules must contain distinct or combined parts that let the students perform these three actions.

- At the **conceptualization** stage, students are exposed to other people's ideas or concepts. For example, reading lecture notes or watching images or videos online.
- At the **construction** stage, students apply these new concepts in the performance of meaningful tasks. For example, performing a task such as answering a quiz or writing a journal online.
- At the **dialogue** stage, students receive feedback on their performance during the course. Without feedback, students cannot self-assess their learning progress. Feedback can be communicated in several ways, including in face-to-face discussions, online discussions, videoconferencing, and entirely online and automatic feedback.

Like with other conventional learning methods, the following guidelines are also applicable for ADL courses. The more iconic and interactive the ADL products, the higher the level of individual retention will reflect the following figure:

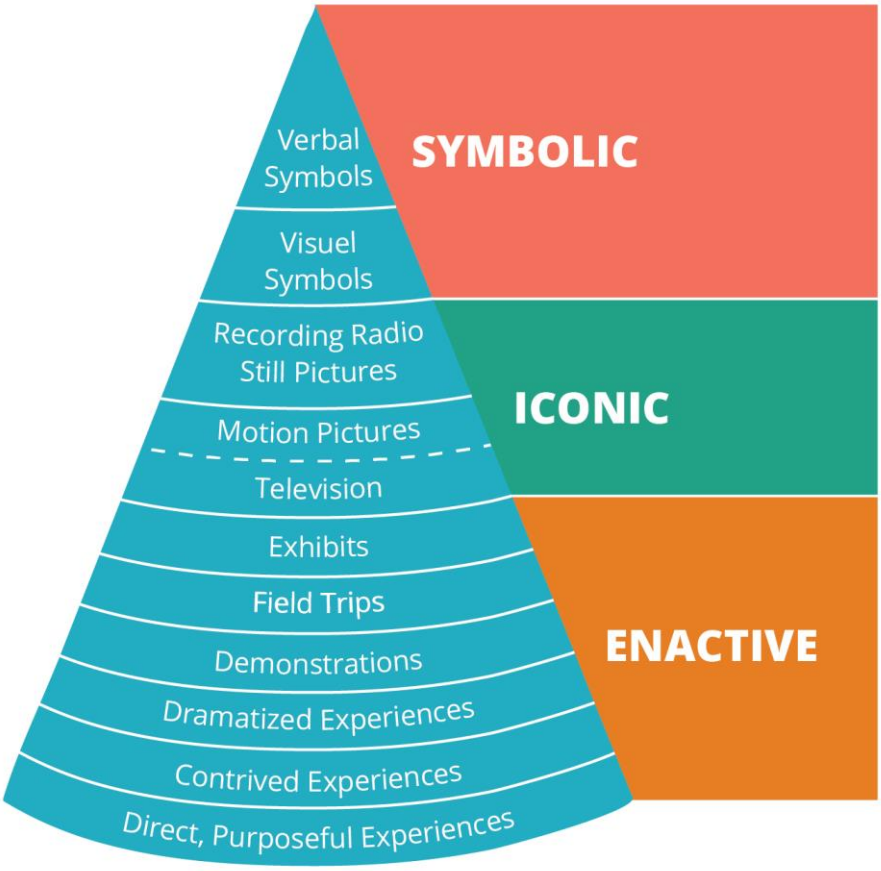


Figure 4-2. "1969 Audiovisual Methods in Teaching," 3rd Edition

Successful learning pedagogy requires an understanding of how students learn, memorize and reflect. Figure 4-2 depicts a notional pyramid of how learners best retain information. ADL modules ideally combine a range of presentation and active teaching methods to optimize learning and retention.

The development team must have the capacity to design, implement, and assess educational activities that meet the needs of all students. ADL development must incorporate learning pedagogy to include a deeper study into the incorporation of instructional strategies that consider real-time personalized learning content-to-learner adaptability.

In order to achieve the LOs, the development team has at its disposal a wide range of tools (synchronous and asynchronous) that are not necessarily designed for learning but are perfectly usable in a training/leaning program. It also is essential that the development team understands and masters the specific pedagogical added-values of all the technical resources (chat, forum,

wiki, blog, vlog, email, simulation activities, virtual classroom, video-conference, survey, podcasting, whiteboard, etc.) in order to integrate them correctly in the learning process. In this regard, the development team must weigh the technical maturity of the target group of learners to assure that anything used or developed for learners is intuitive, navigable, and accessible to the learners.

4.2.2 Actions to be done before starting ADL development

4.2.2.1 Define the Enabling/Learning Objectives (ELOs)

ELOs identify a segment of instruction that constitutes a major step toward achieving the Performance Objective (PO). ELOs define what the individual will learn, and a well-written ELO provides the basis for student assessment. ELOs also guide the sequencing of instruction and other decisions concerning an instructional strategy. The knowledge, skills, and attitude (KSA) elements, which support tasks, are categorized into specific learning domains and structured to reflect different levels of learning required during a course.

To make ELOs precise, the following pattern has proven effective in all areas of training and education:

- **Conditions.** Description of the conditions under which a performance is to be demonstrated.
- **Performance.** Precise, operationalized description of the performance to be demonstrated.
- **Standard.** Description of the values and indicators required for mastering the objective.

The key element of the ELO is *performance*, which is usually stated as an activity with a verb. The conditions and standards contain additional information to correctly teach or train and reliably test mastery of the ELO.

Example 1 (higher-level objective):

- **Conditions:** Given any indicators of the installation of an Improvised Explosive Device (IED) (the range representing the most common threats in current operational theaters).
- **Performance:** React to a given IED threat in line with NATO standard procedure.
- **Standard:** First measures must be 100% correct, according to regulations XY.

The ELO itself does not always describe exactly how it will be covered with an ADL module. In the above example, “react” in the real world may mean to “move away” from a threat. With the ADL module this may translate into “choosing” a text-option or “move away” from various other alternatives in a virtual environment.

There are usually several levels of ELOs. Top-level learning objectives describe an overall performance in a more general way. To ensure precision, higher-level learning objectives need

to be broken down into sub-objectives, and further down to those ELOs that represent entry-level skills. This is what is often referred to in instructional design as the learning hierarchy. This hierarchy of LOs will correspond with the internal structure of the course and its subdivision into chapters and modules. The above LO might be broken down further:

- Identifying signs of IED installations in the right places.
- Identifying the typical indicators for IED installations.
- Reacting correctly to an identified IED threat.

Example 2 (sub-objective):

- **Conditions:** Given any indicators of the installation of an IED (the range representing the ten most common threats in current operational theaters), as well as normal electrical/mechanical installations, and without looking up information or referring to notes.
- **Performance:** Identify indicators of the installation of an IED.
- **Standard:** Typical and reliable IED indicators: 90%. Possible (but unreliable) IED indicators: 80%.

The conditions stated in an ELO may significantly affect the amount of effort put into training it. In the above example, the conditions indicate that the module needs to cover the ten most common threats and not just one or two. In addition, normal electrical/mechanical installations also are to be treated as content. Further, the conditions state that no additional reference information may be used, which calls for “learning by heart” (i.e., instinct or gut feeling) involving regular rehearsals.

The standard to fulfill a specific ELO is of great importance when it comes to self-assessment and/or testing. In the above example, learners are expected to identify typical and reliable indicators of IEDs in 90% of cases, the percentage for possible but unreliable indicators being a bit lower. To correctly test the above objective, a test would in fact require numerous items (e.g., 10 examples of reliable indicators of which 9 must be identified, and 10 examples of possible indicators of which 8 must be identified, plus multiple instances showing no threat at all).

4.2.2.2 Educational assessment items

The main goal of an educational or learner assessment is to measure how, at the end of the learning module or at the end of the course, the learner masters the desired performance (i.e., knowledge, skills, attitudes, and beliefs) set by the ELOs. It is thus crucial that the assessments are thought out, planned, and designed in direct alignment with the hierarchy of ELOs. Each ELO and each learning sub-objective will be covered by at least one or multiple assessment items.

Educational assessment is often divided into formative assessment and summative assessment.

Formative assessment or *diagnostic testing* is a range of formal and informal assessment procedures employed throughout the learning process, principally to improve the students' attainment of the KSAs outlined in the ELO. It typically involves qualitative feedback rather than quantitative feedback (scores).

Formative assessment items are learner-oriented and serve four principal purposes in an ADL course:

1. Provide feedback on course participants' level of objective mastery.
2. Direct attention/focus on core aspects of course.
3. Motivate course participants' interaction with course material.
4. Promote instructors' accountability for student learning.

Summative assessment is an evaluation of the student's learning by comparing it with some standard or benchmark. The summative assessment items are exclusively learning-oriented, and they are generally carried out at the end of a learning module and at the end of the course. They exclusively serve to measure the achievement of the competencies specified in the ELOs. Summative assessment items are evaluative and are typically used to assign the student's course grade.

A learning module (or a set of learning modules) usually finishes with a final summative test that serves to prove mastery for the records. For ADL courses, such tests are usually taken online in a proctored environment, to fulfill the legal requirements of a test. These requirements may become important if, for instance, an accident that occurs after training is attributed to lack of training.

4.2.2.3 Kirkpatrick-Phillips Training Evaluation Model

In order to be able to improve all aspects of the course (content, technical environment, interactivity, pedagogical aspects, coaching, etc.), it is absolutely necessary to include evaluations. The key purpose is to include feedback for future revisions to improve training.

The following levels of the Kirkpatrick-Phillips Training evaluation model have proven helpful:

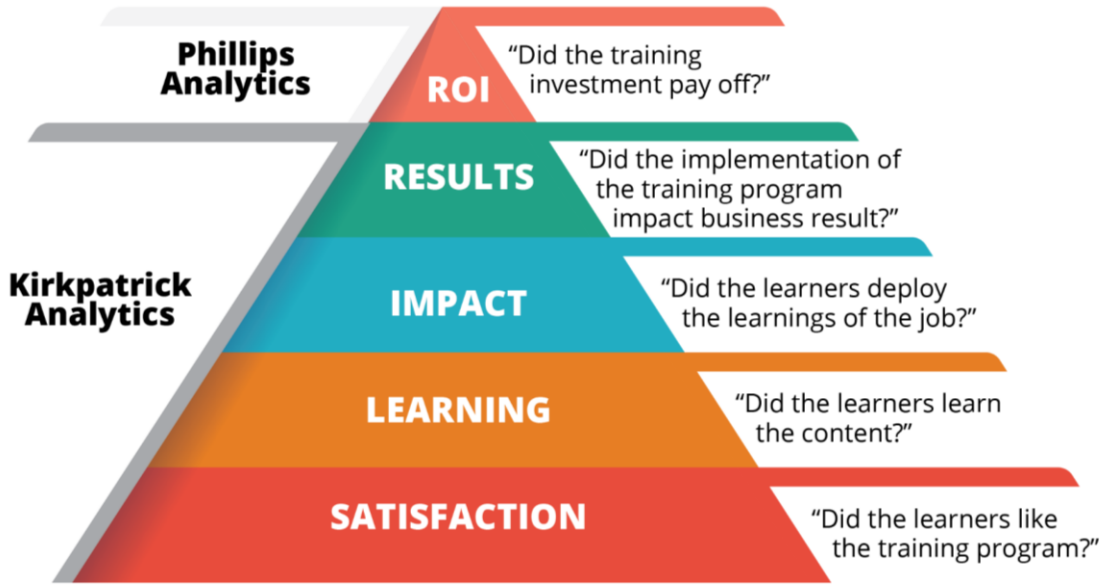


Figure 4-3. The Kirkpatrick-Phillips training evaluation model

For this chapter, we will focus on the initial three tiers (Satisfaction, Learning, and Impact) because the top two tiers are more closely associated with evaluation (the "E" in ADDIE) that is discussed in Chapter 8.

1. **Satisfaction**: The first level captures immediate feedback on the course by the trainees. This type of evaluation is often known to many as "smile-sheets" distributed in classrooms. With ADL, this first reaction can be evaluated using an online survey. It is important that this first feedback is provided immediately after taking the ADL course. With Learning Management Systems (LMSs), reminders may be automated. Access to the next course level can be made dependent upon completing a survey.
2. **Learning**: This second level evaluates whether learners have mastered the content. With ADL this usually happens in the form of a final, online test. Such assessments may take place at the end of the course or later, to evaluate long-term retention of what was learned.
3. **Impact**: This third level evaluates the impact of the training on the trainee's behavior. This level too can be accessed using online surveys that address trainees and/or supervisors sometime after the training is complete. The goal of this survey is to find out the impact that the training had on the performance of the trainees.

4.2.2.4 The storyboard from the pedagogical point of view

Like the blueprint for a house, ADL design should derive from a carefully crafted plan. This plan is called a *storyboard*.

A storyboard can be an outline or a script with actors, dialog, and directions. The dialogue can be either on-screen, spoken, or both. The actors are not people, but rather on-screen elements like text boxes, images, videos, and things the learner clicks. The following is an example of a simple storyboard:

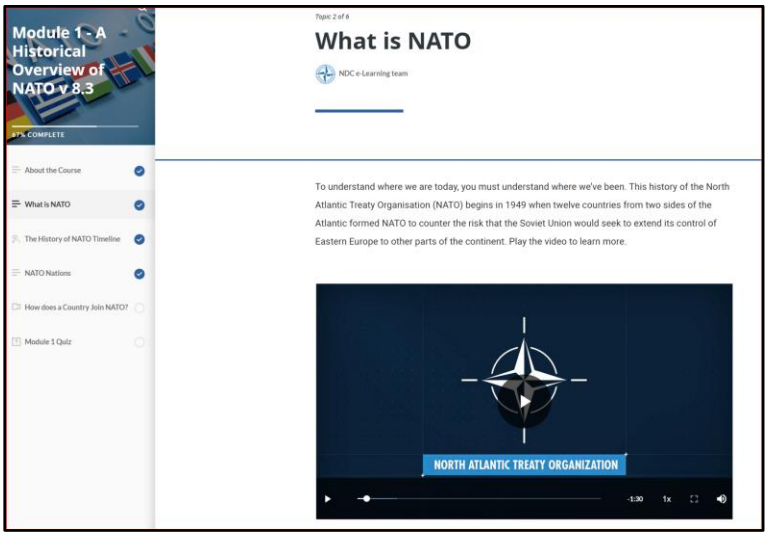


Figure 4-4. Sample storyboard [3]

The storyboard's primary value is that it forces the developer to have a reason and a consistent approach to everything he or she does. The storyboard is the plan for sequencing and splitting the content, applying a consistent style, establishing pedagogical rules, designing meaningful activities, providing feedback or instructions to the learner, etc.

From the pedagogical point of view, the storyboard consists of the description of sequential steps that the student must go through to successfully complete the learning activity and achieve the assigned LOs. The following should be taken into consideration while designing the scenario of an ADL course:

- Stay focused on the topic and provide a consistent thematic presentation of the learning course.
- Deliver information in short sequences that allow the student to set his or her own pace to absorb the material.
- Do not provide too many alternatives. A complicated tree-like course structure is not as good as a linear-type course. Branching may be an option to provide several examples to a specific topic or to explore a topic from various viewpoints. However, when the program contains branching options, it must make sure the learner is forced to explore all branches before proceeding to the next topic.
- Clearly label optional material. If optional material (examples or complementary information) is included in the module, it should be clearly labeled as such to ensure the learner knows that completion of the module does not depend on having studied the optional material. Additionally, material designated as "optional" must not be included as testable content within the design of the assessment instruments.
- Make the pieces of the learning material reasonably sized. Break down the learning material into small and logical instructional sequences. Such sequences (made up of

[3] ADL 037 Introduction to NATO

one or several screens) should not follow each other automatically; instead, they should be started by the user with the buttons “next,” “previous,” or “repeat.” This way, the user may repeat a small sequence only if something was not understood.

- Build a clear hierarchy structure. If the learning material is extensive, break it down into coherent thematic modules with clear and consistent story lines and content. It is not recommended to group more than one learning subject into a module. It is better to use more modules in the course than overload the modules with different subjects.
- Present only one topic per slide. Most likely, the student will remember none of the concurrent topics if a slide is overloaded with several related items. However, this does not mean that the entire learning material within a larger topic should be placed on only one slide; in most cases that would be difficult and messy.

4.2.3 Pedagogical educational tips

This section provides a series of pedagogical attention points to consider when designing the content outline and storyboard. It also gives useful tips on how to achieve an optimal design of a course.

4.2.3.1 Know your audience

The primary educational prerequisite for proficient instructional design is to “know your target audience.” That is, know their skills, needs, and motivations. As well, recognize that the learner is variable and accordingly, design instruction with multiple means of engagement, representation, action, and expression. For further information see UDL: The UDL Guidelines (cast.org).

4.2.3.2 Inform your audience about the course

The first section of a course should be an introduction that provides information about the course, such as general prerequisites for the course, LOs, overview of the course (structure, organization, timing, type and organization of tests), and reference to external material (books, websites, etc.). The information should also state how much time is needed to go through the material.

Important: Well-developed ADL modules usually have a menu that is relatively self-explanatory. Avoid extensive descriptions of the content and structure. If a course design requires a lot of explanation, then it is probably a poorly designed course.

4.2.3.3 Didactical reduction

Didactics is the science of teaching. Didactical reduction is the process in which content/text is reduced in its complexity in order to reach optimal comprehension for the target audience. Didactical reduction is a core tenet of effective instructional design/development. Didactical reduction is achieved by

- removing all non-essential information;
- simplifying the terminology, wherever possible;

- transforming differentiated statements into general statements;
- using pictures and graphics to illustrate complex topics;
- using simple examples to explain difficult theories; and
- KISS (Keep it short and simple).

4.2.3.4 Small learning units

A lesson (learning module) should cover a minimum of 15 minutes and no more than 30 minutes of learning. If the module is longer, it should be divided into two or more lessons/modules. This is often referred to as “chunking.”

4.2.3.5 Short text chunks

Avoid pages that are densely packed with text. Break complex text into segments that are separated by white space and headings. Good practices are using headings, subheadings, paragraphs, lists, and tables to structure the text and disperse long texts over several pages. The following example shows use of white space, short headings, and a callout to structure text.

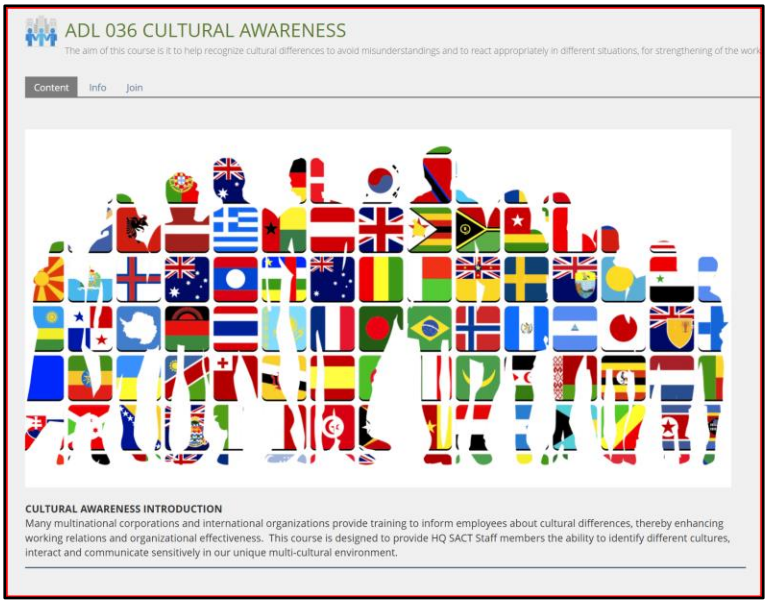


Figure 4-5. Sample use of white space [4]

4.2.3.6 A picture is worth a thousand words

Use media such as pictures, graphics, video, and animation to illustrate, clarify, visualize, and simplify complex connections and information. In the following example, pictures are used instead of text to illustrate and inform the student.

[4] ADL 036 cultural awareness

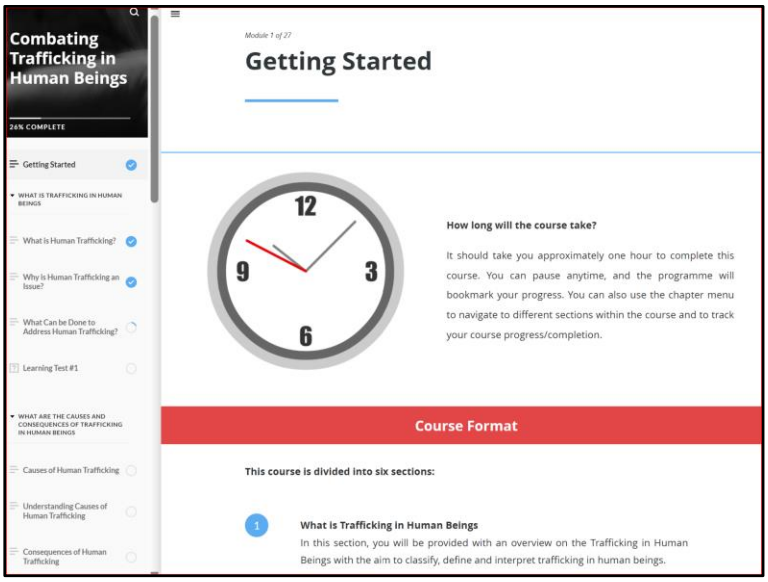


Figure 4-6. Sample use of pictures to tell a story [5]

[5] ADL 009 Combatting Trafficking in Human Beings

4.2.3.7 Get your students motivated: The ARCS model

The ARCS model, developed by John M. Keller, is a problem-solving approach to designing the motivational aspects of courses (not only ADL courses) to stimulate and sustain students' motivation to learn. The ARCS model[6] is composed of four factors:

Attention

The first and single most important aspect of the ARCS model is gaining and keeping the learner's attention. Strategies for attention include sensory stimuli, inquiry arousal (thought-provoking questions), and variability (variance in exercises and use of media).

Relevance

Attention and motivation will not be maintained unless the learner believes the training is relevant. The training program should answer the critical question, "What's in it for me?" Clearly state the course's benefits. This applies not only to the whole program but also to specific content. Example: "Correctly charging the radio battery is important. With this particular radio, a low battery will cause the radio to switch off with no warning. It will need at least ten minutes of charging before it can be switched on again!"

Confidence

The confidence aspect of the ARCS model is required so that students put effort into the program. If they think they are incapable of achieving the objectives or that it will take too much time or effort, their motivation will decrease. In technology-based training programs, students should be given estimates of the time needed to complete lessons and/or a measure of their progress throughout the program.

Satisfaction

Finally, learners must obtain some form of satisfaction or reward from the learning experience. This can be in the form of entertainment or a sense of achievement. A self-assessment game, for example, might end with an animation sequence acknowledging the player's high score. A passing grade on a post-test might be rewarded with a completion certificate. Other forms of external rewards would include praise from a supervisor, a raise, or a promotion. Ultimately, the best way for learners to achieve satisfaction is for them to discover that their new skills can be immediately useful and beneficial in their jobs.

6

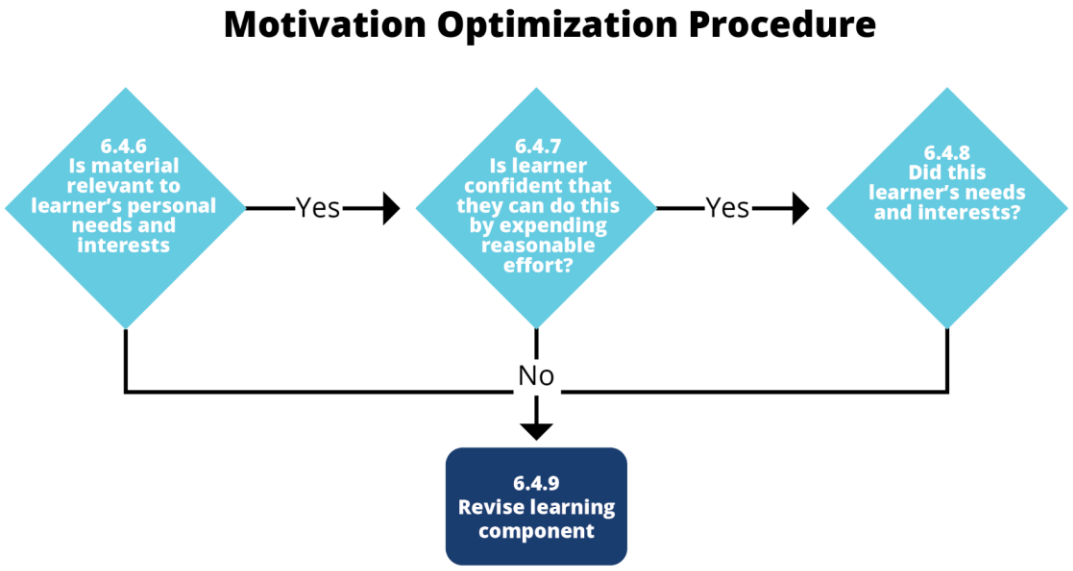


Figure 4-7. Motivation model

4.2.3.8 Innovation and creativity

During the development of the ADL course, the project team must constantly show creativity and innovation (think outside the box) not only on the choice of the technical solution to be implemented but also on the scenario and content level. The aim is not to artificially and unnecessarily make the course more complex, but to develop an engaging one that will offer learners varied and attractive content, approaches, and interfaces.

4.2.3.9 Activity and interactivity

The ADL course must motivate learners to become (and remain) active by stimulating the interactivity between

- the learner and the content.
- the learner and the teacher.
- the learners themselves.
- the learner and their peers.

4.2.3.10 Learning and positive emotions

The design team must ensure that the course content regularly creates positive feelings (joy, surprise, amazement, etc.). Feelings often dictate our daily behaviors, choices, and perceptions. Positive feelings make communication more effective, and they confer high-level impact to delivered messages. Positive emotions play a key function in the learning process by improving

- the understanding and retention of the content; and
- the motivation, attention, and commitment of the learner.

The use of technology is not the best way to create positive feelings and is, for a non-specialist, often a source of frustration when poorly designed. In the conception of the scenario, content, and user interface, the design team must be aware of the negative effect of potential negative feelings (frustration, monotony, annoyance), and must try to avoid them.

4.2.3.11 Storytelling

One of the best ways to learn is through storytelling. This principle is also perfectly applicable for e-Learning. Adult learners must see the relevance of something in order to feel persuaded to learn about it. Explaining concepts in the context of a story that learners can relate to is crucial to the learning process. By helping learners integrate knowledge into their mental models in meaningful ways, the realistic context of a story makes information easier to remember. Cleverly crafted stories also stimulate an emotional response to training content, such as a desire to help, curiosity about how something works, or a drive to achieve. Thus, the story helps persuade learners to engage in the training, and ultimately perform the desired behaviors.

4.2.3.12 Tracking of the activity of the learners

To evaluate the content's adequacy to meet the learners' needs, it is helpful to know the amount of time they have spent on the different LOs. The LMS captures the access data, tracks each student's learning activity, and stores the initial and final timestamp of each LO accessed. Using LMS parameters and filters, the results can be viewed and analyzed by the instructor. For example, the instructor can know what specific material was used most often by students, what kind of media they prefer, what time and day of the week students prefer, and even if the scores and grades reflect the amount of time the students accessed the content. Using the data captured by the LMS, the instructor will be able to reflect on a learner's behavior and performance, and then make some inferences about the content quality. If you are tracking learning events outside of a browser that has a connection to an LMS, you may want to consider using the ADL Experience API (xAPI) specification. See chapter 9 dfor more details.

4.2.3.13 Distance learning and coaching

While taking an ADL course, the learner can have the sensation of being alone with the content, the computer, and the technology. To counter this isolation, and to ensure the motivation and the commitment of the learner, a personalized coach may be considered. The aim of this coaching is to

- guide, help and stimulate the learner; and
- follow and help manage the learner's progression through the course.

In this context, the traditional role of the teacher evolves to the role of guide, facilitator, mentor and/or coach. The instructional team may be able to provide coaching opportunities if resources are available.

The workload generated by this coaching is one of the major stakes of managing ADL. It is very important to choose the adequate coaching method (reactive or proactive) and the optimal combination of communication and collaboration tools. This choice will be based on the LOs, the profile and the technical maturity of the learners, the profile and the technical maturity of the

teachers, the number of learners, the duration of the course, and the limitations of the learning environment (especially the availability of material and human resources).

4.3 Instructional Design

4.3.1 Overview

This section provides guidance on the correct application of education and training strategies related to the instructional systems design (ISD) processes to be followed when developing ADL courses. The ISD processes are broadly similar to those used for the design of traditional classroom-based learning. Most importantly, the ISD processes for ADL should be based on the sound pedagogical practices described in the previous chapter. This information will benefit both policy makers and ISDs, and it will assist in producing a credible and interactive ADL course.

The ISD process consists of five stages:

1. Communication of objectives
2. Task contents
3. Engaging material
4. Interface design
5. Layout

4.3.1.1 Communication of objectives

This section describes the elements of effective ISD and how to identify engaging materials. Firstly, when thinking about the project in the design phase (i.e., developing the course storyboard), consider the four As of ISD:

1) Attraction

- You have approximately 0.1 second to attract a potential learner; therefore, you must create an attractive design to capture the attention of the learner to motivate him or her to continue using your ADL course.
- The course should be easy to use and flow in a cohesive manner.
- Three five-minute modules with a single learning point may be more effective than one 15-minute module that covers three similar points.

2) Attention

- Each module should focus on a single learning point. Consideration should be given to understanding the processes rather than just simple knowledge transfer.
- The information within the course should be concise and accurate, and it should be exactly what the user requires.
- Include hyperlinks to additional information such as books, Internet sites, and journals that assist in directing information and reinforcing theory.

3) Availability

- The Internet provides easy access to courses and information that change rapidly. What is relevant today may not be tomorrow. Focus on short-term memory rather than long-term memory by delivering information in a way that can be easily and instantaneously transferred by the user to fulfill the needs of the current task. Just-in-time and workflow models help satisfy these needs.
- Different versions of courses should be easily identified outside of the learning environment (i.e., on the LMS).
- The content should always be easy to find: not just the module in the system or course in the LMS, but also the data within the module.

4) Application

- The single most important factor is the motivation of the learner to complete the course. Excite the users during the intervention so they will want to use what the module contains. Each module should encourage learners to go and use the information they have gained, or process what they have learned, immediately.
- Provide assessment within the course at the right time and as a separate intervention. This is best included when the user has had time to reflect, explore the theory, or actually use what they have learned in a task on which they are working. Designers can assist the learners by providing checklists or job aids that they can follow to complete a task.
- Developers need to clarify concepts and transform abstract information into material that is relevant and applicable. Using questions to build on learners' experiences, and leading them toward the learning point, is a means to increase relevance.

4.3.1.2 Task contents

If the task contents within a course do not motivate the learners to engage, they will not see any relevance for doing the training. It is best to present the learning material in various ways. (e.g., Using text descriptions, diagrams, still images, rich media, interactive graphical media, 3D models, diagrams with pop-up explanations, etc.) Having a variety of relevant media for the students is essential. The learners also need to experiment with the material to ensure they fully understand the concepts. This can be done through test questions, case studies, simulations, games and other tasks. Tutorials are required to provide guidance in response to the students' practical work (e.g., automated feedback, checklists, or means by which learners can check their own work.)

4.3.1.3 Engaging materials

Consider why film and TV can be engaging, how good instructors can make even the most mundane subjects interesting, and why you click on certain websites and avoid others. Then think about those ADL programs that you have enjoyed and consider what made the program enjoyable. What did these programs include to hold and maintain your attention? Did they use audio, rich media, etc.?

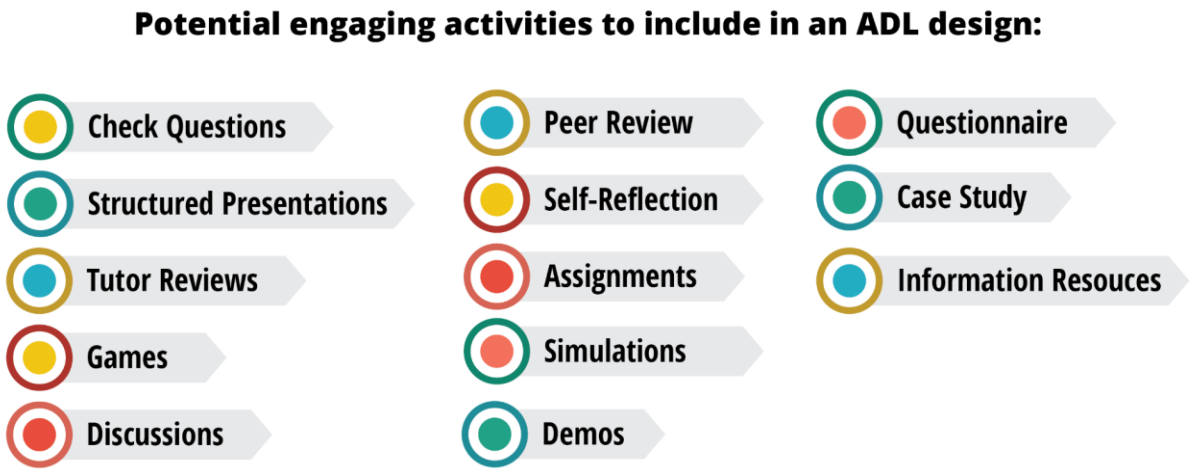


Figure 4-8: potential engaging activiteits

It is important to note that while sound and motion can attract attention and help engage the learners, evidence indicates that relevant material and interactivity are key to reinforcing and maintaining engagement. It is best to use various media and meaningful interactivity when the learning content demands it (e.g., to explain things that cannot be adequately conveyed using text and graphics). Concentration of meaningful interactivity is one of the reasons why self-study materials can be so efficient in reducing learning times; it challenges the learners and heightens their attention levels.

4.3.1.4 Interface design

Some basic guidelines should be followed to ensure courseware does not become distracting to the user. If the interface design is bad, learners can quickly lose interest and motivation. Amending the layout, color scheme, text, graphics, and audio could significantly increase the likelihood of someone reading and remembering the well thought-out content.

In general, content should account for about 70% of the ADL screen, leaving about 30% for the total interface elements, as shown in this example:

Figure 4-9. Sample interface design

4.3.1.5 Layout (Primary Optical Area)

A moving object on a screen will always become a master anchor point for the eye. If the moving object is at the bottom of the page, it becomes difficult for readers to move their eyes back up to the top of the page. Therefore, the best practice is to not have any moving objects on the screen once the text is being displayed. A video may look good and display the developer's creativity, but it could be a distraction for the student.

In the following example, the red highlight moves in a clockwise direction to show the area of emphasis as the narration plays. There is no text to distract the student (except for object labels).

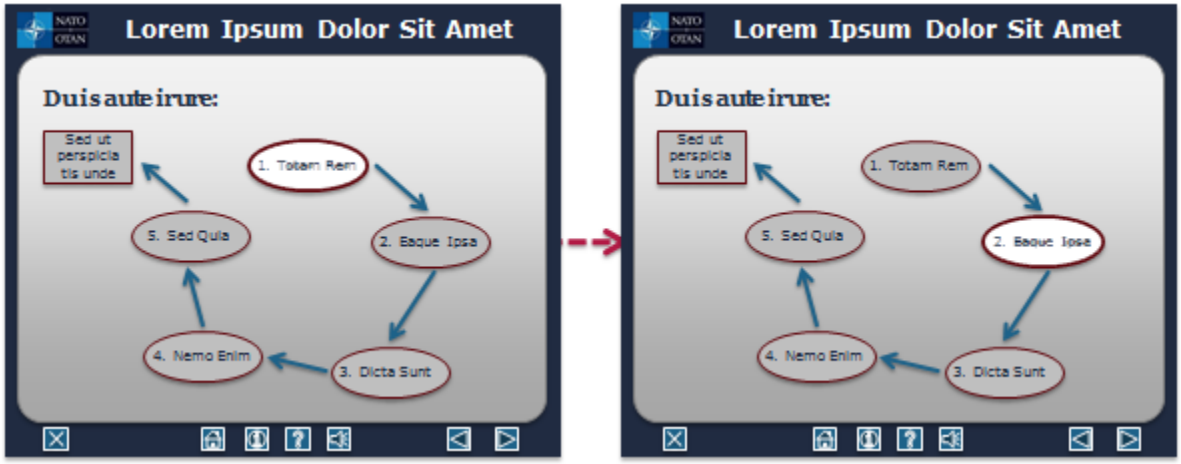


Figure 4-10. Sample of proper layout concept

The Primary Optical Area (POA) is the point where the eye starts scanning. The POA should be where the information begins, so the eye does not go back after starting at the POA. Moving objects or engaging images often become the Master Anchor and override the POA; therefore, pay close attention when animation or pictures are introduced and played.

4.3.1.6 Text layout

It is important to choose the correct font type and size and to remain consistent throughout. Verdana is the most popular font for screen reading, followed by Arial. Both are sans serif fonts. Body text should always be in sans serif, while headings should use a font of high contrast to a serif font.

When using text for describing events (not headings), it is best to use a minimum of 12-point font with 14-point spacing; this is what our brains are used to reading. Double line spacing can become confusing. And as a rule of thumb, only four sentences in a block can be read before the eye becomes tired. Use text bullets to help separate blocks.

4.3.1.7 Color schemes

The organization which will use the ADL may express a desired color scheme, but great care and attention should be placed on this design element to consider the needs of those personnel who have specific learning difficulties. Eye strain and clarity of words can all be affected by the choice of color schemes. Some organizations allow the end-user to change the screen background color for themselves. This is easy to do and something you may want to consider.

- Similar colors can contrast well, but background patterns can make it difficult to read the text. Good practice includes either yellow on blue, or pastel colored backgrounds with black text. Although gradients can aid drawing the eye down the page, avoid introducing a Moiré Effect whereby the image will blur and reduce clarity.

- Do not use too many different colors, particularly for text. Aim for no more than four colors. Once a set of colors has been chosen, stay consistent throughout. (Note: Colorblind individuals may not be able to distinguish between certain colors. Make sure that colors are not the only method used to convey important information.)

Figure 4-11 - Colors have associations

- Remember, wrong color = wrong message. Associations can build up in a program (e.g., one color text for correct feedback and another for incorrect). It is also important to note

that color schemes are merely one part of the design considerations. (i.e., Do not rely on color schemes to try to create engagement). Often, a change in font, using words like “STOP” or “CAUTION,” or using engaging graphics can be just as (or even more) effective than the color scheme.

- A house style metaphor can be the easiest way to remain consistent throughout. By establishing the house style at the inception of the design phase, developers can ensure the correct color scheme, logo, text style, and layout are set for the entire the learning content.

4.3.1.8 Text Emphasis

There are various ways to emphasize text. Developers may decide to enlarge the text deemed important, **bold** the text, or use a different **color**. It is important that any text superimposed on a graphic is readable. The use of a semi-transparent bar (shown below) is one means to maximize legibility.

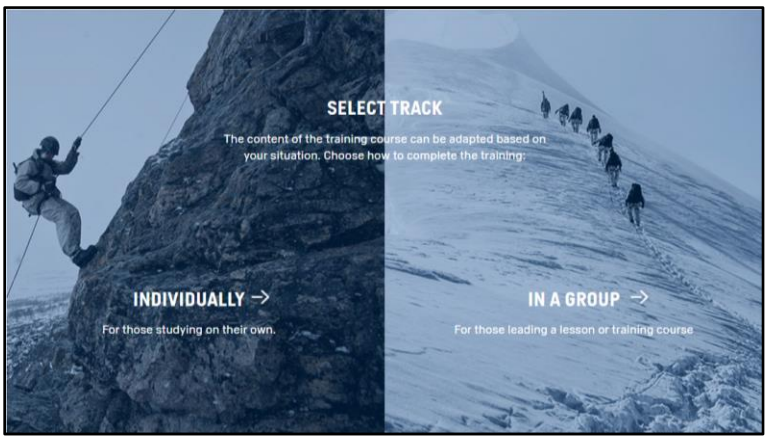


Figure 4-12. Use of a semi-transparent bar to maximize legibility [7]

4.3.1.9 Text and Graphics

The use of text with graphics is an effective way of reinforcing information for the students. By putting text either close to the graphic, or better still, as part of the graphic to which it refers, students are nearly assured not just to look at the picture.

4.3.1.10 Narration

Words presented by audio are better than on-screen text, especially when they are describing an on-screen graphic, because the input is being spread over two channels. However, some people don’t like reading the text while listening to the audio. Providing learners with choice is also an important motivator therefore, the ability to turn off text or audio should always be

[7] Swedish Armed Forces, Cold weather

provided as an option. Probably the best way to use audio and text is to introduce key bullets of text at the appropriate points in the audio narrative. This will help to reinforce the learning points without overloading the learner.

There are two mistakes that negatively affect acceptance and comprehension of content and must be avoided:

1. Narration of a long text that is displayed in parallel on the screen. Learners can and want to read text themselves. Displaying parts of the narrated text at the appropriate moment is more effective. They may be single words or short statements.
2. Having narration and screen text that differ in words or word order. Having people read any text while a different text is narrated negatively affects comprehension and retention. Whatever is narrated must be identical to the screen text, even with short statements or simple key words. At the same time, avoid reading all content displayed word-for-word.

4.3.1.11 Evidence based practices

When designing e-Learning courses, it is important to incorporate both best practices from industry and evidence-based practice from designed research experiments. The following principles for e-Learning are the result of research presented by Dr. Richard Mayer and Dr. Ruth Clark[8]:

1. **Multimedia Principle:** Student retention is improved through words and graphics rather than through words alone.
2. **Contiguity Principle:** Students learn better when corresponding words and pictures are presented near each other rather than far from each other on the page or screen.
3. **Modality Principle:** Students learn better from animation and narration than from animation and on-screen text.
4. **Redundancy Principle:** Students learn better when graphics are explained with words in audio or text, but not both.
5. **Coherence Principle:** Students learn better when extraneous words, pictures, and sounds are excluded rather than included.
6. **Personalization Principle:** Students learn better when a conversational style of writing is used rather than a formal style.
7. **Segmenting Principle:** Students learn better when information is structured in bite size chunks.

Using the above evidence-based practices when designing e-Learning programs and storyboards will lead to better student retention and understanding.

8

4.4 Summary

Below are some summary points to remember when designing courseware:

1. Keep it simple – text, sound, motion and color may be used to support the instruction. However, if an element does not support the information being relayed, then remove it.
2. Provide a harmonious and consistent variety of text, sound, motion and color that holds the attention of the learner throughout the entire course.
3. If using simulations or problem-solving interactions, replicate the real-work environment as much as possible.
4. Graphics and pictures should support instruction and reinforce a message, not just provide superfluous fillers.
5. Exam elements should accurately question the learning objectives and key learning points to be achieved.

5 Development

5.1 Scope

This chapter provides guidance and practical considerations for developing ADL learning content in a standardized manner. It addresses content creation and sharing, while also highlighting the standards that support content development, packaging, and delivery. To enable sharing and interoperability, ADL courses should be developed using a course authoring tool that produces standardized content packages.

5.2 Introduction

There are many ways to produce digital content. However, requirements influence the way digital content is designed and used. Some of these requirements include:

- Sharing digital learning content such as videos, training packages and 3D models
- Searching for digital learning content internally, and across vendors and nations
- Setting and managing course and content learning objectives
- Tracking learner progress during consumption of learning content
- Storing learner data and course progress
- Adapting learning content to learner's previous achievements and learner goals (i.e., learner profile).
- Accessing learning content through a variety of platforms.
- Engaging in a virtual environment or simulation.
- Generating completion evidence such as competencies, certification and badges
- Storing trainee/trainer information such as name, cohort and course
- Generating and incorporating course/Content Metadata.
- Communicating and collaborating with trainers and trainees.

5.3 Authoring tools

An on-premise authoring tool is installed and runs on local computers or internal company servers. This means the organization controls the data, security, and updates, but it usually requires manual maintenance, higher upfront costs, and limited remote access. This can be done using authoring tools (such as Adobe Captivate, Camtasia, Articulate, or similar), where content is created and then wrapped as a course package in one of the supported standards, or

built directly within a Learning Management System using a course builder that supports these standards or its own LMS-compatible format.

A cloud-based authoring tool runs online and is accessed through a web browser. It allows easy collaboration, automatic updates, and access from anywhere, with lower upfront costs, but it depends on internet connectivity and external hosting for data and security. Similarly, content can be created in these online tools and packaged according to standard formats, or developed directly within a Learning Management System that supports course building and standard-based or native formats.

5.4 STANAG 2591

STANAG 2591 is the current NATO standard for Advanced Distributed Learning. The standard lists xAPI, CMI5, SCORM and LTI T&E industry technical standards.

The STANAG 2591 has undergone several developments. In NATO STANAG 2591 “Advanced Distributed Learning” (08 May 2013) it is stated: Participating nations agree to adopt SCORM®.[9] In the revised STANAG, Nations were advised to migrate toward cmi5, xAPI as the standard to conform with the following:

- Learning Management Systems (LMSs)
- Content (both packaged and unpackaged)

In a further development of STANAG 2591, LTI (Learning Tools Interoperability) has been included to allow sharing of learning content between vendor and nation Learner Management Systems.

5.4.1 NATO T&E STANAG 2591 Standards Governance

5.3.1.1 NATO Learning Technology Interoperability Group (NLTIG)

The NATO Learning Technology Interoperability Group is the authority on the NATO STANAG 2591. The STANAG 2591 work strand is one of the core outputs of the NLTIG. NLTIG meets twice per year during which time standards can be agreed upon and put forward for inclusion in STANAG 2591.

5.3.1.2 NATO Coalition Warrior Interoperability Exercise (CWIX)

The NATO Coalition Warrior Interoperability Exercise (CWIX) provides a forum to test Training & Education (T&E) technical standards within a NATO operational context. Successful testing at CWIX may result in recommendations for new or updated standards to be incorporated into STANAG 2591. T&E technical standards were first introduced at CWIX in 2025, with NATO JADL, Finland, and the United Kingdom as the founding contributors. Since then, T&E has become an established and recurring work strand within CWIX.

[9] NSO NSDD - Link to the STANAG 2591

5.4.2 Standards Bodies

Several well- known standards organizations contribute to the development and endorsement of technical learning standards. Within the Training and Education domain, the most prominent are IEEE and 1EdTech. Both organizations have developed standards that are referenced in STANAG 2591.

5.3.2.1 IEEE

The IEEE Learning Technology Standards Committee (LTSC) follows an open and transparent formal standards development process and fully supports the IEEE's sponsorship of the OpenStand Initiative. LTSC coordinates with other organizations, both formally and informally, that produce specifications and standards for learning technologies. LTSC welcomes new members who can volunteer their time and expertise to help understand and solve product interoperability issues caused by the rapid advancement of new learning technologies. Please contact the LTSC Secretary or a relevant Work Group Chair if you are interested in participating.

IEEE is well known for its work across several standards as well as its contribution to the Total Learning Architecture concept. This includes xAPI and CMI5 as featured on STANAG 2591. Other standards developed or under development by IEEE includes Metadata P2881.

5.3.2.2 1EdTech

1EdTech is a united community committed to achieving an open, trusted, and innovative education technology ecosystem that serves the lifelong needs of every learner. The organization gives a voice to all stakeholders working to improve educational opportunities and experiences for the greater good. Their mission is to unite the education community to build an integrated foundation of open standards that makes educational technology work better for everyone—reducing complexity, accelerating innovation, and expanding possibilities for learners worldwide. 1EdTech is well known for its work within the K12 space. 1EdTech is known for LTI as part of STANAG 2591. It is also known for Open Badges, Student Information System, CASE, Common Cartridge and UniformID (from W3C Decentralised Identifiers).

5.4.3 Sharable Content Object Reference Model (SCORM®)

SCORM is a set of technical standards for e-Learning software products. SCORM® tells programmers how to write their code so that it can function well with other e-Learning software. Specifically, SCORM® governs how online learning content and Learning Management Systems (LMSs) communicate with each other. SCORM® does not speak to instructional design or any other pedagogical concerns; it is purely a technical standard.

Be aware content stored on one LMS cannot be accessed by another LMS. The user would need an account on each LMS. SCORM does not address the transfer of data between LMSs.

SCORM® integrates a set of related technical standards, specifications, and guidelines designed to meet functional requirements for accessible, interoperable, durable, and reusable content and systems. SCORM® content can be delivered to learners via any SCORM®-compliant LMS using the same version of SCORM®. A brief explanation and example for each of the four functional requirements (also referred to as the “ilities”) are presented here:

Accessibility. The ability to locate and access instructional components from multiple locations and deliver them to other locations.
Example: A SCORM® course can be moved from one SCORM®-conformant system to another SCORM®-conformant system without complex reconfiguration/installation. There are different formats of SCORM-players to play a SCORM you need the correct version.

Interoperability. The ability to take instructional components developed in one system and use them in another system.
Example: Content packaged for delivery in one SCORM®-compliant LMS can be loaded into another SCORM®-conformant LMS for delivery to learners.

Durability. The ability to withstand technology evolution and/or changes without costly redesign, reconfiguration or recoding.
Example: Upgrading to a new version of an LMS will have no effect on the delivery of content to learners.

Reusability. The flexibility to incorporate instructional components in multiple applications and contexts.
Example: E-Learning content designed for one organization can be redeployed, repurposed, or referenced by other organizations that have similar learning needs.

For further information see Sharable Content Object Reference Model (SCORM®) | ADL Initiative (adlnet.gov)

5.4.4 Experience API (xAPI) Standard

xAPI is a data and interface standard that lets software applications capture and share (big) data on human performance, along with associated context information (i.e., “experience” data). Combined with learning analytics, xAPI promises to revolutionize the way education and training are conducted, managed, and measured. xAPI can be incorporated into nearly any (new or existing) learning technology, and it is agnostic about the type of learning content being delivered. xAPI is open-source and licensed under Apache License, Version 2.0.

“xAPI” stands for Experience Application Programming Interface. The ‘x’ stands for experience, because xAPI enables detailed recording and transfer of “learning experience” data, whether those data come from an e-learning experience, a simulation-based training experience, a tablet-based educational experience, or even an operational (on-the-job) experience.

In software, an Application Programming Interface (API) allows two or more applications to exchange data with (or “talk to”) one another. In the context of education and training

technologies, APIs can be used to share data about learners and learning activities. Hence, xAPI is a particular standard designed to enable the interoperable exchange of data about learners' behaviors and performance. In other words, it encodes someone's performance using a standard format, and it follows standardized transportation rules to move that data to a data store or between applications.

xAPI can be implemented in any digital environment, including mobile learning, simulations, virtual worlds, serious games, real-world activities, mobile and wearable devices, experiential learning, and more. It can be used to track and store data on any imaginable activity, such as:

- Reading an article or interacting with an eBook
- Watching a training video, stopping and starting it
- Training progress data from a simulation
- Performance in a mobile app
- Chatting with a mentor
- Physiological measures, such as heart-rate data
- Micro-interactions with e-learning content
- Team performance in a multi-player serious game
- Quiz scores and answer history by question
- Real-world performance in an operational context

For further information see [Experience API (xAPI) Standard | ADL Initiative (adlnet.gov)]

5.4.5 cmi5

cmi5 is an xAPI profile that provides a set of rules for how online courses are imported, launched, and tracked using a Learning Management System (LMS) and xAPI, which is a key piece missing from the xAPI data standard. cmi5 uses a simplified tracking model specifying only the most essential elements for interoperability across most learning instances, including score, status, and time. While cmi5 only explicitly defines the necessities, it's capable of recording and reporting on much more. To think of cmi5 another way using an analogy:

> "Imagine that xAPI is like the electrical service in your home, and cmi5 is like a wall socket. The wall socket is a simple "plug and play" standard for using electricity with consumer appliances (a very common "use case"). The additional rules imposed by the wall socket for connecting to the electric wiring make it much easier to use. You don't have to have special knowledge or hire an electrician – you just plug it in and it works (as long as the appliance and the wall socket follow those 'extra rules')."
>
> Bill McDonald, cmi5 Working Group Leader 4

The cmi5 specification was designed to bridge the divide between SCORM and xAPI by reproducing the functionality of SCORM while leveraging the technology benefits that xAPI supplies. The purpose was to replace SCORM as the de facto format for online courses and traditional computer-based training. For further information see [cmi5 Specification | ADL Initiative (adlnet.gov)]

5.4.6 Learning Tools Interoperability

When creating a course in a Learning Management System (LMS), it can be helpful to connect with external learning content or apps. This is possible using **Learning Tools Interoperability (LTI)**, a feature supported by many LMS platforms.

LTI allows you to:

- Sync student lists (course rosters)
- Add content from third-party providers
- Import grades back into your LMS

LTI simplifies the process of integrating high-quality, interactive, or specialized learning tools into your course — **without requiring custom development or complex technical setup**. It helps:

- **Course creators** save time by using ready-made tools and content
- **Learners** enjoy a smoother experience with single sign-on access and consistent navigation
- **Organizations** reduce costs and complexity by reusing trusted content across different platforms

LTI involves two parts:

- The **LTI Tool Consumer** – usually your LMS
- The **LTI Tool Provider** – the third-party app or content you want to connect

As a course creator using LTI, you usually just need to set up the LMS. Most LMSs already have the tool consumer features built in.To connect an LTI tool, you'll need some information from the tool provider, including:

- A **URL** for the specific tool or content (used for navigation)
- A **consumer key and shared secret** (used for secure login and authentication)

Both the LMS and the third-party provider usually offer instructions to help with this setup. The exact steps may vary depending on the provider, but the basic information above is commonly needed.

Many common LMS platforms can also act as an LTI tool provider. This is useful when creating an LTI tool to be consumed by a remote LMS or LTI tool consumer. To configure the LMS as an

LTI tool provider, a plugin or additional software is often required. By way of example, this is the case for both the ILIAS and Moodle LMS platforms.

Learning Tools Interoperability (LTI) is a standard of the IMS Global Learning Consortium. For further information see http://www.imsglobal.org/activity/learning-tools-interoperability.

6. Development of ADL – Methodology

This chapter focuses on the best procedure to develop ADL products. While the focus is on web-based training products, some of the key principles equally apply to any other instructional product.

6.1. Introduction

Producing ADL of any kind is a major project, involving several roles and responsibilities. This chapter provides step-by-step guidance on how to set up a production team and how to efficiently produce learning content that is in line with the training requirements.

6.2. Staffing for a project

6.2.1. Typical Roles

The setup of a project team differs widely between organizations and specific projects. How a team is set up depends heavily on the skills of its individuals. The minimum roles involved typically include the following:

- **Customer.** Asks for the project to be completed.
- **Subject Matter Expert (SME).** Provides background and content expertise.
- **Project Manager (PM).** Oversees the planning and progress of the project.
- **Instructional Systems Designer (ISD).** Responsible for the instructional design of the content according to established procedures.
- **Multimedia Developer (MD).** Responsible for creating all media according to the ISD's inputs.
- **Courseware Developer (CD).** Responsible for bringing together all elements in an authoring tool among others.
- **Learning Management System (LMS) Administrator.** Responsible for uploading courses to an LMS and making it accessible to students.

The following RASCI-matrix (Responsible, Accountable, Supported, Consulted, Informed) shows the role assignments of the different roles.

	Customer	**SME**	**ISD**	**MD**	**CD**	**LMS Admin**
Define Project Goals and Scope	R, A	C	S	I	I	I
Provide Content Expertise	I	R, A	S	I	I	I
Develop Instructional Design	C	S	R, A	I	I	I

Create Media Assets	I	C	S	R, A	I	I
Develop Course in Authoring Tool	I	I	C	S	R, A	I
Conduct Quality Assurance	C	S	R, A	S	S	I
Upload and Configure in LMS	I	I	C	I	S	R, A
Final Review and Sign Off	R, A	S	S	C	C	I
Monitor Course Post Launch	C	I	S	I	I	R, A

In smaller production units, and depending upon the tools used for development, some of the roles may be combined in one person.

6.2.1.1. Special role of the customer

The customer is the person or organization for whom a project is being produced. His or her inputs play a vital role in the design and completion of a successful project. This especially applies to any special expectations regarding the outcome.

6.3. Key role of the subject matter expert

The SME is the key person to provide all inputs required to produce content that is in line with and focused on the real-world tasks to be mastered according to established rules and operating procedures, and oriented towards what the learners will be expected to perform under real-life conditions.

6.3.1.1. How to identify a good SME

In order to best support any training project, an SME should be

- available to the project team for early, often extensive, project meetings and follow-up enquiries by e-mail or via other channels;
- available and ready to review major project steps from concepts to storyboard and final products;
- able to focus on the essentials according to a project, regardless of his or her vast knowledge and experience;
- able to identify the knowledge/skills for the successful completion of a performance goal;
- able to communicate effectively with ISDs and other project personnel, who likely have less knowledge in the SME's field of expertise; and
- committed to the scope of the project.

Choosing/tasking the best-suited SME is essential to successfully and efficiently completing any training project. Besides the attributes listed above, a good SME also combines solid knowledge of the content to be taught and experience with applying the knowledge in real-life situations.

Sometimes the best approach may be to have two SMEs: One covering the subject matter, and one covering the required real-life experience.

6.3.1.2. What most SMEs are not

Many SMEs are not trained and experienced writers or ISDs. Do not try to force such work upon them unless they are comfortable doing it. Inform the SMEs that they are not expected to produce ready-to-use text. This task belongs to the ISD.

6.3.1.3. How to get the most out of SMEs

SMEs fulfill project-related tasks as well as other duties. The following approaches can help establish successful long-term collaboration:

- Get the SME officially tasked to support the project, including assignment of work time.
- Clearly inform the SME about the target audience and the real-life performance to be supported by the training; also tell him or her what does *not* belong to the scope of the project.
- Inform the SME about the overall project plan and milestones as well as the timing of his/her critical contributions.
- Provide the SME with a summary of whatever analysis and concept work has already been carried out and signed off.
- Limit the workload on the SME by encouraging pragmatic approaches to provide inputs. Possible work methods include:
    - Have the SME mark up any existing material with comments, suggested deletions, updates, or additions.
    - Invite the SME for an interview and have him or her explain processes with pictures (or other media) while videotaping everything.
    - Provide the SME with a detailed questionnaire asking for specific answers and draft-inputs (e.g., single PowerPoint slides, commented manual pages, handwritten notes, etc.).
    - Do as much of the writing as possible, with the SME only having to review critical work steps and the final product.
- Finally, do not forget to officially thank the SME for his or her contribution and invite the SME to any project wrap-up activities.

6.4. Typical project phases and milestones

Successful project management relies on clear structure, collaboration, and timely decision-making. By following a step-by-step approach and involving stakeholders at the right moments, teams can avoid costly rework and ensure quality results. The following outlines the key principles and phases for effectively developing web-based training modules.

6.4.1. Basic principles for a successful project

The secret to successfully running any project is having step-by-step procedures which involve all stakeholders at the right time, and carefully making decisions before attempting any work. This will greatly reduce costly and time-consuming rework due to incorrect assumptions.

6.4.1.1. Basic rule about critical steps

Have the output of all critical intermediate steps signed-off before starting any work.

6.4.1.2. Overview of the work phases

There are many ways to produce content, from experimental prototyping to production according to strict workflows. The following approach covers the latter. It assumes that a careful analysis of the training problem has been completed which resulted in an array of well-defined learning objectives for one or more web-based training modules:

- Start: Kick-off meeting
- Phase 1: Develop the basic concept and structure
- Phase 2: Develop the design and content outline
- Phase 3: Develop storyboards
- Phase 4: Produce media elements
- Phase 5: Conduct the programming
- Phase 6: Test the course on the target LMS
- End: Conduct an After Action Review/Final meeting

6.4.2. Start - Kick-off meeting

The kick-off meeting is key to a smooth start and continuation of a project. It typically includes the following elements:

- Introduction to the project (background, goals, key analysis results)
- Introduction of all project partners
- Definition of all roles, covering what is and what is not expected from each person
- Presentation/fine-tuning of the project plan and milestones with all partner schedules
- Identification and open discussion of any critical issues that may help ensure the success of the project
- Definition of the next steps

NOTE: It is important that before the kick-off meeting is concluded all participants are in agreement on the plan and on all key decisions taken. All participants also should receive copies of the meeting minutes.

6.4.3. Phase 1 – Basic concept and structure

If it has not already been outlined in the advance work, start by clearly defining a basic concept and an idea about the structure of the content to be developed. This preliminary phase gives everyone a chance to discuss a range of approaches and identify the most promising one before investing time and money in more detailed work.

The result of this early phase typically may include the following:

- The **key building blocks** of the final product
  - Example: One web-based Introductory Module with self-assessment questions, one online-test, an online glossary, a version of the glossary for smartphones, new online Frequently Asked Questions (FAQs) on a selected website, etc.
- **Raw description of the structure**
  - Example: Main Chapters only of the web-based training modules, Sections of the FAQs
- Basic assumptions regarding **the size of the project**
  - Example: Web-based training module of 60 minutes or 80 slides including 20 questions, random final test with 10 out of 20 questions, glossary with about 200 terms, FAQs with about 50 questions in total
- **Raw design approach**
  - Example: SCORM® learning module with menu on the left, standard layout and sub-navigation as used for other projects with adapted design to meet the content. The design at this early stage may be a simple sketch on paper. There is no need to invest in hours of fine design at this point

6.4.4. Phase 2 – Design and content outline

The preparation of a Storyboard should provide an overview of the course progress, ensuring that there is a natural flow in the learning. Because the storyboard describes what is to happen on each screen, it depends on some key decisions regarding layout and navigation. If these decisions are not made early, the storyboard likely will not suit the interaction options. In addition, this phase ensures that the storyboard writer has a solid, approved plan to guide his or her work. This phase usually results in the following:

6.4.4.1. Design

- **Basic design for each screen** and **screen variant** according to the specs and the screen size of the delivery platforms
  - Example: Image with reference list, video with keywords, assessment-item, animation, etc.
- **Sizes to be considered when producing media**
  - Example: Size of videos, maximum allowable text, standard images and zoomed images, font sizes for titles, body text, symbols for bullet lists, icons for content classification, etc.

6.4.4.2. Content Outline

The content outline is a **first draft**, describing the contents and illustrations in keywords only.

> Example: Introduction consisting of an attractive animated splash page followed by general information about the module. Users may proceed directly to the menu. Learning time: 1 minute, overall.

A **table format** – with a row for each content element and the **allotted time expected for each content element** – is an easy and clear way to depict the outline. Include pauses and time for reflection. The table greatly supports control of the agreed-upon learning time.

Another row may contain hints on media that are either available or need to be produced. This way, research and production of some of the media can start early, without waiting for the complete storyboard.

6.4.4.3. Test and self-assessment items

Writing the assessment items and having them signed off before starting the storyboard helps enhance the **alignment of the final content to the learning objectives.**

Even with greatest care, some learning objectives may be interpreted differently by different people. Classic instructional design processes recommend writing all test items before starting with the storyboard because the **self-assessment items help clarify any deviations early.**

It is essential that work not proceed to the next phase until all the above items are signed off by the SMEs and other crucial project team members.

6.4.5. Phase 3 – Storyboard

The storyboard is the final, detailed plan for building an ADL course. It contains a thorough description of all content elements (screen text, narration, images, highlighting elements, text labels, etc.), including the correct synchronization of all appearing, disappearing or moving elements with sound/narration and all hints regarding navigation.

There are many ways to write a storyboard. One option is to write it in table form; another option is to use a database approach that allows easy export of narration text or other elements for production purposes.

A good storyboard takes into account all earlier decisions and relies on the range of interactions and visualizations defined in the basic concept.

> Learners need to be able to process the content. Thus, too many things should not happen on the screen at the same time. For example, if you present a complex diagram,
>
> - build it up component-by-component;
> - have the sequence or the narration pause briefly, before showing the next element; and
> - do not present the complete narration as screen text in parallel; instead, only display keywords or phrases synchronous to the narration.

6.4.6. Phase 4 – Production of media elements

The production of media elements provides all the material according to the storyboard and the defined design specs. In the course of producing these elements, distinguish source materials and production output. AI tools can be used to produce content.

IMPORTANT NOTE: When using third-party materials (graphics, photos, images, videos, etc.), make sure not to violate any copyright laws and stay away from any legally restricted media. Whatever media is used, organizations should consider intellectual property rights and legal issues pertaining to reuse/re-purpose rights. Use of AI-tools should also be mentioned when producing content.

The following hints illustrate some of the key factors to be observed in media production. Main factor to consider is bandwidth, not in every situation the needed bandwidth is available. This can be solved by creating an on/offline consideration.

6.4.6.1. Images

- With today's use of artificial intelligence, it is easy to generate images. When AI is used, this must be disclosed.
- Never enlarge images that are too small for their intended purpose.
- Always use layers when working with images containing text. Layering greatly simplifies any corrections and allows for fast translation, if required.

6.4.6.2. Videos

- Make sure to use the correct output size and file format. If in doubt, do some test pages in the final export format and run them on the typical platforms and browsers before continuing with the work.
- Render videos in the final output size, as defined in the design concept.
- Resizing videos “on the fly” may result in bad quality or performance problems.

6.4.6.3. Sound

- Playing sound and video uses system resources on the learner’s platform.
- Make sure that the quality of sound (and video) does not surpass the limits of the typical learner’s delivery platform.

6.4.7. Phase 5 - Programming

The programming phase includes the following elements:

- Integration of all media elements into screens/sequences according to the storyboard
- Definition of all timed effects
- Programming of all standard and special navigation elements
- The set-up of all communications between the content and an LMS or other components

Depending on the production software used, this phase may or may not require higher-level programmers. Whatever programmer is working on the task, he or she must stick to the storyboard.

Tip: Involving the programmer early in the project can help ensure that ADL plan is realized without unexpected costs and unpleasant delays.

6.4.8. Phase 6 – Testing

The planned product will be the result of the programming, if all the phases were followed, including all sign-offs of important intermediate steps. Nonetheless, even with the most capable production team, flaws or errors in the program can and almost certainly will remain undetected without thorough testing.

Thorough testing of web-based learning includes its deployment on the development team's own LMS, and eventually some other LMSs, with a range of testers going through the content with all expected browsers.

The range of testers should support the following final tests:

- Technical quality (Instructional Designer, all users)
- Subject matter (SMEs, experienced professionals)
- Instructional design quality (all testers)
- Crash-test (experienced users, checking the program's robustness in case of unplanned/uncommon interactions). Example: Clicking "next" or another menu item before the narration has stopped: Will the sound stop or still run while new content is displayed?

The test should also include proofreading the course. The proofreading should not only check spelling and grammar but also ensure that the content is understandable for the target audience.

When all these tests have been conducted and no intolerable flaws have been detected, the program can be officially deployed for use in training.

Important: Have all tests documented and the SME's written sign-off filed.

6.4.9. End: After Action Review and final meeting

The end of any project is a great opportunity for everybody involved to learn and see the fruits of their labor. Make sure to plan an event at which the development group may look back on the project as a team, identify potential improvements for the next project, and identify points that worked well (i.e., sustains).

6.5. Rapid content production

Rapid Content Production refers to tools and processes to produce ADL content on a short timetable. The reduced production time is typically met by using special tools which support a

limited range of predefined design and interaction features, thus requiring only minimal training. Rapid content can thus be produced by anyone – even those without programming skills. However, even with rapid content production, the basics of instructional design and ADL development, along with some expertise in designing attractive screens, are a must for developing effective content.

Most of the rapid content production tools on the market support the creation of ADL modules based on PowerPoint content, which is usually widely available from traditional instructor-based training. As PowerPoint is widely known, content can be easily created or adapted without the use of complex graphic design and image editing tools. And even for recording and editing sound and narration, most of the required tools are embedded in easy-to-use format.

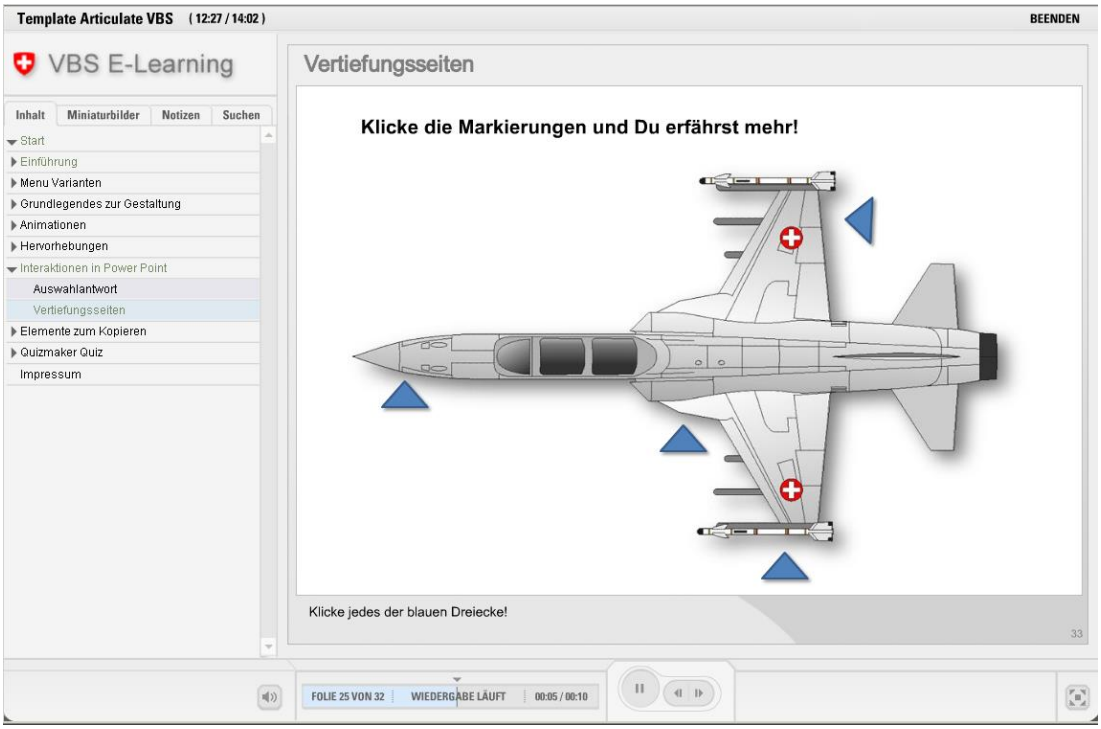


Figure 6-1. Example of PowerPoint-based Rapid e-Learning (Articulate Presenter, Layout of the Swiss DoD)

Please consider the following factors when trying to establish rapid ADL production.

Pure import of existing PowerPoint material – with added narration and animation and sound effects – will not result in success. For the best results, the original PowerPoint content should be adjusted to get away from the classic “presentation-look.” This typically means

- removing the “standard” slide backgrounds and other usual PowerPoint design elements;
- reducing screen text to keywords and having the full statements narrated;

- making use of narrated graphics, diagrams, and images, with highlights and text labels added; and
- adding, wherever possible, interactive functionality such as hotspots on images to get more information, and question items using the tool's built-in authoring features.

Good Rapid ADL tools will support wide use of PowerPoint hyperlinks and animations.

When establishing Rapid ADL, make sure to first organize sound design templates and some binding guidelines for production. Another option is to offer productive workshops, where rapid content is produced with some coaching by experienced professionals.

The development of Rapid ADL content tools is very dynamic; therefore, this handbook does not provide a list of tools. Current tools are easily found via the Internet.

7. Implementation

In any description of the Analysis, Design, Development, Implementation & Evaluation (ADDIE) ADL development method, the *Implementation* step is critical. Note that a wide variety of possible scenarios for implementation may be available. This diversity stems from case-specific and non-pedagogical policies that must be considered. Here, implementation means that the ADL course module is about to be deployed (i.e., made available from the LMS) for its intended audience.

Implementing a designed and developed course module includes two steps:

- Deploy it (make the course module available)
- Run it (have a learner go through the contents of the course module)

Prerequisites for the first step can be outlined by organizational policies, the learning infrastructure, and the availability of expertise. The second step is defined by the designers and developers of the content. Because the steps may influence each other, it is wise to carefully compare the desired outcomes with the constraints of each of the two scenarios outlined in the next section.

7.1. Deployment

Deployment of a course module means that it is being made available – with the aid of a system – to someone (i.e., the learners), by someone (i.e., the administrator).

Technical aspects are concerned with bandwidth (e.g., high definition or HD), the required client (e.g., Internet browser), format (e.g., xAPI), required plug-ins (e.g., H5P, BigBlueButton (BBB)), and security requirements (e.g. classification demanding the course to be installed on a secure network).

There may be two scenarios for deployment:

- In the simplest deployment scenario, a course module is made available to anyone who has access to the system on which it runs. There may be some administration involved, but that may well be limited to automatic logging or time-stamping. This would suggest that the course module itself may either be voluntary, or that it might be an optional part of the formal learning program, while the initiative to run the course module is (technically) left up to the learner.
- A more complex scenario could involve the following:
    - Planning and scheduling the course for a more specific audience at a specific timeslot
    - Active communication
    - More detailed administration

Because the course is now scheduled, it will probably also be monitored more accurately, requiring the registration of a specific result rather than a check-the-box exercise. These more

complex scenarios will have more added value when administratively linked to a capable student/personnel administration management system (e.g., a human resource system).

In this way, the course can be used directly as part of a regular training program, a procedure to fill a vacancy, or as qualification for a task/job without the requirement of detailed administration.

7.2. Running a course

Running a course is all about a learner going through the course contents, with or without (i.e., a remote user) the aid of a teacher/coach.

In the most basic scenario, the learner progresses through the course using a linear structure—navigating via a menu or “previous/next” buttons—until either all content has been accessed or the learner chooses to exit.

In more advanced scenarios, the course actively engages the learner beyond passive viewing. This may include interactive exercises, assessments, assignments (potentially involving peer or instructor collaboration), simulations, and other forms of learner interaction. While greater engagement generally leads to improved retention (see Figure 3-4 in Section 3.2.1 of this Handbook), increased complexity also introduces a higher risk of technical or instructional issues, in line with the principle of “Murphy’s Law.”

Between these two extremes exists a broad spectrum of instructional design options, each presenting unique challenges and requiring careful consideration of pedagogical and technical implications. The chosen approach to implementation will inevitably influence the course development process—and may, in turn, be shaped by it.

7.3. A model for implementation

Any implementation can be described by a model that highlights four key elements:

- Procedures
- Information (required/conveyed)
- Tools
- Roles (people involved)

Procedures tell us what needs to be done as logically connected activities. Of course, the implementation procedures are always part of a larger chain (ADDIE). A common way of stating a procedure is by using a verb and a noun (i.e., “Do this”).

Information tells us what goes in or comes out of an activity. It is mostly described as units of information (e.g., ADL module, an evaluation report, or a log file). Information resulting from a procedure is almost always input into another activity. A common guideline is to use a neutral noun to describe the purpose of the information.

Tools describe network systems that are involved, infrastructure databases, interfaces, or any other “technical” support the process requires. Preferably, the tools mentioned are (or can be) part of an interconnected infrastructure.

People involved tell us what roles are recognized in the process with respect to the different procedures and – when appropriate – with a connection to the tools (e.g., authorization diagram).

Architectural models developed using the aforementioned elements, though never fully accurate, are often perceived as acceptable. Their primary value lies in facilitating communication and serving as a foundation for further refinement. The main challenge is choosing the right level of granularity—too much detail may improve accuracy but undermine the clarity of a concise, high-level message.

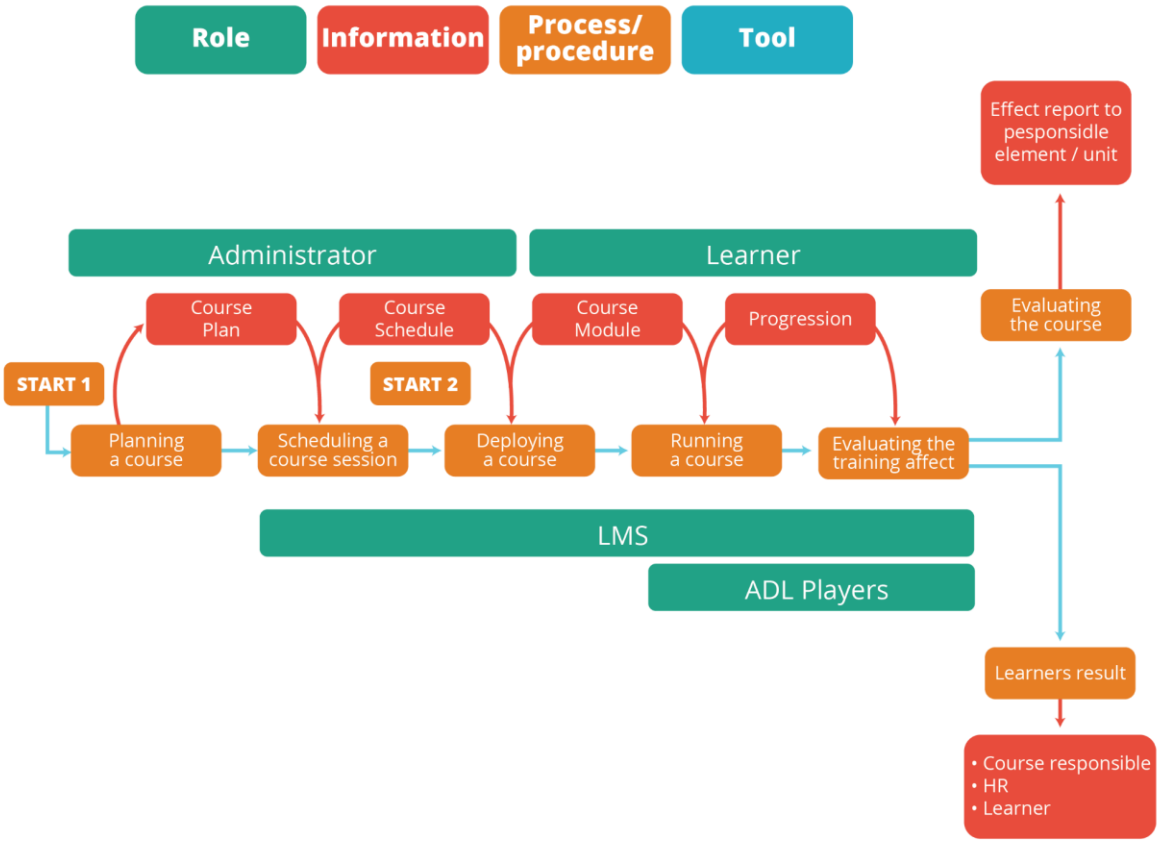


Figure 7-1 Model of the implementation of courses (sample)

Figure 7-1 shows a sample of a model which can be used for implementing or as an idea to build a model.

7.3.1. The information

Basically, there are three groups of information:

- Learner information
  - Personal data (name, ID, email, etc.)
  - Qualifications
- Course module information
  - Module details (description, prerequisites, content, etc.)
  - Session information
  - Planning/schedule
- Progression of competence development
  - Result/score, percentage of completion, time used, acquired qualification(s), certificate(s), etc.
  - Administrative details (logging, timestamp, etc.)

7.3.2. The roles

7.3.2.1. Administrator

In the most basic scenario, an administrator is only required to make course modules available. The administrator will then stand by until a system failure arises. In more complex scenarios, the administrator will have ongoing tasks regarding security, deployment, access, and support.

7.3.2.2. Learner

The learner is the most important end-user of any course module, which is the only truly mandatory role.

7.3.2.3. Coach/Instructor

Additional roles, such as a coach or an instructor, are possible. Their involvement is related to the purpose of the course. (e.g., Is it self-paced or instructor led? Does it require social interaction? etc.)

7.3.2.4 Data coach

A **data coach** supports instructors, designers, and stakeholders in understanding and using learning data effectively. Their main role is to ensure that data collected through learning technologies (e.g., via xAPI or LMS analytics) is translated into actionable insights that improve both learning outcomes and instructional design.

7.4. Summary

Implementation is part of the ADDIE process and refers to an ADL course module that is ready to be deployed (i.e., made available from the LMS) for its intended audience. Implementing an ADL course module includes two steps: Deploying the course/module and running the course/module. Prerequisites for deployment are outlined by organizational policies, the learning infrastructure, and the availability of expertise. Running the course module is defined by the ISDs and content developers. There are numerous scenarios for implementing a course; so, it is important to seek a balance between what your organization's training requirements are and its long-term capabilities. Proper implementation requires well-prepared systems (whether dedicated or integrated off-the-shelf toolsets), well-prepared experts (whether administrator and

learner or designers, instructional/interaction), developers (pedagogical/technical), subject matter experts, instructors, and corresponding development methods/policies.

8. Process Evaluation

8.1. General information about evaluation

To ensure quality, and provide information for improvement and future development, it is necessary to focus on the process of evaluation. As a crucial stage in the ADDIE process, and to enhance quality, evaluation involves learning effectiveness, student satisfaction, and cost effectiveness.

The Kirkpatrick-Phillip straining evaluation model, presented earlier in Chapter 3 (Design), is also included here to help clarify the difference between learner assessments (associated with learning outcomes), and the evaluation of the course's effectiveness. Learning evaluations focus on whether the learner retains what he or she is supposed to learn. The "E" in ADDIE focuses more on the evaluation of the course effectiveness. (e.g., Does the course accomplish what it is designed to achieve?) The key purposes of evaluation are to improve the training and to include feedback in future revisions.

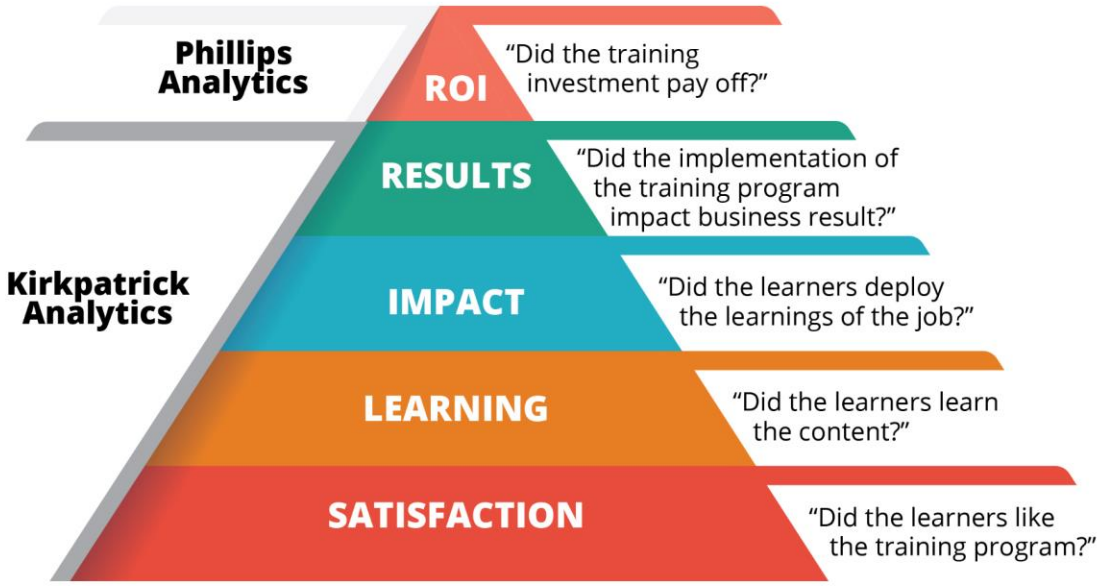


Figure 8-1. The Kirkpatrick-Phillips training evaluation model

Though it is not clearly delineated, learner evaluations generally focus on the bottom three tiers of the Kirkpatrick-Phillips model (Satisfaction, Learning, and Impact) – as discussed in Chapter 4 – while evaluation focuses more on Results and the Return on Investment (ROI) of the

course. Here are the definitions for the top two tiers (Levels 4 and 5) of the Kirkpatrick-Phillips model:

> **Results**: This level evaluates whether the training has led to tangible results. For instance, a safety-related course might seek to find out whether the number of accidents actually has decreased.
>
> **ROI:** The Return on Investment evaluation is a complex undertaking which should be considered as part of a development project. While ROI typically measures the monetary effectiveness of the training, it can also be considered as an extension of the results.

8.1.1. Purposes of evaluations

Evaluation involves systematic and careful data collection and analysis in order to answer a specific research question. The "research question" most often asked in this phase of the ADDIE process is: How effective was the training? Regarding this question, it is possible to enumerate three main **purposes of evaluations**:

- To make judgments (judgment-oriented) aimed at determining the worth, value, or success of a program
- To make improvements (improvement-oriented) connected with improving a given program while it is being implemented
- To generate knowledge (knowledge-oriented) that helps build theory and sometimes informs the policy-making processes.

8.1.2. Evaluators

Evaluation may be conducted by internal or external evaluators. The key is that the evaluator possesses intimate knowledge of the intentions and desired outcomes of the training. Often, evaluations center on asking a former student who has completed the designated training to conduct a post-evaluation. The intent would be to learn from the student how he or she *now* feels about the effectiveness of the training (i.e., once he or she is on the job and has had the opportunity to apply the training in the workplace). Another method is to ask the former student's supervisor whether he or she feels the training was worthwhile. (i.e., Did the student gain noticeable improvement in his or her performance after completing the training?)

8.1.3. Evaluation characteristics and criteria

Evaluation must fulfill the following conditions: independency, reliability, objectivity, and impartiality. It should also be systematic and based on specified methodology.

Additionally, the evaluation should focus on criteria which include:

- **Relevance.** Whether the teaching objectives addressed to identified problems;
- **Efficiency.** Input and output ratio (efforts and effects);
- **Effectiveness.** Whether the objectives have been achieved in an acceptable time;
- **Impact.** To what extent the benefits learners obtain will affect others;

- **Sustainability of the effects.** Whether the project's effects remain without further resource expenditures;
- **Interoperability.** Assess its compliance with standards (e.g., SCORM, xAPI, LTI), ability to exchange data accurately with the LMS, consistency across platforms, and seamless integration with external tools.

8.1.4. Confidentiality

A crucial element of any type of evaluation is the maintenance of respondents' confidentiality. If possible, the questionnaire should be anonymous. It is especially important in online evaluations when respondents may not be willing to answer the questions. Furthermore, respondents should be told why the information is being collected and how the results will be beneficial in improving the course. They should be asked to reply honestly: even if their feedback is negative, this is just as useful as positive feedback. It is also recommended to present the results of evaluation in the respondent's domestic language.

The survey should begin with an introduction in which the organizer of the survey indicates the purpose of the survey and the conditions of participation (i.e., time, anonymity). The instructions for the survey should be clear and brief, and it should be written in the natural language of the respondent. The tool should display progress (e.g., Question 1/10, 2/10).

8.2. Types of evaluation

8.2.1. Surveys and polls

The survey is one of the most effective methods of data gathering (post-evaluation) on ADL courses/programs. This is because some LMSs contain tools for preparing questionnaires with varied types of questions. The following are types of possible questions to construct in LMSs:

- **Matrix questions.** Identical response categories are assigned to multiple questions.
- **Close-ended questions.** The set of responses is set, and most scales are close-ended. Examples of close-ended questions are yes/no, multiple choice, and scaled questions.
- **Contingency questions.** The question is answered only if the respondent gives a particular response to a previous question.
- **Open-ended questions.** No options or predefined categories are suggested. Open-ended questions can generate large amounts of data that can take a long time to process and analyze. (Hence, piloting and deliberate question preparations must be taken into consideration.) The following are some example types of open-ended questions:
    - **Completely unstructured.** For example, "What is your opinion of the course?"
    - **Word association.** Words are presented, and the respondent mentions the first word that comes to mind.
    - **Sentence completion**, story completion, or picture completion.

8.2.2. Online questionnaires

The main advantage of using online questionnaires is that the responses can be quickly gathered in a standardized way; therefore, questionnaires are more objective, certainly more so than interviews. On the other hand, as they are standardized, there are no possibilities to explain any points in the questions that participants might misinterpret.

8.2.3. Interviews

While interviews may seem to be the most effective means of collecting information about the effectiveness of a particular training, they are more difficult to develop, and they normally are more costly to conduct than surveys, polls, and/or online questionnaires. Also, there may not be an opportunity to interview all course or training participants.

8.2.4 Output

During a course, various types of output may be produced—such as jobsheets, answers to questions, and other assignments. This output provides valuable insights into the clarity of the questions and whether the training aligns with the course objectives. In digital learning environments, learning analytics can enhance the evaluation by tracking data such as completion rates, time spent on tasks, and quiz results. Analyzing this data helps identify learning patterns, engagement levels, and areas where the course may need improvement.

8.3. Summary

Evaluation is a crucial stage of the ADDIE process for enhancing quality. Evaluation involves learning effectiveness, access, student satisfaction, and cost effectiveness. Evaluation can be defined as purposeful gathering, analysis, and discussion of evidence from relevant sources about the quality, effectiveness, and impact of provision, development, and policy. Although there are several methods for conducting evaluations, it is critical that each method protects the respondent’s confidentiality.

9. Current and Emerging Technologies for Training and Education

9.1 Scope

As learning environments become increasingly learner-centric, individuals expect greater control over how they access, manage, and share learning resources. Informal learning—often enabled through mobile technologies and social platforms—plays a growing role alongside formal education and training. These developments reflect broader changes in how learning environments are perceived and organised within Advanced Distributed Learning (ADL). They illustrate a shift in emphasis from centrally delivered instruction to distributed, learner-influenced learning environments.

This chapter gives a brief overview of current and emerging technologies and teaching approaches relevant to ADL. Instead of listing specific tools that may quickly become outdated, it highlights key concepts that can guide the design of future learning environments. The goal is to provide general orientation and a shared understanding, not detailed design instructions or technology choices. Technologies like social media, virtual and augmented reality, mobile platforms, serious games, and gamification are now well- established, but how they are used in learning continues to evolve rapidly.

As learning technologies continue to evolve, key considerations for future learning environments include:

- Increased reliance on informal and peer-supported learning beyond the classroom.
- Greater emphasis on training and performance development, with skills refined through practice and on-the-job experience.
- The need for learning solutions that remain effective with or without technology.
- Delivery of content across multiple media to support flexibility and learner choice.
- Recognition that some skills require face-to-face instruction.
- Continued attention to appropriate comprehension and reading levels.
- Development of adaptability and cognitive agility as core, career-long competencies.
- Expanded instructor roles requiring instructional, facilitation, and technical skills.

Given the rapid pace of technological change, the following sections highlight key technology areas and design considerations to support effective and sustainable ADL-enabled education and training. Detailed instructional design guidance, implementation strategies, and decision-making frameworks are addressed elsewhere in this handbook. This distinction aligns Chapter 9 with the overarching scope of the ADL Handbook while maintaining its descriptive and exploratory focus.

9.2 Collaboration Tools

Collaboration tools enable learners to work together regardless of location. They are most effective when used by groups, while one-to-one interaction is often better supported through simpler communication methods such as e-mail, chat, or other forms of communication. From a

conceptual perspective, collaboration tools illustrate how learning increasingly shifts from individual content consumption to shared knowledge construction. They demonstrate changes in how interaction, responsibility, and knowledge ownership are organised within ADL environments.

These tools support co-creation of content, shared reflection, discussion, and collective learning. Their use requires learners to be aware of their online presence, identity, reputation, relationships, and activities, as well as how information and content are shared within a networked environment.

Collaboration tools can be broadly divided into content-focused tools and communication-focused tools.

9.2.1 Content-Focused Collaboration Tools

Content-focused tools support sharing, annotating, and jointly developing learning materials, such as documents, images, videos, and problem solutions. Shared content becomes the focal point for discussion, commentary, and collaborative improvement. This illustrates a shift from static instructional materials toward evolving learning artefacts.

These tools primarily:

- enable file sharing and content publishing, and
- support simultaneous or iterative collaborative editing.

They are particularly effective for problem-solving, decision-making, and project-based learning, allowing participants to contribute actively while instructors can observe and guide the learning process. The examples provided are illustrative of potential learning patterns rather than prescriptive design recommendations.

9.2.2 Communication-Focused Collaboration Tools

Communication-focused tools support synchronous and asynchronous interaction between learners, instructors, and subject matter experts. They exemplify how communication structures extend beyond physical classrooms in ADL contexts.

- **Synchronous tools** (e.g. instant messaging, VoIP, video conferencing) enable real-time interaction and are well suited for guidance, discussion, and instruction, subject to constraints such as time zones, bandwidth, and security.
- **Asynchronous tools** (e.g. e-mail, discussion forums, blogs) allow participants to communicate over time and are less dependent on connectivity, making them suitable for reflection, structured discussion, and informal knowledge exchange.

Wikis combine content creation and collaboration by allowing participants to jointly develop and maintain shared knowledge spaces. Their inclusion illustrates collective knowledge

development rather than advocating a specific instructional method. They support both formal and informal learning, encourage collective ownership of knowledge, and foster critical thinking through continuous review and refinement of content. Clear guidance on intended use is recommended to balance structure and learner creativity.

9.3 Virtual Classrooms / Learning Spaces

Virtual classrooms enable real-time, visually supported interaction between instructors and learners regardless of location. They represent a digital translation of familiar instructional formats into distributed learning environments. They are based on video conferencing technology extended with instructional, management, and collaboration features. Virtual classrooms can support eTeaching (including MOOCs), eTraining (one-to-many instruction), and eCollaboration (peer-to-peer learning), and should be designed in accordance with established pedagogical models.

Virtual classrooms retain the core elements of face-to-face instruction, such as presentations, references, and interactive activities, while eliminating the need for travel and physical co-location. This section describes common characteristics rather than recommended deployment models.

9.3.1 Core Capabilities

Virtual classrooms typically provide:

- **Screen sharing, monitoring, and remote control**, enabling instructors to observe learner activity and provide immediate feedback.
- **Interactive whiteboards**, supporting visual explanation and collaborative knowledge construction.
- **Audio and video streaming**, improving engagement and enabling demonstration of concepts and physical artefacts.
- **File sharing**, allowing structured exchange of learning materials and learner outputs.
- **Tracking training objectives**, supporting focus, contextualisation, and progress monitoring in line with a Systems Approach to Training.
- **Training journals or portfolios**, enabling documentation of learner activities, evidence of achievement, and support for assessment.
- **Multiple communication channels**, supporting instructor-to-learner, learner-to-learner, group interaction, and breakout activities.
- **Secure access and user authentication**, ensuring controlled participation.
- **Monitoring,** tracking attendance, task allocation, and assignment submission.
- **Formative and summative assessment**, including polling, testing, automated marking, proctoring, and grading.
- I**ntegration with learning ecosystems**, such as LMSs, learner record stores, office tools, and plagiarism detection systems.

9.3.2 Online Synchronous Learning Models

Virtual classrooms support several synchronous learning formats:

- **Lectures**, enabling large-scale delivery with limited interaction.
- **Tutorials**, supporting small-group instruction with guided interaction.
- **Knowledge-sharing sessions**, enabling peer-based collaboration and problem-solving, often supported by breakout rooms.

Sessions can be recorded for later access. For larger events, the separation of instructional and administrative roles (e.g. instructor and host) is recommended.

9.3.3 Massive Open Online Courses (MOOCs)

MOOCs are designed for large-scale, open participation and typically combine video lectures, readings, assignments, and discussion forums. Instructional design for MOOCs must support scalability through peer interaction, automation, or both. MOOCs vary from collaborative, learner-centred models to broadcast-style delivery and continue to evolve in content format and pedagogical approach.

A Small Private Online Course (SPOC) can be seen as the counterpart to a MOOC. While MOOCs are designed for large, open audiences with minimal entry barriers, SPOCs are limited to a smaller, defined group of learners, often within an organization or educational institution. This allows for more interaction, guidance, and tailored content. SPOCs are still relevant today, especially in corporate training and formal education, but their role has partly evolved. Many organizations now combine the SPOC concept with synchronous learning models—such as live virtual sessions and cohort-based training—to increase engagement and support, rather than relying solely on self-paced, fully asynchronous formats.

9.4 Mobile Learning

Mobile learning (m-Learning) leverages mobile technologies to support the acquisition and reinforcement of knowledge, skills, and behaviours across education, training, and performance support. Within this chapter, mobile learning is used to illustrate how learning increasingly becomes independent of time and place. Rather than being defined by specific devices or learner profiles, mobile learning should be understood as a flexible approach that enables learning independent of time, location, and context.

m-Learning supports both formal and informal learning, as well as individual and collaborative use cases. Its role within ADL is conceptual rather than normative. It is not a simplified form of e-Learning, but a complementary capability that enhances learning and performance through timely access to information and resources.

9.4.1 Role within ADL

Mobile learning should be treated as an integral component of the learning ecosystem, supplementing and reinforcing other learning modalities rather than replacing them. Effective m-Learning solutions focus on learner needs and performance outcomes, not on the technology itself. Examples of the possibilities of the technology are visible in table 9-1.

Instructional designers should carefully assess whether m-Learning is an appropriate solution during the analysis phase, as it is particularly well suited for just-in-time learning, performance support, microlearning, and contextualised learning.

Training Modules	Performance Support or Job Aids	User-Generated Content
Just-in-Time Learning	On-the-Job Support	Note Taking
Microlearning	Alerts/Reminders	Translation
Reach-back/Review	Games and Simulations	Photos/Videos
Forms and Checklists	E-books/Text Books	Spaced Learning
Coaching/Mentoring	Procedures	Audio Capture
Conferencing	Collaboration	Surveys or Polls
Feedback	Location-Specific Content	Reporting
Social Networking	Tests/Quizzes/Evaluations	Augmented Reality
Video/Audio Recordings	Field Guides	Contextualized Learning
Podcasts	Presentations/Papers	Manuals or Reference Guides
Glossary		

Table 9-1

9.4.2 Design Considerations

Learning objectives must drive design decisions. Developers should avoid starting from device capabilities and instead focus on what support learners need and when. Mobile devices vary widely in features and usage patterns, and development strategies must account for the target audience, usage context, connectivity, and security requirements.

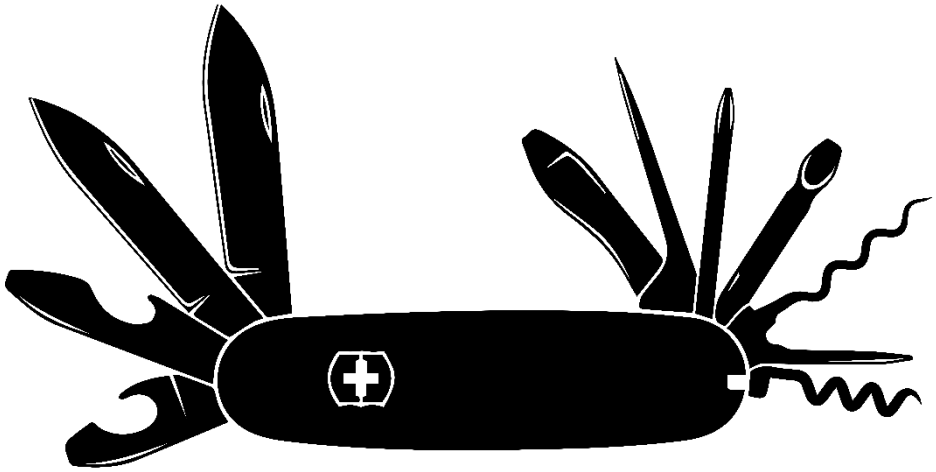


Figure 9 -1 Mobile apps have endless functions

9.4.3 Devices and Connectivity

Mobile devices extend beyond smartphones and include tablets and other handheld platforms. While connectivity has improved significantly with modern networks, bandwidth limitations and offline access remain important considerations. Content should be optimized for mobile delivery and designed to function under varying connectivity conditions.

- **Image Compression.** Files must be optimized for quicker load times.
    - **HTML5** · provides persistent local data storage within the browser, enabling content to function during periods of limited or no connectivity. Unlike cookies, this data is not automatically transmitted to a server. Instead, it remains stored locally as key–value pairs within the user's browser.

9.4.4 Application Approaches

Mobile learning solutions can be delivered through:

- **Native applications**, offering deeper device integration but requiring platform-specific development and distribution.
- **Mobile web applications**, accessible through browsers and easier to maintain across platforms.
- **Hybrid approaches**, combining web technologies with native packaging to balance accessibility, cost, and user experience.

The choice of approach should be based on functional requirements, distribution strategy, maintenance considerations, and learner expectations, rather than on technology preferences alone.

9.4.5 Development and Distribution

Mobile development requires careful planning, particularly for app distribution, platform compatibility, maintenance, and lifecycle management. Supporting multiple platforms increases accessibility but also adds complexity. Hybrid and standards-based solutions offer long-term advantages in scalability and sustainability.

9.5 Simulations and Serious Games

Live training provides high training value but is resource-intensive, time-consuming, and limited in repeatability. As a result, it is often not feasible to fully train individuals and units across the full range of required scenarios and proficiency levels. Complex skills, which require repetition and experimentation, cannot always be adequately developed through live training alone. Simulations and serious games offer a way to address these challenges.

9.5.1 Role of Simulations

Simulations provide a safe, repeatable, and cost-effective training environment in which learners can practice complex tasks and decision-making without operational risk. They demonstrate how experiential learning can be supported through technology. Simulation-based training allows instructors to start, stop, modify, and repeat scenarios, enabling targeted rehearsal, immediate feedback, and structured after-action review (AAR). These capabilities significantly enhance training effectiveness while reducing resource demands.

Simulations are a core component of Modelling and Simulation (M&S), which supports not only training but also analysis, experimentation, planning, and decision-making across military domains.

Simulations can be applied at multiple levels of abstraction, ranging from:

- Engineering-level models
- Engagement level models
- Mission/battle models
- Theatre/campaign-level simulations.

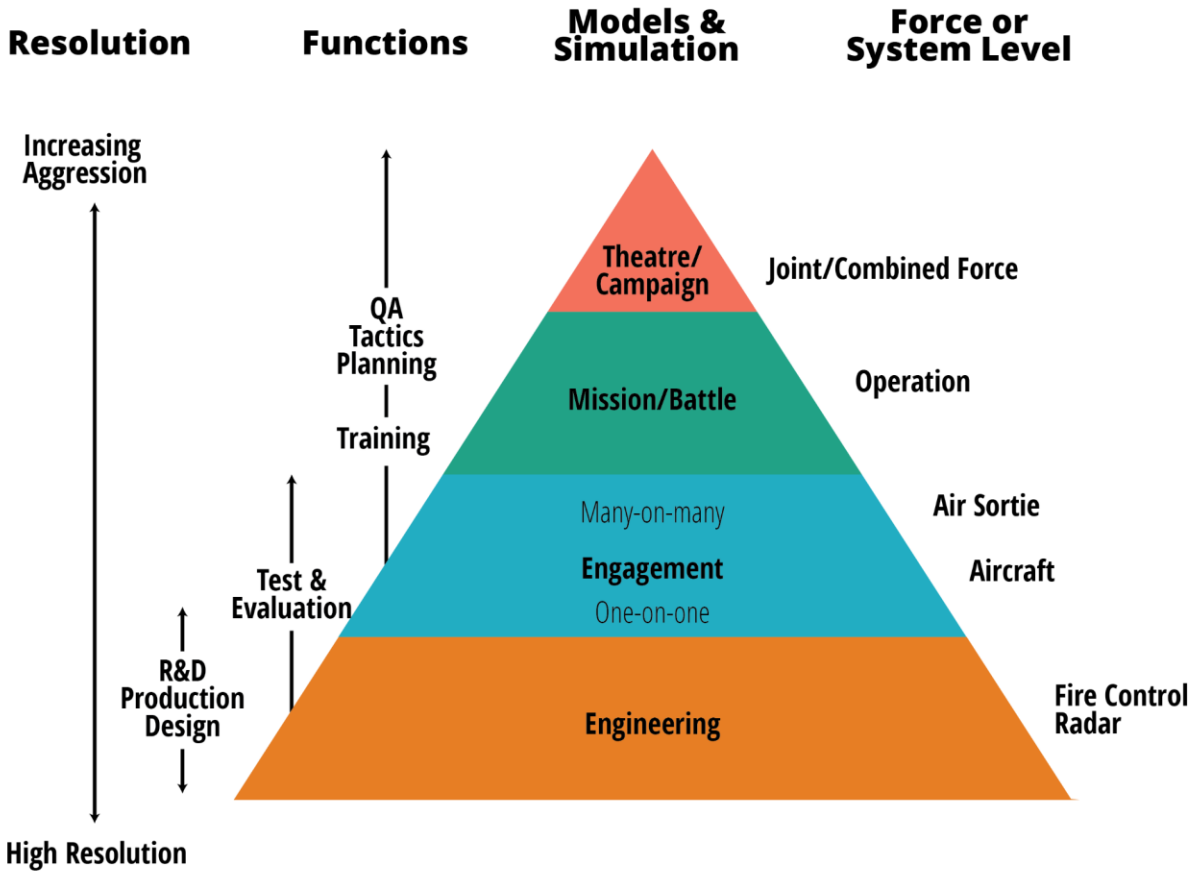


Figure 9-2. The models and simulations hierarchy from the US DoD.

Each level serves specific training or analytical purposes and must be selected based on the intended learning or operational objectives.

Simulation-based environments are commonly categorised as:

- **Live simulation**: real personnel operating real equipment with simulated effects.
- **Virtual simulation**: real personnel operating simulated equipment in a simulated environment.
- **Constructive simulation**: simulated entities operating in a simulated environment under human control.

Modern training increasingly integrates these categories to provide a **realistic and scalable synthetic training environment**. Advances in computing, networking, and game technology have enabled high-fidelity simulations to be deployed on standard hardware and delivered through networked and web-based platforms, including mobile devices.

Within ADL, simulations support a shift from static learning content to **interactive, learner-driven experiences**, allowing trainees to explore tactics, test decisions, and learn through iterative experimentation. This shift illustrates evolving instructional possibilities rather than mandated training approaches.

Figure 9-3. Simulation of an aircraft

9.5.2 Gamification

Gamification is the application of game-design elements and game principles in non-game contexts. In this chapter, gamification is presented as a trend influencing engagement rather than as a standalone instructional solution. Gamification commonly employs game design elements to improve user engagement, organizational productivity, https://en.wikipedia.org/wiki/Gamification flow, learning, crowd sourcing, employee recruitment and evaluation, ease of use, usefulness of systems, physical exercise, traffic violations, voter apathy, and more. A collection of research on gamification shows that a majority of studies on gamification find it has positive effects on individuals. However, individual and contextual differences exist. Gamification can also improve an individual's ability to comprehend digital content and understand a certain area of study such as music.

9.5.3 Serious Games

Serious games are **computer-based games designed primarily for training and education rather than entertainment**. They integrate pedagogical principles into game mechanics to deliver learning objectives through structured scenarios and challenges.

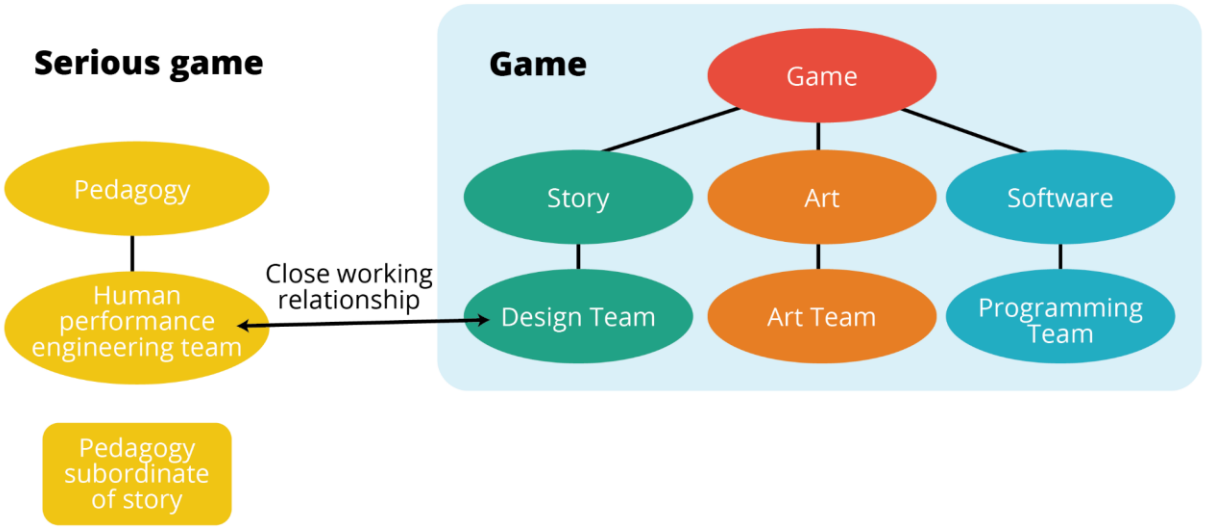


Figure 9-4. Relation between games generally and serious games (Zyda, 2005)

There are many contexts where serious gaming can be helpful (figure 9-9). In military contexts, serious games are used to support:

- **Education, Training and simulation**
- **Mission rehearsal and preparation**
- **Combat modelling, analysis, and doctrine development**

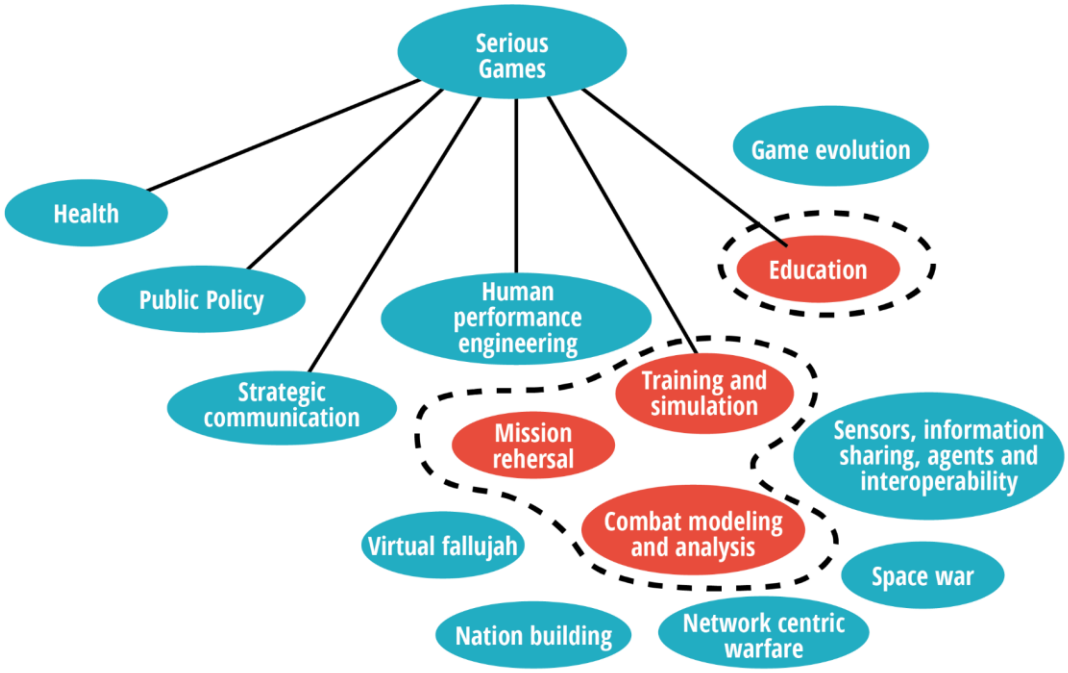


Figure 9-5. Serious games as a general concept (Zyda, 2005)

Serious games leverage engagement, competition, and immersion to motivate learners while maintaining instructional focus. While they share technical and structural similarities with simulations, engagement is their primary motivational driver, whereas simulations place greater emphasis on **accuracy, realism, and analytical value**.

Simulations and serious games complement live training by enabling **repeated, risk-free, and scalable training** across a wide range of operational contexts. When aligned with learning objectives and integrated into ADL solutions, they enhance skill development, decision-making, and mission readiness in an effective and resource-efficient manner.

9.6 Artificial Intelligence

Artificial intelligence (AI) involves the use of statistical and computational techniques to train machines to mimic human learning and problem-solving abilities. Within Chapter 9, AI is addressed as an emerging capability shaping future learning environments. In the training and education domain, AI has already been applied to endeavors such as military simulation, content recommendation, and intelligent tutoring systems. It is also an indispensable tool for the analysis and interpretation of large data sets.

As research advances and computational power grows, AI is becoming more prevalent across the industry, so it is critical to understand its applications, strengths, and limitations. This section examines the current state of AI in training and education and explores the exciting frontiers of contemporary research to help organizations prepare for the road ahead.

The development of large language models and artificial intelligence is making many tasks easier. This development is progressing rapidly. To ensure that AI is used safely within the military training domain, there are some basic rules that must be taken into account. When using open AI sources:

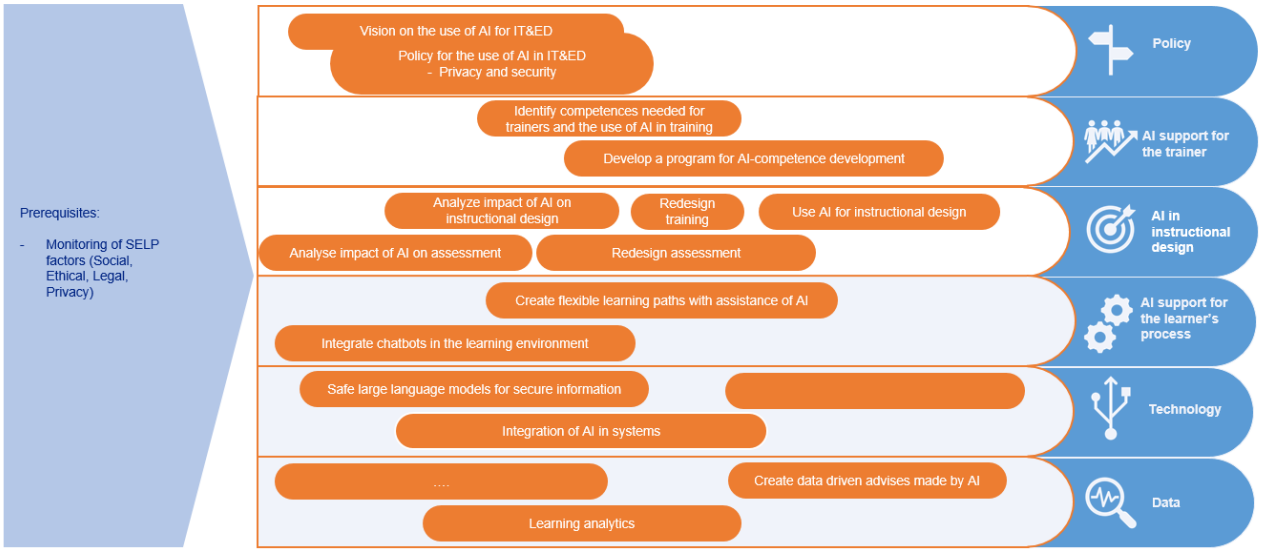
- Check your national regulations regarding the use of AI.
- Never use names or email addresses connected to Defense.
- Never use confidential information.
- Consider copyright and source referencing when using the information.

Several key areas can be identified where AI can make a substantial contribution (These examples are indicative and non-exhaustive, intended to support awareness rather than implementation).:

- AI can enhance the learning process. For example, it can support instructors in assessing assignments, providing continuous feedback, and predicting dropout risks. For learners, AI enables direct guidance through chatbots, simulations, and personalised learning paths.
- AI plays a role in instructional design, such as generating educational materials and developing new assessment formats.

- AI enables the creation of customised learning and development trajectories tailored to individual tasks and capabilities.
- AI can assist policymakers by providing data-driven insights and automated reporting, leading to a more responsive and efficient policy cycle.

Based on the results of the survey, several steps have been identified for the use of AI within IT&ED. These steps, shown in figure 9-6 are intended to support further progress in the use of AI for training within NATO. These are not fixed steps, but should be used as an inspiration.



9-6 Suggested steps for use of AI in training

9.8 Summary

NATO Learning and Technology Interoperability Group (NATO LTIG) is looking at contemporary technologies for their use in military training and educational processes in a new way. Learning resources should be accessible everywhere, whenever they are needed, and offered in different formats regarding the conditions and locations that the learner requires.

The advantages of social tools, mobile applications, virtual worlds, serious games, and simulations as described in this Handbook can be used for advanced learning purposes. This chapter has provided a conceptual overview of developments influencing contemporary ADL learning environments. Blended approaches – in which high-skilled teachers and trainers implement appropriate pedagogy and didactics in the learning/training scenarios – combined with some of these advanced tools can help provide high motivation and engagement of the learners, and produce excellent results. Guidance on concrete design, implementation, and evaluation is addressed in other chapters of this handbook.