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GLOBAL AVIATION TRAINING  
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# **Taxonomy to Assist in the Identification of Instructional Methods (E-learning, Classroom and Blended Training)**

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## **1. Introduction**

During the 2015 Council Off-site Strategy Meeting (COSM 2015) on Training and Capacity Building in Civil Aviation, the ICAO Council adopted a number of recommendations with concrete strategies and steps to address challenges and opportunities for training and capacity-building amongst Member States. It was recommended in particular that the Secretariat ensure the implementation of comprehensive data-driven and competency-based methodologies for the design, development, and delivery of training in aviation, and to assess the effectiveness of ICAO training courses. One of the main activities identified to achieve this was implementing a taxonomy that will help determine how best to use classroom instruction or e-learning, or else combining (blending) them to take full advantage of computer technology for training.

This proposed taxonomy is therefore intended as a framework to help select and use instructional methods. Because making these decisions always requires considering local conditions, and because conditions vary widely between locations, it is not intended as a definitive set of rules that dictate decisions. It remains instead a tool to help determine how to create the best conditions for learning.

After defining what is a taxonomy and clarifying its purpose, this paper explores how existing taxonomies for writing instructional objectives form the basis for selecting and using instructional methods. It then reviews the characteristics of classroom instruction, e-learning and blended learning and the types of performance outcomes they help achieve. It concludes with examples of how to apply this taxonomy to decide about using classroom instruction, e-learning and blended learning.

## **2. Background and Contributing Taxonomies**

### **2.1 Definition and Purpose**

A taxonomy is a system to orderly classify items into groups based on their relationships [1]. It is therefore a system of classification that reflects the structural characteristics of the items considered. For this taxonomy, the items are instructional methods and their characteristics include underlying theoretical principles, proven techniques for their use, the specific characteristics of tools and devices through which they are applied and their capacity to achieve desired outcomes.

As stated by Clark (1975) [2], “the most crucial problem in taxonomy development is the actual choice of the attributes forming the basis of the classification scheme”. Because the choice of attributes – or characteristics - to consider is always somewhat arbitrary, they must be clearly defined and explained so that the logic of the proposed classification system becomes apparent and defensible. With this in mind, the attributes of this taxonomy will be presented and discussed in the following sections.

While some taxonomies can be highly formal and prescriptive (like those used to classify plants or animals), others are more conceptual and relative, and more subject to the influence of external factors. For example, whereas a dog would not become a cat because of the context in which it exists, the relative importance or merit of instructional methods may change significantly depending on situations and circumstances. The purpose of this taxonomy is therefore not to formally prescribe the use of instructional methods in any situation or circumstance, but instead to provide criteria to better decide how to use them and meet different needs.

## **2.2 Taxonomies for Writing Instructional Objectives**

Various taxonomies exist that explore the characteristics or attributes of teaching strategies or other aspects of teaching and learning. They are used to describe different kinds of learning behaviors that students should develop, help identify different stages of learning and provide a useful tool to clearly state the objectives of instruction in terms of expected outcomes. Other taxonomies have also been proposed to classify educational games [3], organize the broad use of technology in education [4] or investigate learning styles [5]. Not all taxonomies, however, are considered equally useful, either because they are too limited or because they have become outdated. Furthermore, none were found that directly address using e-learning and blended learning with classroom instruction [6, 7]. Accordingly, the taxonomies that most inform this one are those developed to help write instructional objectives, and in particular those created by Benjamin Bloom and his colleagues.

Starting in the late 1940's, Bloom and a team of cognitive psychologists initiated work to develop a taxonomy of expected learning outcomes in terms of the mental activities involved in becoming able to perform something. Because it focused on mental activities, the taxonomy referred to the cognitive domain. Later, David Krathwohl developed a similar taxonomy for the affective domain that focused on the emotional and attitudinal aspects of effective performance, while Kibler proposed a taxonomy for

the psychomotor domain that classified the physical actions involved in effective performance. Because they remain important tools to plan instruction, these taxonomies are discussed below [8, 9].

### 2.3 The Cognitive Domain

Bloom's cognitive domain arranges mental activity into six levels: knowledge, comprehension, application, analysis, synthesis, and evaluation. In the 1990's, the domain was revised by Anderson *et al* who proposed a slightly different terminology to identify levels: remember, understand, apply, analyze, evaluate and create (Figure 1) [10, 11, 12, 13].

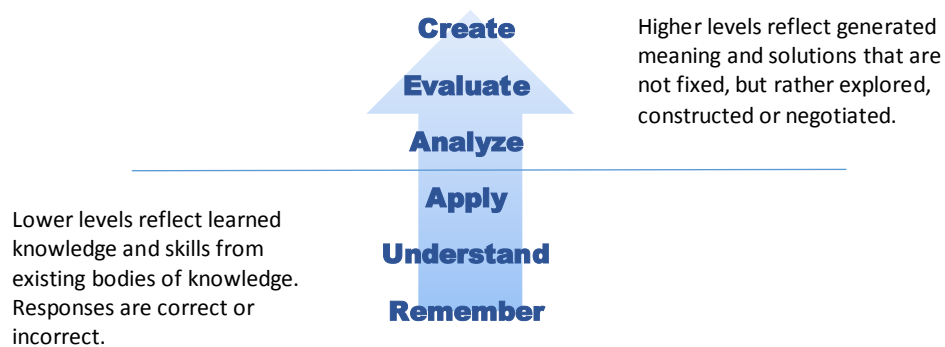


Figure 1: Taxonomy of Anderson *et al*

This taxonomy implies a hierarchy in terms of how difficult or demanding it may be to complete tasks for learning. Memorizing airlines codes (acquiring knowledge), for example, is assumed to be easier than learning to conduct safety audits (evaluation). It proposes a progression (or instructional sequence) and helps identify the key attributes of instructional methods that can be used to achieve the objectives for each level. For example, while reading a book may be enough to learn definitions, it is likely not enough to learn to handle emergency situations. Table 1<sup>1</sup> further defines the levels of the Anderson taxonomy.

<sup>1</sup> From Iowa State University Center for Excellence in Learning and Teaching - <http://www.celt.iastate.edu/teaching-resources/effective-practice/revised-blooms-taxonomy/>

Table 1: The Cognitive Domain of Anderson et al

lower order thinking skills			higher order thinking skills		
remember	understand	apply	analyze	evaluate	create
<b>recognizing</b> <ul style="list-style-type: none"> <li>identifying</li> </ul> <b>recalling</b> <ul style="list-style-type: none"> <li>retrieving</li> </ul>	<b>interpreting</b> <ul style="list-style-type: none"> <li>clarifying</li> <li>paraphrasing</li> <li>representing</li> <li>translating</li> </ul> <b>exemplifying</b> <ul style="list-style-type: none"> <li>illustrating</li> <li>instantiating</li> </ul> <b>classifying</b> <ul style="list-style-type: none"> <li>categorizing</li> <li>subsuming</li> </ul> <b>summarizing</b> <ul style="list-style-type: none"> <li>abstracting</li> <li>generalizing</li> </ul> <b>inferring</b> <ul style="list-style-type: none"> <li>concluding</li> <li>extrapolating</li> <li>interpolating</li> <li>predicting</li> </ul> <b>comparing</b> <ul style="list-style-type: none"> <li>contrasting</li> <li>mapping</li> <li>matching</li> </ul> <b>explaining</b> <ul style="list-style-type: none"> <li>constructing models</li> </ul>	<b>executing</b> <ul style="list-style-type: none"> <li>carrying out</li> </ul> <b>implementing</b> <ul style="list-style-type: none"> <li>using</li> </ul>	<b>differentiating</b> <ul style="list-style-type: none"> <li>discriminating</li> <li>distinguishing</li> <li>focusing</li> <li>selecting</li> </ul> <b>organizing</b> <ul style="list-style-type: none"> <li>finding coherence</li> <li>integrating</li> <li>outlining</li> <li>parsing</li> <li>structuring</li> </ul> <b>attributing</b> <ul style="list-style-type: none"> <li>deconstructing</li> </ul>	<b>checking</b> <ul style="list-style-type: none"> <li>coordinating</li> <li>detecting</li> <li>monitoring</li> <li>testing</li> </ul> <b>critiquing</b> <ul style="list-style-type: none"> <li>judging</li> </ul>	<b>generating</b> <ul style="list-style-type: none"> <li>hypothesizing</li> </ul> <b>planning</b> <ul style="list-style-type: none"> <li>designing</li> </ul> <b>producing</b> <ul style="list-style-type: none"> <li>constructing</li> </ul>

The Bloom and Anderson taxonomies are relevant to this one because of the performance outcomes that can be associated with each level. It allows linking learning objectives with specific work-related competencies and measure how well they are achieved. For example, the verbs listed in the column Understand suggest specific actions that learners could perform to not only state they understand but demonstrate it in practical terms. Because some instructional methods are more useful to develop some knowledge than others, the taxonomy helps confirm which methods to use to achieve stated outcomes. It therefore becomes an important tool to link learning objectives, instructional methods and job-related, performance-based outcomes.

## 2.4 The Affective Domain

The affective domain attempts to map the development of attitudes, principles, codes and values. As shown in Table 2<sup>2</sup>, it includes 5 levels ranging from a willingness to accept new information to becoming characterized by the values and principles that regulate behavior.

<sup>2</sup> Adapted from Tomei [4] and O'Neill [11]

Table 2: Affective Domain

Levels	Definition	Related Verbs
Receiving	Developing awareness of ideas and phenomena	Differentiate, set apart, separate, accumulate, select, combine, listen, control, acknowledge, ask, attend, be aware, listen, receive, reply, select, show alertness, tolerate, use, view, watch
Responding	Committing to the ideas etc. by responding to them	Comply, follow, commend, volunteer, discuss, practice, acclaim, augment, agree (to), answer, ask, assist, communicate, comply, consent, conform, contribute, cooperate, discuss, follow-up, greet, help, indicate, inquire, label, obey, participate, pursue, question, react, read, reply, report, request, respond, seek, select, visit, volunteer, write
Valuing	Being willing to be seen as valuing certain ideas or material	Relinquish, specify, subsidize, help, support, protest, debate, argue, accept, adopt, approve, complete, choose, commit, describe, desire, differentiate, display, endorse, exhibit, explain, express, form, initiate, invite, join, justify, prefer, propose, read, report, sanction, select, share, study, work
Organizing	To begin to harmonize internalized values	Theorize, abstract, compare, balance, define, formulate, organize, adapt, adhere, alter, arrange, categorize, classify, combine, compare, complete, defend, explain, establish, formulate, generalize, group, identify, integrate, modify, order, organize, prepare, rank, rate, relate, synthesize, systemize
Characterizing	To act consistent with the internalized values	Revise, change, complete, rate, manage, resolve, act, advocate, behave, characterize, conform, continue, defend, devote, disclose, discriminate, display, encourage, endure, exemplify, function, incorporate, influence, justify, listen, maintain, modify, pattern, practice, preserve, perform, question, revise, retain, support, uphold, use

## 2.5 The Psychomotor Domain

The psychomotor domain focuses on the physical dimensions of learning and task performance and is demonstrated by physical skills that may involve coordination and dexterity, object manipulation, body movements, using precision instruments or working with tools. Psychomotor skills are required to perform a wide range of job tasks involving using tools, equipment or the body to complete tasks.

The taxonomy that was first proposed for this domain included 5 levels that also represent a sequence progressing from initial learning to task mastery: imitation, manipulation, precision, articulation, naturalization. This initial version, however, has since been expanded to include the levels in Table 3<sup>3</sup>.

<sup>3</sup> Adapted from Clark [15]

Table 3: The Psychomotor Domain

Levels	Definition
Perception (awareness)	The ability to use sensory cues to guide motor ability, from sensory stimulation to action.
Set	Readiness to act. Becoming ready to respond to different situations.
Guided responses	Early stages in skill acquisition involving imitation and trial and error.
Basic proficiency	The ability to perform with some confidence and proficiency but without mastery.
Complex responding / mastery	Skillful performance that is fully integrated and automatic. Implies a high level of accuracy and proficiency.
Adaptation	The ability to modify actions to meet different or unusual requirements.
Origination	The ability to develop new actions of behavior patterns by adapting already highly developed skills.

While perception is considered the first level of this taxonomy, it forms elsewhere a separate domain with distinct levels that emphasize the role of perception in task performance [14]. The first level is sensation and focuses on the ability to use sensual information to make sense of the information received. This would be the case of chefs, for example, that rely on taste to guide their work. Other levels would include the ability to perceive in three dimensions (important for piloting and air traffic control, for example) and to differentiate between colors (important to handle dangerous goods, for example). This taxonomy, however, is not as well known or used for instructional design as those proposed for the psychomotor domain.

## 2.6 The Interactive Domain

The previous taxonomies focus on individual performance and therefore do not address what happens between individuals that affects performance. Interpersonal skills are nevertheless increasingly recognized as essential to perform effectively in many jobs or job situations.

To address this gap, a taxonomy of social, interpersonal and interactive skills has been proposed that integrates (in some ways) elements from the cognitive and affective domains. The ability to negotiate effectively, for example, involves knowing about the techniques of effective negotiation and how to use them, but also on being able to create a positive emotional environment or else deal with emotional issues that arise. These skills have been grouped into the interpersonal domain presented in Table 4<sup>4</sup>.

<sup>4</sup> Adapted from Romiszowski [13] and UNLV Online Education [14].



Table 4: The Interpersonal Domain

Category	Description
Seeking / giving information	Seeking or offering clarification of facts or opinions to / from individuals.
Proposing	Putting forward a new concept, suggestion or course of action that can be actioned.
Supporting	Conscious and direct declaration of support or agreement with another person or his concepts.
Including	Direct and positive attempt to involve another group member.
Summarizing	Summarizing or restating in a compact form the content of previous discussions or considerations.
Disagreeing	Conscious, direct and reasoned declaration of difference of opinion, or criticism of another person's concepts.

It should be noted that the hierarchical relationship between levels is not as clear for this taxonomy as it is elsewhere. While the levels of the cognitive domain imply a progression - or learning sequence - from less difficult to more difficult skills, there is no obvious sequence for the interpersonal domain. Instead, the skills to develop and how they may be arranged into a learning sequence often depend on the specific type of performance to develop. As a result, it may be more appropriate to represent this taxonomy as complementary skills rather than as a table implying order or sequence (Figure 2). Nevertheless, this taxonomy acts as an important reminder of the need to address interpersonal skills during training.



Figure 2: Taxonomy of Interpersonal Skills

## 2.7 Performance-based Learning and Instruction

Workplace learning can be defined as all the ways that learning takes place at work or in relationship to it. It is the integrated use of learning and other interventions for the purpose of improving individual and organizational performance. Achieving measurable outcomes in terms of job-related performance is therefore a key attribute of workplace learning. As a particular form of workplace learning, training refers to developing in oneself or others any skills and knowledge that relate to specific useful competencies. It seeks to achieve the specific goals of improving one's capability, capacity, productivity and performance [16, 17].

Performance is the result of all that we do to achieve goals or objectives, based on defined standards. It involves developing competencies that are fundamental to effective performance. It is the yardstick by which we measure how well we achieve what can or must be done to remain viable and productive. Because improving job-performance is a key goal of workplace learning, instructional methods must always first be selected or combined based on how well they allow developing job-related competencies.

While the importance of improving job performance is conceptually recognized by many involved in aviation training, it is often neglected in practice. Despite a growing diversification of tools and methods that improve learning and instruction, training in aviation continues to rely heavily on traditional classroom instruction rich in lectures and presentations, primarily because it also relies on subject matter experts to lead instruction who don't have equivalent expertise in learning and instruction. As a result, much of what is done in aviation training is limited to achieving the lower levels of the cognitive domain. The five taxonomies presented above should instead be seen as different sides of effective job performance that must equally be addressed for competent performance (Figure 3). Effective instruction therefore lies somewhere at the intersection of these taxonomies instead of only in one area.

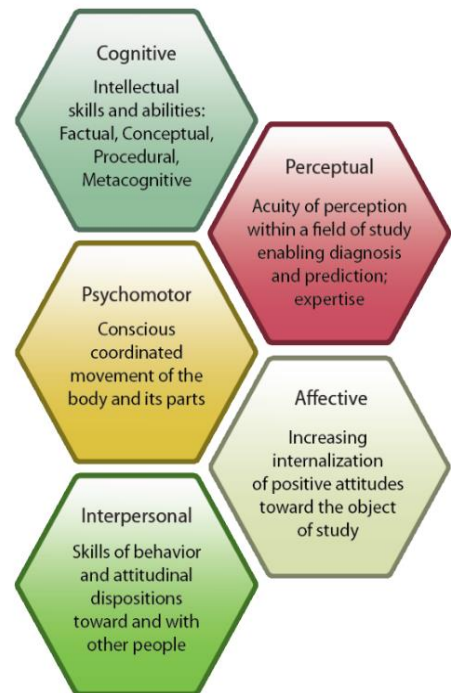


Figure 3: An integrated view of the 5 Taxonomies (UNLV Education Online)

Because it reflects a performance-based approach to training, this taxonomy for using classroom instruction, e-learning and blended learning builds on the ones presented above and assumes the following:

- (a) Instructional methods each have inherent characteristics that best allow developing the competencies associated with a particular taxonomy or taxonomic level.
- (b) Because most jobs include competencies associated with more than one taxonomy, any single instructional method is unlikely to meet all the requirements of effective training for performance improvement.
- (c) Any single instructional method is therefore inherently not any better or more appropriate than any other method. A method is instead better or worse depending on how well it allows developing the type of skill implied by a taxonomy or taxonomic level, to achieve specific performance outcomes.

## **2.8 Classroom Instruction Vs Technology-based Learning: The “No Significant Difference” Phenomenon**

A review of the research on the effectiveness of classroom instruction versus distance learning carried out near the turn of the century revealed that *“when the course materials and teaching methodology were held constant, there were no significant differences (NSD) between student outcomes in a distance delivery course as compared to a face-to-face course”* [18]. In other words, the most important factor to create effective learning is not the inherent attributes of any particular method but attention to design. Good instructional design that carefully considers how best to address specific needs and that applies proven principles and practices to create the best conditions for learning affects learning outcomes more than the characteristics of individual methods. Context and the conditions under which learning is expected to occur also become determining factors. For example, because classroom instruction and e-learning can both be used to present content, the quality and availability of good instructors or of computer technology may be the most important factors to decide which to use.

This taxonomy of instructional methods therefore further assumes that,

- (a) Good instructional design is fundamental to good instruction and effective learning. Whereas compromise is always possible when selecting instructional methods, there should be no compromise about applying the principles and practices of effective design. Furthermore, design is a

specialty that must be learned and practiced. It is therefore wrong to assume that subject matter experts who know content are also de facto good instructional designers.

- (b) Context and conditions are fundamentally important and directly affect the choice of instructional methods. Selecting appropriate instructional methods therefore requires addressing the conditions that exist within the context where learning occurs.

### 3. Instructional Methods

#### 3.1 Definition

An instructional method is a particular process or approach used to facilitate learning in accordance with recommended practices. It is a way of structuring an instructional event to engage learners in the process of acquiring and integrating relevant knowledge and skills. It includes all purposefully designed activities (from lectures to advanced simulations) that facilitate learning.

Each instructional method has attributes that determines its effectiveness to achieve [performance-based] objectives. At the same time, instructional methods often share some fundamental attributes that allow grouping them into categories. Because there is more than one way to offer classroom instruction or e-learning, for example, this taxonomy considers classroom instruction, e-learning and blended learning as categories of instructional methods that each include more specific ways to facilitate learning. In turn, because improving job-related performance remains the key goal to achieve, the methods in each category must first allow reaching that goal before being further considered. This relationship forms the basic structure of this taxonomy (Figure 4).

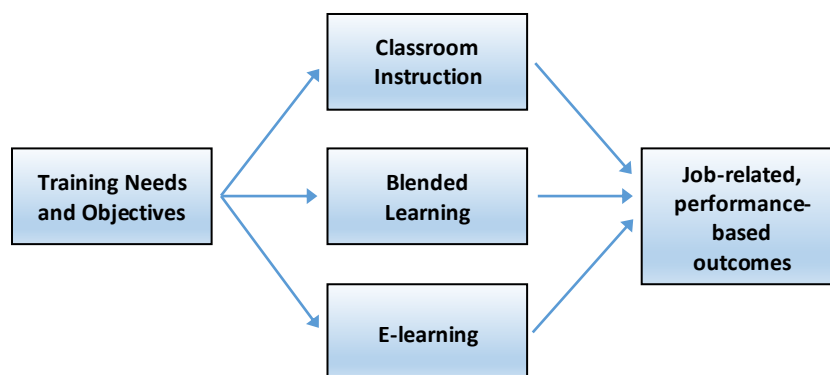


Figure 4: Basic Structure of the Proposed Taxonomy

### 3.2 Classroom Instruction

Classroom instruction is essentially a series of instructional activities intended for a group of learners working with an instructor in a dedicated location. Its three distinguishing attributes are being directed by a live instructor; involving a group of learners; and, occurring in a location separate from the workplace. [19]

Classroom instruction includes a number of instructional methods ranging from those that emphasize instructor activities to those emphasizing learner engagement (Figure 5). (The methods identified in this figure are further defined in Appendix A.)

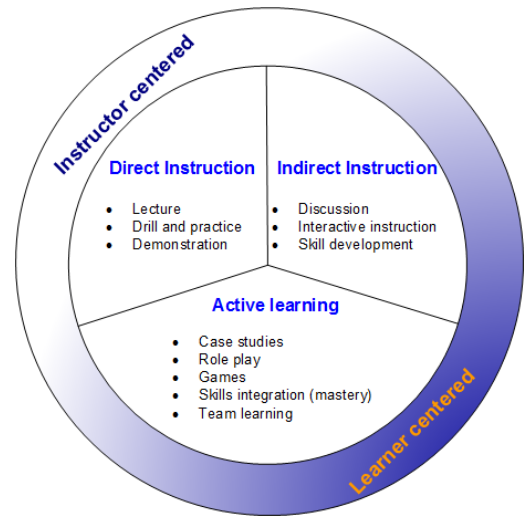


Figure 5: Methods for Classroom Instruction

These methods also reflect the structure of different taxonomies. Lectures, for example, often focus on remembering and understanding - the first two levels of the cognitive domain - more than on other levels. Case studies, however, may support higher levels of this domain and also promote learning associated with the affective domain. As a general rule, however, classroom instruction that is limited to presenting content through direct instruction is also limited to achieving objectives at lower levels of the cognitive domain.

Because classroom instruction involves a group of learners that are co-located and that influence each other (through class discussions or exercises, for example), it is fundamentally a social activity that should integrate the emerging principles and practices of social learning. This type of learning assumes that it occurs not only through instructor actions but also through learner interaction. It is essentially learning with and from others, including through computer technology. It involves three or more people working together to achieve a common goal that involves learning [20].

This taxonomy of instructional methods assumes that effective classroom instruction addresses more than a few levels of the cognitive domain and integrates social learning whenever possible. It therefore

assumes that effective classroom instruction is more than presenting content to a group of passive learners.

### **3.3 E-learning**

E-learning is all the ways that Information Communication Technologies (ICT) are used to prepare and deliver content, and engage learners in the process of acquiring relevant knowledge and skills. Because ICT is itself a diverse set of technological tools and resources used to create, disseminate, store, and manage information [21, 22], e-learning is not about using specific equipment or completing specific tasks but about using technology to achieve goals and objectives related to learning. As such, it is about purpose and intention: it is the intentional use of ICT for learning. “Technology integration pertains to the use of technology as an essential tool in the teaching and learning process. When technology becomes an integral part of the curriculum and learning activities, learning with computers becomes meaningful and purposeful.” [23]

E-learning is characterized by presenting content that is relevant to stated objectives; by the deliberate application of instructional techniques to facilitate learning; by the integration of media elements like sound or images to assist with presenting and applying content; by allowing to gradually build essential knowledge and skills; and by promoting communication and collaboration as needed [24, 25]. It excludes using word processing software or spreadsheets, for example, to complete the different tasks of the training function (like writing lesson plans or tracking grades). It also excludes equipment dedicated to specific training like Air Traffic Control or full function/motion flight simulators. It can include, however, simulation software that runs on common computers (like Microsoft’s Flight Simulator, ATC Simulator or Airway Sim) when they are used for training. Finally, e-learning may be delivered on standalone computers; via local networks or through the Internet; to computers at specific locations or on mobile devices (m-learning<sup>5</sup>). Appendix B identifies and defines various types of e-learning and clarifies the terminology used.

As a broader category, e-learning can be structured into different learning activities. It can, for example, be used to present content; guide learners through drill and practice exercises; engage them in discussion; or develop more advanced skills through simulation or case studies. E-learning can also take

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<sup>5</sup> A form of distance learning prepared for and delivered on personal electronic devices like smartphones or tablets.

advantage of the growing popularity of social media to integrate social learning. Using e-learning does not exclude using a qualified instructor to guide learning. It can instead be used within the classroom to complement instruction or outside the classroom to bridge distances between instructor and learners.

Figure 6 provides a simple illustration of the relationship between learning objectives, activities and the technological challenges involved in using them. For example, e-learning modules delivered on individual computers are usually less technologically demanding and can help achieve a range of objectives. Virtual classrooms are more technologically demanding and can reach groups of learners, but often only allow achieving lower level objectives. Finally, collaborative learning that occurs online is also technologically more demanding but can help achieve higher level objectives or else those of the interpersonal domain.

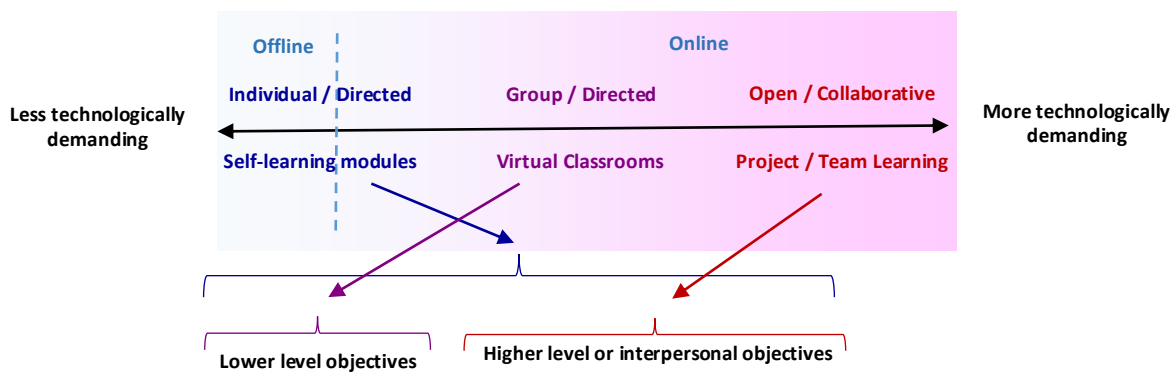


Figure 6: Relationship between objectives, activities and technological challenges

Figure 6 also illustrates the effects of conditions and context on decisions about using instructional methods. For example, although it may be determined that online learning would be most effective to achieve objectives associated with more open and collaborative learning, it would only be relevant if the existing technological infrastructure can support this activity (i.e. stable and reliable access to the Internet, access to relevant software, effective technical support).

### 3.4 Blended Learning

The term blended learning was introduced to describe the purposeful integration of face-to-face and online learning experiences to capitalize on the strengths of both instructional methods and more effectively achieve intended learning outcomes. This definition has since broadened to include other

instructional methods. For example, it is not limited to online learning and can include different forms of e-learning. The defining characteristic of true blended learning remains, however, the purposeful integration of methods based on sound design decisions.

Blended learning is therefore not a method or category of methods, but refers instead to the integrated use (i.e. deliberate and purposeful) of various instructional methods, tools and techniques to create the best possible conditions for learning. It is the planned combination of approaches that can integrate individualized and group instruction, classroom and online learning offered synchronously or asynchronously, locally or at a distance as needed to achieve objectives. It can integrate any kind of materials and activities provided that they together allow achieving the objectives of training. [26, 27]

Blended learning can therefore be used in different ways to improve a single course or a range of courses. For example, it can be used to start and end classroom instruction (Figure 7); to create more flexible and effective programs (Figure 8); or to more effectively support learning during a course (Figure 9). Appendix C reviews some key principles for using blended learning.

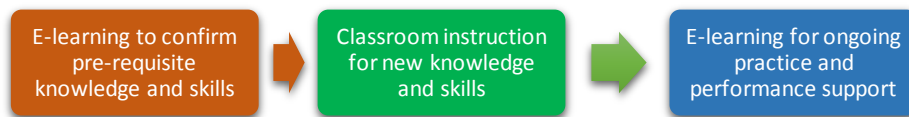


Figure 7: Blended Learning to prepare and extend classroom instruction



Figure 9: Blended learning for a program. Circles represent courses or other learning activities of the program

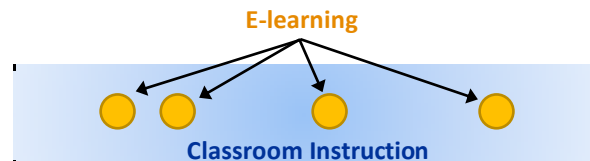


Figure 8: Blended learning as the integration of e-learning to improve classroom instruction



## 4. Applying the Taxonomy of Instructional Methods

This proposed taxonomy for using classroom instruction, e-learning and blending learning is applied by taking into account the objectives of the intended training and the context or conditions under which it will be offered. Because of the many different ways instructional methods can be combined depending on objectives and local conditions, no single tool can account for all possible arrangements under all conditions. The tools presented in this section to help apply the taxonomy therefore address general or typical situations. Users should consult these tables and make necessary adjustments to meet their own needs.

This taxonomy also assumes that instructional methods are only selected after analyzing job tasks and their related performance requirements, and then translating them into learning objectives. Decisions about using one or more methods can only be justified based on this preliminary work. The most important factor that affects using this taxonomy is therefore how well organizations identify their training needs in the form of expected performance (the tasks to complete and how well to complete them). Figure 10 shows the essential sequence of steps that lead to effective decisions about using instructional methods to achieve performance-based outcomes.

*Figure 10: Sequence of Steps to achieve performance-based outcomes*



The guidelines for using this taxonomy are presented in the following tables.

Cognitive skills. Because developing cognitive skills is often fundamental to effective task performance, Table 5 explores how classroom instruction, e-learning or blended learning can be used to achieve objectives at different levels of this domain. It assumes that all decisions about instructional methods also consider existing context and conditions.

Context and conditions. Table 6 illustrates how context and conditions (listed in no particular order) affect decisions about using classroom instruction, e-learning and blended learning. The conditions identified in this table can be compared to local ones to identify those most likely to affect the training that is planned and anticipate how they may affect using classroom instruction, e-learning or blended learning.

Scenarios. Table 7 proposes different scenarios to illustrate how classroom instruction, e-learning and blended learning can be used to achieve training objectives. As previously discussed, these scenarios are examples only that don't cover all possible permutations of conditions and objectives. Because e-learning and blended learning require using computer technology, the table also assumes that ICT is available and reliable at the location where training will be offered. Organizations that don't have reliable access to ICT may have to rely on classroom instruction for all their training regardless of how well it helps achieve objectives.

The role and importance of computers and computer technology for learning and performance-improvement has grown significantly over the past twenty or thirty years and will continue to grow at an accelerated pace in the coming years. Virtual reality, online virtual worlds and robotics are only some examples of the tools that will soon become common for training. The interest and demand for using personal computing devices at work and outside of work will also continue to grow and push the adoption and use of e-learning, blended learning and mobile learning. As a result, organizations that aren't prepared to integrate technology may become less able to meet the demands of workplace learning and less attractive to talented employees. In the end, however, effective training will continue to be about improving performance more than about using tools or technology.

Table 5: Examples of the Links Between the Levels of the Cognitive Domain and Instructional Methods

Cognitive Domain	Classroom Instruction	Blended Learning	E-learning
Remember	Lecture or presentation	Classroom instruction that also uses e-learning to broadcast parts of the presentation to an audience at a distance.	<ul style="list-style-type: none"> <li>E-learning module, delivered locally or online.</li> <li>Recorded lectures accessed through an online library of learning materials.</li> </ul>
Understand	<ul style="list-style-type: none"> <li>Interactive instruction</li> <li>Discussion</li> <li>Demonstration</li> </ul>	Interactive instruction (classroom) combined with, <ul style="list-style-type: none"> <li>E-learning modules that illustrate concepts and provide practice applying them (individually or in groups).</li> <li>Access to online information and resources that further illustrate and explain concepts.</li> </ul>	<ul style="list-style-type: none"> <li>E-learning module, delivered locally or online.</li> </ul>
Apply	<ul style="list-style-type: none"> <li>Demonstration</li> <li>Drill and practice</li> <li>Skill development/integration</li> <li>Role play</li> <li>Games</li> </ul>	<ul style="list-style-type: none"> <li>Skill introduction and description in class.</li> <li>Skill demonstration via e-learning.</li> <li>Games via e-learning to further illustrate skill application and practice them.</li> <li>Live drill and practice and skills integration to perfect skills and for testing.</li> </ul>	<ul style="list-style-type: none"> <li>E-learning modules focused on skill demonstration and practice.</li> <li>Electronic games.</li> <li>Access to videos or other resources to illustrate and reinforce skill development.</li> </ul>
Analyze	<ul style="list-style-type: none"> <li>Discussion</li> <li>Case studies</li> <li>Games</li> <li>Team learning</li> </ul>	<ul style="list-style-type: none"> <li>Discussion and case studies done in class complemented with electronic games and online discussion for team learning.</li> </ul>	<ul style="list-style-type: none"> <li>Electronic modules with cases studies.</li> <li>Individual or multi-player games.</li> <li>Online discussion and team work.</li> <li>Simulation (scenarios of situations that require analysis)</li> </ul>
Evaluate	<ul style="list-style-type: none"> <li>Discussion,</li> <li>Team learning</li> <li>Case studies</li> <li>Games</li> </ul>	<ul style="list-style-type: none"> <li>Discussion and case studies done in class complemented with electronic games and online discussion for team learning.</li> <li>Computer-based simulations completed in class as a group exercise.</li> </ul>	<ul style="list-style-type: none"> <li>Electronic modules with cases studies.</li> <li>Individual or multi-player games.</li> <li>Online discussion and team work.</li> <li>Computer-based simulation (scenarios of situations that require evaluation).</li> </ul>
Create	<ul style="list-style-type: none"> <li>Individual or team projects</li> <li>Open-ended problem solving (multiple solutions)</li> </ul>	<ul style="list-style-type: none"> <li>Projects completed in class using the internet to locate and access relevant resources.</li> </ul>	<ul style="list-style-type: none"> <li>Access to key resources via the internet.</li> <li>Online collaboration for team work.</li> </ul>

Table 6: Factors Related to Context and Conditions

Factors	Definition	Impact on Methods
Culture, values and expectations.	The accumulation of values, beliefs, attitudes, experience and expertise that characterize an organization (organizational culture) and the society in which it exists.	Some organizations and their employees may reject e-learning (or other learning activities) because of the norms and values of the society to which they belong. Some cultures that value learning in the presence of a qualified teacher, for example, may reject e-learning or accept it with more difficulty. The opposite may occur in places where using technology is culturally accepted or valued.
Population size	The number of people to be trained over time. This may include employees, suppliers or others that interact with the organization and that require training.	As a general rule, e-learning becomes more relevant as the size of the population increases, especially when many must complete the same training. Classroom instruction that must be repeated over time can become very expensive.
Geographical spread / distance	The extent to which organizational offices and employees are spread over different locations. For example, an organization with a central and satellite offices.	E-learning is particularly effective to bridge distances and reach learners where they are. It helps reduce the cost of training, make it more timely and reduce scheduling problems.
Instructional expertise	The extent to which learning specialists are available to create, deliver and maintain learning activities.	Designing and developing effective e-learning is generally more demanding than creating classroom instruction. Organizations without this expertise may have to hire specialists or contract with them to create e-learning.
Availability, stability and dependability of ICT	The extent to which ICT is available and can be depended on for continuous access for e-learning, online learning, mobile learning and other technology-based activities.	E-learning in all its forms requires ready access to stable and dependable computers and their networks. Poor technology can prevent using e-learning or make it difficult to use. This can affect both the quality of learning and learner motivation.
Cost	The cost of designing and delivering training over time.	As a general rule, e-learning is costlier to design and develop than classroom instruction, but much less costly to deliver and repeat over time. True cost assessment must therefore consider initial design and development, and delivery over time.
Access to experts or specialized sources of information	The extent to which experts, essential information or other resources are available for training.	E-learning, especially when offered online, can greatly increase the opportunities to access information and other resources. This can be particularly important when relevant information and expertise is not available locally and therefore cannot be used for classroom instruction.
Extended / ongoing communication and collaboration	The extent to which training continues formally or informally beyond what is done at a particular time or place.	E-learning, social learning and mobile learning can all help extend the classroom and support performance improvement directly at work. This allows applying the concepts of 'just-enough' and 'just-in-time' training, and of performance support.
Quality of instruction over time	The extent to which instructional standards are maintained over time.	Because it depends on human delivery and is affected by existing conditions, the quality of classroom instruction is more likely to vary over time than the quality of e-learning.

Table 7: Possible scenarios and their impact on instructional methods

	Conditions								Taxonomic Domain					Instructional Method			Notes
	Population		Location		SME		Repeat Trg.		Cog.	Aff.	Psych.	Inter.	Perc.	CI	E-L	BL	
	<50	>50	1	>1	Local	Ext.	<5	>5									
1.	✓		✓		✓		✓		←→					✓			Use CI for training only offered a few times to a small population at a single location. For all types of objectives.
2.		✓		✓	✓			✓							✓		Use e-learning as self-instruction for cognitive objectives, for a larger, dispersed population. May need to blend with online, collaborative learning for objectives at higher levels.
3.	✓			✓	✓		✓			✓					✓		Use e-learning as online synchronous sessions for a small, dispersed population, for affective objectives.
4.	✓		✓		✓		✓				✓			✓			Use CI (or field practice) for psychomotor objectives, for a smaller population and fewer courses
5.	✓		✓		✓		✓					✓		✓			Use CI for a small, local population for interpersonal objectives.
6.	✓		✓		✓		←→						✓	✓			Use CI (or field work) for objectives of the perceptual domain, for a smaller population at a single location.
7.		✓		✓	←→			✓					✓			✓	Blend e-learning as self-instruction and online sessions for a larger, dispersed population, when involving external SME. Arrange for local OJT / coaching to ensure practice.
8.		✓		✓	←→			✓				✓				✓	Blend self-instruction modules for cognitive objectives and online synchronous sessions for interpersonal objectives, for a larger, dispersed population, especially when including external SME. Arrange for local OJT / coaching to ensure practice.
9.		✓		✓	←→			✓			✓					✓	Use e-learning as self-instruction to introduce and demonstrate skills. Blend with online synchronous sessions to include external expertise. Arrange for local OJT / coaching to ensure practice.
10.		✓		✓	←→			✓	✓						✓		Use self-instruction offered through mobile learning for a dispersed population that needs performance support, especially for cognitive objectives.
11.		✓	←→			✓		✓							✓		Use e-learning (self-instruction) for a larger population, for cognitive objectives. Capture and integrate external SME expertise into e-learning to more easily repeat training.
12.		✓		✓		✓		✓	←→							✓	Blend self-instruction and online learning for a larger, dispersed population when using external SME for repeated training. Arrange for local practice and coaching to achieve all objectives.

## Appendix A: Instructional Methods for Classroom Instruction

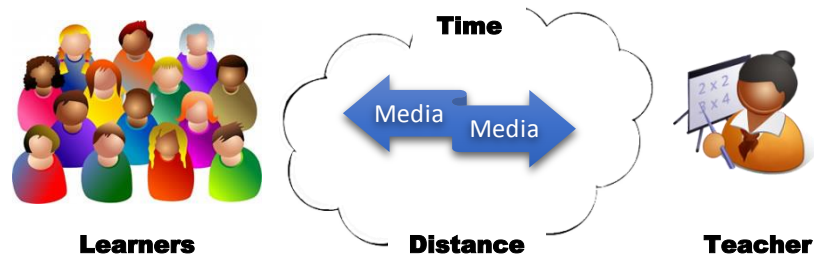
- Lecture:** A usually uninterrupted formal talk or presentation on a particular subject. A common method consisting of a one-way transmission of information by an instructor to an audience (class), focusing primarily on knowledge, with few or no interruptions.
- Drill and practice:** A method of instruction characterized by the systematic repetition of certain skills leading to their habitual use. A form of rehearsal leading to automatic execution of skills in accordance with stated standards.
- Demonstration:** A method in which the instructor combines explanations, examples and actual performance to illustrate a principle or show students how to do something.
- Discussion:** A method in which the whole class participates in a structured conversation to exchange views, explore topics or investigate solutions to a problem.
- Interactive instruction:** A method during which an instructor makes a formal presentation while encouraging student participation through questions (for example).
- Skill development and integration:** A method consisting of allowing students to practice performing a skill, first with guidance or other assistance and later independently until becoming able to perform it competently.
- Case studies:** The review and analysis of a real situation that was documented to learn from the actions taken and outcomes achieved.
- Simulation:** Using equipment and/or situations to create realistic conditions for improved student practice.
- Role play:** Scenarios acted out by 2 or more people to practice relevant behavior.
- Games:** Any activity or exercise during which students compete against each other or a machine under set rules to complete a task and achieve the best result possible.

## Appendix B: E-learning

### Distance Learning

Since the turn of this century, the popularity of e-learning has grown steadily until becoming the expected way of reaching learners at a distance. E-learning, however, involves using computer technology to communicate and does not include other ways of promoting learning at a distance. That is instead what distance learning is about: it is all the ways used to **establish and maintain communication between learner and teacher separated by a physical distance, and facilitate learning in a manner that reduces psychological distance and promotes social integration** (Figure 11).

Figure 11: Distance Learning



The idea of physical distance implies that student and teacher cannot meet regularly and must therefore work separately. Psychological distance implies the sense of being cut off or not part of something, or of not being able to communicate, share and otherwise interact with others as desired.

We can therefore identify five essential characteristics of distance learning:

1. The physical separation of students and teachers.
2. The need to plan, select and use strategies and activities that minimize psychological distance during asynchronous communication.
3. A communication process that is purposeful and led by a teacher, with clearly defined start and end points and structured to achieve objectives.
4. A greater degree of autonomy and responsibility for the student, including initiating and monitoring communications with other students and teachers.
5. Using instructional methods and activities that generate multi-way communication between participants, promotes social interaction and helps achieve both cognitive and affective objectives.

Table 8 further compares classroom instruction and distance learning.

Table 8: Classroom Instruction and Distance Learning

Characteristic	On-site (Classroom) Education	Distance Education
Concept of distance	Student & instructor are co-located and communicate synchronously. It is commonly assumed that physical proximity reduces psychological distance.	Student and instructor are separated by distance and time so that communication occurs at intervals (asynchronous). Face-to-face meetings are not an essential part of instruction but may happen as needed.
Interaction	Interaction is desirable and actively promoted by the instructor. It may also occur more spontaneously and continue without direct instructor involvement.	The extent and quality of interaction depends largely on the instructor's ability to generate and sustain it, the type of media used and how well the institution supports the instructional process.
Role of media	Depends on the objectives, availability and individual preferences. Verbal communication remains the main communication channel. Although media play an important role for learning, they are not essential for student-instructor communication.	Media is fundamental to teaching and learning. Communication must be mediated to overcome distances and direct verbal communication becomes much less important. Media create the essential bridge between instructor and learner.
Preparation & delivery	Instructors often work independently to prepare and deliver instruction. Team work for preparation and/or delivery is not common, or not the norm.	Instructors must often work with other experts to prepare and deliver distance learning. For example, with ICT specialists to use technology or with writers and editors to prepare good documents.
Facilities	The quality and availability of classrooms and other teaching facilities directly impacts the teaching-learning process. Facilities represent significant investments that require ongoing maintenance and attention.	Distance learning requires tools to communicate, that can be used anywhere. Special facilities for learning are not necessary. Institutions offering distance learning invest more in the quality of instructional design and in their communication infrastructure than in facilities.
Instructional methods	Lectures and other types of presentation often dominate the teaching-learning process. At the same time, many methods can be used individually or together as needed.	Often depends on the communication channel used. Reliable ICT, for example, allows using different methods while communicating through documents is limited to using text.

## E-learning

E-learning is about using Information Communication Technologies (ICT) to prepare and deliver content, and engage learners in the process of acquiring relevant knowledge and skills. It is therefore instruction delivered on a computing device either locally or via the Internet (online). Computing devices include any computer, whether desktop, laptop or mobile (tablet or smartphone) that allows interacting with selected software and websites. The nature of the device and its characteristics only matter in terms of being able to access information, communicate and complete tasks.

E-learning allows<sup>6</sup>,

- Presenting content relevant to the learning objectives, along with all necessary explanations or examples.
- Integrating media elements like images, audio or video to complement and enrich the learning experience.

<sup>6</sup> Adapted from Clark and Mayer [25]



- Reinforcing practice by providing immediate and focused feedback on how well something is done.
- Individualizing learning through the shared control of pace, place, path (how to reach an objective) and depth (how much to learn).

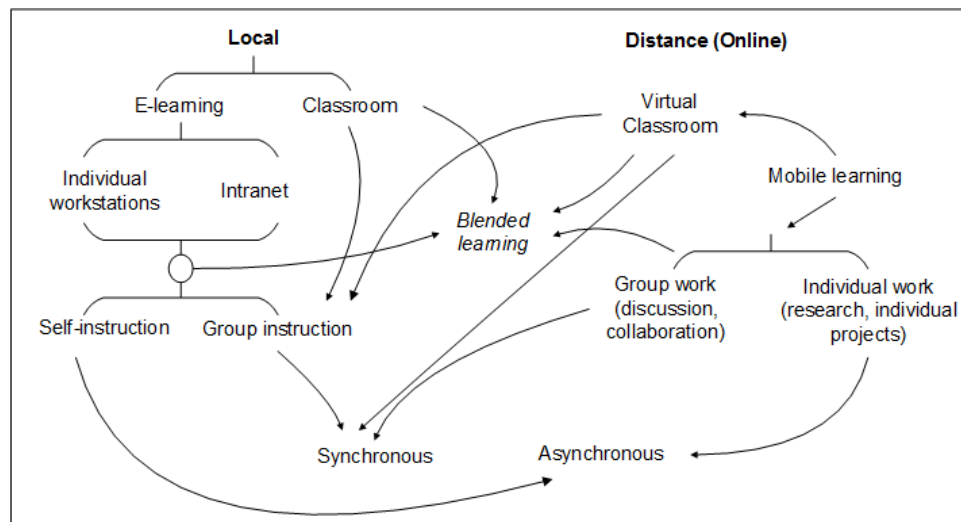
Good e-learning is<sup>7</sup>,

- **Efficient:** structures learning to achieve objectives as quickly and directly as possible. Efficient e-learning is focused and includes only as much content and practice as needed to acquire and integrate relevant knowledge and skills. The purpose of e-learning is supporting learning and not entertaining: it is NOT edutainment (promoting learning through entertainment like television programs).
- **Effective:** applies all relevant tools and methods to achieve learning objectives. Good e-learning leads to measurable results in terms of ability to perform.
- **Engaging:** creates a positive learning experience that is interesting and motivating. This can be achieved by ensuring relevance, using an appropriate writing style, using media to complement and enrich instruction, including relevant exercises or activities, or through collaboration.

Simply delivering content digitally therefore does not constitute e-learning. That requires instead deliberately arranging content and media elements during design to take advantage of the characteristics of a device or environment (i.e. online) for learning. Creating effective e-learning is more than taking existing classroom instruction and presenting it online: it is instead creating a new learning experience that requires using different tools and techniques. Effective e-learning happens by design!

As a category of instructional methods that use computers for learning, e-learning can assume many different forms depending on conditions, equipment or objectives. Methods can be grouped in different ways depending on existing conditions or the relative importance of different criteria. Figure 12 illustrates how different conditions affect the type of e-learning used. Table 9 illustrates how e-learning can be grouped into different categories.

Figure 12: E-learning Conceptual Framework of Types and Forms



<sup>7</sup> Adapted from David Merrill [29]

Table 9: Categories of E-learning

Category / Criteria	Definition	E-learning Example
Delivery over time	E-learning can be delivered synchronously or asynchronously.	When learners and instructor work together at the same time, instruction is considered synchronous. This is the case when using virtual classrooms. It becomes asynchronous when they interact at different intervals over time. This is the case when using self-instructional modules or email to communicate.
Information sharing	E-learning that is used primarily to share information, without concern for achievement.  Because it does not involve measuring achievement, it is not always considered e-learning. It is included here because sharing information can still lead to learning.	Webinars focused on presenting information, open to many participants and without formal confirmation of achievement.
Knowledge building	E-learning focused on building job-related knowledge to achieve specific objectives. Aims at acquiring, integrating and applying knowledge. Can be used for certification training.	Self-instructional materials in different forms, delivered locally or online are popular examples of this type of e-learning.
Skill development	E-learning focused on developing job-related skills defined in learning objectives.  Because of various limitations, e-learning focused more often on developing cognitive rather than psychomotor skills. Can be used for certification training.	Can be used to develop a wide range of cognitive skills like analyzing, creating or problem solving. Limitations occur because of the type of software needed to develop relevant exercises and activities, because of the level of complexity involved in crating exercises, because of the time, effort or cost involved. Includes different types of simulation.
Individual or group learning	E-learning created to support individual learning or group interaction / social learning.	Self-instructional modules are typical examples of e-learning for individual use. Virtual classes, online collaboration or group projects represent using e-learning for group work or for learning together (social learning).
Low / high technology	The extent to which e-learning demands using tools and technology that are more or less sophisticated or demanding to use.  This criterion is important to determine what an organization or institution can realistically achieve via e-learning given available resources.	Email is an example of low technology that does not demand special tools or technology. It is common, text-based and widely available.  Simulations or virtual worlds may demand more advanced technology, to properly display information or provide essential interaction.
Games	Using games as an exercise or activity to promote learning and retention. Games help increase interest and motivation and create opportunities for practice.	Games used for e-learning share the same characteristics as any other one: <ul style="list-style-type: none"> <li>• Driven by goal-based challenges (e.g. solving puzzles, acquiring assets, managing environments).</li> <li>• Involve some form of competition, either against the game itself or against other players.</li> <li>• Result in success or failure. Failure, however, is only about game results and don't involve other judgments.</li> <li>• Repeatable: games can be played over and over again for pleasure or to develop mastery.</li> </ul>

It should be noted that these categories are neither mutually exclusive nor restrictive. An “e-learning solution” may include more than one type of e-learning: what matters most is using the right tools to solve the right learning problem.

The following paragraphs further explain some of the terms associated with e-learning.

### **Synchronous / Asynchronous**

Things or events that exist or occur at the same time occur synchronously. Because students and instructor work together at the same time, classroom instruction is a synchronous event. Exchanges of email occur instead asynchronously because emails are written in sequence, at different intervals. A telephone conversation is another example of synchronous communication while working independently through learning materials and getting feedback later represents asynchronous communication.

E-learning events can be synchronous or asynchronous. Virtual classes, for example, are synchronous while self-instructional modules are usually completed asynchronously.

### **Self-Instruction**

Self-instruction is essentially a form of independent study. It involves directly interacting with materials specifically designed for learning without the direct support or participation of an instructor. While an instructor may be available to help as needed, learning materials are designed to directly present all necessary information, engage learners and provide practice as needed.

Because learners can complete materials when and where they wish, and because self-instruction does not require working directly with an instructor, it occurs asynchronously.

### **Virtual Classroom**

A virtual classroom is an event that occurs online instead of at a physical location. The physical classroom is replaced by software and services that are used to bring people together, share information or collaborate online. It nevertheless remains an organized event, led and managed by an instructor, that occurs at a specified time and is scheduled to last a certain amount of time.

Virtual classes are therefore structured events during which a teacher interacts synchronously online with a number of learners. Good virtual classes must be prepared with the same care and attention as classroom instruction. The instructor must not only present content but also manage the technology through which the class occurs and learner participation. Instructors must therefore often work with others (like ICT specialists) to prepare and deliver their virtual classes.

Virtual classrooms can effectively bridge both physical and psychological distances by allowing a dispersed population to come together and interact. At the same time, because it can be difficult to maintain attention and interest for longer periods of time when working online, virtual classes are usually shorter than typical classroom lessons and may not be appropriate for longer courses (e.g. week-long courses).

## **Virtual Worlds and Simulations**

A virtual world is a simulated environment that exists online, via a website. It is typically structured to reflect some aspect of reality and allow users to interact directly with the elements of that environment under quasi-realistic conditions. There are virtual worlds, for example, that allow practicing surgery in a hospital setting. At the same time, powerful simulations that are created for work or play (games) now exist that blur the lines between virtual worlds and simulations.

Virtual worlds and other simulations are often much more cost effective to purchase and operate than real equipment. They provide a safer and more secure environment for practice and extend the classroom beyond normal hours. Many good (and inexpensive) simulations already exist that can complement classroom instruction. For example, good flight simulators, air traffic control simulators and airport or airline operations simulations exist that can significantly improve the quality and quantity of practice available during instruction at a very affordable cost.

## **Webinars**

A webinar is essentially a seminar or other presentation that occurs online. While a seminar refers to a small group of students engaged in more advanced or specialized study, webinars are often more open and accessible to a larger population. They are typically more about sharing information than achieving specific, performance-based objectives. They are typically less than an hour long, focused on a single topic, with some interaction but no formal control of learning.

Webinars can become an effective way of sharing information within an organization. “Lunch webinars”, for example, have been used to introduce new products, services or procedures, or to explain how different parts of the organization work.

## **Mobile Learning**

Mobile learning is a form of e-learning designed specifically to display and work properly on mobile computing devices like tablets or smartphones. Mobile learning, however, is not only about delivering e-learning on a mobile device but instead adapting instruction to take advantage of the features and functions of those devices.

Mobile devices have become so popular and pervasive over the past twenty years that many now consider them indispensable. Popularity, however, does not alone justify using them for learning. Mobile learning is most effective when learners are themselves mobile and need access to relevant information or training when and where they are. A technician, for example, that travels to various sites to maintain equipment may greatly benefit from being able to access short lessons on maintenance routines as needed. Used this way, mobile learning can complement job aids or other tools for performance support.

## **Levels of Achievement**

The level of proficiency that can be achieved through e-learning depends entirely on the instructional objectives identified and the quality of instructional design. Much of the e-learning that is currently available is about presenting content more than practicing skills. This type of e-learning may be suitable

to achieve lower levels of proficiency but is often not enough to achieve higher ones. This often happens, however, more because of poor design than because of limitations with e-learning.

Table 10 illustrates with examples of how different types of e-learning can help achieve the different levels of proficiency identified in Annex 1 of ICAO’s Training and Development Guide.

Table 10: E-learning and Levels of Achievement

Type of E-learning	Description	Advantages / Pitfalls	Level of Achievement*					
			0	1	2	3	4	5
Knowledge-based self-instructional course (module).	Short courses or modules that present content and develop knowledge. The content can be factual (e.g. airline city codes) or conceptual (e.g. principles of flight).	Can be delivered locally or online, accessed in class or elsewhere. When well designed, can be as effective as classroom instruction. When poorly designed, can become a “page turner” that is like reading a book. Page turning is not effective for learning.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drill and practice	Materials designed specifically for skill mastery through extensive practice and repetition.	Can be very effective to develop specific, lower level or procedural skills. For example, becoming able to quickly follow emergency procedures.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online collaboration	Working collaboratively online to complete various learning activities that can range for discussion to advanced projects.	Combines e-learning and social learning. Allows learning to resolve problems that are more complex or that don’t have unique solutions. Can also be used to promote team work or address objectives of the affective domain. Can be difficult to monitor and manage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Virtual classes / webinars	Leading a class online rather than in the classroom.	Typically used to present information with some discussion or interaction. Like webinars, they are often limited to achieving lower levels of proficiency. Virtual classes and webinars often don’t directly allow achieving measurable outcomes.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Simulation / virtual worlds	Software that recreates situations and environment to acquire, practice and master skills. I	Often the best way to develop the ability to think, act and react, or else to develop more advanced skill proficiency. Can be completed individually or in groups. Can therefore promote team work and collaboration.  Sometimes overused because they are interesting and challenging. While helpful to develop higher levels of proficiency, they may be more than necessary to achieve lower ones. Can be time consuming and expensive to develop new ones.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Research, creative work	Using the tools available locally or online for research, or to create, invent, explore, investigate.	The Internet allows accessing a broad range of tools and information that can help with learning. Many good websites present and explain concepts or provide other information. Search engines can help explore topics or research projects.  It can be argued that using existing tools not designed for learning is not e-learning. At the same time, when used purposefully they can become important resources for learning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

\* Based on the classification in the ICAO Training and Development Guide, Annex 1.

## Appendix C: Principles for Using Blended Learning

Principle	Description
Start with good instructional design for blended learning.	Blended learning should not be an “accident” but something selected when designing instruction BECAUSE it can best help achieve objectives. Opportunities to use blended learning should therefore be identified during design and planned accordingly.
Integrate ICT as needed.	Using ICT and blended learning ARE NOT synonymous! While ICT makes some form of blended learning possible, it is not an essential condition for success. A good blend mixes what works, not what’s trendy. Put people and their learning first, not technology.
Extend the classroom	One of the great advantages of using blended learning is extending the classroom beyond its physical limits. This may include opportunities for research or group work, for example.
Blend to best use the inherent advantages of each tool or technique	Select tools that complement each other to optimize their overall effect. For example, using videos to demonstrate performance, e-learning for safe practice and actual equipment for the final performance.
Consider different ways of presenting the same information.	Blended learning can also help look at things from different perspectives. A class, for example, could start with a presentation during which concepts are introduced and then studied in more detail using material available online.  Using different ways to present the same information is also a good way to address potential differences in learning styles. While the concept of learning styles remains much debated, it is generally accepted that presenting the same information in different ways promotes understanding and assimilation.
Encourage independence (from the instructor) and interaction with others.	Use blended learning to develop the habit and ability to learn autonomously and not only wait for the instructor. Use it also to encourage group work and social learning.
Add flexibility and adaptability	Use blended learning to create more flexible options to complete a module, class or course. This can be a very important feature for workplace learning that must reach learners at a distance, in different time zones or with different schedules.
Be clear and provide necessary directions and support	Always clearly indicate the purpose of the proposed blended learning, what it involves and how best to complete related activities. While encouraging learners to work alone or together, NEVER LEAVE them alone! Whether in person or through ICT, always provide learners with a way to ask questions, confirm their work or otherwise resolve problems.
Identify all relevant resources, confirm the blend will work	After deciding to use blended learning, identify all the resources needed to create the blend (use what you have). Assemble and test all parts individually and together. Be sure to review the blend as a single unit, i.e. complete with all it includes. You may otherwise not get a clear picture of how it works.

*Adapted from Rossett and Douglis [28]*

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