Task Group for Individual Training & Education Developments (IT & ED)

THE NATO ADVANCED DISTRIBUTED LEARNING HANDBOOK

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

Version 2018

This page intentionally left blank.

Table of Contents

NATO ADL HANDBOOK

1   Background

1.1   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; rather, it is an overarching look at ADL concepts and some of the tools that are used to develop ADL. The intent is for Nations to "supplement" this handbook with additional guidance that is applicable to their own policies and procedures.

1.2   How to use this handbook

This document is intended to be used as a practical guide providing pragmatic guidance and examples for the creation, use and implementation of ADL. This document can be read from beginning to end to gain a general understanding, or it can be used 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.

1.3   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 technologies. 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." Additionally, Bi-SC 75-7 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.

Early forms of distributed learning emerged in the form of correspondence studying 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 "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 that the term ADL is more encompassing to include instructional multi-media 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.)

1.4   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 (See Figure 1-1, below.). ADDIE is a common chain of processes to describe the creation, use and evaluation of training materials. ADDIE represents a sequence of steps, but often, the steps run concurrently. The concurrence of steps (and their sub-steps) are ometimes referred to as "agile design and development" or "successive approximation."
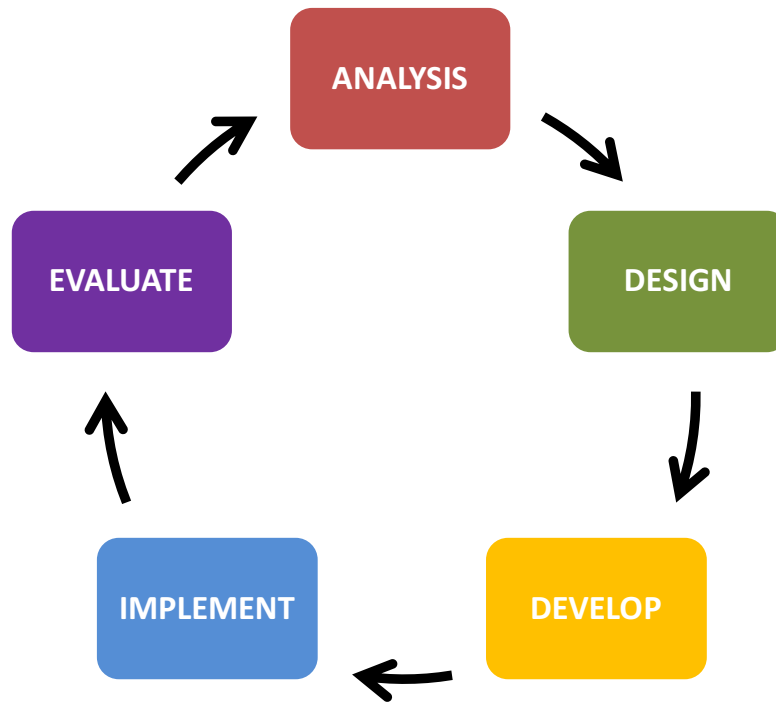
Figure 1-1. ADDIE Process

Some of the information found in this handbook is based on the **ADL Content Production Kit**[2], established by the Partnership for Peace Consortium's (PfPC) ADL Working Group (WG), a productive group of 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.

The **NATO Bi-SC 75-7 E&ITD** is an important reference document. This document is a comprehensive training and education solutions reference, and also includes information on training needs analysis (TNA) as required with any strategic NATO project. The latest version was endorsed on 10 September 2015 and is available through NATO Transnet: https://portal.transnet.act.nato.int/Pages/home.aspx.

1.5   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.

1.6 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. We want to specifically thank the following people for their efforts in bringing this handbook to fruition.

AUSTRIA	Col Gerhard Kletzmayr, MBA	Federal Ministry of Defence, Austria
BELGIUM	LtC Eric Plasman Maj Philippe Kellen	DGFmn - Belgian Defense *Brussels, Belgium*
BOSNIA HERZEGOVINA	LtCol Sasa Konjevic	*Armed Forces of Bosnia Herzegovina*
DENMARK	Major Carsten Brender Major Michael Thorsen	Royal Danish Defence College *Copenhagen, Denmark*
FINLAND	Major Tuomas Tihula *(Chief of ADL Sector)*	Finnish Defence Forces Shared Services Center, Learning and Image Unit *Tuusula, Finland*
FRANCE	LtCol Guy Zimmermann *(ADL Project Officer)* LCol Sébastien Louail Project Engineering Manager	French Air Force Academy *Salon de Provence, France* French Air Force – Human Resources Directorate Tours, France
LITHUANIA	Major Vilius Senkis	TRADOC
MACEDONIA	LtCol Jugoslav Achkoski, PhD	Military Academy General Mihajlo Apostolski Republic of Macedonia

NATO Partner Nation	Contributor's Name (Title)	Organization and Location
NETHER-LANDS	Mr. W.J. "Walt" Smeulers	Ministry of Defense *Utrecht, Netherlands*
NORWAY	CDR Geir Isaksen *(Staff Officer ADL)*	Norwegian Defense University College *Oslo, Norway*
PARTNER-SHIP FOR PEACE CONSOR-TIUM	Mr. Reto Schilliger *(Previous Chairman, PfPC ADL WG)* *Ms. Greta Keremidchiva*	International Relations and Security Network (ISN) *Zurich, Switzerland* Chair, Partnership for Peace Consortium ADL Working Group
NATO Partner Nation	Contributor's Name *(Title)*	Organization and Location
POLAND	LtCol Datiusz Poczekalewicz *(Chief, ADL Division)* Małgorzata Gawlik-Kobylińska *(Instructional Designer)*	National Defence University Distance Learning Division *Warsaw, Poland*
ROMANIA	Daniel Beligan (Head of ADL Department)	National Defence University Carol I Romania MoD
SLOVENIA	Dr. Darko Scannicar, PhD	Slovenian Armed Forces
SERBIA	Col Goran Šimić, PhD	Military Academy, University of Defense *Belgrade, Serbia*
SWEDEN	Major Tohmas Ax *(Project Manager)*	Military Academy development unit for leadership and pedagogy (FMLOPE) *Halmstad, Sweden*
SWITZER-LAND	LCol Christian Hornung *(Head of E-Learning; Ing FH)*	Joint Staff, Swiss Armed Forces *Bern, Switzerland*

	Col GS Jan Uebersax (SG) Tobias Bucher (Coordination E-Learning Contents)	
TURKEY	Ms. Nilufur Önlüel LCOL Ilhan Ulubatli	Turkish General Staff
UKRAINE	LCol Maksym Tyshchenko	National Defence University of Ukraine named after Ivan Chernyakhovsky
UNITED STATES	Dr. Tom Archibald Mr. Dean Marvin (Senior Military Analyst) Ms. Heather Walls (Editor) Dr. Sae Schatz Dr. Farzana Nabi	Advanced Distributed Learning Initiative *Alexandria, VA, USA*
UNITED KINGDOM	Maj Claudia Harvey	Defence Academy of the United Kingdom
NATO SCHOOL	LCdr. Remi Tremblay *Director SET* Ms. Tanja Geiss *(ADL Chair)* Mr. Gigi Roman *(ADL Specialist)*	NATO School Oberammergau, Advanced Distributed Learning

2 Analysis

2.1 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). 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.

2.2   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 best 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 old 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 discrepancy. Some common reasons for the 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). These reports can be accessed through NATO Transnet: https://portal.transnet.act.nato.int/Pages/home.aspx.

Figure 2-1.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 leading from the definition of a need for E&IT training through 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 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).
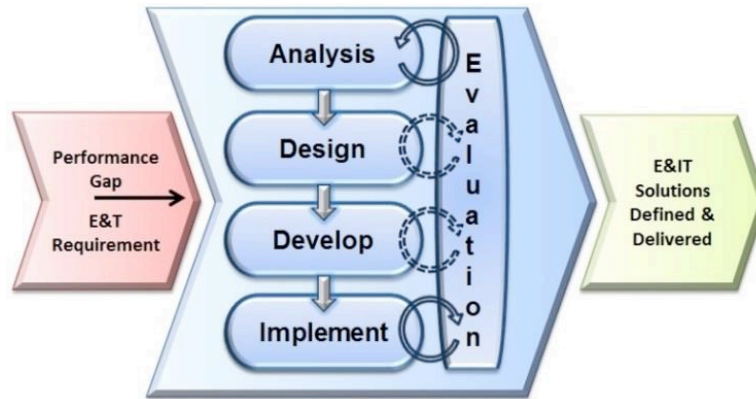
Figure 2-2 Performance Gap to E&IT solutions
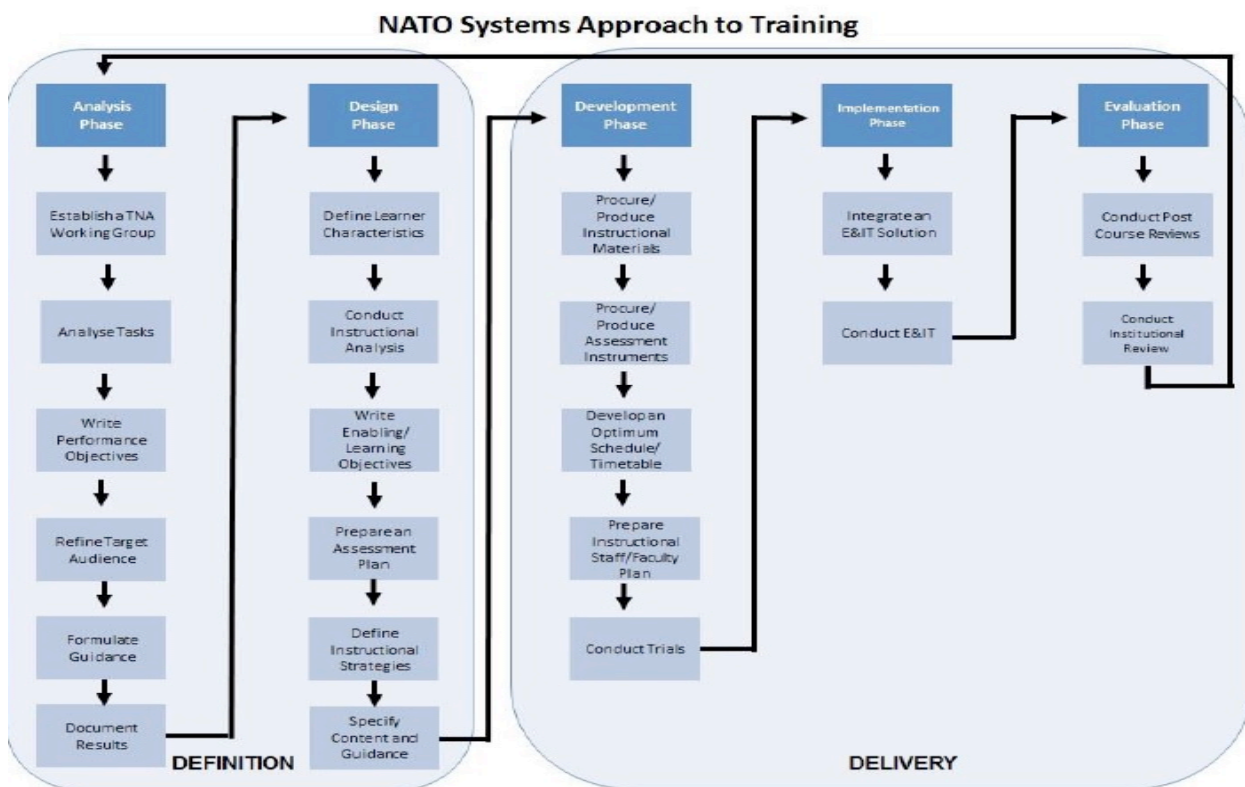
Figure 2-3. NATO Systems Approach to Training

2.3   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 interest 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 provide 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: Analyse Tasks

Step 3: Write Performance Objectives

Step 4: Refine Target Audience

Step 5: Formulate Guidance

Step 6: Document the Results

2.3.1 Analyse 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 also identifies other reasons that might affect performance (e.g., incompatibility of technologies, tools and procedures).
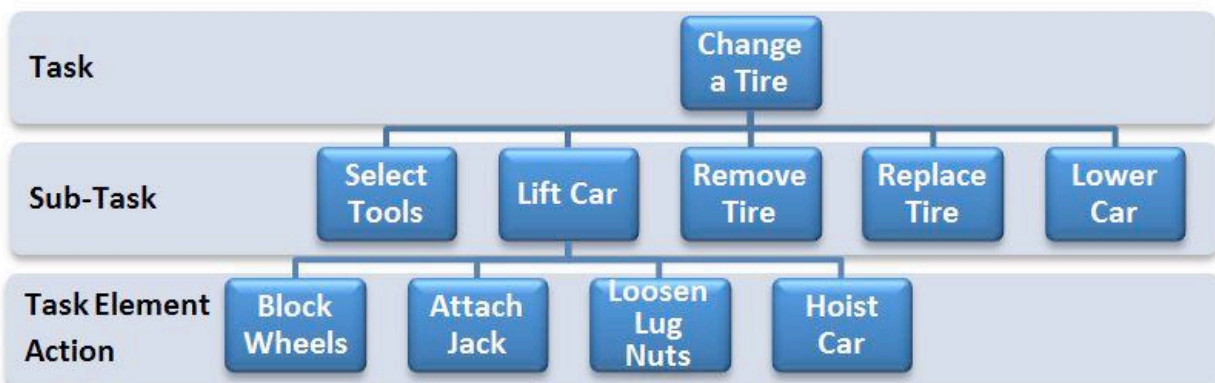
Figure 2-4. Simplified Task Analysis

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 a must, 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 – maybe 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 - maybe there were just some signs missing on the equipment to remind operators of what they learned a long time ago.

2.3.2   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 as well as a standard that defines the proficiency level to 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 clear, concise and precise 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". The determining factors in grouping or combining tasks are similarity and 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 include measures of completeness, soundness of judgment, accuracy, and/or speed.

2.3.3 Refine the Target Audience

Training projects often address several groups of learners that, in the context of a training project, are required to master the same, partially similar, or different performance tasks. These groups should be identified and characterized early, to be able to analyze all of their relevant tasks.

Example: When developing training for new equipment, there may be primary users and maintenance personnel, with the latter expected to complete maintenance work not expected from primary users. There might be an overlap in performance regarding very basic operations. For instance, the maintenance personnel will hardly be expected to use the equipment in combat operations. The training solution in such cases will require a modular approach, with some modules addressing only one training gap and other modules addressing other gaps.

For any training project, it is equally important to know the characteristics of the target audience. These characteristics 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 to build on knowledge and skills that cannot be expected. Whenever style and content do not align with the needs of the target audience, the content will not be effective.

2.3.4 Formulate Guidance

With a clear picture of what an E&IT solution is expected to achieve and the intended audience, it is now 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 concerning how the E&IT requirement will likely be resolved.

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

a. **Residential Delivery:** This is mainly instructor-led training and education, and involves bringing students to a centralized location.

b. **Distributed Delivery:** This involves taking a course to the students. Distributed delivery is usually accomplished by the following means:

    i. **E-Learning/Advanced Distributed Learning (ADL)**. These E&IT solutions can involve the use of an array of communications and collaboration tools as well as virtual/online environments; they maybe self-directed (individual) programmed instructional packages, or 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 locations.

c. **Blended Learning:** A combination of residential and distributed instruction options. The potential to reach large numbers, seemingly anytime and anywhere while still leveraging the benefits of residential delivery, makes the blended approach attractive.

2.3.5 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 in order to document the WG's decisions, assumptions and methodologies. The record of decisions is an important document for e-Learning designers and developers as it provides insight into what the intent is, and what outcomes need to be achieved. A well-rounded analysis will provide the following:

a. **Requirement 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 may include additional details to support the design of E&IT solutions.

2.4 Summary

The Analysis Phase concludes with a clear definition of the E&IT requirements and provides guidance for designing E&IT solutions. If we are lucky, designers and developers of e-Learning will be presented with a solid rationale and requirements to guide us through the remaining SAT phases. However, even with guidance, we have to examine our options, and choose the best one. One option is to develop the content in-house. Another option is to consider reusing or repurposing content that is available to be shared by other organizations (contact your national NATO Training Group representative for more information!). The third option is to consider buying off-the-shelf commercial content. The forth option is to initiate a contract with a vendor for custom development. The topics discussed in this chapter are pertinent to whatever option is selected.

3 Design

3.1 Scope

This chapter focuses on designing a course or training that includes ADL content, and 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.

3.2 Pedagogy/andragogy

3.2.1 Introduction: Generalities about pedagogy/andragogy

While it is possible that the design team may be limited to only one person, the design of an ADL course usually requires teamwork in which the pedagogy/andragogy has to be considered from the very beginning of the process.

What do these terms mean?

- **Pedagogy** can be defined as the art of teaching. It refers to the strategies, methods, and styles of instruction. In general, pedagogy is more focused on acquiring knowledge.

- **Andragogy** is most commonly referred to an approach to learning focused on the adult learner, but can also refer to the intrinsic motivation of the self-directed learner (child or adult). The teacher is the facilitator of learning rather than what we have historically viewed as the all-knowing dispenser of knowledge utilizing a pre-set curriculum with rigid guidelines.[3]

Before considering content design, the pedagogical team, in close coordination with instructors/teachers, has to choose the right combination of face-to-face education and ADL. Various types of training methods can be distinguished according to the proportion of face-to-face courses and ADL courses, and also from the implementation (or not) of dedicated coaching. Here are some examples of 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.
- **Blended learning:** In order to achieve the training objectives, blended learning combines traditional face-to-face classroom methods 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 profit from coaching, ideally provided by the instructors giving the face-to-face courses. For certification courses, blended learning is an effective means of providing practical application exercises.
- **Remote face-to-face learning:** The students are not physically present in a training room, but are instead connected to the teacher and peers via solutions such as live video, chat sessions, Help Desks, and/or virtual classrooms.
- **Distance learning:** The students are not physically present in a traditional educational setting and participate in a distance educational program in a virtual learning environment. The students still benefit from coaching related to the learned material .

- **Self-learning:** This is self-directed learning where the content is placed online for the students but without any 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)
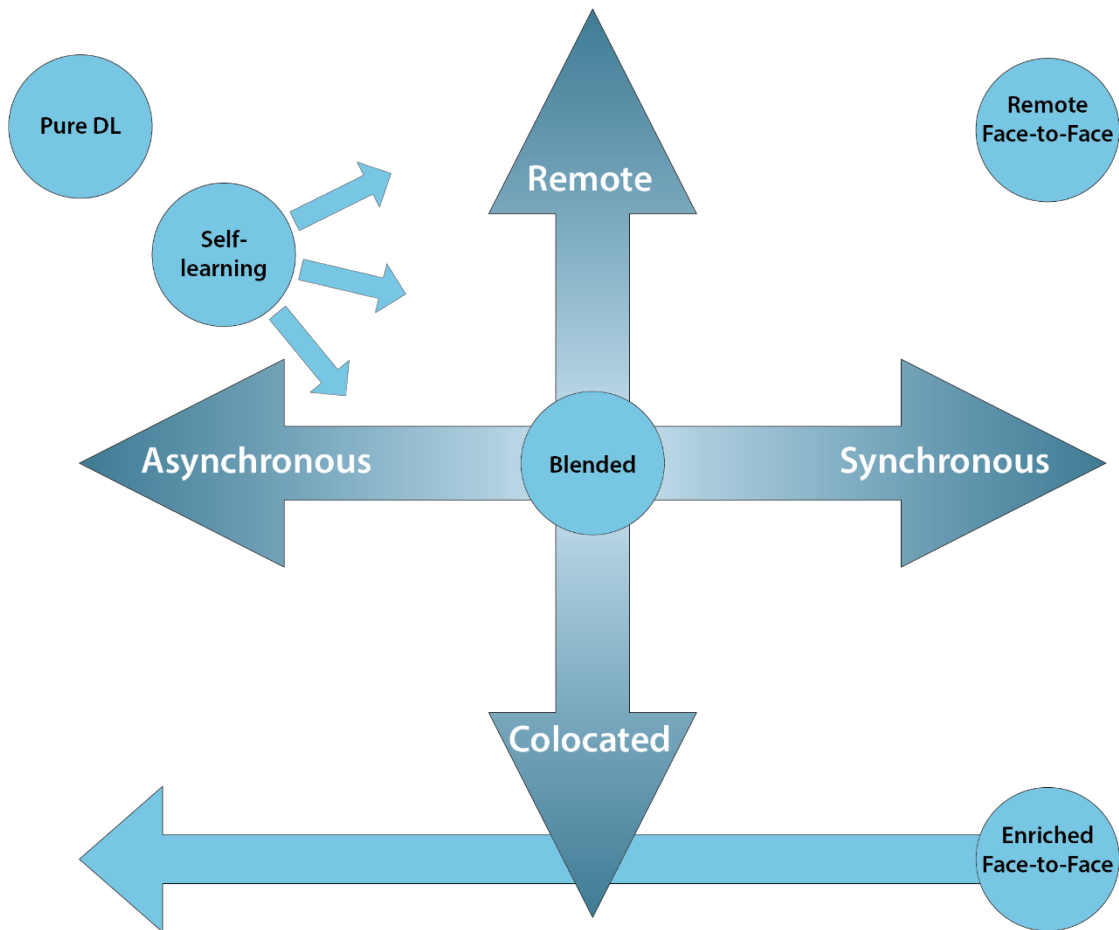
Figure 3-1. Remote vs. Co-Located & Asynchronous vs. Synchronous

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

Producing effective ADL instruction requires a comprehension of the processes by which students learn and interact with technology. While the basic principles of pedagogy used for conventional courses are also applicable for ADL courses, 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 without physical contact. The instructor should periodically check comprehension and provide feedback.
- If the ADL course is web-based, the interaction with technology can be an obstacle not only for the learners but also for teachers.

In general, while pedagogy refers to the teaching of children, where the teacher is the focal point, andragogy shifts the focus to the adult learner. When developing an ADL course, it's important to understand and apply the six principles of teaching adults. Adults learn best when4:

- 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 problem-based rather than content-oriented,
- The process is positive and encouraging. Adults respond better to internal versus external motivators.
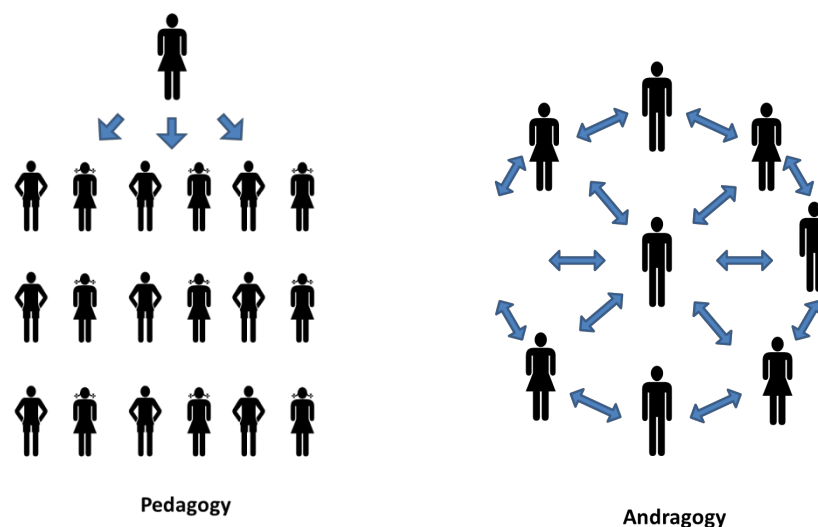
Figure 3-2. Pedagogy and Andragogy

Adult learning with technology involves a cycle of **conceptualisation** (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 **conceptualisation** 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, students are asked to perform 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 a number of 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 we make our ADL products the higher the level of individual retention will be:
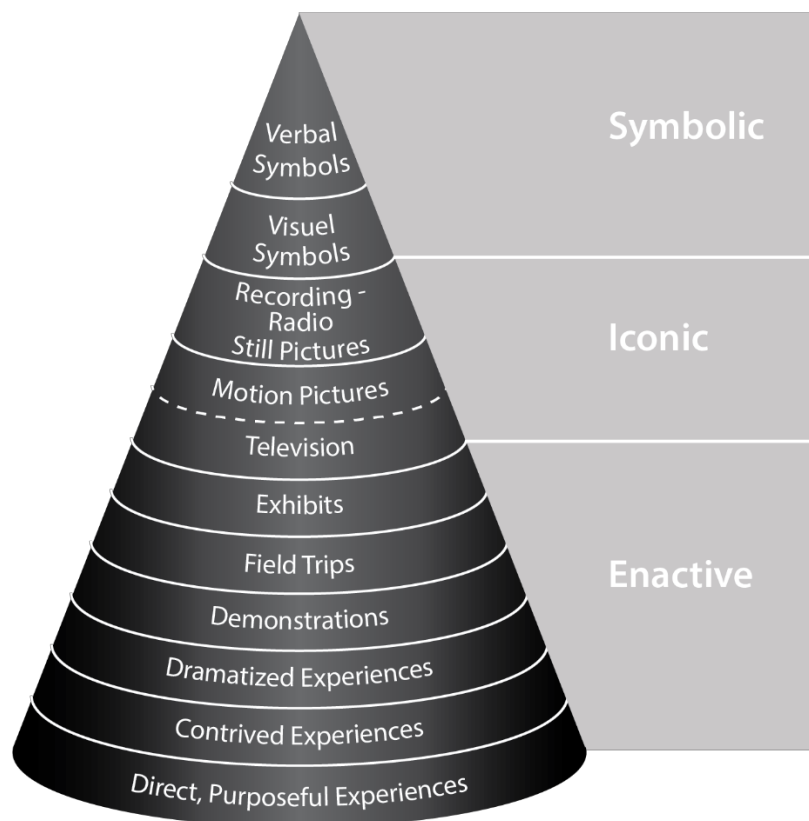
Figure 3-3. "1969 Audiovisual Methods in Teaching 3rd Edition

Successful learning pedagogy/andragogy requires us to understand how students/adults learn, memorize and reflect. Figure 3-4 depicts a notional "pyramid" of how learner's best retain what they have been

taught. The developed ADL modules ideally combine a range of presentation and 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 take into account real-time personalized learning content-to-learner adaptability.

In order to achieve the LOs, the development team has at their disposal a large range of tools (synchronous and asynchronous) that are not necessarily designed for learning, but are perfectly usable in a training/leaning program. It's also 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 be able to integrate then correctly in the learning process. In this regard, the development team must take into account the technical maturity of the target group of learners.

3.2.2 Actions to be done before starting the development

3.2.2.1 Define the Enabling / Learning Objectives (ELOs)

ELOs identify a segment of instruction that constitutes a major step to enable the achievement of the Performance Objective (PO). ELOs define what the individual will learn and are the basis for providing evidence of student progress. A well-written ELO provides the basis for student assessment and is generally the basis for the decision to develop an ELO. The ELOs will also guide the sequencing of instruction and other decisions, which follow, concerning an instructional strategy. The supporting 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 itself 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 how exactly 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.

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 are 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 into several more for:

- Identifying signs of IED installations in the right places;
- Identifying the typical indicators for IED installations; and
- 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 are to be treated as content too! 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).

3.2.2.2   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 in order 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 participant's 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 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.

3.2.2.3 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's absolutely necessary to include evaluations. Its 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:

Phillips Analytics

Kirkpatrick´s Analytics

ROI — "Did the training investment pay off?"

Results — "Did the implementation of the traning program impact business result?"

Impact — "Did the learners deploy the learnings on the job?"

Learning — "Did the learners learn the content?"

Satisfaction — "Did the learners like the training program?"
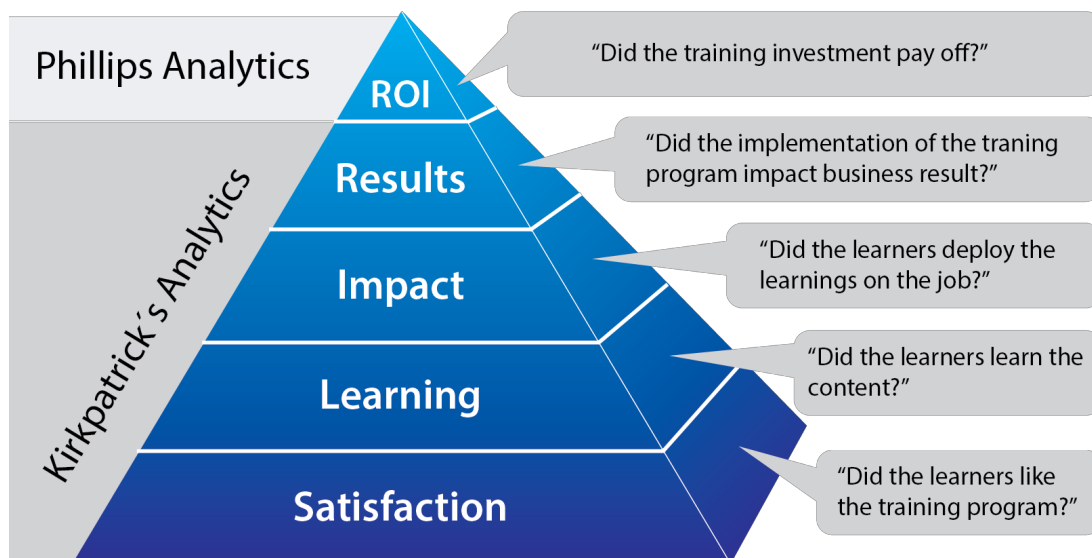
Figure 3-4. The Kirkpatrick-Phillips training evaluation model

For this chapter, we'll focus on the initial 3 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 7.

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. It is also possible to make access to the next course level 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.

3.2.2.4 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 3-5. Sample Storyboard

The storyboard's primary value is that it forces you to have a reason and a consistent approach to

everything you do. 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 your program contains branching options, make sure that the learner is forced to explore all branches before proceeding to the next topic.
- Clearly label optional material. If you include material that is optional (examples or complementary information) in your module, make sure to clearly label it as such and ensure the learner knows that completion of the module does not depend on having studied the optional material. Additionally, within the design of your assessment instruments you should ensure that material designated as "optional" is not included as testable content.
- 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 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 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. Overloading a slide with several related topics is not recommended. Most likely, the student will remember none of those concurrent topics. This does not mean that the entire learning material within a larger topic should be placed on only one slide; in most cases that will be difficult and messy.

3.2.3 Pedagogical and educational tips

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

3.2.3.1 Know your audience

The number one educational prerequisite for proficient instructional design is to "know your target audience," that is, know their skills, needs, and motivations.

3.2.3.2 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 pretty self-explanatory. Extensive descriptions of the content and structure should be avoided. If your course design requires a lot of explanation, then it's probably a poorly designed course.

3.2.3.3   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
- KISS (Keep it short and simple)

3.2.3.4   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."

3.2.3.5   Short Text Chunks
Avoid pages that are densely packed with text and 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 3-6. Sample Use of White Space

3.2.3.6 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.

Figure 3-7. Sample use of Pictures to Tell a Story

3.2.3.7 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[5]is comprised 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. Put simply, the training program should answer the critical question, "What's in it for me? "Benefits of the course should be clearly stated. 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 required 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 job.
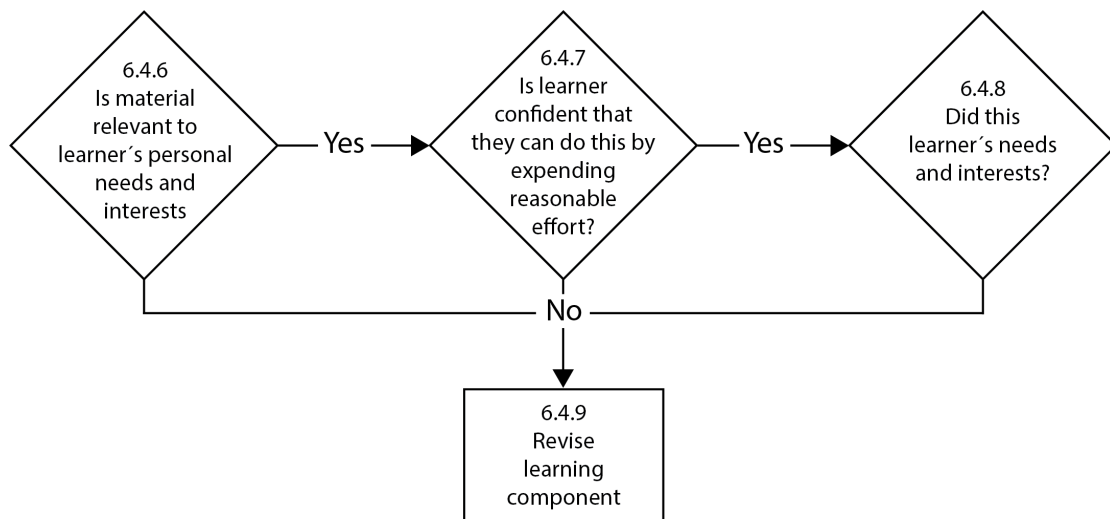
Motivation Optimization Procedure

Figure 3-8. MotivationModel

3.2.3.8   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 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.

3.2.3.9   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

3.2.3.10 Learning and positive emotions

The design team must ensure that the course content regularly creates positive feelings (joy, surprise, amazement, etc.). The feelings often dictate our daily behaviors, choices, and perceptions. Positive feelings make the communication more effective, and 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,
- 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. In the conception of the scenario, content, and user interface, the design team must be aware of the negative impact of potential negative feelings (frustration, monotony, annoyance), and must try to avoid them.

3.2.3.11 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.

3.2.3.12 Tracking of the activity of the learners

In order to evaluate the content to determine whether or not it is adequate to 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 a LMS, you may want to consider using the ADL Experience API (xAPI) specification. See https://adlnet.gov/research/performance-tracking-analysis/experience-api/ for more details.

3.2.3.13 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. In order to counter this isolation, and 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
- 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's 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 numbers of learners, the duration of the course, and the limitations of the learning environment (especially the availability of material and human resources).

3.3   Instructional Design

3.3.1   Overview

This section will provide guidance on the correct application of education and training strategies related to 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 practice described in the previous chapter. This information will benefit both policy makers and ISDs, and assist in producing a credible and interactive ADL course.

The ISD process consists of a number of separate stages:

1. Communication of Objectives
2. Task Contents
3. Engaging Material
4. Interface Design
5. Layout

3.3.1.1   Communication of Objectives

This section describes the elements of effective ISD and how to identify engaging materials. Firstly, when you are thinking about your project in the design phase (i.e., developing the course storyboard), you should consider the 4As of ISD:

1) Attraction

- You have approximately 0.1 seconds 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 5-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's 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 need 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 they are working on. You can assist the learner 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 learner's experiences, and leading them toward the learning point is a means to increase relevance.

3.3.1.2 Task Contents

If the task contents within a course don't motivate the learner 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., text descriptions, diagrams, still images; rich media, interactive graphical media, 3D models, diagrams with pop-up explanations, etc.). It is essential that you choose a variety of relevant media for your students. The

learners also need to experiment with the learning material to ensure they fully understand the concepts. This can be done by utilizing 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.)

3.3.1.3   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.?

In deciding what engaging activities you may want to include in your design, here is a short list:

✓ Check Questions	✓ Peer Review
✓ Structured Presentations	✓ Self-Reflection
✓ Tutor Reviews	✓ Assignments
✓ Games	✓ Simulations
✓ Discussions	✓ Demos
✓ Questionnaire	✓ Information Resources
✓ Case Study	✓ Peer Review

It's important to note that sound and motion can attract attention and help engage the learners, but supporting evidence indicates that it is relevant material and interactivity that will reinforce and maintain engagement. It's 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 as these challenge the learners and heighten their attention levels.

3.3.1.4   Interface Design

There are some basic guidelines that should be followed to ensure your courseware does not become distracting to the user. If you get the interface design wrong, it means the learners could quickly lose interest/motivation. If you amend the layout, color scheme, text, graphics and audio, you could significantly increase the likelihood of someone reading and remembering your 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 3-9. Sample Interface Design

3.3.1.5   Layout (Primary Optical Area)

It is known that a moving object on a screen will always become a master anchor point for the eye and if the moving object is at the bottom of the page then 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 your text is being displayed. Remember, a video or Flash file may look good and display your creativity utilizing these mediums, but to the student, it could be a distraction.

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).
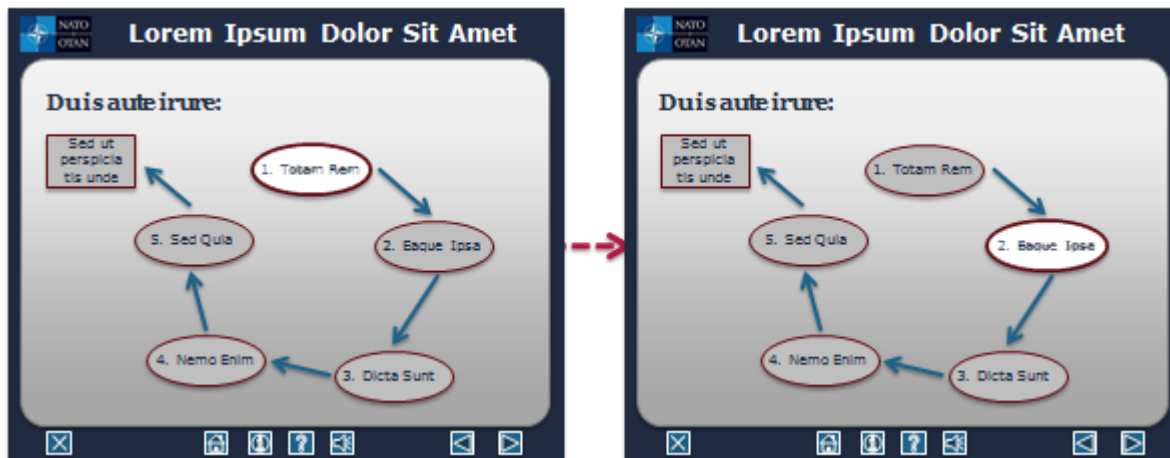
Figure 3-10. Sample of proper layout concept

The Primary Optical Area (POA) is where the eye starts scanning from. You want the POA to be where the start of your info is as the eye doesn't go back after starting at the POA. Moving objects or engaging images often become the Master Anchor and override the POA; therefore, be aware when animation or pictures are introduced and played.

3.3.1.6   Text Layout

It is important that you choose the correct font type and size, and that you remain consistent throughout. The most popular font for screen reading is Verdana followed by Arial, both of which are sans serif fonts. Sans serif should always be used for body text, in contrast to headings, which should use a font of high contrast to a serif font.

In terms of font size, when using text for describing events (not headings) it is best to use a minimum of 12pt font with 14pt spacing as this is what the brain is used to reading. Double line spacing can become confusing, and as a rule of thumb, only 4 sentences in a block can be read before the eye becomes tired. Using text bullets can help separate blocks.

3.3.1.7   Color Schemes

Color schemes during the design phase may be dictated by your organization. However, great care and attention should be placed on this element of your design as you will need 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 quite well, but be aware that 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, be aware of the style you are using and avoid introducing a Moiré Effect whereby the image will blur and reduce clarity.

- Do not use too many different colors, particularly for text. You should try to aim for no more than 4 colors. Once a set of colors has been chosen, stay consistent throughout. (Note: Be aware that colorblind individuals may not be able to distinguish between certain colors. Make sure that colors are not the only method you use to convey important information.)

  Colors have associations: RED = STOP and WRONG, GREEN = GO and CORRECT, YELLOW = LOOK HERE.

  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's also important to note that color schemes are merely a part of your 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 setting up your house style at the inception of the design phase, you can ensure that you have the correct color scheme, logo, text style and layout set for the rest of the learning content.

3.3.1.8   Text Emphasis

There are various ways to emphasize text. You may decide to enlarge the text you deem important, **embolden**, or use a different color. You should also ensure that any text that is superimposed on a graphic is readable. The use of a semi-transparent bar (shown below) is one means to maximize legibility.

Figure 3-11. Use of a semi-transparent bar to maximize legibility

3.3.1.9   Text and Graphics
The use of text with graphics is a very good way of reinforcing the information you are trying to impart to your students. By putting text either close to the graphic, or better still, as part of the graphic it's referring to, you ensure that the student does not just look at the picture.

3.3.1.10 Narration
It is worth considering that words presented by audio are better than on-screen text especially when they are describing an on-screen graphic. This is because you are essentially spreading the input over two channels. However, some people don't like reading the text whilst listening to the audio. Therefore the ability to turn off text or audio should always be 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. Adults can and want to read text themselves. But a better way is to display parts of the narrated text at the appropriate moment. These 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 screen text when it comes to short statements or simple key words. But avoid reading the content displayed word-for-word!

3.3.1.11 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[6]:

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 structure in bite size chunks.

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

3.4 Summary

Below are some summary points to remember when designing your courseware.

1. Keep it simple – text, sound, motion and color may be used to support the instruction. However, if it doesn't 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 the 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.

4 Development

4.1 Scope

This chapter will cover tips and considerations for developing ADL. It covers topics such as standardization and development methodology.

4.2 Introduction

There are many ways to produce electronic content. However, requirements affect the way a piece of electronic content is designed. Some of these requirements include:

- Tracking learner progress
- Storing learner data
- Adapting content to learner's previous achievements (i.e., learner profile)
- Viewing content on hand-held mobile devices
- Engaging in a virtual environment or simulation
- Communicating with others

4.3 Standardization

Content can be produced in a way that increases interoperability through the use of standards. This section provides guidance on the technical standards and specifications to be used to ensure interoperability, reusability, and portability of content both for production of traditional e-Learning, and new areas like mobile learning elements.

4.3.1 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 "play well" with other e-Learning software**. It is the de facto industry standard for e-Learning interoperability. 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.

NATO STANAG 2591 "Advanced Distributed Learning" (8 May 2013) states: Participating nations agree to adopt SCORM® 2004 3rd Edition as the standard for the purpose of conformance of the following:

- Learning Management Systems (LMSs)
- Content Packages
- Sharable Content Objects (SCOs)

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:
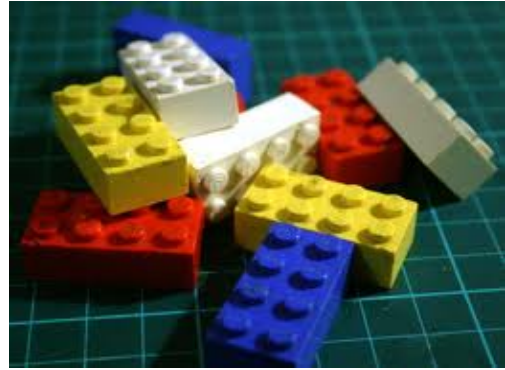
Accessibility. The ability to locate and access instructional components from multiple locations and deliver them to other locations.

> *Example*: You can move a SCORM® course from one SCORM®-conformant system to another SCORM®-conformant system without complex reconfiguration/installation.

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 impact 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.

4.3.1.1 SCORM®Conformance

Conformance is about functional requirement. SCORM® is a set of functional requirements, so if a product adheres to these requirements, it is conformant. The SCORM® Test Suite contains the software, procedures, and supporting documents to verify SCORM®conformance of LMSs, content packages, and Sharable Content Objects (SCOs). It provides a detailed log of each test outcome.

A SCORM® product tested and validated successfully in the SCORM® Test Suite is considered "conformant."Conformance is the result of an error-free, repeatable test that proves content or systems meet the minimum requirements defined in SCORM®.

4.3.2 Implementing SCORM®

4.3.2.1 Determining if SCORM® should be used

If your organization is developing learning content for the web, you may think that it must use SCORM®. That is not necessarily true. The two major benefits of SCORM® are: enabling interoperability; and reusability of tracked data across learning objects. You may NOT need to develop in SCORM® if:

- The content is meant to live and die within a single system.
- There is no requirement for tracking course results and progress.
- The intended audience does not access content through a LMS.
- The content has a short life span (e.g., only developed for a single purpose and for a specific amount of time).
- Your organization already has custom tracking code, and the content you are creating wouldn't leave your system.

The biggest factor in determining whether SCORM® should be used is the end-deployment environment. If your organization has a SCORM®-conformant LMS and normally develops SCORM® content, it makes sense to do so. Determining how much SCORM® should be used
If SCORM® is a necessity for your content or organization, the next step is figuring out how much SCORM® should be used. The first step is to determine the version of SCORM needed. There should only be two answers to this question: SCORM® 1.2 or SCORM® 2004 3rd Edition. Consult with the requirements or LMS provider before proceeding with development.

SCORM® 1.2 is the earliest stable version of SCORM® that is still supported today. It is the most widely adopted version of SCORM®. SCORM® 1.2 has no concept of content sequencing. This means that most SCORM® 1.2 content is either free-choice and allows the user to take whichever content they want at any time, or the content handles all sequencing and navigation internally. This is a slippery slope, however, because it typically means entire courses end up as a single sharable content object (SCO). This hurts reusability and the ability to track multiple learning objects across SCORM® (normally, each SCO reports a score, completion data, and success data. If there is only one SCO, granularity is lost if this information is not tracked elsewhere). The biggest shortcoming of SCORM® 1.2, however, is the idea of mandatory and optional data model elements for the LMS. If your organization or content is relying on an unfamiliar SCORM® 1.2 LMS, verify that it implements all SCORM® 1.2 Data Model Elements, not just the mandatory ones. **An LMS can be SCORM® 1.2 conformant and not support these elements.** Another important caveat of SCORM® 1.2 is that a learning object is either "completed," "passed," or "failed" and never more than one of these.
SCORM® 2004 3rd Edition and SCORM® 2004 4th Edition are very similar, but the 2004 3rd Edition is recommended for use.

4.3.2.2 Are you designing for reuse?

SCORM® is typically used to enable reusable content. This could mean reuse within a course, within a curriculum, within an organization, or across organizations.

The term "reuse" is rather straight forward, but requires some explanation when developing for reuse across organizations. For ease of explanation, we'll use an example. Let's say that your organization is tasked to develop content on First Aid. Before beginning development, you should search for content that can be reused. Here are three options that may help your organization save development costs:

1. **Reuse.** You may be able to "discover" First Aid content that meets your needs, is freely available, and your organization can simply download the content to your LMS and provide access to it.
2. **Repurpose.** You may discover some First Aid content that is pretty good, but doesn't quite meet your needs - yet the content is freely available and accessible. You may be able to download the content and "repurpose" it by deleting/adding the information that makes the content pertinent to your organizational needs.
3. **Reference.** You may discover that another organization already hosts content that fully meets your needs, and that the LMS that hosts the content is fully compatible with your LMS (or that you possibly don't need to track student data). You can then "reference" the content, so that the people in your organization can meet their training requirements by accessing the content hosted on another LMS.

There are rules when designing for reuse, such as making files similarly accessible, making the content itself context-free, and implementing SCORM® calls and packaging. If the content you are creating is meant to live in a single course and never leave that course, it may not be worth the time investment to make the content reusable. If this is the lifecycle of the content, there is nothing wrong with not making it reusable! It is still possible to create that content as SCORM® content, but to leave out some areas of reusability.

Designing for reuse involves a different mindset throughout the content creation process. Reusability is a sliding scale, not simply a box to be checked. Simply implementing the most basic SCORM® requirements enables interoperability, which is a form of reusability itself. From file structures (flat is best), to file naming conventions (avoid calling things "Lesson 2" for example), to the removal of context within content (again, "Lesson 2" or references to other SCOs), there is a lot of work in making content reusable. Metadata can also be used to make content more "findable" in repositories, but is not a requirement of SCORM®.

Finally, consider "sizing" or "chunking" to ensure the content can be easily reused or repurposed. As mentioned above, an entire course that is wrapped as a single SCO greatly limits the likelihood of reuse. Although SCORM® doesn't define or mandate SCO size, developers should consider "chunking" the content into reusable pieces. To further enhance reuse, provide the source material down to the asset level. Going back to our example of developing a First Aid course, a good example of chunking would be to develop SCOs such as "Stop the Bleeding," "How to Help a Choking Victim," and "Cardio Pulmonary Resuscitation (CPR)." These chunks are much more reusable than wrapping all these (and other) sections into a single SCO entitled "Basic First Aid."

4.3.2.3   Impact on Design

You've probably heard that SCORM® doesn't change how you design your content. This is only a half-truth. SCORM® implemented to the simplest degree doesn't impact design, but, if done well, will cause some implementation changes from how a course is typically made. There are the typical reuse considerations mentioned in the previous section, but here are some others:

Understanding LMS Controls and Content Controls

A common discrepancy when launching SCORM® content in a LMS, particularly across LMSs, is how the controls work. Some LMSs expect SCORM® controls to be within the content, some expect to maintain their own controls and launch the content in a frame. Given that it is very likely that a SCO has more than one page or frame, it is quite possible to end up with a set of controls for paging and a set of controls for navigating between SCOs. While designing for reuse is important, designing for the target LMS shouldn't be overlooked at the cost of reusability.

Sequencing

While SCORM®sequencing enables more than 99% of behaviors an instructional system designer (ISD) would look for, there are still a couple of odd cases that cannot be accomplished with SCORM®. The ISD's concern, however, should be with the 99%. An ISD can likely describe a fully viable sequencing strategy that is implementable within SCORM® 2004, but a SCORM® programmer may not be able to re-produce it easily, even though it is possible. This arises because although SCORM® implements "simple sequencing," all scenarios are not simple.

4.3.2.4   Technical and Instructional Implementation Details

Both ISDs and learning content creators can refer to individualized guides on SCORM® Best Practices. These guides are available for free from https://www.adlnet.gov/research/SCORM.

SCORM® Users Guide for Instructional Designers

https://www.adlnet.gov/public/uploads/SCORM_Users_Guide_for_ISDs.pdf

SCORM® Users Guide for Programmers

https://www.adlnet.gov/public/uploads/SCORM_Users_Guide_for_Programmers.pdf

5 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.

5.1 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.

5.2 Staffing for a project

5.2.1 Typical Roles

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

- **Customer** asking for the project to be completed
- **Subject Matter Expert (SME)** providing background and content expertise
- **Project Manager (PM)** overseeing 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
- **Programmer (PR)** responsible for bringing together all elements in an authoring tool such as Flash, Articulate, Lectora, ILIAS SCORM Editor, and others
- **Learning Management System (LMS) Administrator**, responsible for uploading courses to an LMS and making it accessible to students

In smaller production units, and depending on the tools used for development, some of the roles may be combined in one person. For the purpose of brevity, we do not describe each role in detail.

5.2.1.1 Special role of the Customer

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

5.3 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.

5.3.1.1 How to identify a good SME

In order to best support any training project, a 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
- Communicate effectively with ISDs and other project personnel who likely have less knowledge in the SME's field of expertise
- 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 regarding 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.

5.3.1.2   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.

5.3.1.3   How to get the most out of SMEs

SMEs fulfill project-related task besides other duties. The following approaches may support you in establishing successful long-term collaboration:

- Get the SME officially tasked to support your 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 and 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 and about the timing of his/her critical contributions!
- Provide him or her with a summary of whatever analysis and concept work has already been carried out and signed off.
- Limit the workload on the SME to support you by encouraging pragmatic approaches to provide inputs. Possible work methods:
  - Have him or her mark up any existing material with comments, suggested deletions, updates, or additions
  - Invite him or her for an interview and have him explain processes with pictures (or other media) while videotaping everything
  - Provide him or her with a detailed questionnaire asking for very 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!

5.4   Typical project phases and milestones

5.4.1   Basic principles for a successful project

The secret to successfully running any project is step-by-step procedures involving all stakeholders at the right time; carefully making decisions before attempting any work. This way, costly and time-consuming rework due to incorrect assumptions is highly reduced.

5.4.1.1   Basic rule about critical steps

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

5.4.1.2   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, assuming that a careful analysis of the training problem has been completed that 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

Each of the phases is covered in more detail in the following sections:

5.4.2   Start - Kick-off meeting

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

- Introduction to the project at hand (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
  Important:
- Have all participants agree on the plan and all key decisions taken
- Distribute the meeting minutes to all!

5.4.3   Phase 1 – Basic concept and structure

Depending on the work that has been done upfront, it may be necessary to first develop a basic concept and an idea about the structure of the content to be developed. This preliminary phase provides an

opportunity for everyone 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 may typically include:

- 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. No need to invest in hours of fine design yet!

5.4.4   Phase 2 – Design and content outline

This phase provides a solid basis for writing the story board. As the storyboard describes what is to happen on each screen, it also depends on some key decisions regarding layout and navigation. If these decisions are not made early, the storyboard will most probably not suit the interaction options. In addition, this phase also makes sure that the storyboard writer has a solid, approved plan to work from. The phase typically provides the following results:

5.4.4.1   Design

- **Basic design for each screen** and **screen variant** according to the specs and the screen size of the delivery platforms
    - *Example*: Image with bullet-list, video with key words, 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.

5.4.4.2   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.

5.4.4.3 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 clearly recommend writing all test items before starting with the storyboard, because the **self-assessment items help clarify any deviations early.**

Remember: Do not proceed to the next phase before all of the above items are signed off by the SMEs and other crucial project team members!

5.4.5 Phase 3– Storyboard

The storyboard is the final, detailed plan for building your 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. This is why 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
- Do not present the complete narration as screen text in parallel; instead, only display keywords or phrases synchronous to the narration

5.4.6 Phase 5 – 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, you need to distinguish source materials and production output.

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.

The following hints illustrate some of the key factors to be observed in media production:

5.4.6.1 Images

- With today's digital cameras, it is easy to quickly create your own image material.
- Never enlarge images that are too small for your purpose.
- Always use layers when working with images containing text. Layering greatly simplifies any corrections and also allows for fast translation, if required.

5.4.6.2 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 your 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.

5.4.6.3 Sound

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

5.4.7 Phase 5 - Programming

The programming phase includes:

- 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 a 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: By involving the programmer early in the project, you may ensure that whatever you plan to do can be realized without unexpected costs and unpleasant delays.

5.4.8 Phase 6 – Testing

Assuming that you followed all the phases, including all sign-offs of important intermediate steps, the result of the programming will be a planned product. Nonetheless, even with the most capable production team, there can and WILL be flaws or errors in the program that remain undetected without thorough testing.

Thorough testing of web-based learning includes its deployment on your own 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 programs 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 of the course. Not only for spelling and grammar, but also to 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.

5.4.9 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 a corresponding event where you may look back on the project as a team, and identify potential improvements for the next project as well as points that worked well (i.e., sustains).

5.4.10 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 reached by using special tools supporting a limited range of predefined design and interaction features, and 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 when it comes to recording and editing sound and narration, most of the required tools are embedded in easy-to-use format.
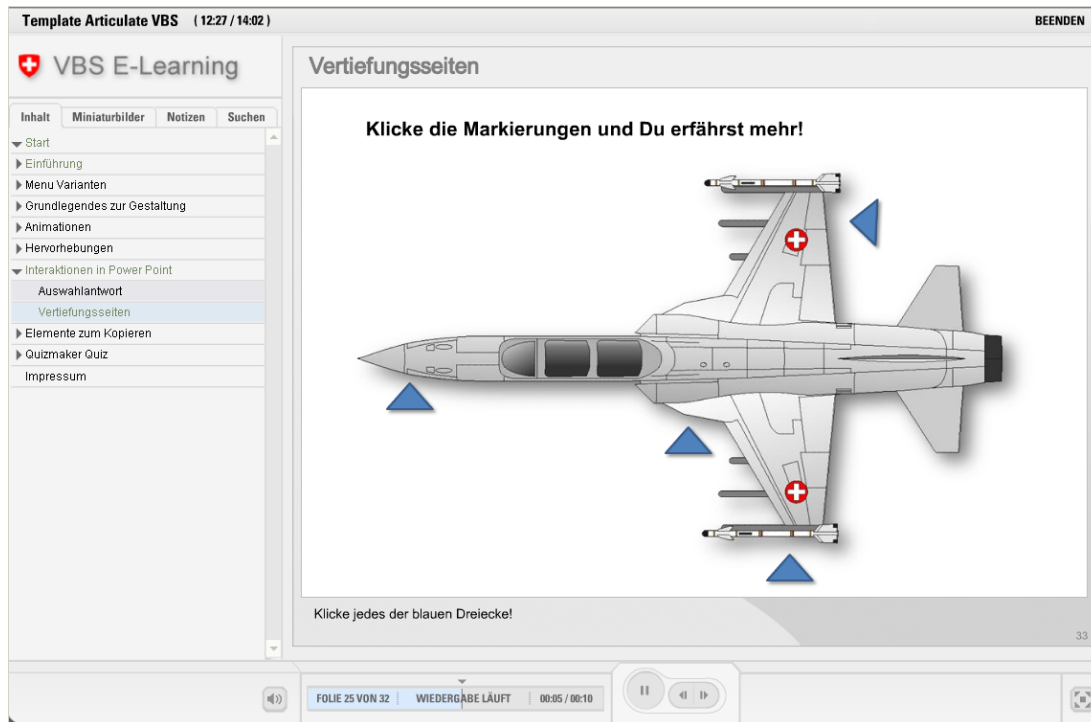
Figure 5-1. Example of PowerPoint-based Rapid e-Learning (Articulate Presenter, Layout of the Swiss DoD)

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 best results, the original PowerPoint content should be adjusted to get away from the classic "presentation-look." This typically means:

- Removing the typical "standard" slide backgrounds and other typical 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
- Wherever possible, add 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 support wide use of PowerPoint hyperlinks and animations

When it comes to establishing Rapid ADL in your organization, make sure to first establish 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.

As the development of Rapid ADL content tools is very dynamic, this handbook does not provide a list of tools. You may easily find the current ones via the Internet.

6 Implementation

In any description of the Analysis, Design, Development, Implementation,& Evaluation (ADDIE) ADL development method, the *Implementation* step is critical. Note that there may be a wide variety of possible scenarios for implementation available. This diversity stems from case-specific and non-pedagogical policies that must be taken into account. 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:

1. Deploy it (make the course module available)
2. 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.

6.1 Deployment

Deployment of a course module means that it's 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., SCORM), required plug-ins (e.g., Flash module),and security requirements (e.g. classification demanding the course to be installed on a secure network).

There may be two scenarios for deployment:

- The simplest scenario for deployment would be that 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, and therefore require 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., human resource system (HRS)).

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

6.2 Running a course

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

In the simplest scenario, the user opens the course and moves through the contents by tree, or "previous/next" navigation, until the last part of the course has been opened, or when the learner decides that he or she has seen enough.

In a more complex scenario, the course invites the learner to do more than just see it. There may be exercises, tests, assignments (possibly involving student-student or student-teacher collaboration), simulations and other interactions as part of the course. The bottom line is that the more a learner gets involved, the better they will remember (see Figure 3-4in Section 3.2.1 of this Handbook), but the more complex the situation gets, the more can and will go wrong (e.g.,"Murphy's Law").

Between the simplest and most complex scenarios lies a world of possibilities (challenges, if you like) that require a clear understanding of consequences and requirements. Whatever method of implementation is chosen, it may have repercussions on the method of development, and vice versa.

6.3 A model for implementation

Any implementation can be described by a model that zooms in on 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 that is the result of 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, and interfaces, or any other "technical" support the process requires. Preferably, the tools that are 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).

A beautiful part of drawing up architectural models with the aid of the above-mentioned elements is that no matter how much effort you put in, and although they *never* describe the actual truth, they still look very acceptable. Foremost, they allow for communication on the topic and offer a basis for further detailing. The real challenge is to know what level of granularity to apply to the models. A lot of detail enhances the accuracy, but can detract from the simple one-page message you're trying to convey.
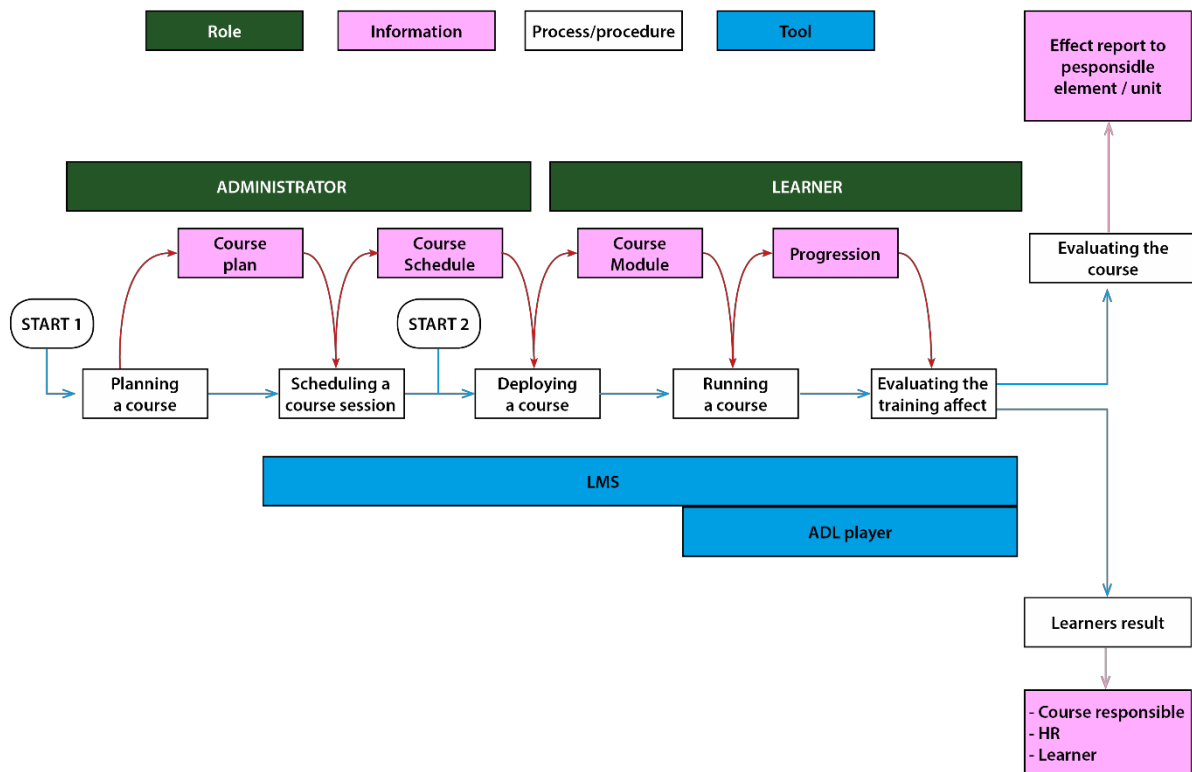
Figure 6-1 Model of the implementation of courses (Sample)

Figure 6-1 shows a sample of a model that can be used for implementing or as an idea to build your own model.

6.3.1 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.)

6.3.2 The roles

6.3.2.1 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 with regards to security, deployment, access, and support.

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

6.3.2.3 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.)

6.4 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.

7   Process `Evaluation

7.1   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 as a means 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 or not 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's designed to accomplish?).The key purpose of evaluation is to improve the training, and to include feedback in future revisions.
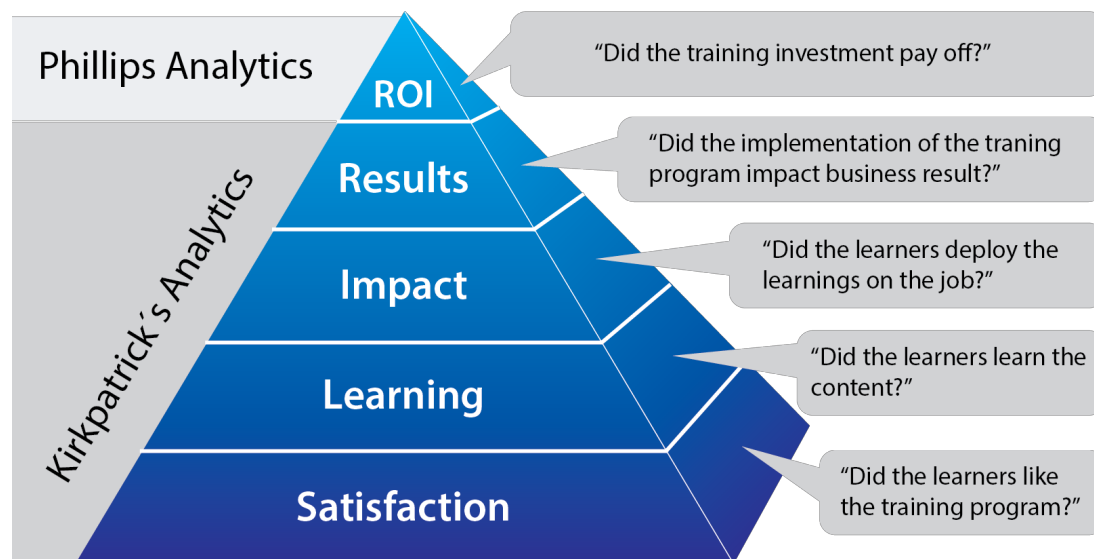
Figure 7-1. The Kirkpatrick-Phillips training evaluation model

It's not clearly delineated, but in general, learner evaluations focus on the bottom three tiers of the Kirkpatrick-Phillips model (Satisfaction, Learning, and Impact) that were discussed in Chapter 3, while evaluation focuses more on Results and 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, with a safety-related course, it might seek to find out whether the number of accidents has really decreased.

ROI: The Return on Investment evaluation is a complex undertaking that 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.

7.1.1 Purposes of Evaluations

Evaluation involves systematic and careful data collection and analysis in order to answer a specific research question[7]. The "research question" most often asked in this phase of the ADDIE process is: How effective was the training? Regarding this question, it's possible to enumerate three main **purposes of evaluations**[8]:

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

7.1.2 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?).

7.1.3 Evaluation Characteristics and Criteria

Evaluation has to fulfill the following conditions: independency, reliability, objectivity, and should be impartial; it should also be systematic and based on specified methodology.

It should also be focused on criteria such as:

- **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 possess will affect others
- **Sustainability of the effects** – whether the project's effects remain without further resource expenditures

7.1.4 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 written in the natural language of the respondent. The tool should display progress (for example, Question 1/10, 2/10, etc.).

7.2   Types of Evaluation

7.2.1   Surveys& Polls

Among methods of data gathering (post-evaluation) on ADL courses/programs, one of the most effective forms is the survey. This is due to the fact that some LMSs possess tools for preparing questionnaires with varied types of questions. The types of possible questions to construct in LMSs are:

1. **Matrix questions** – where identical response categories are assigned to multiple questions
2. **Close-ended questions** – giving a fixed set of responses. Most scales are close-ended. Examples of close-ended questions are: yes/no, multiple choice, scaled questions
3. **Contingency questions** – a question that is answered only if the respondent gives a particular response to a previous question
4. **Open ended questions** – where 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. Some example types of open-ended questions are:
   a. **Completely unstructured**– for example, "What is your opinion of the course?"
   b. **Word association**– words are presented and the respondent mentions the first word that comes to mind
   c. **Sentence completion**, story completion, or picture completion

7.2.2   Online questionnaires

The main advantage of using online questionnaires is that the responses can be quickly gathered in a standardized way, so 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.

7.2.3   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 normally 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.

7.3   Summary

Evaluation is a crucial stage of the ADDIE process as a means to enhance 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 respondent's confidentiality.

8   Examples of Emerging Technologies for Training and Education

8.1   Scope

As we move toward a more learner-centric environment, individuals need options "outside the classroom." In many cases, learners want to manage their own learning environments and share, organize, collaborate on and access all kinds of resources (video, audio, images, etc.). In this sense, the overall informal learning. Informal learning is increasingly being supported by technologies such as social media and purpose of this chapter is to emphasize that conventional classroom and ADL systems do not support virtual environment, and is available from mobile devices.

This chapter gives an overview of new learning technologies and methods to be considered when developing courses and training. Social networks (Facebook, Twitter, etc.), virtual worlds (VBS, Second Life, VR),mobile platforms, serious games, gamification and augmented reality are no longer considered "emerging" technologies, but the ways of their utilization to teach and/or augment more traditional learning are rapidly developing. This chapter will highlight considerations in implementing these technologies. The authors of this Handbook intentionally did not try to include a list of specific emerging technologies because the material would quickly become outdated. Instead, we provided some overarching "concepts" to consider when designing ADL.

Here are some general considerations about the future learning environment:

- The future classroom will be increasingly aided by "informal learning" from outside the classroom. Social media will provide peer-to-peer and mentor-to-student capabilities that are critical to personalized instruction.
- The future may rely more on "training" than "education." Instead of spending a lot of time educating students for a particular skill, it will save time and resources to teach only basic skills, and allow the students to hone their skills on the job.
- Technology may (at times) not be available. Also, we can't assume that everyone possesses technical skills, but we may be able to assume that there are varying levels of expertise. We need to ensure that students can function well without technology. How do we help avoid "regression" when technology is not available?
- We need to offer "content" in a variety of mediums. Although there is a lot of debate about "learning styles," it is probably safe to assume that offering a variety of mediums gives learners choices in how, where, and when they learn.
- Some aspects of military training will remain the same, because some skills have to be taught face-to-face (e.g., teamwork, military "culture," marksmanship, etc).
- Reading levels are a "common denominator." We will continue to develop instruction and teach at the appropriate level of comprehension.

- We need to teach toward "adaptability" or "cognitive agility." This skill will be an overarching one that will be used throughout a learner's career.
- Instructors are multifaceted (e.g., they often provide IT support, facilitate the classroom, teach the class, and manage the courseware). We need to teach these skills to instructors and help them be better prepared for the future "classroom."

Technology is changing rapidly. Considering the past few years, we can easily recognize how much technology has progressed over that time. New learning technologies provide different tools to educational organizations and individuals. In the following sub-chapters, essential information about emerging technologies that are used in learning is provided. Collaboration Tools

8.2   Collaboration tools

Collaborative tools can be used by students to learn together, regardless of location and distance. However, it is important to bear in mind that collaborative tools are truly effective only when used by groups of more than two people. Otherwise, it is more advisable to use e-mail or other forms of communication.

These tools enable users to create content together, collaborate with each other, work, reflect, and learn together. Social tools force the individual user to be aware of his or her environment, and to be responsible about their presence on the network. They become visible to different groups of people based on their activities and interests. The users have to be informed about their:

- **Presence** – Who is online? Where are my teachers, instructors, classmates and/or colleagues?
- **Identity** – Who am I? How do I present myself to in the virtual world? Who can see my profile and my content, and how can they access it?
- **Reputation** – My value to the community based on ratings given by other community members.
- **Relations** – My social network.
- **Conversation** – Who are the people I talk to and what do we talk about?
- **Activities** – What is going on right now?
- **Groups** – Formed as a result of individual interests and activities.
- **Sharing** – Common content, information, and knowledge exchanged with others.

Social tools can be divided in two general groups: tools focused on content and tools focused on communication.

8.2.1   Social tools focused on content

Content-focused social tools can be used for ADL purposes. Learning content, student media, and problem solutions can be shared with the group. The discussion between participants can be notes (annotations) that represent additional learning material (e.g., useful for better understanding and description of the content). Content focused social tools have two main purposes:

- To provide possibilities for file sharing (text documents, videos, images and other media files) among the participants (social group members). Shared documents can be described and commented on.
- To support collaborative work on shared content.

File sharing tools allow for content sharing and/or publishing. They emphasize technical character because content has to be transformed from original content to web-readable format. An author (publisher) can describe the content (by metadata), this way, search engines can index shared content, which makes it easy to find and reuse by other people.

Figure 8-1. Sharing content tool

Users can add their comments related to the specific content, this way the content becomes the center of gravity around which users can add additional information. Users can discuss issues and share ideas through the use of commenting tools. Administering comments or notes (accepting or rejecting) is necessary.

Collaborative (team) work on the same content represents another approach for using content-focused social tools in ADL. Such tools are found to be very effective in supporting problem-solving and decision-making processes. In addition, it can be used to support work on other collaborative projects. Using this process, participants can edit the content simultaneously.
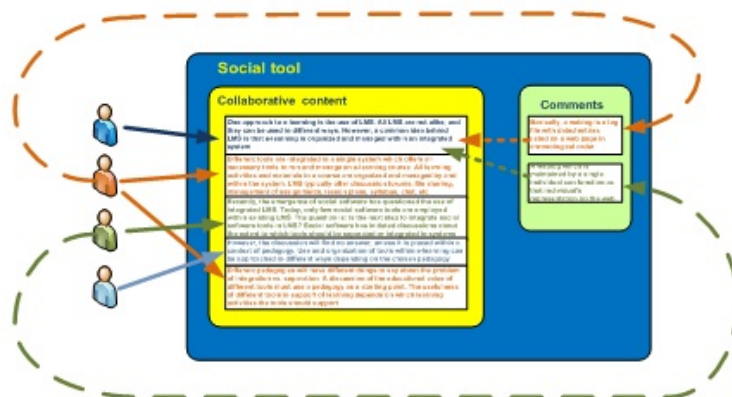

Figure 8-2. Collaborative (team) work on the same content

In addition to document editing, users can add comments to the content, this way content creators play an additional role of advisor, with collaborative content reviewed during the process of creation.

8.2.2   Social tools focused on communication

The main purpose of social tools focused on communication is to provide the synchronous (instant messaging, VoIP, video conferencing) and asynchronous communication (discussion forums, blogs) between participants (students, teachers, instructors or subject matter experts).

Synchronous communication tools enable real-time communication between participants and their collaboration at the same time. They enable the users to be in different places and communicate with each other regardless of distance, although distance can sometimes be a limiting factor for this kind of communication (i.e., participants are located in different time zones). Another constraint is the link bandwidth, especially rich media tools such as video and audio conferencing.

Instant messaging represents the most common synchronous tool used in e-Learning systems. It includes interactive exchange of short messages between participants. This is especially useful in the situation of limited data throughput, and in situations where a correspondent needs help or information. Instant messaging tools are embedded in the ADL systems as widgets, this way the student can see notification of arriving messages immediately after they are sent. Messaging usually occurs between two users (i.e., teacher and student, or two students). Instant messaging is useful when exchanging short messages.

VoIP (Voice over IP) tools provide users with audio communication. This tool replaces the traditional telephone communication (i.e., telephone lines and devices are not needed) with digitalized voice through Internet connection. VoIP tools are usually stand-alone client tools connected to the VoIP web service provider (e.g. Skype, Vonage, Ooma, etc.). VoIP communication is designed for one-on-one communication because it is hard for participants to recognize the voices of different people i.e., VoIP multicasting. Conference call can also be used if a participant wants to send the same information to more than one user (i.e., teacher can perform some audio lessons in this way). VoIP communication has better communication efficiency than instant messaging because of direct voice communication. Typing is avoided and there is no need for correcting typing errors.

Video conferencing tools provide users with video communication. Video communication is useful for giving online lessons and organizing online workshops. The impression of the physical presence of participants makes the emotional aspect of learning more expressed than in other synchronous techniques. There are two types of video conferencing tools: direct communication between participants and communication with the provider's mediation.

Stand-alone client applications connected to the video conferencing provider such as Adobe Connect, or Team Viewer represents the first type. Basic web equipment (camera, headphones and microphone) is required with software implemented as a light client application. Multimedia streaming is performed by tunneling through an HTTP-based Internet network. Due to HTTP over-heading, network, and server occupancy, the quality of video might be change during the connection, and the quality of service is not guaranteed. On the other hand, low cost is the main advantage of this approach.

The other type of video conferencing (or MOOC) includes tools without a provider's mediation (i.e., Polycom system). Every video conferencing site (i.e., equipped space in which participants can communicate using video) has to have its own video conferencing equipment (i.e., video streaming server, camera and microphone as minimum equipment), and fixed IP address. This way, the overall system acts as a network of peer entities. The communication rate and signal quality is usually better than stand-alone applications due to the avoidance of HTTP over-heading (the use of internal data formats).
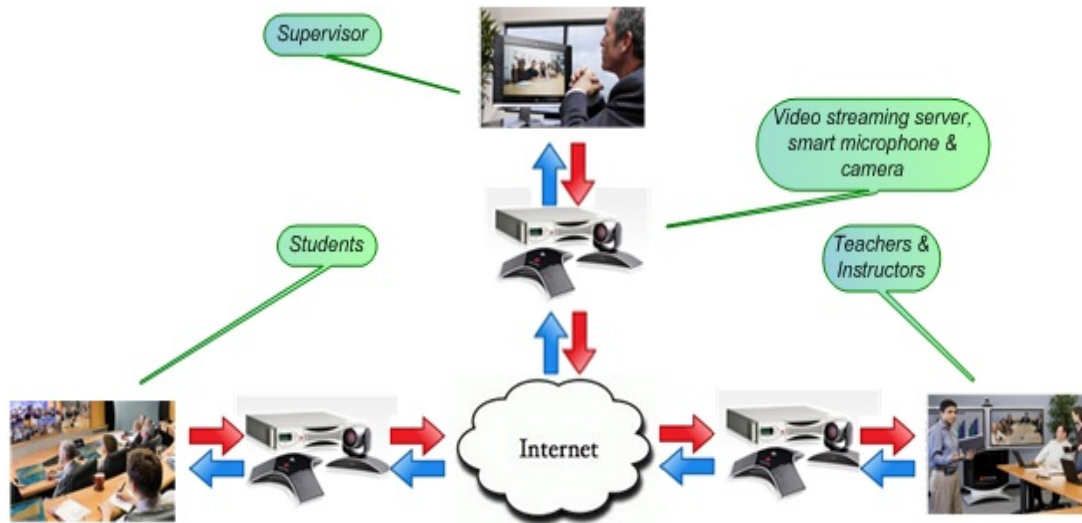

Figure 8-3. Video conferencing without provider's mediation

This solution is much more expensive than solutions using existing Web services, but it provides higher security and signal quality. There is no limit to the number of participants. Advanced equipment such as smart microphones and cameras can locate the voice source and automatically zoom in on the speaker. The camera can be preprogrammed for different zoom and positions, and the speaker can control it using a remote controller. It is especially useful for teachers to make video transitions between them, the whiteboard, screen with presentation slides, and/or some other equipment.

Asynchronous communication tools are very useful when the users can't take part in communicating at the same time. The most common asynchronous communication tools are e-mail, forums and blogs. These tools are embedded in almost all of the e-Learning systems. They are designed for interchanging text format messages, and therefore, they are less dependent on link bandwidth.

E-mail represents the most common asynchronous communication tool.

On *discussion forums* (discussion boards), participants communicate by posting messages to a bulletin board system. Messages connected to the same topic are called posts and they are chronologically chained by the system. They form message threads. This series of message exchanges can occur over minutes, hours or even months. Discussion boards are common social communication tools, and are often used in online education. They can be used in formal learning environments to discuss issues and share ideas between the participants. An instructor usually gives a task (e.g., a discussion topic) to the group of students. Then, he or she tracks the posts and helps students during the activity. In formal learning

environments, the topics are usually time limited and teachers can evaluate the contribution of each participant.

Blogging tools enable users to create their own web pages (blog homepage), add different content (blog entries), and to share with others. Sharing allows other people to post their comments. Because of these characteristics, blogs are more suitable for informal learning environments. Users manage their own blogs and can respond to comments, remove unsuitable posts, and create new entries. Communication may occur between those commenting on the blog post, or between the blog creator and the readers. Blog tools can also be embedded as a tool in a LMS. They can be used in a course, and speak to the openness of a course. Blogs can be helpful for sharing and/or collecting information and ideas from others, and provide a venue to express opinions and attitudes.

8.3 Virtual Classrooms Learning space/

The advantage of virtual classrooms is that a visual connection between two or more people can take place very easily and quickly, all around the world. The basic tool is a video conference tool with extended management options. It can be used as a learning tool with different types as eTeaching (conference or MOOC), eTraining (1 teacher and less than 10 students), and eCollaboration (3-4 persons). These types of learning tools are used in accordance with the existing teaching mode; virtual classrooms are designed according to pedagogical concepts.

Teachers and participants use various didactical tools in a normal session like pen-and-paper, e-presentation (PowerPoint, Adobe, …), and references, etc. All of these possibilities are kept within the eSessions.

The advantage of a virtual classroom is that the participants stay at home or at the office, and travel to the training center is not necessary.

8.3.1 Online Synchronous Learning

There are different ways collaborating online. The following models can be used.

Lecture

Like in a typical university lecture, the teacher presents a theme and the students who are interested can take part in this lecture. The interaction is limited (the students can only ask questions through chat). There is no limitation on the number of students who can participate in the lecture, except for server capacity.

Tutorial

The Tutorial is designed as a small class with a teacher and up to 20 students. The students can participate through questions, exercises etc. but the conversation will normally be delimited to between the teacher and one student at a time.

Knowledge sharing

Knowledge sharing takes place in a discussion group (3 – 5 persons). There is only a facilitator for administrative purpose. Every participant can see, speak, hear and act. Normally a virtual whiteboard is used between the participants. Knowledge sharing can be used in connection with a tutorial if the system used can handle break-out rooms.

Common for "Lecture" and "Knowledge sharing" is that the session can be recorded for later use.

When conducting an "Lecture" it is a good idea to consider having a host and an Instructor. The host is the manager of the event and assumes all the administrative tasks: invitations, virtual room reservation, session configuration, etc.

8.3.2 MOOCs

A **massive open online course** (**MOOC**) is course aimed at large-scale interactive participation and open access via the web. In addition to traditional course materials such as video, readings, and problem sets, MOOCs provide interactive user forums that help build a community for the students, professors, and teaching assistants (TAs). MOOCs are a recent development in distance education.

Although early MOOCs often emphasized open access features, such as open licensing of content, open structure and learning goals, and connectivity to promote the reuse and remixing of resources, some notable, newer MOOCs use closed licenses for their course materials, while maintaining free access for students.

Many MOOCs use a video lecture style of pedagogy, repeating the old form of teaching using new technology. Nevertheless, Sebastian Thrun testified before the (U.S.) President's Council of Advisors on Science and Technology (PCAST) that MOOCs"are 'designed to be challenges,' not lectures, and the amount of data generated from these assessments can be evaluated 'massively using machine learning' at work behind the scenes." This approach, he said, "dispels 'the medieval set of myths' guiding teacher efficacy and student outcomes, and replaces it with evidence-based, 'modern, data-driven' educational methodologies that may be the instruments responsible for a 'fundamental transformation of education' itself."

Because of the massive scale of learners, and the likelihood of a high student-to-teacher ratio, MOOCs require instructional design that facilitates large-scale feedback and interaction. There are two basic approaches:
- Crowd-sourced interaction and feedback by leveraging the MOOC network (e.g. for peer-review, group collaboration)
- Automated feedback through objective, online assessments (e.g., quizzes and exams)

Connected MOOCs rely on the former approach; broadcast MOOCs such as those offered by Coursera or Udacity rely more on the latter.

Because a MOOC provides a way of connecting distributed instructors and learners across a common topic or field of discourse, some instructional design approaches to MOOCs attempt to maximize the

opportunity of connected learners who may or may not know each other through their network. This may include emphasizing collaborative development of the MOOC itself, or of learning paths for individual participants.

The evolution of MOOCs has also seen innovation in instructional materials. An emerging trend in MOOCs is the use of nontraditional textbooks such as graphic novels to improve students' knowledge retention. Others view the possibility of videos and other material produced by a MOOC as becoming the modern form of the textbook. "MOOC is the new textbook," according to David Finegold[9] of Rutgers University.

Producing and delivering MOOCs is a technological challenge. Unlike traditional courses, MOOCs require videographers, instructional designers, IT specialists, and platform specialists.

8.3.3 Related educational practices and courses

There are few standard practices or definitions in the field (of MOOCs?). A number of other organizations such as the Khan Academy, Peer-to-Peer University (P2PU), Udemy and Course Hero are viewed as being similar to MOOCs, but differ in that they work outside the university system, or mainly provide individual lessons that students may take at their own pace, rather than having a massive number of students working on the same course schedule. Udemy allows teachers to sell online courses, with the course creators keeping 70-85% of the profits and all of the intellectual-property rights. Note, however, that Udacity differs from Coursera and edX in that it does not have a calendar-based schedule (asynchronous); students may start a course at any time. While some MOOCs such as Coursera present lectures online, typical to those of traditional classrooms, others such as Udacity offer interactive lessons with activities, quizzes, and exercises interspersed between short videos and talks.

8.4 Mobile Learning

8.4.1 Overview

This section will cover the basics of mobile learning (or m-Learning) as well as the production of content for, and use of, handheld computing devices to provide access to learning content and information resources. A specific definition of m-Learning can be limiting to some organizations. Many of the existing definitions of m-Learning are either too learner-focused or too device-focused. A universally-accepted definition seems improbable. Both the learner and the devices of today as well as the future should be considered in order to provide a more flexible view of mobile learning. A generic definition of mobile learning for the purposes of this Handbook describes m-Learning as:

> "*Leveraging ubiquitous mobile technology for the adoption or augmentation of knowledge, behaviors, or skills through education, training, or performance support while the mobility of the learner may be independent of time, location, and space.*"(The Advanced Distributed Learning (ADL) Initiative's Mobile Learning Decision Path report (p. 5):http://www.adlnet.gov/public/uploads/MLDP-Report.pdf)[10]

This description is intentionally generalized to allow for a growing number of m-Learning scenarios as well as future capabilities of new technology and device types. As an illustration of this, consider Table 8-1 as possible future m-Learning capabilities / augmentations:

M-Learning should be viewed as a way to augment the learner through the use of ubiquitous technology that provides access to learning content and information anytime, anywhere. Unlike other learning technologies, m-Learning is unique in that it can accommodate both formal and informal learning in collaborative or individual learning modes. M-Learning is definitely not just "ADL lite."

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 8-1: Innovation Considerations for m-Learning (list is not all-inclusive)

Mobile should be an integral part of your learning and information infrastructure/architecture. It should not be viewed as a replacement for other learning options, but a supplement or reinforcement for learning and performance support. Think about the user experience and their learning opportunities before making design decisions.

Instructional designers on your m-Learning project team will no doubt have cherished, tried and true instructional design principles, process strategies, and pedagogical models that they've learned from their involvement in traditional e-Learning projects. Unfortunately, some of these may need to be unlearned for m-Learning.
Of special importance are the considerations and decision nodes in the analysis process that could lead development teams to choose m-Learning as the optimal solution. You don't want to end up with m-Learning as a solution to a problem for which it is not appropriate.

Above all, you need to be ready and willing to accept the range of m-Learning solutions (i.e., performance augmentation and informal/social learning) in your repertoire of training strategies if you

want to start down the path of m-Learning. As stated above, your instructional design process model must include paths to these strategies/outcomes.

8.4.2 Design Considerations

Too often, we start with the device rather than the learning or the support requirements. The learning outcome should always be the main focus, but familiarity with the capabilities of handheld devices may open new doors, or require taking a step back.

When thinking about mobile device categories, remember that the mobile device is more than just a phone. Basic mobile phones are limited for m-Learning. Mobile device categories will continue to evolve both from a function and feature perspective, and from vendor marketing messages. The main concern for m-Learning developers is what devices and/or features need to be supported for intended learners.

8.4.2.1 Features

Devices are equipped with various features that could be used to enhance learning. Which features do your learners have?

Figure 8-5. Smartphones are capable!

8.4.2.2 Tablets

Tablets are not normally carried at all times, but their use is growing rapidly in education and training. Other than differences in screen size, learning content for tablets requires development very similar to mobile phone development. Electronic publication (EPUB) formats are growing in popularity for creating digital texts for viewing on tablets and other devices.

8.4.2.3 Connectivity and Bandwidth

For most users, bandwidth is becoming less and less of an issue with the availability of 4G and 5G networks. However, connectivity will always be an important consideration for mobile development strategies. Issues to consider when addressing device connectivity and bandwidth:

Image Compression: Files must be optimized for quicker load times

HTML5: Provides a means for persistent local storage of data (for times of little or no connectivity).Similar to the cookies concept, but not auto-transmitted back to the server. The data remains local as keyed name/value pairs to be stored within the browser.

8.4.2.4 Caveat

All mobile devices are not created equal. Consider the following issues when deciding on a mobile development and design strategy:

- Limited support for Flash player
- Poor/inconsistent support for pop-up windows and framesets
- Limited video support (varying formats supported)

8.4.3 Native Apps

A "native app" is an application specifically designed to run on a device's operating system and machine firmware. It typically needs to be programmed in a unique or proprietary language and development environment for each platform or operating system. The terms "platform" and "operating system" are often used interchangeably in the mobile industry. A native app is so much more than the look and the feel; many things matter including the way that data are stored on the mobile device. In a native app, most of the application is stored locally on the device, but the user data may be stored on the device, in the cloud (remotely), or both.

8.4.3.1 Native App Development

Developing for each native platform requires a specialized development approach, often coupled with an integrated development environment (IDE), or software development kit (SDK).

8.4.3.2 Native App Stores

Each mobile device today usually provides direct access to a specific platform app store, but not all app stores are accessible on each platform since they are proprietary and unique to each device's operating system. For example, iOS apps packaged for iPhone, iPad, and iPod Touch will not be discoverable in the Android Marketplace (now renamed Google Play). Each app store has a unique process, file formats, and specific requirements for distribution to their app store. The process of distributing your app to these different app stores for each platform can be very time-consuming, and should be considered in your overall distribution strategy.

8.4.4 Mobile Apps

It is also possible to develop mobile apps using HTML5 and web technologies such as JavaScript and CSS, and deliver them to the end-user using the mobile browser. These are known as "Web Apps." This term can be confusing because even native apps are dependent upon leveraging the web to deliver content.

As mentioned earlier, two important things to consider in your mobile development strategy are distribution and access. Each mobile device will provide a dedicated app store for your specific device platform. While not every mobile device will be able to have an Android-based app on it, every mobile device does have a web browser! Compared to native applications, mobile web apps are usually much easier to develop and maintain. They don't require any third-party validation or fee to be online, and are fully available to everyone. The lines are beginning to blur between native apps and mobile web apps. The primary difference today is that native apps are installed locally on your mobile and only accessible via a proprietary app store, whereas mobile web apps can be accessed in any mobile web browser and may or may not be listed in a particular web app store.

In fact, as standards continue to mature, much of the mobile development world anticipates that there will someday be very few advantages to native app IDEs and SDKs. It is expected that developing with web standards will provide the same types of capabilities that were only previously possible when developing natively. The status of the formal standards for web applications on mobile can be found at the World Wide Web Consortium (W3C) (http://www.w3.org/2013/09/mobile-web-app-state). All of the native app stores also have mobile web apps available to install. In addition, there are a number of independent app stores on the rise!

8.4.5 The Hybrid Approach

While the mobile development community argues about which is the better approach (native or web app), the truth is "Native Apps vs. Web Apps" is not really a debate! There is no winner and there is no loser. The choice of which type to develop is an engineering and design decision that should be based on a solid set of requirements. While developing a mobile web app is easier and more cost effective for development, you must also consider the end-user's view, and meet their expectations for access. End-

users expect ease of use and the discovery of an app to meet their needs. Why not support both mobile web app and native app deliverables?

Facebook, Google, and many other companies are supporting both types. However, these are large companies and can afford to have large development teams to support both. One alternative for any company or organization on a smaller budget is to consider the *hybrid approach* to support both the mobile web and native apps. The hybrid approach gives you the best of both worlds. Hybrid apps allow you to develop using HTML5, CSS, and JavaScript, and support multiple platforms by packaging your content as a native app to be installed directly to the device.

8.4.5.1 Mobile Development Using Frameworks

There are several free open-source frameworks that can be used to develop hybrid mobile apps using HTML 5, JavaScript, and CSS. Mobile apps developed using some of these frameworks can be written once, and deployed to many platforms as both a native app and/or a mobile web app. Some of these frameworks are more mature than others, so try out several and see what works best to meet your requirements.

8.4.5.2 App Store Distribution Processes for Developers

Whether you decide to develop your mobile app using SDKs or HTML5 frameworks, once your app is finally developed, you will be ready to distribute it to each of the app stores and follow several different processes. Most of the app stores require your app to be tested and signed with digitally encrypted certificate keys in advance. In addition, you will have to generate app icons and screen captures and other metadata for your app. The app stores all have different requirements for the resolution of these icons and screen captures as mobile devices support various levels of resolution, so this can be somewhat challenging to support if you aren't prepared in advance.

8.4.6 Mobile Development Resources

Developing for mobile is not an easy task. While there are definitely advantages to developing native apps over mobile web apps, the hybrid approach has the greatest potential for the long-term. In terms of lifecycle maintenance of your app content, it might make sense to consider this approach unless you are only targeting one platform. By targeting multiple platforms you will ensure your app is accessible to as many end-users as possible. If you target both platforms and browsers, then you increase the ubiquity of your mobile app. Your development approach and distribution strategy are key parts of app development. In fact, these could easily account for 50% (or more) of the time it takes to complete your app project. If these two critical aspects aren't taken into account, your project could definitely suffer from missed deadlines and scope creep.

8.5 Simulations and Serious Games

Live training is of high value, but costly and time-consuming in terms of resources. Resources are too limited to perform as much live training as would be required for the big variety of training scenarios mentioned in the preceding paragraphs. In addition, performing complex tasks requires a high level of skills and knowledge, which should be gained through practicing and especially through repetition. In most cases, live training opportunities for units or individuals do not allow repeating parts of an exercise,

of situations or fully train every unit or individual to the high level of skill that is required for today's missions. Therefore, in spite of the resources expended on live training, many educational goals are not fully met[11].

Serious games can help complement live training events in many ways. First, research indicates that computer simulations can improve spatial learning and perceptual skills of learners[12], and can provide additional quality to the learning process, mainly based on textual and verbal interaction. Simulation-based training can be performed in virtual environments that replicate actual scenarios, which keeps learners highly engaged. Interactivity and competition can motivate learners to use all their skills and knowledge in dealing with the concrete tasks, and practicing problem-solving skills. Furthermore, teachers, instructors and trainers have full control of a computer simulation and can react on certain situation (e.g. bring in a dilemma as a quick reaction). This means that they can start, stop, examine or restart a simulation at any time, which is not possible in a real situation[13]. With these capabilities, complex or dangerous skills can be rehearsed multiple times without endangering military members, and at the same time, greatly increase the effectiveness of training opportunities. These are just some of the reasons that simulations are recognized in military environments as a way in which complex training and education can be performed in effective (enriched quality) and efficient (cost reducing) manner.

At last the modern age simulation-based training is build up in a matter the new generation of soldiers grow up with and know "from home", means the soldiers works with resources they recognize and there is much less training needed to get to know the training environment.

8.5.1 Simulations

Many different types of simulations are used all over the world to support training. This domain is also called Modelling & Simulation (M&S) as a whole, and covers more than just training. Many simulations are also used for experimentation to support daily business and to provide the necessary data to support the decision-making process for leaders.

Figure 8-6. High-end simulation for training air-to-air refuelling

Modelling and Simulation is used for the following:

- Research and analysis tool for new concepts, to support policy formulation
- Force planning
- Operations planning and support for deployed forces
- Support in military decision-making for military capability and acquisition
- Support in mission planning and pre-deployment training
- Individual, collective (to the largest units), Joint and Combined training

A definition of the word *simulation* from A Dictionary of Computing:

> *A Simulation is an imitation of the behaviour of some existing or intended system, or some aspect of that behaviour.*

Simulations provide the trainee with a complete insight into a complex process. The added value is found by the data that is collected, which can be used for the after action review (AAR) at the end of a training sequence. The other benefit is that the training will be more effective than without the support of simulation.

Generally speaking, we differentiate between four levels of models going from the most accurate, scientifically-based to the highest aggregation level used for large scale simulation for Commander and Staff training. The four levels include:

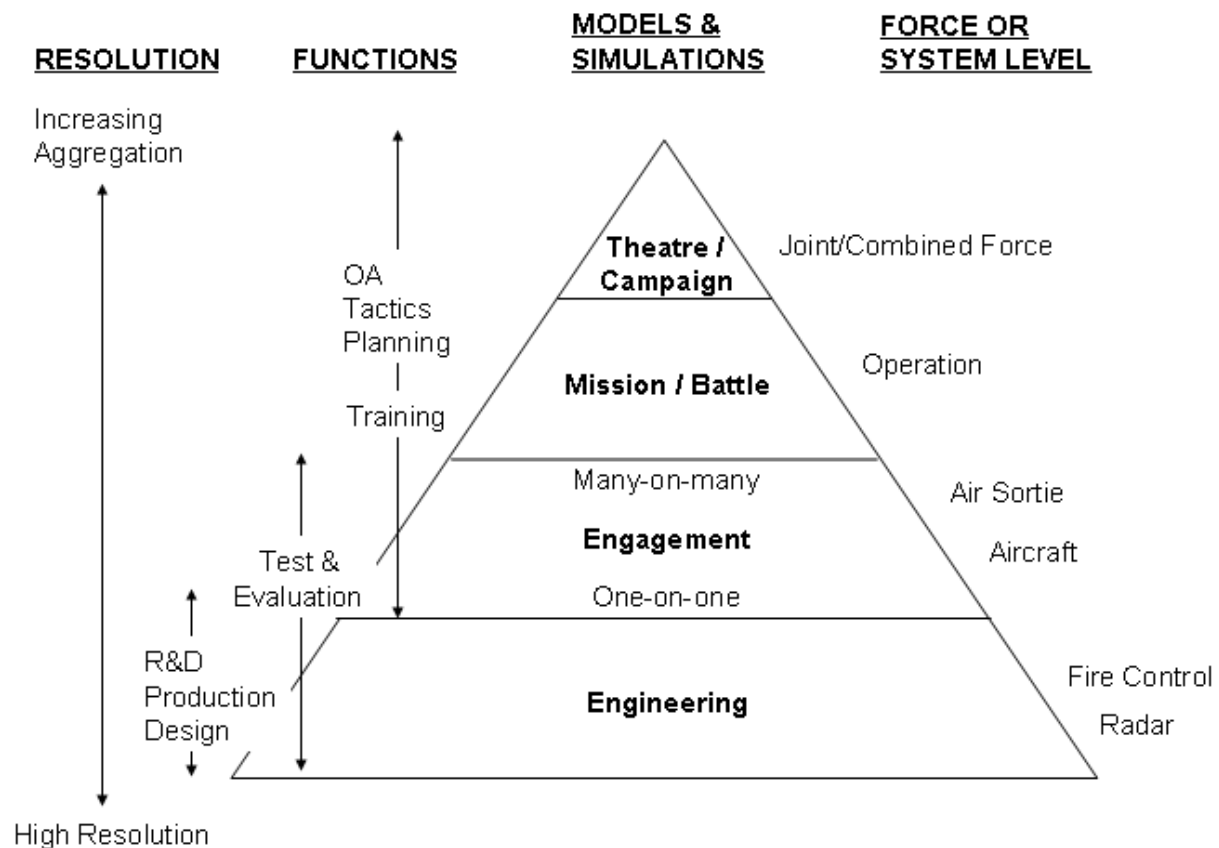- Engineering

- Engagement
- Mission/Battle
- Theatre/Campaign

RESOLUTION   FUNCTIONS   MODELS &   FORCE OR
                                   SIMULATIONS   SYSTEM LEVEL

Increasing
Aggregation

OA
Tactics   Theatre /   Joint/Combined Force
Planning   Campaign

Training   Mission / Battle Operation

                                   Many-on-many   Air Sortie
Test &   Engagement   Aircraft
Evaluation
                                   One-on-one

R&D
Production   Engineering   Fire Control
Design   Radar

High Resolution

Figure 8-7. The models and simulations hierarchy from the US DoD.

Every level of simulation has advantages and disadvantages, and each is focused on specific use. For example a model for experimentation will not meet the needs of a training simulation at brigade-level or higher. So for each task (training/experimentation), the right models have to be selected according to the goals that want to be achieved with that simulation.

The next level is to answer the question about which type of simulation will fit the purpose of that particular task. A model alone will not do the job!

Simulations are basically the interaction between different models in a specific environment. Because of the large variety of tools that are available on the market, the subject is divided in three groups:

- **Live simulation:** Real people, in a real environment, operating real equipment but with simulated effects.

- **Virtual simulation:** Real people, operating simulated equipment in a simulated environment, generating simulated effects. This category may include Persistent Worlds, such as Second Life, that allow the trainee to have a persistent simulation environment that can be used whenever needed, and from any part of the world. Like the Serious Games (Section 8.6.2), Persistent Worlds are beginning to offer low-scale training solutions for individuals and small units.
- **Constructive simulation:** Real people conditioning simulated people or entities, operating simulated equipment in a simulated environment generating simulated effects.

Today more than ever, these three categories are brought together to offer a training environment as close as possible to the reality of the modern battlefield. Armed forces are using these simulation tools for training, but the rapidly evolving game market is used more to acquire low-cost simulations based on game technology to train the lower echelon (e.g. VBS 3). This trend started in the late 1990s, and is generally favored in the simulation environment for training. For example, Serious Games are often complementary to the large-scale simulations built by the defence industry.

The evolution of simulation models, as a consequence of the improvement of processors, video cards, memory, and networks, etc., has resulted in high-fidelity models that are usable today on a generic laptop or desktop PC. Furthermore, this has allowed simulations to be integrated into many tools that we are using every day.

The possibility to distribute simulation over a network is not new, but building simulations as web applications does open new possibilities for learning/training. Just look at the evolution of a game called World of Tank based on web app technologies. With minimal software on your computer, you can participate in game-play over a huge network of individuals from all over the world. The simulation is not done on your computer, but in central servers with access from anywhere in the world. And furthermore with modern technology all this can nowadays be done on tablets and in the field with a mobile connection.

For ADL, this represents an opportunity to move away from static content to a world of dynamic lessons, where the student can interact in new ways. Instead of having a static display for tactical training, the new type of lessons, based on a constructive or a virtual simulation, can project the trainee in a synthetic environment where he or she can discover tactical principles by him- or herself; arranging the platoons, issuing the orders, and then watching to see if his or her tactics succeed or not in that small battle. After analysing the results, he or she could then rearrange or modify tactics and make a new run. This would allow the player to create? understand? the step-by-step principles of a successful tank attack. At the end even a complete operation can be planned and played in the real environment before going into action. The digital native trainees of today are very familiar with this kind of environment, and they often learn more efficiently than with traditional classroom training. There are a few studies that have analysed the different learning habits of different generations from the 1950s to 2000s. The differences are very impressive, and if the lessons target the wrong student generation, the efficiency of the learning can decrease by as much as 20%.Although generalizing is limited, an ADL lesson for senior military members may have to be designed in a different way than for a younger audience.

The field of applications for ADL is large, and to achieve the training goals, the simulation experts and ADL experts should work together from the very beginning. The key here is to be able to produce high quality military training for each particular suite of lessons. If this is not met, the results may not meet the training requirement. At a time where cost efficiency is the central pillar of any project, it is critical that training is developed in an effective and cost-efficient manner.

8.5.2 Serious Games

Today, the role of serious games and virtual technologies is expanding training opportunities for the military. Serious games represent a mental contest, played on the computer (or mobile device) in accordance with gaming rules, which use entertainment for educational purposes and training[14]. Different from most commercial games that are primarily designed for entertainment, serious games have additional pedagogical functionality that provides game scenarios based on learning objectives (Figure 8-8). In this way, pedagogy is used for adding instruction into the gaming.
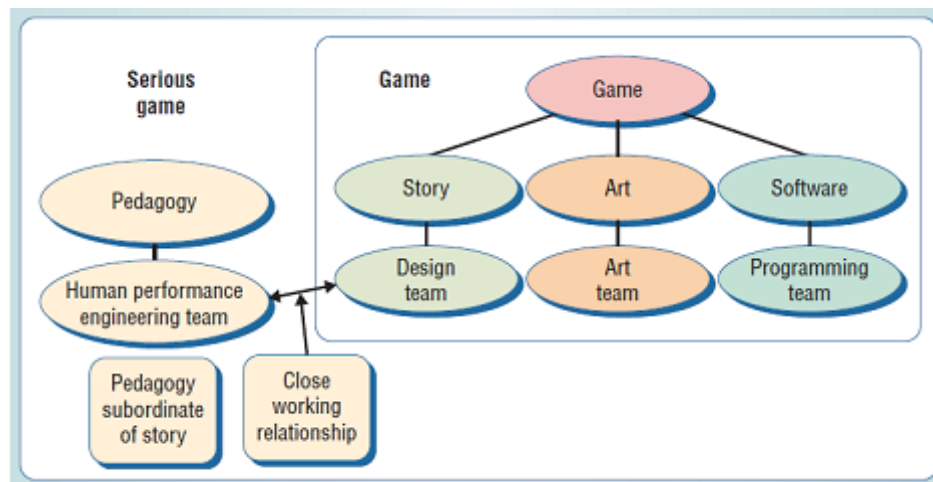

Figure 8-8. Relation between games generally and serious games (Zyda, 2005)

The term "Serious Games" (also referred to as Immersive Learning Environments) is defined as a "3D Virtual environment where one learner controls a single avatar that interacts with other computer-generated avatars, environments and resources."[15]

The mission of modern militaries has changed significantly over the last couple of decades. Beside the traditional military tasks, they are increasingly involved in assisting people in the wake of natural and man-made disasters (e.g., floods, earthquakes, fires, traffic, nuclear and chemical accidents, etc). Moreover, in terms of international cooperation, military personnel need additional skills regarding multi-cultural sensitivities and language. These tasks have a complex nature due to differences with regard to units, organizations, social groups, governmental and non-governmental institutions, emergency services, rescue teams, voluntary groups, and local communities.

Serious games with well-defined learning goals and objectives, with appropriate pedagogy implemented in the system, are recognized as an alternative solution for many different aspects of military education and training.

Owing to strong influence on the users' motivations, serious games are applied in many domains such as healthcare, defense and education (Figure 8-9). They are also related to military training and simulation. Two main directions for their application for military training include: mission rehearsal, and combat modeling and analysis. The first one is used in the mission preparation phase. The other is used in military doctrine research and development.
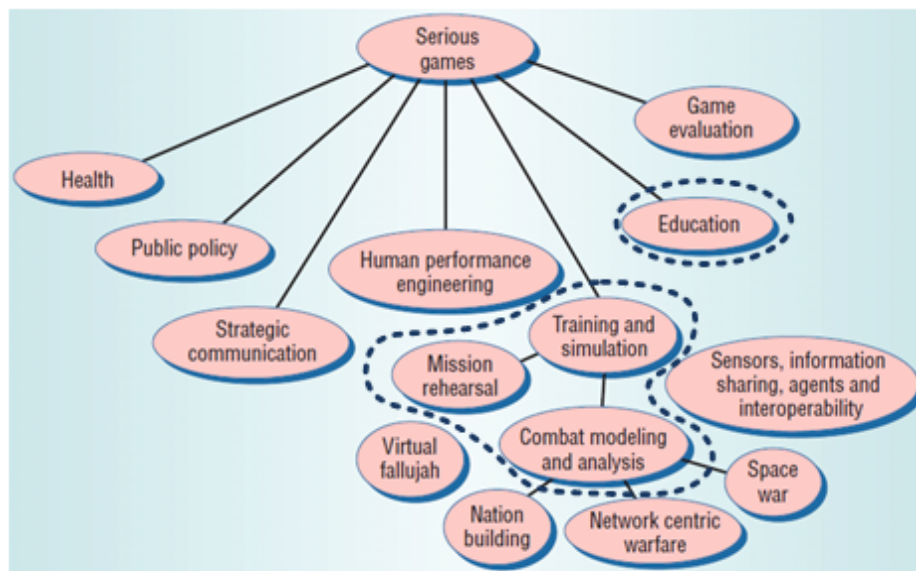
Figure 8-9. Serious games as general concept (Zyda,2005)

Mission rehearsal requires high quality serious game software, which means that high fidelity of terrain, objects, personnel, equipment, and behavior are needed for preparing individual and/or units for combat tasks. Different variants of unit engagement are used in the scenario: the main course of action (defined in accordance with the mission tasks), and alternative courses, which are used for providing uncertainty of the scenario. Alternative courses are also important because they represent the prediction mechanism for implementing the possible directions of situation development.

Based on the diagram above, computer simulations represent the extension of serious games. From this perpsective, simulations have many common characteristics with serious games. Authors more focused on a technology approach highlight the common way in which serious games and simulations are built and structured. They recognize serious games and simulations as two sub-domains under the training domain[16]. Others highlight different characteristics, which are based on differences between gaming and training preferences (e.g., Roman&Brown, 2008). The engagement represents the main goal of the games. While the engagement still exists in simulations, it represents just one of the motivational factors of the learning/training process.

8.6   Gamification

8.6.1   Definition

Gamification is the application of game-design elements and game principles in non-game contexts. Gamification commonly employs game design elements to improve user engagement, organizational productivity, 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.

8.7   Summary

Instructional Training and Education Developments (IT&ED) is looking at contemporary technologies for their use in military training and educational process in the 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.

Although the delivery of ADL can be achieved by using external memory units such USB sticks, CDs or DVDs, and off-line learning, these methods often preclude communication with the teacher or trainer. 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. 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.

Acronyms

ADDIE	Analysis, Design, Development, Implementation & Evaluation
ADL	Advanced Distributed Learning
CMS	Content Management System
E&IT	Education and Individual Training
ELO	Enabling / Learning Objective
HD	High Definition
HRM	Human Resources Management
ISD	Instructional Systems Designer
ISD	Instructional Systems Development
LMS	Learning Management System
LO	Learning Object
MOOC	Massive Open Online Course
PO	Performance Object
SCO	Sharable Content Object
SCORM	Sharable Content Object Reference Model
SME	Subject Matter Expert
TNA	Training Need Analysis
TRA	Training Requirements Analysis
VoIP	Voice over Internet Protocol
xAPI	Experience API

Resources and References

[1] NATO Bi-Strategic Command (Bi-SC) 75-7 Education & Individual Training Directive (E&ITD) https://www.difesa.it/SMD_/EntiMI/ScuolaNBC/Documents/controlloQualita/NATO_BI_SC_%20075_007_2013.pdf

[2] Clark, R.C. & Mayer, R.E. (2016). *E-learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning (4th Ed.)*. Hoboken, New Jersey: Wiley (p. 8).

[3] ADL Content Production Kit https://globalnetplatform.org/system/files/online_course_content_production_kit_v.2.pdf

[4] Knowles, M. (1980). *The Modern Practice of Adult Education: From Pedagogy to Andragogy*. WiltonConnecticut, Associated Press.

[5] Ibid.

[6] Keller, J.M. (2010). *Motivational Design for Learning and Performance: The ARCS Model Approach*. New York: Springer (pp. 43-74).

[7] Clark, R.C. & Mayer, R.E. (2016). *E-learningand the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning (4th Ed.)*. Hoboken, New Jersey: Wiley.

[8] Wilson-Strydom, M. (n.d.) Handbook B4. *Programme Evaluation and its Role in Quality Assurance*. PREST (p. 15).

[9] Babbie, E. and Mouton, J. (2001).*The Practice of Social Research*, Cape Town: Oxford University Press in South Africa (pp. 337-339).

[10] David Finegold - http://ucmweb.rutgers.edu/experts/index.php?a=display&f=expert&id=1389

[11] Advanced Distributed Learning (ADL) Initiative. (n.d.). *The Mobile Learning Decision Path*. In collaboration with the Adayana Government Group and Combat Terrorism Technical Support Office (CTTSO) (p. 5). Available online: http://www.adlnet.gov/public/uploads/MLDP-Report.pdf

[12] Roman, P.& Brown, D. (2007).*Constructive Simulation versus Serious Games: A Canadian Case Study,Proceedings of the 2007 Spring Simulation Multiconference, (SpringSim '07)*, Vol. 3, pp. 217-224.

[13] Lindgren, R., & Schwartz, D. L. (2009). *Spatial Learning and Computer Simulations in Science*, **International Journal of Science Education, 31(3), 419-438.**

[14] Holland, J. (1998). *Emergence: From Chaos to Order*. Redwood City, California: Addison-Wesley.

[15] Zyda, M. (2005).*From Visual Simulation to Virtual Reality to Games*, *Computer* (IEEE Computer Society), Vol. 38/9, pp. 25-32.

[16] Ibid.

[17.]Levesque, J., Cazzolato, F., Perron, J., Hogan, J., Garneau, T., & Moulin, B. (2008).*CAMiCS: Civilian Activity Modelling in Constructive Simulation*, *Proceedings of the 2008 Spring Simulation Multi-conference (SpringSim '08)*, pp. 739-744.

SCORM Resources (Chapter 4, Development)

SCORM 2004 4th Edition
http://www.adlnet.gov/research/SCORM/SCORM-2004-4th-edition/

SCORM Users Guide for Instructional Designers
http://www.adlnet.gov/public/uploads/SCORM_Users_Guide_for_ISDs.pdf

SCORM Users Guide for Programmers
http://www.adlnet.gov/public/uploads/SCORM_Users_Guide_for_Programmers.pdf

Experience API (xAPI) Specification
https://github.com/adlnet/xAPI-Spec

References for Chapter 7, Process Evaluation and Maintenance

Attwell G.(ed.) (2006). Evaluating E-learning A Guide to the Evaluation of E-learning.*Evaluate Europe Handbook Series Volume*2. Retrieved on 2012-12-20 from:
http://www.pontydysgu.org/wp-content/uploads/2007/11/eva_europe_vol2_prefinal.pdf

Robinson, B. (1994). Assuring quality in open and distance learning. In F. (Lockwood ed.) Materials production in open and distance learning, London: Paul Chapman (p. 187).

Wilson-Strydom, M. (n.d.) Handbook B4. *Programme evaluation and its role in quality assurance*. PREST.

References for Chapter 8, Section 6 on Simulations and Serious Games

A Dictionary of Computing. Oxford University Press, 2004. Oxford Reference Online. Oxford University Press.