Erasmus+/ KA2

(Strategic Partnerships for Higher Education)

DELTA: Digital Excavation through Learning and Training in Archaeology 2019-1-EL01-KA203-062875 http://www.project-delta.eu/



IO1. A2 INSTRUCTIONAL METHODOLOGY FOR THE **DELTA C**OURSE

DESIGN AND DEVELOPMENT OF EDUCATIONAL CONTENT



Co-funded by the Erasmus+ Programme of the European Union

Erasmus+/ KA2

DELTA: Digital Excavation through Learning and Training in Archaeology

(Strategic Partnerships for Higher Education)

2019-1-EL01-KA203-062875

http://www.project-delta.eu/

Intellectual Output:	Intellectual Output I – Activity 2. Design and Development of content
Туре:	Preparation
Dissemination level:	Internal
Version:	Final
Delivery date:	May 2020
Keywords:	Instructional design, development of content, course, learning outcomes, ADDIE model, Bloom taxonomy.
Abstract:	This document aims to provide the methodology for designing and developing educational material, with special emphasis to the online learning that will be developed and provided to the public by the DELTA project. It analyses the five phases of the instructional design ADDIE (Analysis, Design, Development, Implementation and Evaluation). Subsequently, it details the methodology to write learning outcomes according to the Bloom Taxonomy, as it is the most critical part for the effectiveness of the course. Last, the reader may find in the Appendix a set of templates that must be filled in and sent to the appropriate roles, following the timetable indicated to the appropriate figures. This methodology was proposed by HOU and all partners adopted it in the implementation of the DELTA course.
Authors:	Achilles Kameas, Panagiota Polymeropoulou – Hellenic Open University





Table of Contents

1. I DELTA	nstructional methodology for designing and developing the course
1.1	Analysis7
1.2	Design Phase
1.3	Development Phase
1.4	Implementation Phase17
1.5	Evaluation Phase18
1.6	Educational material for the DELTA Blended Learning Course 19
2. L	earning outcomes for instructional design23
1.7	Writing learning outcomes24
1.7	7.1 The ABCD approach25
1.7	<i>7.2 The SMART approach</i> 26
1.8	The Bloom Taxonomy27
1.8	8.1 Cognitive domain
1.8	<i>3.2 Affective domain</i>
1.8	<i>B.3 Psychomotor domain</i> 32
1.9	The DELTA methodology for writing learning outcomes 34
3. A	ppendix





List of figures

Figure 1 - 7	Γhe example of a MOOC of 8 weeks - Analysis flowchart	: 8
Figure 3 – [DELTA course Development flowchart	16
Figure 5 – 7	The verb wheel based on Bloom's taxonomy	30

List of tables

Table 1 Course Description (Analysis Phase)11





Abstract

The abstract contains three parts. In the first part, the aim and an overview of the deliverable are provided. The second part contains one paragraph per deliverable chapter and contains the overview of the chapter. The third part concludes the deliverable. Especially, the abstract emphasizes on the effort spent, on the innovation and on other remarkable points.





1. Instructional methodology for designing and developing the DELTA course

The training of Archaeology students under the *Intellectual Output I– IO1 Digital Excavation blended Course*, will follow a blended learning approach, where each student will participate in online and traditional face-to-face learning sessions. After completing the blended course, selected learners will be able to join an engaging and productive intensive study program of 5 days training which will lead to a joint excavation.

The methodology described below concerns solely the first phase; it follows a team-based approach for the online and face to face development and in the framework of the DELTA project.

This methodology – contextualized appropriately for the DELTA MOOC and f2f development - adopts the basic elements of the well-known ADDIE model (Analysis, Design, Development, Implementation and Evaluation), illustrating an iterative and self-corrected training process since it provides continuous assessment in every step.

The quality of the outcomes in each phase is assured by the employment of three roles; the **author**, the **technical reviewer**, and the **scientific reviewer**.

The author is responsible to design and develop the content. The technical reviewer monitors the intermediary outcomes and assures that they follow the instruction, e.g. each particular template is appropriately filled in. The scientific reviewers assures about the coherence and validity of the contents produced.





1.1 Analysis

During the analysis phase the training problem that will be addressed through the DELTA course, will be analyzed in order to specify the purpose of training, the knowledge domain, the main learning goals, the basic learning objectives, the learners' profile and the timeframe of the training process. It is equally important, to define the learners' background knowledge and to set any necessary limitations and knowledge prerequisites.

Indicative questions include the following:

- What are the intended audience and its characteristics?
- What is the desired knowledge outcome?
- What are the learning limitations?
- In what ways the knowledge will be delivered?
- What are the training framework and the duration of the educational process?

The expected outputs of this phase are:

A1. Learners Characteristics: Determination of learners' characteristics and their specific needs.

A2. Course Description: Includes the description of the course, i.e. the training problem it addresses, the context of application, the learning goals, the learning objectives and the learners' needs that the course meets. It also specifies its total duration.

A3. Course Time Table: Determines the course length, the schedule, the sequence and the timetable of the course.

A4. Special Needs for the Learning Environment: Special needs are also described (if any) in order to be included in the learning environment.

The DELTA blended course (online, face to face, ISP) will be a total of 200 hours. The online and f2f will be of 160 hours and the ISP of 40 hours. Each module will be of 40 hours (32 hours online and 8 hours in class). The DELTA course will contain 4 major (course) modules (topics). The four modules will be:

a. Digital Tools for Archaeological Practice/ Excavation;

b. Documentation in situ and after excavation;

c. Digital Preservation of cultural heritage monuments and artifacts -3d representation and reconstruction;





d. Open-Air Museums and Experimental Archaeology - presentation and interpretation of research results and knowledge to wide public.

Every module described above consists of 2 to 5 units (learning activities). In each unit (learning activity) an educational strategy should be applied in order to deliver any combination of core learning objects (e.g. video, presentation, etc), additional educational material (e.g. e-books, additional readings, etc), collaboration objects (e.g. forum), assessment objects (projects, self-evaluation exercises, quizzes).

This is an example of a MOOC of 8 weeks and the division in modules. Here each week contains 2 – 3 modules. Each module is divided in 2-5 Units. Each Unit follows a specific educational strategy with - predefined – self - developed learning objects and developed assessment objects, assessing the knowledge and skills learnt. In each case, is indicated here (Fig. 1) the appropriate Table (TB1, TB2, TB3) that should be filled in by the Author, during the Design phase.



MOOC Course (8 weeks)

Figure 1 – The example of a MOOC of 8 weeks - Analysis flowchart





In this regard, the Tables 1, **Error! Reference source not found.**, and **Error! Reference source not found.** will be used for the Analysis phase.

Before starting designing the Modules, it is essential to have a former description of the course itself (title, description, knowledge domain, educational strategy, target group, type of the course, learning goals and objectives, duration, learners' profile, learners' background knowledge, Access to the educational environment). In the Table below you may see a description of a 8 week MOOC, addressing the digital needs of Museum Professionals.

1	Course (MOOC) title	Museum Professionals in the Digital Era
2	Course description	This course addresses the needs of professionals working in the cultural sectors that would like to exploit the potential of contemporary technologies in order to accomplish their current and future work duties. In this regard, they shall develop their competences in the following areas: (1) Business plan development, (2) Technology trend monitoring (3) Innovating, (4) ICT quality management, (5) Needs identification, (6) Relationships management, (7) Information system and business strategy alignment (8) Forecast development (9) Creative thinking (10) Communication (11) Leadership and change facilitation (12) Time management (13) Team working
3	Knowledge domain	 Knowledge domains of the course are Arts Social and behavioural science Business and administration Computing
4	Educational strategy	The particular course addresses the need of professionals working





		or would like to work in the cultural organizations, especially museums, to use contemporary technologies and collaborate in order to develop authentic cultural experience for the public, as well as to modernize organizations' operations.
5	Course addressed to	This course addresses the basic skill needs of digital strategy managers, digital collections curators, digital interactive experience developers, and online community managers.
6	Course type	Full time
7	Learning goals ¹	 Main learning goals Develop planning digital competences (IS and business strategy alignment, business plan development, technology trend monitoring, innovating). Develop enabling digital competences (needs identification) Develop management digital competences (forecast development) Develop key transferrable / transversal skills (communication, team working, creative thinking, leadership and change facilitator, time management). Develop citizenship digital competences
8	Basic learning objectives	 Basic learning objectives (4 up to 10) Upon completion of the course, the learner will become proficient in planning particular ICT business processes Upon completion of the course, the learner will become proficient in enabling particular ICT business processes Upon completion of the course, the learner will become proficient in the management of particular ICT business processes Upon completion of the course, the learner will become proficient in the management of particular ICT business processes Upon completion of the course, the learner will be able to communicate, team work, think creatively, lead, facilitate

¹ Goals are broad statements, general intentions, intangible, abstract and in general hard to get measures. Objectives are specific, precise, tangible, concrete and measurable. In practice, they are statements that define the expected goal of the course, e.g. "Monitoring and accurate interpretation of data" for "A.7 – Technology Trend Monitoring".





		 change and manage time effectively and efficiently. Overall, the learner will upgrade his proficient level of citizenship digital competences
9	Course length	8 weeks
10	Course schedule (course modules codes, titles and description)	Please see Table TA1.1
11	Learners' profile	The learners are holders of a Bachelor (EQF 6) with working experience in the cultural sector. Alternatively, it addresses the needs also of people (holders of EQF 6) that would like to work in the cultural or the museum sector.
12	Learners' background knowledge	Learners must present general knowledge of information systems and / or computing, arts and business administration.
13	Participation prerequisites	No prerequisites
14	Access to the educational environment	The educational environment (MOOC) is accessible through a personal computer or a tablet, both connected to the internet.

Figure 2 - Course Description (Analysis Phase)

1.2 Design Phase

The design phase is the most essential and demanding one in the particular MOOC development methodology. The purpose of this phase is to define and describe the detailed learning objectives for each module, the units (learning activities) in which each module is divided, the educational strategy that will be applied in each unit and the learning outcomes of each unit. In this phase, it is equally important to define the students' assessment method. Consequently, the learning objects should be designed according to the learning outcomes, as described above.

It should be noted that units (learning activities) demonstrate the way that knowledge (learning objects, additional educational material, quizzes, wikis, projects etc.) should be provided to the learners according to the educational strategy adopted.





The main outputs of this phase are:

B1. Course Module Description: A detailed description for every course Module.

B2. Course Units (Learning Activities) Description: A detailed description of the units (learning activities) per course Module.

B3. Learning Outcomes Writing: A catalog recording the learning outcomes per Unit.

B4. Learning Object Design: A detailed description of the Learning Objects per unit (learning activity).

B5. Learner Assessment Description: A detailed description of the learner assessment of the Unit in each Module.

The activities of the design phase for the DELTA course development are presented in the following flowchart. Each output is related to a specific template (in the appendix) that must be filled in for every module.













ACTION

Authors will fill in the templates

- TB1: Course Module Description (Design phase)
- TB1.1: Course Module Schedule (Design phase)
- TB2: Course Unit (Learning Activity) Description (Design phase)
- TB2.1: Table of learning outcomes for the Cognitive domain of Bloom taxonomy
- TB3: Learning Object Description (Design phase)
- TB3a: Assessment Object Design and Production (Design Phase)
- Face to face activities Table (Design phase)





1.3 Development Phase

The development phase includes the production of the educational material (content) which is based on the design realized in the previous phase.

The learning objects (core, additional supportive material, collaboration and assessment learning objects) are developed as conceived in the previous phase according to their technical type with respect to their learning resource type and subsequently uploaded to the MOOC platform. It is recommended to use the educational material guidelines provided, since there are providing instructions on "what to do" and "what to avoid" during the development process. These guidelines are provided for both the pedagogical and technical aspect of an educational material.

During the development phase, authors could collaborate with multimedia developers, video experts (technical staff), who could contribute in creating or editing qualitative educational videos and additional digital educational material as described in the design phase.

Simultaneously, the technical team sets the MOOC Platform, integrates the educational material into the platform (according to the course module, learning activities templates) and creates the platform manuals.

The main outcomes of this phase are:

C.1 Learning Objects Development: The creation or the adaptation of existing material in order to create all the necessary educational materials and content required for the particular course, based on the previous design.

C.2 Course Development: Set up of the online course in the platform² and integration of the educational material into the platform.

C.3 User Guides Development: Creation of user's manuals for the platform.

² According to the MOOC best practices, each course consists of the following 5 pages: a) the Course Info page with news, announcements and additional information, b) the Courseware page which includes the page that shows the sections of the course and the educational material, c) the Discussion page in which discussion forums will be placed, d) the Progress page, which provides updates with useful information and each learner's personal path and e) the Syllabus Page, which includes the Course / Modules Information.





In the following flowcharts, the reader may see the procedures for the course development (educational material and content, course and user guides).



Figure 2 – DELTA course Development flowchart





1.4 Implementation Phase

During this phase, the educational process is implemented as designed and developed in the previous phases, and the learning effectiveness is evaluated.

The primary goal of this phase is the dissemination and publication of the course. The course can be promoted and disseminated via the social networks, advertising, communities and email DBs, newsletters and relevant websites of culture.

Before delivering the course, a pilot course should run in order to test and evaluate the course, and the functionality of the platform for potential improvements. The participants in the pilot course could be a small number of learners and the experienced scientific staff (trainers).

After the completion of the pilot course, improvements could be made to both the platform and the course, according to the comments and reviews by both parties – trainers and trainees.

Subsequently, the education process will be realized in a predefined time period since tutors and technical staff must support, operate, monitor and audit the education process through the platform.

The main outcomes of this phase are:

D.1 Publication of the available course in communities and social networks.

D.2 Pilot Course running with a small number of learners and scientific personnel.

D.3 Realization of the educational process.

D.4 Support and operation of the education process and the platform.





1.5 Evaluation Phase

The evaluation of the proposed methodology shall be conducted in two directions. Formative evaluations should take place in every phase while the final evaluation takes place at the end of all phases, in order to uncover improvement issues. Therefore, the evaluation consists of formative and summative assessment, which includes:

- (A) Formative Assessment: The formative evaluation is conducted in each stage of the process and includes information collection (check sheets, focus groups results, interviews, questionnaires etc.) in order to identify problems. During the procedure, revisions must be done whenever evaluation considers it necessary. The purpose of the formative evaluation is (a) to estimate the correct implementation of every step of the development process and (b) to verify the scientific quality of the course.
- (B) Summative Assessment: The final assessment measures the effectiveness of the educational procedure; providing feedback from users and team members using interviews, system logs (providing information of platform usage, rates of attendance in every activity etc.), questionnaires etc.





1.6 Educational material for the DELTA Blended Learning Course

The online and self-study, the face to face sessions, plus the assessment components of the **blended training course has foreseen 160 hours of educational material** that should be developed using the existing Methodology.

The DELTA course addresses University students, of undergraduate and post graduate level. The enrollment in the blended course will be open to all University students of Archaeology that have fulfilled at least two years of study in their Faculty and the online training will be held at the same time in the 3 project countries. At least 30 students per country will be taking part in the modules. All partners agreed to have a basic level of skills and competences since not all students are familiar with tools and technologies in archaeology.

The learning material will be designed and developed at level 6 according to European Qualifications Framework (EQF)³.

Core material consists of learning (educational) objects, such as lectures (videos, self-running presentation – power point presentation with voice over) and additional material of any kind for self-study (papers, videos, ebooks etc.).

Assessment objects are part of the Core material. In the VET context, learning materials are designed based on pre-determined expectations and trainees are evaluated to what extent they master these expectations. In order to evaluate the degree of mastery of these expectations in learning we usually use assessment objects.

One of the most common assessment object used is the quiz in which the trainees (as individuals or in teams) attempt to answer questions correctly. It is a "game" to test their knowledge about a certain subject, in order to refine programs and improve their learning. Quizzes are usually scored in points and many of them are designed to determine the trainee's successful

³ The European Qualifications Framework (EQF) acts as a translation device to make national qualifications more readable across Europe, promoting workers' and learners' mobility between countries and facilitating their lifelong learning. The EQF aims to relate different countries' national qualifications systems to a common European reference framework. Individuals and employers will be able to use the EQF to better understand and compare the qualifications levels of different countries and different education and training systems. Since 2012, all new qualifications issued in Europe carry a reference to an appropriate EQF level.



This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



learning process. This can be made by grading and weighing each question's correct answer (sometimes you can also add negative grading in wrong answers).

Quizzes consisting of a number or questions that can be categorized in:

- ✓ Open-ended questions which are hard to assess automatically, but can be used to initiate some individual activity (e.g. read this article and comment...) or even better some group activity (e.g. after reading this article, join the forum discussion about the "XYZ" topic and present your opinion).
- ✓ Closed-ended questions which are ideal for an automated assessment. The most common types of this kind of questions are: Multiple Choice Questions (MCQ), fill-in-the-blank, matching, yes/no (or true/false), drag and drop into text, drag and drop onto image etc.

Practical assignments can include one or more of educational material types as project, example or activity (case study, problem solving, text composition, open ended question) that can be assigned on the learner level or to a group of learners, illustrating collaborative learning activities, in order to enhance trainee engagement and the quality of learning. The practical assignments could be:

Project

With the term "Project", or "creative and synthetic work" we mean a small or large scale, group or individual work, which, through a cross-thematic approach, urges and supports the learner in the interdisciplinary study of a specific subject. The project is based on the core pedagogical principles of self-learning, participatory learning, in-depth and collaborative learning. Through a process of study, research, evaluation, and critical synthesis of resources, the trainee learns how to learn.

Example

Example is a specific (characteristic, representative) and well defined case that clarifies a concept, a rule, a pattern, a method or a process.

Activity

Activities suggest the learner to study a topic and deepen his / her knowledge and understanding to that, enable the learner to apply what he / she has learned, assist him / her to the memorization and exploitation of his / her experiences, and help him / her to link them to the subject under study, gaining control of the knowledge he / she has acquired.



Co-funded by the Erasmus+ Programme of the European Union



For activities usually (unlikely to what is required for the self-assessment exercises), there is no single correct answer (or course of action of the learner) accepted for all learners. It is neither possible for the author of the material to provide all the possible answers and all the possible mistakes of the learners, in order to discuss them under a template answer. This is the main difference between activities and self-assessment exercises. This, of course, does not mean that the activities must stay unanswered by the author. The author of the material should always provide a typical correct answer or provide the key points of subjects or sentences a correct answer should include, when this is not possible, a description of the actions the learner should follow in order to implement correctly the activity.

Activity: Case Study

Case study is an extensive example that describes an actual case where the learner learns (or could learn) what has learned in practice. It starts with a description of the facts of the case, followed by a critical analysis of how it was implemented in practice what the learner learned, and a description of alternative ways of dealing with the situation. Critical analysis and / or description of alternative ways of coping are requested by the learner, depending on the purpose of the case study. Case studies consider an important learning tool that helps the learner to consolidate existing or new knowledge developed.

A case study can be exploited in two ways:

- a. Consolidate existing and / or apply the knowledge developed,
- b. Stimulate the heuristic process towards learning, when the acquisition of the required knowledge has not yet been completed.

In both cases, conclusions are drawn based on the study of the specific case, or at least assumptions are developed for the knowledge under study in its totality.

Activity: Problem solving

Problem solving focuses to the presentation of a real or hypothetical problem of direct interest to the learners, involving them in their analysis and in finding solutions, urging them in parallel to work out ways to implement the solution they have chosen.

Activity: Text composition





The text composition activity describes a subject and asks the learners to study and criticize texts – that are provided to them, or they asked to search for them and choose – in order to compose their own documented text for the description / analysis / interpretation / processing of the topic under study.

Activity: Open type question

An open-ended question that usually requires a wider and more complex treatment for its response than a question in self-assessment exercises.





2. Learning outcomes for instructional design

Adopting learning outcomes in the educational or training process serves the shift of the traditional approach oriented to the teachers towards an approach oriented to the learner.

The "learner-centered" model adopts an "outcome-based" approach, focusing on what the learners will learn, master and be able to do as they progress through the course.

According to the European Qualifications Framework (2017)⁴,

- *Qualification* means a formal outcome of an assessment and validation process which is obtained when a competent authority determines that an individual has achieved learning outcomes to given standards.
- *Learning outcomes* means statements regarding what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and responsibility and autonomy.
- *Knowledge* means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of EQF, knowledge is described as theoretical and / or factual.
- *Skills* means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).
- *Responsibility and autonomy* means the ability of the learner to apply knowledge and skills autonomously and with responsibility.
- Competence means the proven ability to use knowledge, skills and personal, social and / or methodological abilities, in work or study situations and in professional and personal development.

Especially for learning outcomes, the following guidelines apply when developing them:

⁴ Council Recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning (2017/C 189/03).



This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



- Each learning outcome should refer to one and only level in Benjamin Bloom's taxonomy.
- Each learning outcome should contain one and only one action verb; use the list of verbs associated with each level in the taxonomy.
- Each learning outcome should contain one concept of the knowledge domain.
- The learning outcomes must be observable, measurable and capable of being assessed.
- Avoid complicated sentences. If necessary use more one than one sentence to ensure clarity.
- Avoid vague terms like know, understand, learn, be familiar with, be exposed to, be acquainted with, and be aware of. These terms are associated with teaching objectives rather than learning outcomes.
- Bear in mind the timescale within which the outcomes are to be achieved and the available resources. There is always the danger that one can be over-ambitious when writing learning outcomes.
- Before finalizing the learning outcomes, evaluate them with colleagues.

1.7 Writing learning outcomes

Writing learning outcomes with emphasis on correctness and quality requires the employment of particular techniques, like the ABCD and SMART approaches. Additionally, they must address – exclusively and separately – one of the levels identified in the Bloom taxonomy⁵ ⁶, i.e. *the Cognitive (knowledge-based), the Affective (emotion-based) and the Psychomotor (action-based)* domains. Two main approaches are used to write learning outcomes; the ABCD and the SMART approach. The author of learning outcomes may select the most convenient for him / her to use.

⁶ Bloom, B.S., Masia, B.B. and Krathwohl, D. R. (1964). Taxonomy of Educational Objectives Volume II: The Affective Domain. New York: McKay.



⁵ Bloom, B. S.; Engelhart, M. D.; Furst, E. J.; Hill, W. H.; Krathwohl, D. R. (1956). Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain. New York: David McKay Company.

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



1.7.1 The ABCD approach

Back on 1984, Mager⁷ argued that learning objectives should be specific and measurable in order to guide appropriately instructors and learners. In this regard, he introduced the ABCD approach in writing them, which included four main elements: **A**udience, **B**ehavior, **C**ondition and **D**egree of mastery. The description for each is presented below⁸.

Audience (A)	Determines who will master the outcome. A very common way to begin a learning outcome is: "The learner will be able to". Typical questions used are "Who? Who are your learners?".
Behavior (B)	Identifies what a learner is expected to be able to perform as a result of achieving the learning outcome, or, in other words, how will the learner demonstrate achievement of the outcome. Typical questions used are "What? What do you expect the learners to be able to do?"
Condition (C)	Describes the important conditions (if any) under which learner's performance is to occur. Typical questions include "How? Under what conditions or context will the learning occur? What will the learner be given or already be expected to know to accomplish learning?".
Degree of mastery (D)	Wherever possible, describes the criterion of acceptable performance by describing how well the learner must perform in order to be considered acceptable. Typical questions include "How much? How much will be accomplished, how well will the behavior need to be performed, and to what level?"

The reader should keep in mind the following when writing learning outcomes following the ABCD approach.

• The *verb* used to describe a desirable behavior in a learning outcome must come from / comply with the Bloom's taxonomy (Cognitive, affective, psychomotor domains). This verb must describe a behavior

⁸ The ABCD Method of Writing Measurable Objectives. https://www.cusoeprofessionaleducation.org/uploads/2/9/5/8/29585257/writig_o bjectives_abcd2014.pdf



⁷ Mager, R. F. (1984). Preparing instructional objectives, 2nd edition. Belmont, California: Pitman Learning.



that is observable. However, take into account that a performance can be overt or covert:

- An overt performance can be observed directly, whether that performance is visible or audible.
- A covert performance cannot be observed directly; it may be mental, invisible, cognitive, or internal. A covert performance can be used as a learning outcome as long as there is a direct way determining whether it satisfies the outcome.
- The specification of *condition* should be detailed enough so that another competent person would recognize the desired performance. Typical questions include, "What will the learner be allowed to use?", "What will the learner will be denied to use?", "Under what conditions the desired performance is expected to occur?", "Are there any skills that the learner specifically should not develop?".
- Indicators of degrees of mastery (performance) include the time limits, accuracy, quality, etc. By specifying the acceptable level of performance for each outcome, one has the means for determining whether instruction is successful. Both the teacher and the learner would know the quality of performance they have to work for

Examples of well written outcomes are:

- Given a verb in the present tense, the learner will be able to re-write the verb in future tense with no more than two errors in tense.
- Given 2 hours of study, the learner will solve 4 out of 5 problems of bandwidth allocation.
- Given a map of Europe, the learner will be able to list 5 major rivers in 2 minutes.

1.7.2 The SMART approach

SMART⁹ stands for **S**pecific, **M**easurable, **A**ttainable (or **A**ction-oriented), **R**elevant, and **T**ime-Bound.

⁹ Anderson, L. & Krathwohl, D., et al. (2001). A Taxonomy for Learning, Teaching, and Assessing: a revision of Bloom's taxonomy of educational objectives, New York <u>:</u> Longman.





Specific	The learning outcome should be clear and well defined, describing the knowledge, skills and competences that a learner should be able to demonstrate following exposure to a learning activity
Measurable	Achievement of learning objectives can be measured through benchmarks or targets by specific evaluation methods during or after the session
Attainable (Action- oriented)	The objective includes an action verb that demonstrates change or acquisition of knowledge, skills or competences
Relevant	The objective reflects relevant expectations of knowledge, skills and competences acquisition/change given the conditions for instruction
Time-bound	The objective specifies a time frame in which learners are expected to achieve the learning objective(s)—usually by the end of the session

Examples of SMART learning outcomes are:

- Following this session, participants will describe four measures that can protect against lung cancer.
- After attending the lecture and studying chapter 2, learners will list the three domains of Bloom's taxonomy.
- By the end of this course, the learner will become proficient in Microsoft Excel by creating financial spreadsheets to be used to conduct museum's financial analyses. The supervisor will evaluate his spreadsheets and written analysis.

1.8 The Bloom Taxonomy

The aforementioned approaches to writing learning outcomes are based on the work of Benjamin Bloom, who identified three domains of learning – cognitive, affective and psychomotor – each of which is organized as a series of levels or prerequisites. The three domains can be defined as follows:

Cognitive: it is the most widely used of the three domains. It refers mostly to knowledge structures and contains a classification (or taxonomy) of





thinking behaviors from the simple recall of facts up to the process of analysis and evaluation 10 .

Affective: it refers to the way we deal with things emotionally, such as feelings, values, attitudes, motivations, etc., and ranges from mere awareness through to being able to distinguish implicit values through analysis ¹¹.

Psychomotor: it mainly emphasizes physical skills involving co-ordination of the brain and muscular activity and it prevails in areas like laboratory science subjects, health sciences, art, music, engineering, drama and physical education. Bloom and his colleagues never created levels in this domain, though other researchers later did, like Dave (1970)¹² and Simpson (1972)¹³.

Each of these domains is further analyzed in the following sections.

1.8.1 Cognitive domain

Bloom and his colleagues advanced their work mainly in the cognitive domain, as this is required in the majority of cases. They produced a hierarchical framework through one (learner) may build upon prior learning and upscale its knowledge. Apart from other purposes, it is used extensively to write learning outcomes providing the foundations for developers. Its ready-made structure, in conjunction with the provided (list of) verbs, facilitates significantly the writing of learning outcomes.

Bloom's taxonomy of cognitive domain consists of the following six levels (Bloom et al, 19565, Kennedy et al, 2006^{14}):

¹⁴ Kennedy, D., Hyland, A. and Ryan, N. (2006). Writing and using learning outcomes: a practical guide. Article C 3.4-1 in Eric Froment, Jürgen Kohler, Lewis Purser and Lesley Wilson (eds.): EUA Bologna Handbook – Making Bologna Work (Berlin 2006: Raabe Verlag)



¹⁰ Anderson, Lorin W.; Krathwohl, David R., eds. (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Allyn and Bacon. ISBN 978-0-8013-1903-7.

¹¹ http://www.nwlink.com/~donclark/hrd/Bloom/affective_domain.html

¹² Dave, R. H. (1970). Developing and Writing Behavioural Objectives. (R J Armstrong, ed.) Tucson, Arizona: Educational Innovators Press.

¹³ Simpson, E. (1972). The classification of educational objectives in the psychomotor domain: The psychomotor domain. Vol. 3. Washington, DC: Gryphon House.



- 1. **Knowledge:** the ability to recall or remember facts without necessarily understanding them. Some of the action verbs used to assess knowledge are: Arrange, collect, define, describe, duplicate, enumerate, examine, find, identify, label, list, memorize, name, order, outline, present, quote, recall, recognize, recollect, record, recount, relate, repeat, reproduce, show, state, tabulate, tell.
- 2. **Comprehension**: the ability to understand and interpret learned information. Some of the action verbs used to assess comprehension are: Associate, change, clarify, classify, construct, contrast, convert, decode, defend, describe, differentiate, discriminate, discuss, distinguish, estimate, explain, express, extend, generalize, identify, illustrate, indicate, infer, interpret, locate, paraphrase, predict, recognize, report, restate, rewrite, review, select, solve, translate.
- 3. **Application**: the ability to use learned information (i.e. ideas and concepts) to solve problems in new situations. Some of the action verbs used to assess application are: *Apply, assess, calculate, change, choose, complete, compute, construct, demonstrate, develop, discover, dramatize, employ, examine, experiment, find, illustrate, interpret, manipulate, modify, operate, organize, practice, predict, prepare, produce, relate, schedule, select, show, sketch, solve, transfer, use.*
- 4. **Analysis**: the ability to break down information into components and understand organizational structure (i.e. look for inter-relationships). Some of the action verbs used to assess analysis are: *Analyze, appraise, arrange, break down, calculate, categorize, classify, compare, connect, contrast, criticize, debate, deduce, determine, differentiate, discriminate, distinguish, divide, examine, experiment, identify, illustrate, infer, inspect, investigate.*
- 5. **Synthesis**: may be defined as the ability to combine parts together. Some of the action verbs used to assess synthesis are: *Argue, arrange, assemble, categorize, collect, combine, compile, compose, construct, create, design, develop, devise, establish, explain, formulate, generalize, generate, integrate, invent, make, manage, modify, organize, originate, plan, prepare, propose, rearrange, reconstruct, relate, reorganize, revise, rewrite, set up, summarize.*
- 6. **Evaluation:** may be defined as the ability to judge the value of information for a given purpose or situation. Some of the action verbs used to assess evaluation are: *Appraise, ascertain, argue, assess, attach, choose, compare, conclude, contrast, convince, criticize, decide,*



Co-funded by the Erasmus+ Programme of the European Union



defend, discriminate, explain, evaluate, grade, interpret, judge, justify, measure, predict, rate, recommend, relate, resolve.

Examples:	
(Active verb – Bloom's taxonomy level) + (Criterion) + (Concept of the knowledge domain) + (Condition)	
Level 1: Knowledge	Describe the 7 main phases of an information system development life cycle.
Level 3: Application	Construct the conceptual model of a database using the entity relationship model .



Figure 3 – The verb wheel based on Bloom's taxonomy

(Source:http://2.bp.blogspot.com/_337GUHQH0FY/SmpJpr5va5I/AAAAAAABmU /UFiQn59gIT8/s1600-h/bloomwheel.png)



Co-funded by the Erasmus+ Programme of the European Union



When writing learning outcomes for the cognitive domain, it is suggested that:

- One should try to include learning outcomes for all levels of the taxonomy.
- One should try to avoid overloading the list with outcomes which are drawn from the lower levels of the taxonomy.
- One ought not to try to address higher levels until those below them have been covered (the taxonomy is effectively serial in structure).

1.8.2 Affective domain

In order to describe the way in which we deal with things emotionally, Bloom and his colleagues developed five major categories6^{, 15}:

- 1. **Receiving**: refers to a willingness to receive information, e.g. the individual accepts the need for a commitment to service, listens to others with respect, shows sensitivity to social problems, etc. *Verbs* / *keywords: Acknowledge, ask, attentive, courteous, dutiful, follow, give, listen, understand*.
- 2. **Responding:** refers to the individual actively participating in his or her own learning, e.g. shows interest in the subject, is willing to give a presentation, participates in class discussions, enjoys helping others, etc. *Verbs / keywords: Answer, assist, aid, comply, conform, discuss, greet, help, label, perform, present, tell.*
- 3. **Valuing:** ranges from simple acceptance of a value to one of commitment, e.g. the individual demonstrates belief in democratic processes, appreciates the role of science in our everyday lives, shows concern for the welfare of others, shows sensitivity towards individual and cultural differences, etc. *Verbs / keywords: Appreciate, cherish, treasure, demonstrate, initiate, invite, join, justify, propose, respect, share.*
- 4. **Organization:** refers to the process that individuals go through as they bring together different values, resolve conflicts among them and start to internalize the values, e.g. recognizes the need for balance between freedom and responsibility in a democracy, accepts

¹⁵ Verbs / keywords retrieved from <u>Bloom's Taxonomy: The Affective Domain</u>.



This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



responsibility for his or her own behaviour, accepts professional ethical standards, adapts behaviour to a value system, etc. *Verbs / Keywords: compare, relate, synthesize*.

5. **Characterization:** at this level the individual has a value system in terms of their beliefs, ideas and attitudes that control their behavior in a consistent and predictable manner, e.g. displays self-reliance in working independently, displays a professional commitment to ethical practice, shows good personal, social and emotional adjustment, maintains good health habits, etc. *Verbs / keywords: act, discriminate, display, influence, modify, perform, qualify, question, revise, serve, solve, verify*.

1.8.3 Psychomotor domain

As detailed earlier, the psychomotor domain mainly emphasizes physical skills involving co-ordination of the brain and muscular activity; in practice, it prevails in areas like laboratory science subjects, health sciences, art, music, engineering, drama and physical education. Bloom and his colleagues never created levels in this domain, though other researchers later did, like Dave (1970)12 and Simpson (1972)¹³ did.

Dave (1970) proposed a hierarchy consisting of five levels:

- 1. **Imitation**: observing the behaviour of another person and copying this behaviour. This is the first stage in learning a complex skill.
- 2. **Manipulation**: ability to perform certain actions by following instructions and practicing skills.
- 3. **Precision**: ability to carry out a task with few errors and become more precise without the presence of the original source. The skill has been attained and proficiency is indicated by smooth and accurate performance.
- 4. **Articulation**: ability to co-ordinate a series of actions by combining two or more skills. Patterns can be modified to fit special requirements or solve a problem.
- 5. **Naturalization**: displays a high level of performance naturally ("without thinking"). Skills are combined, sequenced and performed consistently with ease.





Subsequently, Simpson (1972) developed a more detailed hierarchy consisting of seven levels¹⁶:

- 1. **Perception**: ability to use observed cues to guide physical activity. *Verbs: Choose, describe, detect, differentiate, distinguish, identify, isolate, relate, select*.
- 2. **Set (mindset)**: readiness to take a particular course of action. This can involve mental, physical and emotional disposition. *Verbs / keywords: Begin, display, explain, move, proceed, react, show, state, volunteer.*
- 3. **Guided response**: attempts at acquiring a physical skill, which lead to better performance. *Verbs / keywords: Copy, trace, follows, react, reproduce, respond*.
- 4. **Mechanism:** the stage where earned responses become more habitual and movements can be performed with some confidence and level of proficiency. *Verbs / Keywords: Assemble, calibrate, construct, dismantle, display, fasten, fix, grind, heat, manipulate, measure, mend, mix, organize, sketch.*
- 5. **Complex Overt Responses:** refers to physical activities involving complex movement patterns. Responses are automatic and proficiency is indicated by accurate and highly coordinated performance with a minimum of wasted effort. *Verbs / Keywords: Assemble, build, calibrate, construct, dismantle, display, fasten, fix, grind, heat, manipulate, measure, mend, mix, organize, sketch. These verbs / keywords are the same with the level "Mechanism" but will have adverbs or adjectives that indicate that the performance is quicker, better, more accurate, etc.*
- 6. **Adaptation:** at this level, skills are well developed and the individual can modify movements to deal with problem situations or to fit special requirements. *Verbs / keywords: Adapt, alter, change, rearrange, reorganize, revise, vary*.
- 7. **Origination:** creativity for special situations is possible because the skills are so highly developed. *Verbs / keywords: Arrange, build, combine, compose, construct, create, design, initiate, make, originate.*

¹⁶ Verbs / keywords retrieved from <u>Bloom's Taxonomy: The Psychomotor Domain</u>.



Co-funded by the

Erasmus+ Programme

of the European Union



1.9 The DELTA methodology for writing learning outcomes

Taking into account the previous theories, methods and approaches, the DELTA partnership adopts the following steps to write learning outcomes:

- **Step 1:** Collect data related to the topic of the course or the module and prepare a textual description.
- **Step 2:** Analyze the meaning of every word given and define every unknown term.
- **Step 3:** Differentiate between knowledge, skill and competence; these correspond to different levels in Bloom's taxonomy.
- **Step 4:** Apply the ABCD and SMART approaches to create one learning outcome for each knowledge, skill or competence.
- **Step 5:** Evaluate the learning outcomes for clarity, coherence, completeness (with respect to the domain AND to Bloom's taxonomy levels) and ability to be assessed.
- **Step 6:** Go to step 1 if any of the above conditions is not met and repeat the cycle.

Note that steps 1 and 2 belong the Preparation phase, steps 3 and 4 belong to the Development phase, whereas steps 5 and 6 belong to the Evaluation phase.





3. Appendix

- A1. TB1 Course Module Description
- A2. TB1.1 Course Module Schedule
- A3. TB2 Course Unit Description
- A4. TB2.1 Learning outcomes for the cognitive domain
- A5. TB2a Identification of Learning Outcomes Steps
- A6. TB3 Learning object
- A7. TB3a Assessment Object
- A8. TB3b Practical Assignment
- DELTA Face to face Activities (DOC)

Instructions

Educational Videos_Guidelines

DELTA_Structural guidelines for online distance learning textual material

DELTA_Structural guidelines for online distance learning presentations

DELTA_Guidelines_to_select_OER_2.0

Templates to produce content

DELTA - Learning Object Template (DOC)

DELTA_Learning Object Template (PPT)

