THE ADL HANDBOOK

Guidelines for the procurement, development, implementation and evaluation of Advanced Distributed Learning

Produced by the:

NATO TRAINING GROUP TASK GROUP – INDIVIDUAL TRAINING AND EDUCATION DEVELOPMENTS

Published by:

ALLIED COMMAND TRANSFORMATION

JOINT FORCE TRAINER
## Amendment Record

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It is with great pleasure that I endorse this NATO Training Group Advanced Distributed Learning (ADL) Handbook for use within NATO and nations. The NATO Training Group represents 28 nations as well as partner nations, who come together to discuss education and training issues, seek areas where coordination and co-operation can be achieved, and most importantly work together in the fellowship of multinational solidarity. The fact the group has successfully existed for over 40 years lends testament to its value to NATO and nations.

The NATO Training Group, Individual Training and Education Developments (IT&ED) has worked over three years to produce this handbook with NATO and partner nations contributing to and approving it. It represents the agreed terminology and best practices for this new fast growing technology that supports education and training, and sets the standards to be aimed for. This along with the NATO ADL STANAG 2591 provides valuable information to existing and new facilities that operate an ADL (e-Learning) capability.

This document and others will continually be reviewed and updated, to ensure they remain relevant and accurate in this ever changing world.

I hope it will prove to be useful to you, and ask you to send any corrections or comments to me.
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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). It 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. It is intended that Nations “supplement” this handbook with more detailed guidance that is more relevant 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 of ADL. This document can be read from beginning to end, or it can be used as a reference manual. The document includes specific advice for Instructional System Designers (ISDs), Subject Matter Experts (SMEs), Programmer/Developers, or Managers.

1.3 What is “Advanced Distributed Learning”? 
The term ADL stands for Advanced Distributed Learning. “Advanced Distributed learning,” or ADL, is a term that 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. Cornell University Library defines distributed learning as: “An instructional model that involves using various information technologies to help students learn. Also known as computer-mediated instruction, it encompasses technologies such as video or audio conferencing, satellite broadcasting, and Web-based multimedia formats.”

Early forms of distributed learning emerged in the 1700’s in the form of correspondence courses offered by institutions and individuals. In the past century “advanced” distributed learning was enriched by new technologies such as telephone, radio, audio tapes, 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 the term “e-Learning” is defined as “the use of electronic media and information and communication technologies in education. E-learning is broadly inclusive of all forms of educational technology.” (Wikipedia) Although the definitions of the terms e-Learning and advanced distributed learning are very similar, most often one is preferred by organizations or communities as an overarching term. For the purposes of this Handbook, the Nations agreed that the term ADL encompasses Instructional Multi-media Instruction (IMI), computer-based instruction (CBI), computer-based training (CBT), web-based training (WBT), electronic learning (commonly referred to as e-Learning), and other terms associated with technology-based or on-line instruction. However, we recognize that ADL and e-Learning can be synonymous terms, and wouldn’t advocate that using either term would be “wrong.”
1.4 About this handbook

This handbook is to support NATO and partner countries in producing effective ADL content for specific or shared training and education needs.

In reading this Handbook, you notice that it’s laid out in an “ADDIE” format. ADDIE is an acronym for: Analysis, Design, Development, Implementation & Evaluation and is a common “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. For some people ADDIE represents the sequential approach to a chain (while in reality parts of a chain run simultaneously).

![ADDIE Process Diagram](image)

*Figure 1-1. ADDIE Process*

Some of the information found in this Handbook is based on the ADL Content Production Kit, established some time ago by the Partnership for Peace Consortium’s ADL Working Group, a productive group of NATO and non-NATO professionals in the field of ADL. We recommend obtaining this separate set of documents containing “how-to” instructions as well as worksheets/checklists for everyday work. The document can be found at [http://www.isn.ethz.ch/e-Education/Available-Resources/ISN-ADL-WG-Content-Production-Kit](http://www.isn.ethz.ch/e-Education/Available-Resources/ISN-ADL-WG-Content-Production-Kit)

Another important document is the NATO Bi-SC Education and Individual Training Directive D 75-7. This document refers to training and education solutions of any kind, and also contains thorough information on up-front training needs analysis (TNA), as required with any strategic NATO project. You can access the DRAFT document at: [http://www.act.nato.int/images/stories/structure/jft/bi-sc-75-2.pdf](http://www.act.nato.int/images/stories/structure/jft/bi-sc-75-2.pdf)
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 accordingly.

1.6 Contributors
This Handbook is compilation of numerous nations working together under the umbrella 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.

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2 Analysis

2.1 Scope
This chapter provides an overview of tips and 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., some that start from scratch, some may be updating “old” courses, and others may be 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 case, this document assumes that some sort of initial gap analysis has been accomplished, and that a more formal Training Need Analysis (TNA) is required. This document offers the following as a means to accomplish the analysis.

2.2 Introduction
Once a training need has been clearly identified, the next step is to establish the appropriate learning objectives. If you have not yet developed learning objectives, you should conduct a TNA to identify the learning objectives align with the performance objectives that will fill any performance gap identified. For details see NATO Bi-SC Education and Individual Training Directive D 75-7 (Annexes C-G).


The overall goal of this process is to ensure that you have a clear description of the learning objectives before you begin to develop ADL. The learning objectives must specify the learning areas of knowledge, skills and attitudes / competencies, and must be described with the requirements, conditions and criteria.

Once you’ve ensured that the learning objectives are clearly stated, you must go through an analysis of these in order to find the best method for achieving the learning objectives.

Training Need Analysis
There are typically two situations that call for the development of a training need analysis:

1. The presence of an obvious or probable performance problem:
   Example: A high number of accidents involving a certain piece of equipment.
2. An upcoming introduction of new equipment, new regulations or new procedures
   Example: A new radio being fielded for ground troops.

Whatever the key issue behind the training is, a thorough TNA must be developed to ensure the best possible training solution. As an overview, a TNA according to NATO involves the following steps:

Task Analysis
The task analysis for the target audience identifies all tasks, sub tasks and task elements as they are carried out by people performing 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., incompatibilities of technologies, tools and procedures with the task to be carried out).
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 the equipment might include tasks such as unloading by crane (knowing the weight, correctly hooking up) or unloading by forklift (e.g., know the weight, know where to support the equipment).

Note: In the case of performance problems, a broad look at all its causes is a must, as some causes may require other than another training course! If, for example, certain equipment shows unexpectedly high downtimes, the reason does not always need to be wrong 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 placards missing on the equipment to remind operators of what they learned long time ago.

Identify and define the target audiences
Training projects often address several groups of learners that, in the context of a training project, are required to master the same, partially same or completely different performances. 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, the latter expected to complete maintenance work that is not expected from the primary users. There might be an overlap in performance regarding very basic operations. For instance, the maintenance personnel will hardly be expected to apply 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 another identified target audience.

For any training project, it is equally important to know the characteristics of the typical individuals of each target audience. These characteristics include current job experience, prior background, education, and training. A good definition of the target audiences 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 miss the target audience, the effectiveness of content will suffer.

Define Performance Objectives (POs)
Based on the task analysis for each target audience, a list of POs is defined that describes all relevant performances in the form of very concrete activities. These objectives include whatever important information regarding the conditions under which a performance must be demonstrated, as well as statements regarding the level expected to master a task.

Example: Given equipment XY in its transport box on any ship or truck, any crane or forklift, safely unload the equipment. All applying rules for crane and forklift operations are to be observed. The equipment must always stay upright, as indicated by the arrows on the transport box. The outer cover may
only be removed after placing the equipment at its place of installation.

Define Learning Objectives (LOs)
The LOs are derived from the POs based on a gap analysis. The gap analysis identifies those performances that do not represent a problem and do not need to be trained and those performances that the training needs to address. While the LOs are based on the POs, they may differ from them due to limitations or constraints imposed by the training situation or training technology.

Example: When a PO states to “correctly hook up the equipment XY to a crane,” the LO for an ADL project may translate to “locate the holes for hooking up the crane cables.” The manual hooking up in this case will either be taught with the real equipment or it may be considered an entry skill.

Conduct Training Strategy/Options Analysis
This phase includes a look at the possible solutions to train each of the LOs. The possible approaches may include a range of instructor-based and/or technology-based solutions. To obtain the best combination of training effectiveness and affordability, a mix is usually needed. Even if you are tasked to produce an ADL-solution, there is always room to improve its effectiveness by providing some add-ons.

Example: With the above example to train the correct handling of equipment XY, the general safety measures for working with cranes and forklifts might be taught via ADL, while all the specific data for handling equipment XY might be provided on placards and also as simple eBooks for use with tablet PCs and/or iPhones. In addition, a summary of the key safety rules for cranes and forklifts might be displayed on the equipment box.

Cost Benefit Analysis
This is the final step of the TNA. Based on all earlier steps, the final decision is made on how the training will be done. To make this decision, the effectiveness and the total cost of training for each of the identified alternatives is compared. The outcome of this final phase is a clear picture of how one or several learning methods are combined to satisfy the overall training need.
### 2.3 Summary

When implementing an ADL training solution, there are normally three options. One option is to develop the content in-house, the second is to consider off-the-shelf (reuse/repurpose), and the other option is to contract the development to a vendor. The topics discussed in this chapter are pertinent to whatever option is selected.
3 Design

3.1 Scope
This chapter will cover tips and consideration that should be taken into account when designing course or training that includes Advanced Distributed Learning (ADL). This includes tips about methods and media selection, applying pedagogy, and appropriate instructional designs.

3.2 Pedagogy/andragogy

3.2.1 Introduction: Generalities about pedagogy/andragogy
While it is possible that the development team may be limited to only one person, the development of an ADL course usually requires teamwork in which the pedagogy/andragogy has to intervene from the beginning to the end of the process. Some exceptions may apply to rapid e-Learning production that involves simple-to-use tools for the production of content directly by subject matter experts or instructors.

Before speaking about the content design, the pedagogical team, in close coordination with the instructors/teachers in charge, 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 (traditional and conventional courses) and ADL courses but 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 to provide practical application exercises.
- **Remote face-to-face learning**: The students are not physically present in a training room, but they are connected to the teacher and peers via solutions such as live video, chat sessions, Help Desks, and/or virtual classrooms.
- **(pure) Distance learning**: The students are not physically present in a traditional educational setting and completely participate in a distance educational program in a virtual learning environment. The student will still profit from coaching related to the learned matters.
- **Self learning**: The content may also be 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)
It’s essential before you start developing training content that you decide the type of training method you want to apply in order to implement the adequate learning structure.

Pedagogy can be defined as the art of teaching. It refers to the strategies, methods and styles of instruction. The adoption of technology adds another element in course development to consider. 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, at the pedagogical point of view the development of ADL courses must take into account the following considerations:

- The learning process happens at distance and normally without the physical presence of the teacher. The ADL courses and their technical environment (the LMS or Learning Management System) must include all the necessary self-educational learning material (needed for a good understanding of the content and to reach the assigned LOs).
- The interactivity/communication between the different interveners will also happen on a virtual way without physical contact. The ADL course must periodically check comprehension and provide feedback.
• If the ADL course will be web based, the interaction with technology can be an obstacle not only for the learners but also for the teachers.

Globally while pedagogy refers to the teaching of children, where the teacher is the focal point, andragogy shifts the focus from the teacher to the learner. When developing an ADL course, it’s important to understand and apply the six principles of teaching adults. Adults learn best when (Knowles, 1980):

• They know the reason for learning of 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-centered rather than content-oriented.
• The process is positive and encouraging. Adults respond better to internal versus external motivators.

Andragogy is an approach to learning focused on the learner. The teacher, with the andragogue in support, is the facilitator of learning rather than what we have historically viewed as the all-knowing dispenser of knowledge utilizing a preset curriculum with rigid guidelines.

Learning with technology and adults 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 performances 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 in the other conventional learning methods, the following rules are also applicable for ADL courses:

![Figure 3-4. “How We Learn” Diagram](image)

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 be able 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/learning 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 them correctly in the learning process. In this reflection 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 The learning objectives (LOs)

LOs provide the basis from which learning content is produced. To serve as a helpful guide to an effective, successful product, LOs must be:

- Based on a task analysis (to make sure that they are relevant)
- Precise (to make sure that they are not misinterpreted)

The first requirement is usually met by an up-front training need analysis or a follow-up analysis of what learners are expected to be able to do on their job.

To make LOs 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 LO 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 LO.

**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 LO 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 “move away” from various other alternatives.

There are usually several levels of LOs. 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 LOs that are finally decided to represent entry-level skills. This is what is often called learning hierarchy in instructional design. 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 a LO may highly 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” involving regular rehearsals.

The standard to fulfill a specific LO 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 all 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 and test how, at the end of the learning module or at the end of the course, the learner masters the desired performance (knowledge, skills, attitudes and beliefs) set by the LOs. It is thus crucial that the assessments are thought out, planned and designed in direct alignment with the hierarchy of LOs. Each LO and each learning sub-objective will be covered by at least one to several 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 student attainment of the LO. It typically involves qualitative feedback rather than quantitative feedback (scores).

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

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

Summative assessment has as its only goal the 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 LOs. 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 the training is attributed to lack of training.

### 3.2.2.3 Kirkpatrick-Phillips Training Evaluation Model

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

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

![Kirkpatrick-Phillips Evaluation Model](image)

**Figure 3-5. 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**: Immediate feedback by the trainees to the course. Known to many by the 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-
2. **Learning:** This 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 as well as some time later, to evaluate long-term retention of what was learned.

3. **Impact:** This level evaluates the impact of the training to the trainee’s behavior. This level, too, can be accessed using online surveys that address trainees and/or supervisors sometime after the training has been completed. The goal of this survey is to find out whether the training had any impact on the performance of the trainees at all.

### 3.2.2.4 The storyboard from the pedagogical point of view

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

A storyboard is like a script with actors, dialog, and directions. The dialogue can be either on-screen, spoken, or both. And 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:

![Sample Storyboard](image)

*Figure 3-6. 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 under consideration while creating 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.
- 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 developing 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 what their skills, needs and motivations are.

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.
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 and difficulty 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 bigger, 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 3-7. Sample Use of White Space*
3.2.3.6 A picture says more than a thousand words

Use media such as pictures, graphics, video, and animations 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.

![Image](image_url)

*Figure 3-8. 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 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 feel that they should put good 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 through 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, though, the best way for learners to achieve satisfaction is for them to discover that their new skills can be immediately useful and beneficial on their job.

Figure 3-9. Motivation Model

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 course that will offer to the learners varied and attractive content, approaches, and interfaces.
3.2.3.9 Activity and interactivity

The ADL course must force the 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 development team must ensure that the course content regularly creates positive emotions (joy, surprise, amazement, etc.). The emotions act constantly on our daily behaviors, on our choices, and on our perceptions. Positive emotions make the communication more effective and confer a high level of impact to the 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

A priori, the use of technology is not the best way to create positive emotions and is, for non-specialist, often a source of frustration and negative emotions. In the conception of the scenario, of the content, and of the user interface, the development team must be aware of the negative impact of potential negative emotions (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 in his/her 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 preferred, what time and day of week students prefer, and even if the scores and grades reflect the amount of time the students had accessed the content. Using the data captured by the LMS, the teacher will be able to reflect about learners’ behavior and performance and then make some inferences about the content quality. If you are tracking learning events outside of a browser that has a connection to an LMS, you may want to consider using the ADL Experience API (xAPI) specification. See http://www.adlnet.gov/tla/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 coach. The instructional team may be able to provide coaching opportunities if the 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, the constraint and the limitation 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 producing 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, you should consider the 4 A’s of ISD when developing the course storyboard:
1) Attraction

- You only have approximately 0.1 seconds to attract a potential learner; therefore, you must create an attraction to ensure the learner wants to continue using your ISD package.
- The course should be easy to use and flow in a cohesive manner.
- Consider that three 5-minute modules each with a single learning point may be more effective than one 15-minute module that covers 3 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 re-findable, 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 area 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 the 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 take away and 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 experience and lead them towards the learning point is a means to increase relevance.
3.3.1.2 Task Contents
If the task contents within a course do not cause the learner to engage, then they will not see any relevance for doing the training. It is best to present the learning material in various ways – text descriptions, diagrams, still images; rich media, interactive graphical media, e.g., 3D models, diagrams with pop-up explanations. It is essential you choose a variety of relevant media for your students. The learners 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 to perform. Tutorials are required to provide guidance in response to the students’ practical work, e.g., automated feedback, checklists, or means with 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 onto certain websites and stay on them. Then think about those ADL programs that you have enjoyed and consider what made the program enjoyable. What did these programs contain to maintain your attention? Did they use audio, rich media, etc.? To assist you in deciding what engaging activities you may want to include in your design, here is a short list:

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

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:
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 the readers to move their eyes back up to the top of the page. Therefore, 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).
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, played and finished.

### 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 with headings, which should use a font of high contrast such as 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 the 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 is either yellow on blue or pastel colored background 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**, 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 3-13. Use of a semi-transparent bar to maximize legibility](image)

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 is 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 essentially you are spreading the input over 2 channels. However, some people do not 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. What can be done is having only parts of the narrated text appear at the correct moment on the screen. Such parts 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.

3.3.2 Summary
Below are some simple 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 which keeps 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 filler.
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, re-usability, 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 as the standard for the purpose of conformance of the following:

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

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 could 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 the following of a functional requirement. The SCORM is a set of functional requirements, so if a product adheres to these requirements, it is conformant. The SCORM Test Suite (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 has been 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 Determine 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 to SCORM are enabling interoperability and reusability of tracked data and launch 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 nothing to be tracked and make meaning out of across other learning objects.
- The intended audience does not access content through a Learning Management System.
- 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 follow suit. The middle-ground is the difficult area, of course, an organization looking to change their environment. If the decision is not clear from your organization’s history, keep reading.

The second biggest factor in determining whether SCORM should be used is the policy of the implementing organization. Does your organization or curriculum have goals, measurable progress, and often wish to capture both progress and success? SCORM enables the tracking of these types of data. If your learning content takes on the form of a library, where individuals can learn as they please and are not tracked, then implementing SCORM is not likely worth the extra effort.

Many other factors in SCORM use depends strictly on the content. If the content audience goes beyond those involved in a registration process, SCORM is not likely the answer. If the content, assessment, and trackable data changes very rapidly, SCORM is not likely the answer. If you wish to track multiple learners within the exact same learning experience, SCORM is not likely the answer.

### 4.3.2.2 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 three answers to this question – SCORM 1.2, SCORM 2004 3rd Edition, and SCORM 2004 4th Edition. If your requirements are different from any of these, the SCORM version is not stable and also not supported by ADL. Please note that SCORM 2004 is sometimes referred to generically. 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 content or organization 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. Most content developers, unless they are used to implementing SCORM 2004 4th Edition, will notice very little change between the two. Over 99% of content designed for 3rd Edition will work in 4th Edition environments simply by changing a single line in the content package to version the content. The differences of the two will not be
discussed in this handbook due to the minimal impact. For the remainder of this section, the use of “SCORM 2004” will refer to both of these versions.

SCORM 2004 offers sequencing and navigation functionality as well as a more updated means of testing conformance. SCORM 2004 fixes all of the shortcomings in SCORM 1.2. SCORM 2004 offers the ability to do branching, pre-requisites, testing out, and other features that would need to be internalized in SCORM 1.2. SCORM 2004 also offers an expanded data model and the ability to create global objectives that can live outside of a single course and can be used to affect learner experiences in an entire curriculum or across all LMS activities. Implementing these behaviors requires a deeper understanding of SCORM, which goes beyond SCORM 1.2 knowledge.

4.3.2.3 Are you designing for re-use

SCORM is typically used to enable re-usable content. This could mean re-use within a course, within a curriculum, within an organization, or across organizations.

The term “re-use” is rather straight forward, but requires some explanation when developing for re-use 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 re-used. Here are three options that may help your organization save development costs:

1. **Re-Use.** 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. **Re-Purpose.** 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 “re-purpose” 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 possibly you do not have a 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 the other LMS.

There are rules when designing for re-use, 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 re-use 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 re-used or re-purposed. As mentioned above, an entire course that is wrapped as a single SCO greatly limits the likelihood of re-use. Although SCORM doesn’t define or mandate SCO size, developers should consider “chunking” the content into re-usable pieces. To further enhance re-use, 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.”

4.3.2.4 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 re-use 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 an 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 re-use 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 done 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.

4.3.2.5 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 www.ADLnet.gov.

SCORM Users Guide for Instructional Designers

SCORM Users Guide for Programmers
5 Development of ADL – Methodology

This chapter advises 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 some guidance on how to set up a production team and how to proceed step-by-step 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 set up 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 subject matter expert (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 correctly and precisely according to established rules and operating procedures 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, an SME should be:
• Available to the project team for early, often extensive, project meetings and later 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/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 a 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 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 feel OK and are able to do 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 are usually fulfilling their project-related task besides their other duties. The following approaches may support you in establishing a 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/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/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/her mark up any existing material with comments, suggested deletions, updates, or additions
  • Invite him/her for an interview and have him explain processes with pictures (or other media) while videotaping everything.
  • Provide him/her with a detailed questionnaire asking for very specific answers and draft inputs (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 a step-by-step procedure, involving all stakeholders at the right time, and carefully making decisions early, before attempting any work. This way, costly and time-consuming rework due to wrong 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 depending on them!

5.4.1.2 Overview of the Work phases
There are many ways to produce content, from experimental prototyping to the production according to a strict workflow. 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 the 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 up front, 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 FAQ.

- **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, FAQ 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 overall 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 subject matter experts 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 not too many things should 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 key words 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 tests 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 learning management system 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 product as planned. Nonetheless, even with the most capable production team, there can and WILL be flaws or errors in the program that stay undetected without thorough testing.

Thorough testing of a web-based training 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?

When all these tests have been conducted and no intolerable flaws been detected, the program may be officially deployed for real 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 optimizations for a next project as well as points that really worked well.

### 5.4.10 Rapid content production

We want to briefly mention rapid content production. Rapid Content Production refers to tools and processes to produce ADL content in very short time. 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 about 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 appealing 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 form.
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 adding narration and some animations and sound effects will not result in appealing results. 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 key words and having the full statements narrated
- Making use of narrated graphics, diagrams, and images, with highlights and text labels added
- Wherever possible add some interaction, 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 ADDIE (Analysis, Design, Development, Implementation, & Evaluation) ADL development method, the step of Implementation 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 (made available from the LMS) for its intended audience.

Implementing a designed and developed course module contains two steps:

1. Deploy it (make the course module available)
2. Run it (have a learner to 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 was defined by the designers and developers of the content.

Because the two 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 is being made available—with the aid of a system—to someone (the learner(s)), by someone (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), etc.

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 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
  - Involve active communication
  - Require more detailed administration

Because the course is now specifically scheduled, it will probably also be monitored more accurately and therefore require the registration of a specific result, rather than a check in the box.

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 qualifying for a task/job without the requirement of detailed administration.

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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 seen/opened or the learner decides that he/she has had enough.

In a more complex scenario, the course invites the learner to do more than just page through it. There may be exercises, tests, assignments (possibly involving student-student or student-teacher collaboration), simulations and other interaction as part of the course. The bottom line may be that the more a learner gets involved, the better they will remember (see Figure 3-4 in 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. (“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 involved network systems, infrastructure databases, and interfaces or any other “technical” support the process needs to perform. Preferably only tools are mentioned that 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 into them, 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 are trying to convey.
6.3.1 The information
Basically there are three groups of information involved:

- 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 towards security, deployment, access, and support.

6.3.2.2 Learner
The Learner is the most important end user of any course module and 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 (is it self-paced or instructor led? Does it require social interaction? etc.)

6.4 Summary
Implementation is part of the ADDIE process that refers to an ADL course module that is ready to be deployed (made available from the LMS) for its intended audience. Implementing an ADL course module contains 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-Phillips training evaluation model, presented earlier in Chapter 3 (Design) is also included here to help clarify the difference between the learner assessments (associated with learning outcomes) and the evaluation of the course’s effectiveness. Learning evaluations focus on whether or not the learner learns what he or she was supposed to learn. The “E” in ADDIE focuses more on the evaluation of the course effectiveness, e.g., does the course accomplish what it was 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](image)

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 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 gone down.

**ROI (Return on Investment)**: 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 (Wilson-Strydom, n.d.: 15). The “research question” most often asked in this phase of the ADDIE process is: How effective was the training? Regarding this fact, it is possible to enumerate three main purposes of evaluations (Babbie and Mouton, 2001):

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 from 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 once he or she is on the job and has had the chance 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 respond to identified problems
- Efficiency – input and output ratio (efforts and effects)
- Effectiveness – whether the objectives have been achieved
- 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. They should be asked to reply honestly: even if their response is negative, this is just as useful as a more positive opinion. It is also recommended to present the results of evaluation in the requesting party’s domestic language.

The survey should begin with the 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 recommended forms is the survey. It is due to the fact that some LMSs possess tools for preparing questionnaires with varied types of questions. The types of questions possible 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 questions, 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, 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.

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
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 (Second Life), mobile platforms, and serious games are no longer considered “emerging” technologies, but how they are used to teach and/or augment more traditional learning is rapidly emerging. This chapter will highlight considerations to make when 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.

One overarching purpose for this chapter is that conventional classroom and ADL systems do not support informal learning that is afforded by technologies such as social media and virtual environment—and can be accessed by mobile devices. 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 and access all kinds of resources (video, audio, images, etc.). They may also want to put the additional descriptions, notes and comments together with the shared content.

8.2 Introduction
Technology is changing rapidly. If you consider the previous 10 years, you’ll easily recognize how much technology has progressed over that time. Not only the technology, but the research in how we think, how we process information, and how we best retain information is progressing. For instance, most people can remember information for a short duration, e.g., study facts to accomplish a passing grade for a test. However, science is revealing new research that a lot of that information is stored in short-term memory and is often not retained for long-term. Also, we are learning that much information that is currently taught in the classroom may best be presented in the form of job aids while the user is actually involved in accomplishing a task. There are many instances in which learning “on-the-job” may increase the chance that the learner will retain that information long-term. Often, mobile learning, or mLearning, may be an effective means to assist job-aiding. So, how we learn may affect how long we retain information. For instance, learning a procedure in a virtual or game-based environment (instead of a traditional classroom lecture) may help facilitate long-term retention. Current research is leading us to consider alternate means of learning in order to enhance retention.

Here are some general considerations about the future learning environment:

- The future classroom will be aided much 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 so much 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—or at least assume 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.
- Need to teach toward “adaptability” or “cognitive agility.” This skill will be an overarching skill that will be used throughout one’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 “classrooms.”

The new learning technologies provide different tools to the educational organizations and individuals.

This chapter provides important information about the emerging technologies that are used in learning. In addition, examples are presented for each particular technology:

Social Tools  |  Virtual Classrooms  |  Mobile Learning  |  Simulations and Serious Games

The remainder of this chapter is divided into four subsections. Section 8.3 is about the tools that incorporate social interaction. Section 8.4 is about the tools which emulate classrooms. Section 8.5 is about mobile learning. Section 8.6 is about simulations and serious gaming.

8.3 Social Tools

Social tools can be used for students to learn together, regardless of location and distance. These tools enable users to create content together, collaborate with each other, work, reflect, and learn together. Social tools force the individual users to be aware of their 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 – Look who am I. Who can see my profile and my content and how they can see 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 we have talked about?
- Activities – What is going on right now?
- Groups – Formed on individual interests
- Sharing – Common content, information, knowledge

Social tools could be divided in two general groups: tools focused on content and tools focused on communication.
8.3.1 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 considered as notes (annotations) that represent additional learning material (useful for better understanding and description of the content). Content focused social tools have two main purposes:

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

File sharing tools provide the ability of content sharing and/or publishing. They have emphasized technical character because content has to be transformed from original content to the Web-readable format. Author (publisher) can describe the content (by metadata). This way, search engines can index shared content which makes it easy to find and re-usable by other people.

![Figure 8-1. Sharing content tool](image)

Use of metadata to describe the online resources in order to provide better classification and annotation for later reuse is well known as social bookmarking. Unlike file sharing, the resources themselves aren’t shared, merely bookmarked so that others can reference them. With social bookmarking, users may understand the content of the resource without needing to read it first. ADL content is usually described by a set of metadata tags. However, social tools enable users to create their own tags. A classification system derived from the process of collaborative creation and management of tags is known as “folksonomy.”

Users can add their comments related to the specific content. This way the content becomes the center of gravity around which users can put additional information. Users can discuss issues and share ideas through the use of commenting tools. Content sharing represents the concept similar to the SCO (Sharable Content Object) in an LMS, as the comments are similar to the student notes related to a SCO. The only difference is the notes can be private or public, while the comments are public. Administering comments or notes (accepting or rejecting) is necessary in both cases.

Collaborative (team) work on the same content represents another approach of 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, team participants can edit the content simultaneously.
In addition to document editing, users can add comments to the content. This way content creators play additional role of advisors, and collaborative content is reviewed during the process of its creation.

**Examples**

*YouTube* is a video-sharing website on which users can upload, share and view videos. Adobe Flash Video and HTML5 are the technologies used to display a wide variety of user-generated video content, including movie clips, TV clips, and music videos, as well as amateur content such as video blogging and short original videos. Most of the content on YouTube has been uploaded by individuals and organizations. Educational institutions offer some of their material via the site, as part of the YouTube partnership program.

*Delicious* is a social bookmarking web service for storing, sharing, and discovering web bookmarks. It does not represent a content repository. Rather, it stores references (bookmarks) with the descriptions of the website content. Delicious uses a non-hierarchical classification system in which users can tag each of their bookmarks with freely chosen index terms (generating a kind of folksonomy). A combined view of everyone’s bookmarks with a given tag is available. Besides the website’s simple interface, different technologies are used in: human-readable URL scheme, a novel domain name, a simple REST-like Application Programming Interface (API), and RSS feeds for web syndication. All bookmarks posted to Delicious are publicly available by default, although users can mark specific bookmarks as private. Imported bookmarks are private by default. The public aspect is emphasized; the site is not focused on storing private (“not shared”) bookmark collections. Delicious linkrolls, tagrolls, network badges, RSS feeds, and the site’s daily blog posting features can be used to display bookmarks on weblogs.

### 8.3.2 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 in a same time. They enable the users to be in different places and communicating 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 tools.

*Instant messaging* represent 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 situation when 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 message immediately after it was sent. Messaging is usually between two users (i.e., teacher and student, or two students). Instant messaging is useful if participants exchange short messages (because it strongly depends on typing speed and typing errors).

VoIP (Voice over IP) tools provide users with audio communication. This tool replaces the traditional telephone communication (telephone lines and devices are not needed) with digitalized voice through the 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-to-one communication, because it is hard for participants to recognize the voices of different people (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 more need for correcting typing errors.

Video conferencing tools provide the users with the video communication. Video communication is useful for giving online lessons and organizing online workshops. The impression of physical presence of participants makes the emotional aspect of learning more expressed than in the 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 HTTP-based Internet network. Because of HTTP over-heading, network, and server occupancy, the quality of video might be changeable during the connection and quality of service is not guaranteed. On the other hand, the low costs represent the main advantage of this approach.

The other type of video conferencing includes tools without provider’s mediation (i.e., Polycom system). Every video conferencing site (equipped space in which participants can video communicate with each other) has to have its own video conferencing equipment (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 avoidance of HTTP over-heading (the use of internal data formats).
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 in communication. 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 that by remote controller. It is especially useful for the teachers to make video transitions between them, whiteboard, screen with presentation slides, 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-mails, forums and blogs. These tools are embedded in almost all of the actual 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. The users interchange the messages in the form of electronic letters. The number of addressed users is not limited. Electronic letter represents stand-alone information entity exposed just to addressed users. E-mail enables the users to attach and send additional content (files of different types). Interaction can be directed in one way, but usually participants use mail threads. It means the first mail initializes the thread and other connected replies are chained in it. It is a way in which e-mails are organized.

On **discussion forums** (discussion boards), participants communicate by posting messages to the 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 environment to discuss issues and share ideas between the participants. Teacher usually gives a task (for instance, 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 usual time limited and teachers can evaluate the contribution of each participant.
Blogging tools enable the users to create their own Web pages (blog homepage), to put different content there (blog entries) and to share them 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. Users can respond on the 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 an LMS. They are used in the course context, and the blog posts are related to the opened course. Blogs can be helpful for students if they need to share and / or collect information and ideas with / from the others. They can express their opinions and attitudes.

8.4 Virtual Classrooms
The advantage of virtual classrooms is that a visual connection between 2 or more people can be made 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), eTraining (1 teacher and less than 10 students) and eCollaboration (3-4 persons). Those types have been defined according to 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 & paper, e-Presentation (PowerPoint, Adobe, Flash…), references… All of these possibilities are kept within the eSessions.

The advantage of virtual classroom is that the participants stay at home or at the office and no travel to the training center is necessary.

8.4.1 eSessions

eTeaching

Like in a University, the teacher presents a theme, and the students who are interested can take part in the lesson. The interaction is limited (only chat) but the whole course can be registered for later review or an implementation in the LMS. There is no student limit, but server resources may limit the number of students.

eTraining

The eTraining is designed as a small class with a teacher and less than 10 students. The leader is the teacher, but the students can participate (questions, exercises, etc.). The course can be saved for later review or as lessons in the LMS.
eCollaboration

The eCollaboration is a small discussion group (less than 4 persons). There is only a session leader for administrative purposes. Every participant can see, speak, hear, and act. Normally, there is a whiteboard open for all participants.

8.4.2 Roles

Host. The host is the manager of the event and assumes all the administrative tasks: invitations, virtual room reservation, session configuration, etc. That person has to have administrative knowledge of the tool.

eTeachers. The eTeacher is the leader and speaker of the session. That person has to understand didactical eSession principles.

Participant. The participant is a student. He or she must have a webcam and a headset.

8.4.3 Technology & Compatibilities

Identification. The identification has to be done within the LMS; it gives various advantages like security, identification and the ability to track the learning progress.

Information Protection. Like any other web tool, the whole web infrastructure has to be encrypted for information security purposes.

8.4.4 MOOCs

A massive open online course (MOOC) is an online course aimed at large-scale interactive participation and open access via the web. In addition to traditional course materials such as videos, 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 connectivism, 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 a 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

Connectivist 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 already, 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 the videos and other material produced by the MOOC as becoming the modern form of the textbook. “MOOC is the new textbook,” according to David Finegold of Rutgers University.

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

8.4.5 Related educational practices and courses

There are few standard practices or definitions in the field yet. A number of other organizations such as 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 all 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.

8.5 Mobile Learning

8.5.1 Overview
This section will cover the basics of mobile 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 definition of “mobile learning” (mLearning) could be limiting to some organizations. Many of the existing definitions of mobile 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 mobile 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.” (from the Advanced Distributed Learning Initiative’s website: http://www.adlnet.gov/mobile-learning/)

This description is intentionally generalized to allow for a growing number of mobile learning scenarios as well as future capabilities of new technology and device types. Mobile 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 and anywhere. Unlike other learning technologies, mobile learning is unique in that it can accommodate both formal and informal learning in collaborative or individual learning modes.

Mobile learning is definitely not just “ADL lite.” Consider the following possibilities for review, updates and reinforcement:

<table>
<thead>
<tr>
<th>Training Modules</th>
<th>Performance Support or Job Aids</th>
<th>User-Generated Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Just-in-Time Learning</td>
<td>On-the-Job Support</td>
<td>Note Taking</td>
</tr>
<tr>
<td>Microlearning</td>
<td>Alerts/Reminders</td>
<td>Translation</td>
</tr>
<tr>
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<td>Social Networking</td>
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<td>Augmented Reality</td>
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</table>
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 mobile learning project team will no doubt have cherished, tried and true instructional design principles, process strategies, and pedagogical models that they have learned from their involvement in traditional e-Learning projects. Unfortunately, some of these may need to be unlearned for mobile learning.

Of special importance are the considerations and decision nodes in the analysis process that could lead development teams to choose mobile learning as the optimal solution. You don’t want to end up with mobile 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 mobile 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 mobile learning. As stated above, your instructional design process model must include paths to these strategies/outcomes. The traditional ADDIE model might not be the best mobile development model.

8.5.2 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 the handheld devices that learners carry 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 mLearning. Mobile device categories will continue to evolve both from a function and feature perspective and from vendor marketing messages. The main concern for mobile learning developers is what devices and/or features need to be supported for the intended learners.

8.5.2.1 Features

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

Table 8-1: Innovation Considerations for mLearning (list is not all-inclusive)
8.5.2.2 Tablets

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

8.5.2.3 Connectivity and Bandwidth
For most users, bandwidth is becoming less and less of an issue with the availability of 3G and 4G networks. However, connectivity will always be an important consideration for mobile development strategy. 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.

8.5.2.4 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)

8.5.3 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 just the look and the feel. Many things matter, including the way that data is stored on the mobile. 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.

8.5.3.1 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).

8.5.3.2 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 won’t 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.

8.5.4 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 Applications 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](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!

### 8.5.5 The Hybrid Approach

While the mobile development community argues about which is the better approach (native or web App), the truth is this: 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 just about any of 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.

#### 8.5.5.1 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.

#### 8.5.5.2 App Store Distribution Processes for Developers

Whether you decide to develop your mobile App using SDKs or using 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 all 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.
8.5.6 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 life cycle maintenance of your App content, it might also 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 even more. 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.

Mobile Resources:

ADL Mobile Learning website (U.S.): http://ml.adlnet.gov


8.6 Simulations and Serious Games
Live training is invaluable, 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 myriad 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 repetition. In most cases, live training opportunities do not allow for units or individuals to repeat parts of an exercise 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 (Roman & Brown, 2008).

Serious games can help complement live training events in many ways. First of all, research indicates that computer simulations can improve spatial learning and perceptual skills of learners (Lindgren & Schwartz, 2009) and can provide additional quality to 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. This means that they can start, stop, examine or restart a simulation at any time, which is not possible in a real situation (Holland, 1998). 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 a complex training and education can be performed in effective (enriched quality) and efficient (cost reducing) manner.

8.6.1 Simulations
Simulations are used all over the world to support training with many different types. 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 the 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 concept, to support policy formulation
- Force planning
- Operations support for the deployed forces
- Support for military decision-making for military capability and acquisition
- Support to 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 and that 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 higher than without the support of simulation. To make it short, simulations can make the training more efficient.
Generally speaking we differentiate between 4 levels of models going from the most accurate scientifically needed models to the highest aggregation level, used for large scale simulation for Commander & Staff training. The 4 levels are:

- Engineering
- Engagement
- Mission/Battle
- Theatre/Campaign

Every level of simulation has advantages/disadvantages, and each is focused on a specific use. A model for experimentation won’t 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 have to be achieved with that simulation.

The next level to look at is to answer the question 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 3 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 those 3 categories are more and more brought together to offer a training environment as close as possible to the reality of the modern battlefield.

Armed forces are using those simulation tools for training, but the rapidly evolving game market is more and more used to acquiring low-cost simulations based on the game technology to train the lower echelon (VBS 2). This trend started in the late 1990’s and has found a place of choice in the simulation environment for training. 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, networks, etc., has resulted in some 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 application technologies. With minimal software on your own computer, you can participate in game-play over a huge network from all over the world. The simulation is not done on your computer, but in central servers with access from anywhere in the world.

For ADL, this represents the realm to get away from static content to enter 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, could project the trainee in a synthetic environment where he or she can discover tactical principles by himself/herself. Arranging the platoons, issuing the orders and then watching to see if his/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 get step-by-step to those principles of a successful tank attack.

The digital native trainees of today are very familiar with that kind of environment, and they often learn more efficiently than in the classical classroom training. There are a few studies that have analysed the different learning habits between the different generations from the 50’s until the year 2000. The differences are very impressive and, if the lessons target the wrong student generation, the efficiency of the learning can be decreased by about 20%.
Although this cannot be generalized too much, 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 should work together with the ADL experts on learning/training projects from the 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. In 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.

**8.6.2 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 with the computer (or mobile devices) in accordance with the gaming rules, which use entertainment for educational purposes and training (Zyda, 2005). 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)](image)

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.” (Zyda, 2005)

The mission of modern militaries has significantly changed during last decades. Beside the traditional military tasks, they are increasingly involved in assisting people in the wake of natural and man-made disasters such as 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 different units, organizations and social groups, governmental and non-governmental institutions, emergency services, rescue teams, voluntary groups, and people from 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’ motivation, 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 ways are recognized as the main directions for their application for military training: mission rehearsal and combat modeling and analysis. The first one is used in the mission preparing phase. The other one is used in military doctrine research and development.

![Figure 8-9. Serious games as general concept (Zyda, 2005)](image)

Mission rehearsal requires high quality of the serious game software. It means the 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: there is the main course of action (defined in accordance with the mission tasks), and alternative courses which are used for providing uncertainty of scenario. Alternative courses are also important because they represent the prediction mechanism for implementing the possible directions of the situation development.

Based on the diagram presented above, computer simulations represent the extension of the serious games. From this prospective, simulations have many common characteristics with the 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 (Levesque, J. et al., 2008). Others point up different characteristics which are based on differences between gaming and training preferences (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 motivation factors of the learning and training process.
8.7 Summary
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 location the learner requires them.

Although the delivery of ADL can be achieved by using external memory units such USB sticks, CDs or DVDs that can be suitable for individual, 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 the 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

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADDIE</td>
<td>Analysis, Design, Development, Implementation &amp; Evaluation</td>
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<td>ADL</td>
<td>Advanced Distributed Learning</td>
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<td>CMS</td>
<td>Content Management System</td>
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<td>HD</td>
<td>High Definition</td>
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<td>HRM</td>
<td>Human Resources Management</td>
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<td>ISD</td>
<td>Instructional Systems Designer</td>
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<tr>
<td>ISD</td>
<td>Instructional Systems Development</td>
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<tr>
<td>LMS</td>
<td>Learning Management System</td>
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<tr>
<td>LO</td>
<td>Learning Object</td>
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<tr>
<td>MOOC</td>
<td>Massive Open Online Course</td>
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<tr>
<td>PO</td>
<td>Performance Object</td>
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<td>SCO</td>
<td>Sharable Content Object</td>
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<td>SCORM</td>
<td>Sharable Content Object Reference Model</td>
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<td>SME</td>
<td>Subject Matter Expert</td>
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<td>TNA</td>
<td>Training Need Analysis</td>
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<tr>
<td>VoIP</td>
<td>Voice over Internet Protocol</td>
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Resources and References

General Resources (Chapter 1, Background)

ADL Content Production Kit
http://www.isn.ethz.ch/e-Education/Available-Resources/ISN-ADL-WG-Content-Production-Kit

NATO Bi-SC Education and Individual Training Directive D 75-7


SCORM Resources (Chapter 4, Development)

SCORM 2004 4th Edition

SCORM Users Guide for Instructional Designers

SCORM Users Guide for Programmers

Experience API (xAPI) Specification
http://www.adlnet.gov/tla/experience-api/

Mobile Learning Resources (Chapter 8, Examples of Emerging Technologies for Training and Education)

ADL Mobile Learning website (U.S.)
http://ml.adlnet.gov

ADL Mobile Learning Handbook
http://mlhandbook.adlnet.gov

References for Chapter 7, Process Evaluation and Maintenance


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


