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Lead Organization:
BOC

Project Coordinator:
ULBS

Contributors:
PRELMET, IDPC, AFIL, VIAMECA

Reviewers:
UNIBG

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1 Introduction to the Quality Assurance of Trainings

Goal of the Handbook on Quality Assurance of Trainings (deliverable D6.3) is to help the project partners of the DigiFoF plan, prepare and run trainings of expected quality, so that the end users can gain needed skills and project partners can avoid common errors related to trainings.

Document begins with an overview of the methodologies which are used for preparing trainings and continues with more in-depth description of the ADDIE method, which is a suggested approach for DigiFoF trainings. Apart from the description of ADDIE stages, additional useful resources such as templates and checklists are also provided. Last part of the document contains suggestions regarding the performance indicators as well as summary and outlook.

Target audience of this document are project partners responsible for some aspects of planning, preparing, testing or running trainings which are part of the DigiFoF project.

2 Quality Assurance of Trainings

2.1 Quality of trainings

There are many aspects which influence whether training can be seen as a successful one or not. First and foremost, successful training should meet the requirements of the stakeholders e.g. in terms of learning outcomes. Participants of the training should also feel that their time was well invested. People responsible for preparing the training should have some guidance which will help them make the best use of their time and resources, so that they can avoid making errors which lead to rework.

In order to avoid attempt to reinvent the wheel it is beneficial to use the proven best practices and incorporate knowledge sharing in a training preparation.

Luckily there are many proven and popular methodologies and approaches which can be used as a guidance and which help assure proper quality of trainings[1].

Since some trainers did not have a chance to use those methodologies yet, introductory document with best practices, templates and checklists (like this one) can speed up preparation of a training and improve its quality, ideally when they are updated with the feedback and findings of users.

[1] This document is meant as a brief introduction to the aspects of trainings quality. Readers interested in additional aspects of quality measurement for trainings can read e.g. https://www.td.org/insights/developing-training-quality-standards. Those interested in e-learning programme accreditation and quality improvement should consider Open ECBCheck. History and overview ot this initiative is available on http://www.click4it.org/index.php/Open_ECBCheck and self-assessment Excel can be downloaded at: http://www.ecb-check.net/criteria-2/

2.2 Overview of methodologies

2.2.1 Instructional Design

As it was already mentioned there are many methodologies useful both for "classic" trainings as well as trainings with electronic component (e-learning or blended learning). Irene Chen[2] mentions over 100 Instructional Design methodologies being used to facilitate learning.

Association for Talent Development defines Instructional Design as follows:
"Instructional design is the creation of learning experiences and materials in a manner that results in the acquisition and application of knowledge and skills. The discipline follows a system of assessing needs, designing a process, developing materials and evaluating its effectiveness. In the context of workplace learning, Instructional Design provides a practical and systematic process for effectively designing effective curricula."[3]

One of the most popular and proven methodologies, used for all kinds of trainings[4], which is commonly used in vocational trainings is ADDIE (described in the chapter 2.3). The following part of this chapter provides a quick overview of other popular[5] instructional systems design frameworks, which can be also used as methodologies for training preparations.

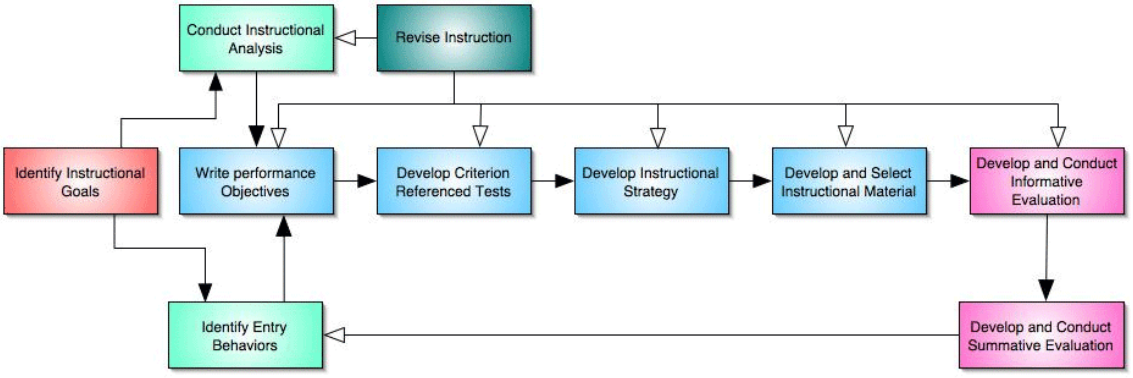
2.2.2 Dick and Carey

Dick and Carey model (also known as Systems Approach Model) was proposed by Walter Dick and Lou Carey in 1978 book "The Systematic Design of Instruction". As the name implies this method employs a systems view focusing on connections and dependencies between elements such as materials, instructor, learners etc.

All the important aspects of ADDIE are present in this model, but there are more steps, which can be seen on a following figure. This makes the SAM well structured, but also pretty complex and highly structured[6].

[2] Chen I., Instructional Design: Concepts, Methodologies, Tools and Applications, IGI Global, 2011, p. 81
[3] https://www.td.org/talent-development-glossary-terms/what-is-instructional-design
[4] Good overview of how ADDIE can be used in e-learning can be found e.g. in: E-learning methodologies. A guide for designing and developing e-learning courses, FAO, 2011, http://www.fao.org/3/i2516e/i2516e.pdf
[5] To learn more about other methodologies see e.g. Survey of Instructional Design Models (5 ed.), Branch R.M., Dousay T.A. Association for Educational Communications & Technology, 2015 https://aect.org/survey_of_instructional_design.php
[6] More information about this methodology can be found e.g. on: https://educationaltechnology.net/dick-and-carey-instructional-model/ or https://lti.umuc.edu/contentadaptor/topics/byid/893e59c7-0ee9-4fad-b988-8c138a5e95ce

Figure 1. Dick and Carey SAM



Source: https://www.instructionaldesign.org/models/dick_carey_model/

2.2.3 Successive Approximation Model

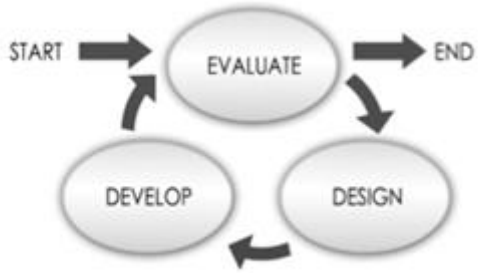
Many methodologies used in trainings have their roots in '70s or '80s and are focused on a structure. This is similar to a waterfall approach in software development.

Since currently agile approach is more popular in business and IT, similar ideas are also being applied to instructional design.

SAM (not to be confused with identical abbreviation applied to Dick and Carey model) is an agile approach to teaching proposed by Michael Allen and Richard Sites in 2012 book named (provocatively) "Leaving ADDIE for SAM: An Agile Model for Developing the Best Learning Experiences".

SAM is focused on assuring that training development method is iterative, collaborative, effective, and manageable. The process[7] can be either simplified or extended – both options are shown below.

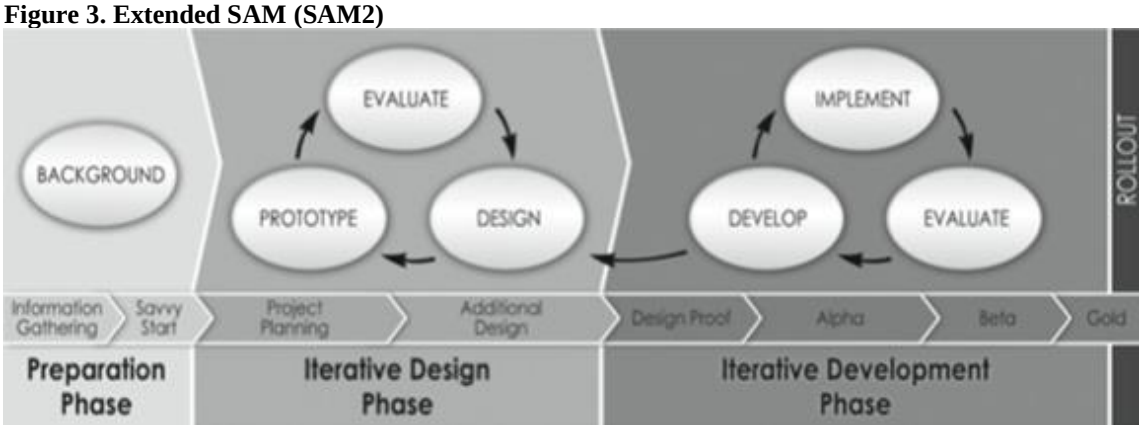
Figure 2. Simplified version of SAM (SAM1)



Source: https://learningsolutionsmag.com/articles/1012/book-review-leaving-addie-for-sam-by-michael-allen-with-richard-sites

[7] More information is available on author's website: https://www.alleninteractions.com/sam-process

Figure 3. Extended SAM (SAM2)



Source: ibidem

While SAM is more modern than ADDIE, ADDIE approach can be implemented in such a way so that principles of SAM such as iterative work, collaboration etc. are preserved.

Thus, ADDIE will be used as a structuring framework in this document.

2.3 ADDIE

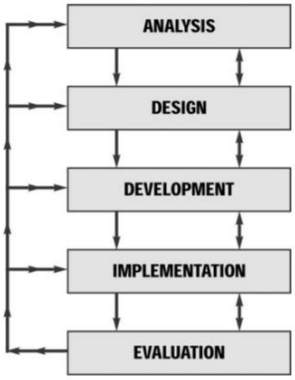
2.3.1 Introduction to ADDIE

While other approaches mentioned so far could be easily attributed to specific authors and publications of origin, ADDIE is different in this aspect.

Researchers[8] mention that ADDIE cannot be attributed to a single person, and that it should be rather treated as an umbrella term for a five-element process of training development, including elements such as Analysis, Design, Development, Implementation and Evaluation, which form the ADDIE acronym.

Michael Molenda[9] tracks the first appearance of ADDIE to 1988 monograph of the American Society for Training and Development (ASTD[10]) where D.J. Grafinger described the process shown below.

Figure 4. ADDIE process



Source: Molenda, M. "In search of the elusive ADDIE model." Performance improvement 42, no. 5 (2003): 34-37

[8] Molenda, Michael. "In search of the elusive ADDIE model." Performance improvement 42, no. 5 (2003): 34-37.
[9] Ibidem
[10] Currently known as Association for Talent Development (ATD)

As already mentioned, ADDIE is very popular among instructional design practitioners since it allows following a tested process and helps organize work. Due to this fact there are many materials[11] referring to ADDIE usage in various scenarios as well as publications providing more in-depth descriptions of what should happen during ADDIE stages[12] or using ADDIE as a structuring framework which can be enriched e.g. with information about budget allocation[13].

The following part of the document provides a brief overview for the purpose of DigiFoF.

2.3.2 Analysis

2.3.2.1 Introduction to Analysis

The analysis phase is the foundation of a learning or training process. The deliverables of this phase are the building blocks for all subsequent design and development activities.

During the analysis phase, educators gather more information about the knowledge, skills, or attitudes the learner needs to attain and what needs to be taught to accomplish this learning. It is also important to thoughtfully weed out extraneous information that does not need to be taught to attain the educational goal, thus better focusing time and resources on essential learning needs. This, in turn, enhances the learners' engagement as they are learning truly applicable information.[14]

Several methods can be used to gather the information during the analysis phase, such as focus groups, one on-one interviews, anonymous questionnaires or surveys, mixed qualitative-quantitative studies, expert consensus or Delphi studies with content experts, audits or tests of current performance, opinions of graduates of the program, or a combination of these techniques.[15]

2.3.2.2 Best practices

Analysis stage consists of various steps shown on a graphic below and described in the following part of this chapter.

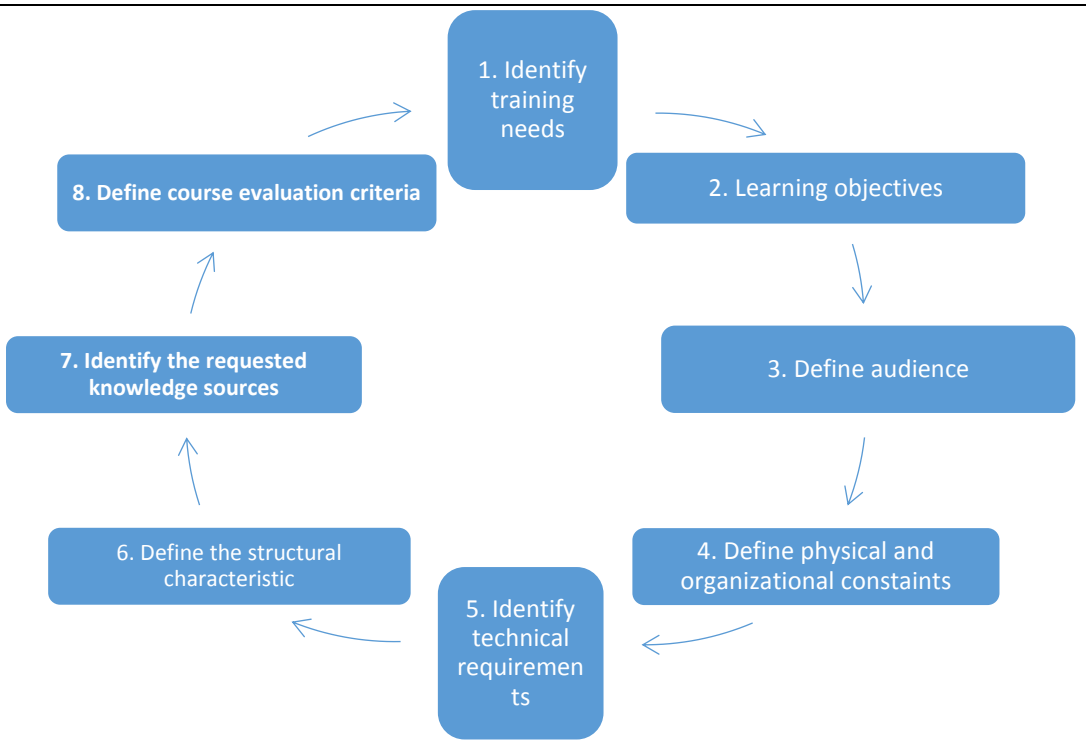
[11] Ranging from overview infographics such as https://nlegault.ca/2011/09/05/infographic-the-addie-model-a-visual-representation/ through whole collections of articles on reputable portals such as https://elearningindustry.com/tags/addie to in-depth descriptions such as http://www.click4it.org/index.php/A.D.D.I.E_Model

[12] E.g. Instructional Design: The ADDIE Approach, Branch R.M., Springer Science & Business Media, 2009 or Morrison, G.R, Designing Effective Instruction. 6th Edition, John Wiley & Sons, 2010

[13] E.g. https://elearninginfographics.com/elearning-implementation-toolkit-infographic/

[14] Cheung L., Using the ADDIE Model of Instructional Design to Teach Chest Radiograph Interpretation, Hindawi Publishing Corporation Journal of Biomedical Education Volume 2016, Article ID 9502572, p. 6

[15] Ibidem.



Source: *own elaboration based on*: R. M. Branch, Instructional Design: The ADDIE Approach, Springer Science+Business Media, London 2019; L. Cheung, *Using the ADDIE Model of Instructional Design to Teach Chest Radiograph Interpretation*, Hindawi Publishing Corporation Journal of Biomedical Education Volume 2016; https://elearningindustry.com/getting-know-addie-analysis; https://michelemartin.typepad.com/addie.pdf

When starting work on a given training, it is reasonable to ask yourself for an effort and ask a few questions. These questions are to be used to better prepare the training course and, consequently, to achieve higher final training effectiveness.
Therefore, you should ask yourself how to answer the following questions:

- Who is the recipient of the training?
- When will it happen?
- What is the main training context?
- Where and in what form will the training take place?
- Why is this training so important? (goal / goals of the training)
- How do you intend to achieve your goals? (methodology and tools as well as requirements).[16]

The acquired knowledge contained in the answer will certainly reduce the risk of training failure and increase the chances of its final success. Good luck in asking questions and even more effective in answering!

Identify training needs

GENERAL QUESTION: **What training needs determine their construction and implementation? What does an employee need? What does the organization expect from an employee?**

[16] More information about the "5W and H" approach can be found on: https://www.talentlms.com/blog/addie-training-model-definition-stages/#Defining%20the%20ADDIE%20training%20model

How it is made, needs analysis is conducted to determine whether the particular skill or knowledge we want to teach is truly needed for the learners to function in the workplace and whether they currently lack this skill or knowledge.[17]

Training needs analysis, sometimes referred to as a TNA, is used to uncover any knowledge or skills gaps across an organization. Once these are pinpointed, it becomes much easier to build the perfect training approach to plug those gaps.

Typically a training needs analysis will try to cover three areas – the needs of the organization, the needs of each team or department, and the needs of each individual.

There are many methods that can be used to carry out the analysis. It may include, among others: surveys, interviews, focus groups, individual interviews, consultations with external experts, and audits of existing training approaches, psychometric style tests, job descriptions/role profiles, performance appraisals, output from SWOT analysis.

Proposed checklist for this step can be found in Appendix A (5.1 Checklist for training needs analysis).

Learning objectives

GENERAL QUESTION: **By the time a student finished this course, he or she should be able to ….? Describe …Demonstrate…. Show …Explain …. What should a student be able to do when he or she has mastered skills, attitude, knowledge?**

Before starting to work on teaching materials, it is vital to **determine the main learning goals** and clearly communicate them to everyone involved in the creation of the course. The goals must be described in detail from the outset, and they must be measurable. Another way analysis can help you is by enabling you to discover early that skills you aim to impart in your course are ill-suited for eLearning and require live courses with workshops. Thus, establishing this early will help save you a lot of time that would have been wasted otherwise.

When you design any course, unit or lesson, the first questions you must ask yourself are:

- What are my goals?
- What do I hope that students will know at the end of our experience?
- What do I want students to be able to do? [18]

Each successive or similar training may have a similar or slightly different goal. The training can also have several main goals, especially in the case of a longer training course. The naming of the main objective / objectives will make it possible to refine the specific objectives of the training or cycle of training.

Having the main goal set, the specific objectives of the training can be passed with full conviction as to the future success to the next stages of shaping and managing the training. Because the hand has the key to success: the answer to the question "why is it done"?

[17] Cheung L., Using the ADDIE Model of Instructional Design to Teach Chest Radiograph Interpretation, Hindawi Publishing Corporation Journal of Biomedical Education Volume 2016, Article ID 9502572, p. 6
[18] https://michelemartin.typepad.com/addie.pdf

When preparing the training material as part of the DigiFoF activities, the main objectives of the project and the expected results with which the training goals should be correlated in terms of learners' competences should be taken into account:

- modernization of content, lab facilities as well as curricula, increased cooperation with industry as well as academia;
- creative thinking and innovation skills, skills in applying state of the art design tools and using open source platforms, teamwork and intercultural skills;
- realize joint academic/company lecturing, tutoring and supervision for students to be able to work scientifically on real-world problems;
- improved qualifications for the design of FoF;
- using a problem-based learning approach;
- better quality teaching, use of modern open community-based tools;
- better qualified workers have an impact on organisational structure and processes;
- increased knowledge of international (project) collaborations.

Proposed checklist for this step can be found in Appendix A (5.2 Checklist for establishing goals).

Define audience

GENERAL QUESTION: Who will be using the learning materials you produce for studying? What your learners already know?

In this part of the analysis, it should be specified who the recipients of our training are. The challenge is therefore to define common features that connect the target group. They can be crucial in the final efficiency of training. Such features may be: age, sex, socio-economic status, type of position occupied, number of years of experience in a similar job position, level of formal education, etc.
Other criteria defining the common characteristics of the group of recipients are also indicated: cultural origin, physical impairment or impairment of learning ability, interest, experience, personal goals and attitudes, scientific preferences, motivation, communication skills, text editor skills, cooperation skills, experience with different methods and ways of teaching, previous e-learning experience.[19]

Based on the above, it should be stated that this part of the preparation of the training course should be devoted to proper understanding of the training beneficiary.
It is worth to use the following hints in the form of a short checklist:

- What is the origin of students (age, education, profession, position and organization) and what are the preferred learning styles?
- What is their current level of knowledge about the topic related to the training? (use the competence test).
- What are their expectations for the training (use of phone calls, a short survey or feedback form). What knowledge and skills must be learned?

[19] J. Vejvodová, The ADDIE Model: Dead or Alive?, Department of Czech Language and Literature, Institute of Lifelong Learning, University of West Bohemia.

- How diverse are their knowledge and learning styles?
- How well can they learn?
- What are your study skills?
- What is their motivation to participate in training and interests, attitudes towards teaching / learning methods?
- What are their obstacles to learning (eg fear, color blindness, lack of concentration, access to a computer)?[20]

This analysis should be taken in relation to the target group of the DigiFoF project which is: Students, Teachers, Industry Professionals, enterprises - as an environment.

Proposed checklist for this step can be found in Appendix A (5.3 Checklist for audience analysis).

Define the physical and organizational constraints

GENERAL QUESTION: What are the ways in which physical and organizational constraints can be overcome in order to increase the effectiveness of training?

At this stage of the analysis phase, technical and organizational requirements should be specified to facilitate the achievement of the final training results. Therefore, here it is necessary to finally determine how the training will be conducted: on-the-spot training, on-line training with the use of e-learning tools, and blended learning. Consequently, the advantages and disadvantages of the chosen method of providing knowledge of skills and attitudes should be traced. The choice of delivery system should depend on how well the alternative will contribute to the desired training outcome.

For example, the use of computer training would be ideal for practical practice in developing the skills needed to use new computer software. Students in a class without computer equipment would be less inclined to achieve the desired result.

Therefore, you are encouraged to make a list of things and processes that must be prepared and implemented in a given form of the school to ensure the desired level of preparation at the start, guaranteeing the achievement of the final desired training results. On this occasion, under the account of the final costing of training, it is reasonable to skimp the costs of preparing a given type of training. Especially in the institution of incurring expenditures not yet recorded in the organization. After calculating the costs of overcoming physical and organic limitations, it may be necessary to choose other types of training - in a different form.

Proposed checklist for this step can be found in Appendix A (5.4 Checklist for constraints analysis).

[20] https://michelemartin.typepad.com/addie.pdf

Identify technical requirements

GENERAL QUESTION: **What are the technical requirements of the course?**

During the current stage of training preparation, it is necessary to consider what technical requirements set before us the previous arrangements for training, including goal to achieve, specificity and requirements of the group and the subject of the training. This is particularly important when deciding to use online learning tools.

Therefore, it is reasonable to use the following recommendations. As you identify the available technology resources, keep in mind the number of computers available, if applicable, and any other electronic devices that will be required for hands-on activities. It is also important to identify non-digital technology that will be required to complete the entire ADDIE process, such as flip charts, writing utensils, dry marker boards, easels and, adhesive notepad.[21]

It is important not to neglect this part to prepare for the training. Because technical conditions and not fully satisfactory level of efficiency of all types of tools are very often a factor limiting the level of, among others, effective time devoted to the substantive part of the training. The technical side of the training is also an important support in achieving the high level of the assumed final effects of the training.

Define the structural characteristic

GENERAL QUESTION: Which system to give training and distribution of knowledge and skills?

Information gathered during the preceding steps of analysis will help you establish the structure of the course in the following stage.[22]

This phase of preparations is therefore a specific consumption of previous arrangements. The precise state of the current knowledge of the training participants will make it easier to decide how to divide the content of the training into the relevant modules in terms of content and time of their duration and the sequence of transfer.

Proposed checklist for this step can be found in Appendix A (5.5 Checklist for course structure analysis).

Identify the requested knowledge sources

GENERAL QUESTION: **Where are the key sources of knowledge to offer to participants? / Who has the key knowledge to offer as part of the training?**

The next step on the road to training excellence is to determine the location of knowledge carriers offered in the designed training. It is about indicating own and external resources (people, previous training materials, etc.)
Pre-existing resources may be available that contain valuable content. These resources could then be used as references for content, as references for learning strategies, as parts

[21] R. M. Branch, Instructional Design: The ADDIE Approach, Springer Science+Business Media, London 2019, s. 43
[22] https://elearningindustry.com/getting-know-addie-analysis [5.07.2019]

used in the learning environment without alteration, and as parts used only for illustration or examples.[23]

When indicating the sources of knowledge carriers one should also take into account their number, the way of combining together (internal trainer with an external trainer, to what extent of knowledge, skills) and related costs.

Proposed checklist for this step can be found in Appendix A (5.6 Checklist for knowledge sources analysis).

Define course evaluation criteria

GENERAL QUESTION: How will you measure the effectiveness or efficiency of training?

If you want to achieve the desired effect of your current training and the next higher one – you need to specify how to assess the knowledge acquired by students. [24]
The role of the analysis of results is to choose the means that will provide information on whether the curriculum achieves its purpose.[25]
The task at this stage is the selection of tools according to which the training will be validated. First in terms of content (knowledge, skills, attitude). Certification tests in the case of knowledge will certainly be helpful. One should not forget about other elements of the training referred to in the earlier stages of the analysis phase. How then, after the course, validate the economic side of the training, technical, organizational.

Proposed checklist for this step can be found in Appendix A (5.7 Checklist for evaluation criteria analysis).

2.3.3 Design

2.3.3.1 Introduction to Design

The aim of this section is to provide a handy description about the design of a trainings course in the context of the DigiFoF project to be used during the development stage in line to the ADDIE model. In particular, the scope of this section is to describe useful indication to elaborate an efficient and flexible structure of the proposed trainings that can be adapted either for on-line as well as for face to face courses (workshops, laboratories, lessons).

In particular, the DigiFoF project aims to apply methods and concepts coming from different disciplines to provide a holistic education about digital skills. Moreover, the project aims to produce interdisciplinary training materials and case-studies to be offered to students and professionals. As a results, given the heterogeneity of the proposed trainings, the present section is structured in order to provide a general description about

[23] R. M. Branch, Instructional Design: The ADDIE Approach, Springer Science+Business Media, 2019, p. 43.
[24] https://elearningindustry.com/getting-know-addie-analysis [5.07.2019]
[25] Lawrence Cheung, Using the ADDIE Model of Instructional Design to Teach Chest Radiograph Interpretation, Hindawi Publishing Corporation Journal of Biomedical Education Volume 2016, Article ID 9502572, 6 pages

the structure of the trainings that should be offered as well as about their format. Therefore, a process has been elaborated in order to provide helpful indication to elaborate a structure and format for trainings that can be flexible and adaptable to the specific needs of learners, in a specific context.

2.3.3.2 Pre-requisites

As it will be seen in a following parts of this chapter, Design is strongly dependent on a results of the Analysis phase. This allows to design a course which will be aligned with expectations of stakeholders (training needs analysis, learning goals, technological aspects etc).

2.3.3.3 Best practices

As it was already mentioned in a previous chapter design of an efficient training requires **i)** Needs assessment; **ii)** Setting Objectives; **iii)** Implementation and Design; **iv)** Evaluation.

In line with the proposed process, the first step is to assess the needs of the learners. From a general perspective, is important to know in the detail the specific needs of the learners in relation to the proposed topic. Once the needs are identified, the objectives for which the training is to be conducted have to be established in order to help them in understand the global structure of the training and how it would be beneficial for them.

The setting of objectives could be based for instance on gaps seen in the training programs conducted earlier and on the foreseen skill sets. According to this, in order to measure whether the objective will been achieved 2 skills assessments could be foreseen at the beginning (to assess the starting point of the learners) and at the end of the trainings (to assess the achieved knowlege).

In line with the setted objectives, the next step consists in elaborate the training program i.e. to define the structure of the course and its organization in terms of content, agenda and scheduling. In this phase a crucial step is the identification of the person in charge of carrying out the training. The person in charge of carrying out the training can be identified in an experienced professionals, either academic, business, industry experts with a proven qualifications to provide the trainings.

A set of preliminary indications helpful to design the DigiFoF trainings can be taken from the analysis of D1.2 - *"Analysis of user needs"* and from the previous experience of the consortium partners in similar activities. In the detail, D1.2 – in line with its limitations – (e.g., the non-representative sampling among the FoF stakeholders in partners countries) has point out useful recommendations that can be perceived as an indication for the implementation and design of the training modules addressing digital skills and competences for FoF design, either for students as well as for industrial professionals.

Among these indications, it can be observed how the respondend companies are expecting a direct contact with the trainers being oriented to face – face courses (lessons) despite to on-line trainings or webinars with and average duration of these trainings between 4 – 8 hours.

Concerning the target audience, respondend have indicated how the main benificiary group is composed by middle management and in particular engineers working in product and/or service design as well as employees in charge of product/business model innovation.

A further consideration regard the fact that the preferred languages for training is the learners mother tongue. This results, suggest and reinforce the fact that trainings courses should be customized and adapted in relation to the specific needs of the learners indicanting how – for instance – the training materials could be developed in English, and then – eventually – translated into the local language of the consortium partner entitled to provide the course.

Starting from these consideration and taking into account the experience of the consortium partners, some indications about a course structure able to guarantee the quality assurance of the trainings are provided here, which can be used as a starting point for each training (adapted according to the needs on specific inputs from the Analysis phase):

- The training courses can be composed by modules each of them composed by specific sessions with an average duration of the training between 4 and 8 Hours (max 1 day).

- The course can be structured as a mix between theoretical content and collection of practical use cases in a well balance way according to the topic (e.g., weight of use cases: 30 – 50%).

- The course should also present a well balance ratio between lectures and practical exercises (e.g., 60% theoretical and 40% exercise).

- Exercises can be also structured considering a problem-based learning approach in order to involve the learners to solve case-studies by applying the theoretical knowledge acquired.

Similarly, some indications about the development of the training materials are here provided:

- Training materials should be composed by a general overview of the topics, with some methods and guidelines with a collection of use cases in order to see the practical applications and the possible implications.

- The material should target technicians and middle manager, which means that courses should also include some technical aspects in order to make it useful and challenging for the learners.

- Training materials should be kept concise avoiding unnecessary details, including example to help learners understand the material better.

The structure of the trainings courses can be describe as follow:

Training Course - EXAMPLE

Thematics:
Description of the thematics that will be the aim of the training.
Objective of the course
Description of the objective of the training.
Target
Description of the target audience.

Proposed thematics (e.g.,):

1. MODULE 1
2. MODULE 2
3. MODULE 3
4. ...

MODULE	SESSIONS (I.E. CONTENTS)
1. MODULE 1 **(hours)**	• Section 1 • Section 2 • Section 3 • ...
2. MODULE 2 **(hours)**	• Section 1 • Section 2 • Section 3 • ...
3. MODULE 3 **(hours)**	• Section 1 • Section 2 • Section 3 • ....

Table 1: Trainings course structure (proposal)

According to Table 1, an important aspect in the design phase of the training is represented by timing and scheduling. Indeed, timing includes everything is required to complete the training i.e. i) presentation of materials; ii) break; iii) launch; Welcome/Wrap -up. Scheduling should take in consideration all these aspects and be performed according to the lengh of the training.

An important reccomandation to ensure the quality of the training program is to review the outline of the course with the help of a subject matter expert to guarantee that the flow of the course is in line with the training objectives. If possible outline should be extended with more information, so that the following Development phase is easier. Practitioners

suggest[26] using for this purpose mindmaps or storyboards which are low-fidelity (draft) versions of the target course materials which allow performing tests much easier and allows e.g. adding scripts for video-based lectures.

After the learners have completed the course, it would be also helpful to to hold a meeting with them to discuss the results in order to summarize the main idea of the trainings and its goals.

A Final Assessment is then required to evaluate the improvements of the skills and to understand whether the objective of the course has been fulfilled. To ensuare the quality of the assessment, the right type of test should be chose in relation to the planned goals of training e.g., if the trainings is meant to broaden the knowledge of the learners a standard test (e.g., Multiple Choice) will be considered. Viceversa, if the course is meant to teach to the learners a practical skills, a real-life task will be provide to test practical knowledge acquired. This aspect is covered more in depth in a chapter about Evaluation.

Proposed checklist for this step can be found in Appendix A (5.8 Checklist for design).

2.3.4 Development

2.3.4.1 Introduction to Development

The Development stage builds upon the previous steps to make sure that content that will be created will be in line with the learner's needs and overall plans. Goal of this stage is to create the actual content used for the trainings including also activities and assessments as well as guides.

2.3.4.2 Pre-requisites

As already mentioned, this stage builds upon Analysis and Design. Therefore, important pre-requisites are the design document as well as a storyboard. Additionally, training needs analysis is needed to make sure the content is in line with expectations.

2.3.4.3 Best practices

In order make sure that quality of the developed content is appropriate it is very important to take into account several aspects such as:

a) Gathering feedback early and often
b) Using appropriate technology for the training
c) Providing all interested parties with content relevant for them and engaging

The points above will be described more in depth in the following part of this section. Also, a checklist summarising most important points will be provided at the end of the document.

Gathering feedback early and often

[26] See e.g. https://elearningindustry.com/addie-model-instructional-design-using

Two main risks while developing trainings are: preparing content not aligned with requirements (including needs of the students) as well as preparing great content, which meets those requirements, but the form does not make it successful.

The first risk can be easily avoided thanks to the previous stages of ADDIE, which were described in the earlier section. If the results of those stages are guiding the content development, the overall risk is greatly reduced.

For example, training needs analysis from the Analysis phase helps us to avoid adding irrelevant content which would be too basic, too advanced or simply not helpful for the students.

In a similar way high level design as well as the storyboards which are created in the design phase can be used to test if the flow of the training is appropriate, if the content is arranged in a logical way, whether there are appropriate activities for students and if all the important aspects are covered.

Second risk is not so easy to avoid if the waterfall approach to content development is used i.e. testing starts only after everything is ready. In this case, it is possible that many days of effort will be wasted if the form of the training is not helpful for the students and discourages them from using the knowledge inside the course.

Fortunately, both risks can be mitigated if content development is organised in an agile way which asks for early and frequent feedback.

Suggested approach for the content development would be to start by analysing the results of previous ADDIE stages and building upon them. For example, storyboard from a Design phase which was tested and officially approved can now be turned into first prototype of the course with more content and proper media. Please note that this will not be a final content. The goal is to gather feedback.

Depending on the selected delivery methods work in this stage may differ a bit.

On-site learning
When face to face trainings or webinar-based trainings are planned, it is possible that technology selected will be PowerPoint or similar software. In this case content will be mainly slides.

Online learning
If the content will be presented as a video recording, probably apart from the slides, a script will be needed for the purpose of audio recording. In case of e-learning it is also possible to use slides as a basis of the content, however for more interactive forms of e-learning a wireframe/mockup may be needed which will show how the planned content could look like.

Examples of rapid prototypes using wireframes can be found e.g. on: https://community.articulate.com/articles/elearning-prototypes-wireframes

Tools commonly used for making mockups/wireframes include:

- PowerPoint
- Sketch (https://www.sketch.com)
- Adobe XD (https://www.adobe.com/products/xd.html)
- Invision (https://www.invisionapp.com/)
- Axure (https://www.axure.com/)

After doing tests of the prototype which shows the look and feel as well as the selected part of the content, developer can be sure that a selected strategy is appropriate and there will not be last minute requests for changing all of the created content.

It is also beneficial to gather feedback later on during the development phase in order to make sure if everything is correct, logical and easy for understand for the end users. Such feedback could take part after each big section of the content is ready. At the very least tests should take place after all the content is ready.

Useful tests should be planned in advance, so that participants have time and there is still possibility to take their feedback into account.

Testers should ideally have backgrounds similar to the planned end-users of trainings. Also, people who will be running the trainings should be invited for tests if they are not already involved in the development activities. However, it is usually not sufficient to run tests only with people who do the development of the content, since they may be too familiar with the content and will not notice some errors and problems.

Tests should also cover aspects of accessibility and inclusiveness. For example in case of slide-based onsite trainings, fonts should be big enough and easy to read, and contrasts should be high enough for all users. Following links can be used as a starting point:
https://support.office.com/en-us/article/make-your-powerpoint-presentations-accessible-to-people-with-disabilities-6f7772b2-2f33-4bd2-8ca7-dae3b2b3ef25
https://www.w3.org/WAI/teach-advocate/accessible-presentations/#preparing-slides-and-projected-material-speakers

In a similar way, if the training is web-based, used technology should support the accessibility. Good starting point can be the following link: https://www.td.org/insights/accessibility-for-e-learning-section-508-and-wcag

Apart from the content, form of presentation and accessibility, tests should also cover aspects such as grammar and spelling, technical aspects (e.g. navigation, quizzes not working properly), and consistency throughout the course, so that different sections share common look and feel in terms of visual design as well as language.

As a last aspect of testing, training pilot should be run in an enviroment as similar to the target as possible to get real-life feedback from a selected group of participants.

Using appropriate technology for the training

As already mentioned in a previous section there are many possible ways of running a training. Decision regarding the delivery method should be available as an input from earlier stages of ADDIE, but specific technology details will need to be finalised in this stage.

Ideally, the technology used should be helping training participants achieve their goals, so it should be something not distracting them from the learning.

On-site learning
This is not a significant problem for onsite trainings since they are instructor-led and users do not need to worry which application is used as long the slides are projected properly and printouts are ready, this can become an issue for other delivery methods.

Online learning
For example webinar-based trainings should be easy for participants to join from various devices (PC, Mac, mobile), allow VoIP audio support along with optional dial-in plus have a recording feature so that the videos can be provided for users who could not take part live.

Tools commonly used for webinars include:

- GoToWebinar (https://www.gotomeeting.com/en-pl/webinar)
- Zoom (https://zoom.us/)

In case of e-learning courses additional consideration is whether the tool creates content, which can be used in LMS thanks to the standards such as SCORM or xAPI and which file formats are used for presentations. Tools which use Flash export should be avoided, instead HTML5 option should be preferred since it is more open and easy to access for the end users.

Tools commonly used for e-learning authoring include:

- Articulate 360 (Storyline/Rise) (https://articulate.com/)
- Adobe Captivate (https://www.adobe.com/ca/products/captivate.html)
- Camtasia (https://www.techsmith.com/video-editor.html)
- iSpring Suite (https://www.ispringsolutions.com)
- Adapt (https://www.adaptlearning.org/)

Providing all interested parties with content relevant for them and engaging

Development of the training content is a difficult task since there are many users of the content. First and obvious group are students, but also needs of teachers should be considered for example by providing them not only ready set of slides and materials for students, but also providing guides for the trainers as well as notes for each of the slides.

In addition, there is a very dangerous trap for people developing the content. While naturally designers do their best to make sure that their content covers all the aspects specified in learning goals it is also very tempting to overload the course with too much content.

This should be avoided for several reasons.

Firstly – adding more content may overload the student, not allowing them to gather needed knowledge. Helpful approach here is distinguishing between “nice to know” and “need to know” elements and focusing on the latter. Additionally, content developers should focus on enhancing performance of the students instead of simply providing

information since information itself with no connection with daily needs of the students will not be beneficial and thus will be easily forgotten.

Secondly – various statistics show that creating one hour of training requires from 20 to even 500+ hours of work (more details can be found on: http://www.chapmanalliance.com/howlong/ and https://www.td.org/insights/how-long-does-it-take-to-develop-one-hour-of-training-updated-for-2017). Therefore, development of content which does not add value for the students can be very costly and time consuming.

Finally – since people participating in trainings have limited time, every minute spent on providing them with unnecessary information leaves less time for activities and assessments which would help make sure that they will be engaged and will use the knowledge in practice.

Since activities and assessments play very important role in engaging users it is important to develop the content in such way that they are not simply passively receiving information, but can use them in practice. There should also be a good mix between the slides and activities such as questions, quizzes, exercises of various kinds etc, so that student does not spend more than 20-45 minutes on a pure lecture – especially if this is presentation with text only.

As with the previous aspects, selected delivery mode will have an impact on this.

On-site learning
For instructor-led trainings elements that can engage students include e.g. pre-work which can be checked during the training, classwork such as individual or group exercises, case studies and practical assignments as well as homework. To help students get the most out of the training there should also be some additional materials and handouts available.

To make sure trainers can run the on-site training properly guides for them should also be created[27].

Online learning
For webinar-based trainings parts of presentation can also be mixed with polls and quizzes. Many tools also allow offering handouts to participants either via links to file-sharing services or as direct file download.

For e-learning there are some additional ways to make the content more engaging. Since various learners have various needs it may be beneficial to offer them non-linear experience where they can select which topics are interesting for them and which are not. Online courses also allow repeating the content, so that students can learn at their own pace. Additional options for boosting student engagement are interactive scenarios where users can experiment with various choices and see their consequences (more information about the 3C model can be found on: https://blogs.articulate.com/rapid-elearning/build-branched-e-learning-scenarios-in-three-simple-steps/).

[27] See e.g. Instructional Design: The ADDIE Approach, Branch R.M., Springer Science & Business Media, 2009, p. 118-121

Important consideration for e-learning is that users usually expect much shorter learning blocks. For example Udemy, one of the learing course marketplaces with over 30M students suggests that videos being parts of the course should be no longer than 20 minutes, ideally around 5 minutes each.

Last element which can make students more engaged is the visual aspect. In order to help students consume the course content easier it is important to use a common look and feel of the materials, so that materials look consistent and student does not need to get used to different colors, fonts, layouts etc in every section.

For this purpose usage of templates is beneficial.

Since text-only content is usually not very visually compelling, materials should be also using diagrams, graphics and other media files which support the leaning objective.

Important consideration here is to make sure that they are used in a consistent way (e.g. that cliparts are not used together with high quality photos) and that all media are used according to the rules.

There are several ways to acquire media such as photos, vector images and videos for the course materials.

First option is to use one of the many stock photography sites. Popular options include: iStock, Adobe Stock, Shutterstock, and Depositphotos. Those are paid services which offer high quality media. User should however always remember about checking the license terms to make sure media can be used.

Second option is to use content available under Creative Commons licenses (https://creativecommons.org/). There are various CC licenses with different requirements regarding comercial usage and attribution, but the safest option is the CC0 license which allows all use (both non-commercia and comercial), allows changes (so called derivative Works) and does not ask for attribution.

There are many sites offering CC photos, so the easiest way is to use the aggregator engines such as https://www.pexels.com or https://search.creativecommons.org/.

Final thing worth mentioning is importance of proper citation and attribution. This allows learners to get more information if they are interested in additional details, but also helps avoid copyright disputes.

Proposed checklist for this step can be found in Appendix A (5.9 Checklist for content development).

2.3.4.4 Templates

As it was mentioned in a previous section, usage of templates is beneficial since it helps create consistent look and feel of the training content.

Proposed template of the slides is provided as an attachment for this document.

2.3.5 Implementation

2.3.5.1 Introduction to Implementation

Implementation is a part were content created in previous phases can be used in real life environment during actual trainings. It is very important to remember that having all the materials ready does not mean that trainer's work is now a simple formality. Apart from the main goal of this stage which is obviously to deliver the expected results thanks to the training (e.g. help training participants sharpen some existing skills or acquire new ones which are needed for their work), second goal is to make sure that all the feedback we get during this phase translates into further actions improving the training.

2.3.5.2 Pre-requisites

In order to be able to implement the course input from the Development phase is needed. Specifics will be different for various delivery methods, but required elements should include course materials along with additional content (curriculum, schedule, some kind of promotional materials, etc), activities and assessments, as well as guides for the trainers (especially if people acting as trainers were not involved in Development phase).

2.3.5.3 Best practices

Common pitfall for this stage is assuming that since all the content is ready, all the rest is a simple task of transferring the materials to students. Successful teachers know however that students can be very different, and it is not possible to simply follow a plan without any adaptations[28].

Below you can see selection of good practices for different delivery methods, which can be used in trainings. However, regardless of the selected delivery method the first crucial element is to make sure that there will be some participants of the training by using promotional materials to make potential students aware of the training and willing to enroll and participate.

On-site learning

Before actual instructor-led training can take place several things need to happen.

As it was already mentioned, if the trainer did not participate in preparation of the content, there should be some preparation pase – ideally using the guides, if not possible simply by working with course materials in advance in order to have an understanding of the course flow.

To make sure training participants can take advantage of the course they also need some preparation including e.g. information about how this training is supposed to work, what are they supposed to do, where and when (e.g. defining groups for activities such as case studies, discussing deadlines for additional activities etc).

Next element is the technical preparation. In a perfect world all possible technical problems would be already identified during tests and pilots, but trainer should always make sure that the place where the training takes place is properly prepared in advance. This includes e.g. making sure that computers work smoothly, all necessary programs are

[28] Famous quote „No battle plan ever survives contact with the enemy" attributed to Helmuth von Moltke summarizes well this fact of life.

installed, internet/intranet with is working, so that all needed content can be accessed, projecting slides works as expected and class layout allows all students to see what is shown. Additionally tangible elements should also be prepared (printouts – if needed, flipcharts/whiteboard and markers etc).

Next element is delivery of the training. As already mentioned, trainer should always be prepared for some unexpected elements, so it is always a good idea to have some backup content in case of more advanced group which finishes activities earlier or asks more advanced questions. In a similar fashion if a group needs more time some element, trainer should have some time buffer or be prepared to help them in some other way. Goal here is to make sure that trainer not only passes the materials and information to students, but also assures they acquire new knowledge which will improve their performance.

Finally – trainer should use every opportunity to gather the feedback regarding the course. Apart from the assessments which show results of the students, trainer should also monitor attendance (both by formal means such as lists or forms or aspects such as being late or not taking part actively[29]) and note both feedback received from the post training evaluation form (found in Appendix A) and own ideas for further improvements.

Online learning

Running trainings online shares some characteristics with on-site training, however different delivery methods mean that trainer has to interact with students in additional/different ways.

As in a previous part, trainer should prepare for the training in advance. However in case of performing training via webinars some extra time should be planned to make sure the software can be operated smoothly, and that a trainer does not skip any important step such as e.g. remembering to record the session[30]. Also for e-learning trainer should take some time to understand how does the delivery platform work, so that e.g. no question asked by student is overlooked.

Since the students may also not have previous experience with selected technology it is a good idea to start the training by showing how can they participate, how to ask questions[31], interact with lecturer and other students etc.

Technical preparations for online trainings are often more complicated than for on-site ones. For example for webinars registration page needs to be prepared where participants can enrol. Trainer needs to prepare digital handouts in advance as well as quizzes and assessments. For other e-learning methods, trainer needs to make sure that e.g. all the recordings and other content are properly uploaded to the learning environment and make them accessible to students at proper moments[32].

[29] To help boosting attention of participants it is helpful to start by defining common rules of work such as putting away smartphones for the time of training.

[30] In some tools such as GoToWebinar this can happen automatically, but in others teacher needs to record a session.

[31] This will differ between various tools. For example GoToWebinar allows participants to "Raise a hand" or ask a question via "Q and A" feature.

[32] For some trainings all content is available right from the beginning, so that more advanced students can learn at their own pace. For others, where keeping common pace is more important, so called dripping is used so that new sections appear at a predefined moment.

Actual delivery of the online training differs a lot from an on-site training. While in a class trainer can easily see whether students work as expected and everything is clear, online delivery does not give such immediate feedback. Therefore trainer needs to use the available options to make the training good experience for participants and gather some feedback as soon as possible. This can be done e.g. by adding more interactive elements, so that it is easier to spot student who does not understand something or using available statistics to understand how the students participate[33].

Online trainings should also have some option for students with extra questions. For webinars it is not always possible to answer the more advanced question during Q and A part. In this case trainer should answer after the session and document this, so that for other training this aspect can be included in materials (main or supplementary ones for trainer). For learning platforms trainers should plan to check the question/discussion area, to answer where needed.

2.3.6 Evaluation

2.3.6.1 Introduction to Evaluation

In order to reach the objectives of the project – i.e. to meet the needs of expertise required and voiced by the Industry 4.0 by fostering knowledge and skills transfer between manufacturing industry academia – the majority of the planned activities is to prepare training materials in order to give both teachers and learners user-friendly and qualitative content items/tools. One of the added values of the project is the process of quality assurance ensuring the relevance, the appropriateness and the understanding of every deliverable, including trainings developed in WP3, WP4 and WP5. It is all the more important that these trainings have to be used and stay relevant in the long run.

2.3.6.2 Pre-requisites

Evaluation stage is linked with all other elements of ADDIE, so that work is performed in an iterative way, which allows to get feedback and improve quality faster. Apart from inputs defined in Analysis phase which will be guiding the Evaluation, also other stages where some tests and feedback take place are providing input for Evaluation (which in turn returns improvement ideas).

2.3.6.3 Best practices

Ensuring high-value quality of training materials implies setting up homogenous and continuous evaluation processes from the creation to the final use. Regarding the application form, evaluation processes are executed by internal and external evaluators that are defined, by reference to the Quality assurance and management plan, as:

- **Internal evaluators** are senior members of the DigiFoF consortium (one per partner);

[33] GoToWebinar shows during the session information about students which are potentially not attentive because GTW is not their main window (which may mean they are multitasking). In a similar way, many learning platforms provide statistics showing whether students watch the videos fully, which content do they skip, where do they drop out etc.

- **External evaluators** are senior members in their field. When senior members are more involved in upstream evaluation work, it will be also interesting to collect evaluation feedback from the learners directly concerned by the trainings.

As mentioned above, evaluation must be organized at different steps in order that the training materials do not remain monolithic blocks quickly losing their interest. Evaluation could rather be seen as a way of maintaining the relevance of the content by making some changes if needed. We identify three different steps where evaluation is necessary:

- When the training materials have just been created: it will be important to get a review based on the content quality, relevance of skills/knowledge, adequacy with the project's requirements… This evaluation will be made on the basis of a template and must be done at the very latest 15 days before the planned date of the first use of the reviewed training. The training editor will receive the completed evaluation templates to take into account any useful remarks and will present a new and final version of the training. The validation process of each training will be subject to a conference call between the consortium members who will agree or not with the launching of the training.
- During the trainings, according to a formative approach, teachers may be brought to set up continuous evaluation for their learners in order to foster learning progress and to advise both teachers and learners of what is achieved and what needs to be improved.
- After the trainings, feedback from learners will be something utmost to collect in order to identify good and bad points, fulfilled expectations and those which are not… Post-trainings evaluation should be used as a satisfaction survey to help trainings authors/editors to adapt their production.

Proposed templates for this step can be found in Appendix A (5.10 Template for evaluation of trainings and 5.11 Template for post-training evaluation).

3 Performance indicators

3.1 QA indicators

As already mentioned at the beginning, goal of this document is to improve the quality of the training materials produced within DigiFoF project.

In order to measure the impact of the proposed improvements following performance indicators are suggested:

a) Number of materials (content such as course modules, slides, other outputs mentioned in this document as well as other DigiFoF deliverables, etc.) for which Quality Assurance was performed using the proposed checklists.
b) Assessment of partners preparing trainings regarding impact of this document on a training quality.

For a first performance indicator suggested target value is 75 materials.

For a second one suggested indicator is based on a survey among project partners and has a target of 4 on a 1-5 scale where 1 means strong negative impact on quality, 3 – no impact on quality, and 5 – strong positive impact on quality.

4 Conclusion and outlook

4.1 Summary of the document

The following document provided a brief overview of various aspects influencing the quality of trainings.

Readers learned about the various approaches towards training preparations including ADDIE. Overview of the ADDIE stages was provided along with best practices and suggestions for the DigiFoF project partners.

In addition, checklists which can facilitate training preparations were provided.

4.2 Outlook and evolution plan

After the second version of this document is provided to the project partners first round of feedback and updates from partners is expected.

Resulting version with consolidated feedback will be then passed again to DigiFoF partners for translation according to the project plan.

Translated versions will be used for the purpose of training preparations. Depending on the feedback from end users (i.e. people using templates and checklists from this document as well as the content of the document itself during work on training materials) this document and/or checklists will be updated.

5 Appendix A - checklists and templates

5.1 Checklist for training needs analysis

☑	Questions to ask	Answers
	What are your employees doing that they shouldn't be doing?	
	What specific things would you like to see your people do, but don't?	
	When you envision workers performing this job properly, what do you see them doing?	
	What prevents you from performing a prescribed task to standards?	
	Are job aids available and if so, are they accurate? Are they being used?	
	Are the standards reasonable? If not, why?	
	If you could change one thing in the way you perform your work, what would it be?	
	What task would you like to see your workers trained on? What would you like to be trained on?	
	What new technology would benefit you the most in the performance of your work?	
	What new technology would you like to see invented to help you with your work? Why?	

5.2 Checklist for establishing goals

☑	Questions to ask	Answers
	What does your course aim to teach?	
	What is an expected final level of (here please describe a competence or skill) after a course?	
	What knowledge and skills it will impart to the learners who complete it?	

5.3 Checklist for audience analysis

☑	Questions to ask	Answers
	Who is the primary target audience for the course? (e.g. new hired engineers).	
	What is the typical background of the students/participants who will undergo the program? Personal and educational information such as age, nationality, previous experiences and interests should be determined.	
	What are the past knowledge levels, experiences, interests, cultural background etc. of the learners?	
	What will be required in terms of skills, intelligence and physical/psychological action-reaction? (e.g. language or software skills)	
	What type of learning environment is preferred?	
	Who will be using the learning materials you produce for studying?	

5.4 Checklist for constraints analysis

☑	Questions to ask	Answers
	Are there any limitations imposed by the rules of the organization you design for that need to be taken into account?	
	Is the overall length of the course or the time allotted to the study of individual modules limited in any way?	
	In what setting the education will take place? In a physical classroom/auditorium, or remotely?	
	Do the physical rooms meet all the requirements of the course, or can those requirements be met should the need arise?	
	Will the setting impact the effectiveness of education?	
	Does one option for online or face-to-face? Or a blend of both?	
	If online is preferred what will be the difference in learning outcomes between classroom-based learning and web-based learning?	
	What are the Pros and Cons between online- and classroom-based study?	

	What type of learning environment is preferred?	

5.5 Checklist for course structure analysis

☑	**Questions to ask**	**Answers**
	Do you need to split the course into individual modules and include step-by-step instructions?	
	At what key points do you need to test the acquisition and retention of knowledge?	
	What weight is to be assigned to each test?	
	Will the modules differ in size and importance?	
	How will the learners use the course material in the future?	
	Determining limiting factors to the overall goal of the project. What limiting factors exist with respect to resources, including technical, support, time, human resources, technical skills, financial factors, support factors?	

5.6 Checklist for knowledge sources analysis

☑	**Questions to ask**	**Answers**
	Who or what will serve as the main source of information?	
	Are the necessary information sources available in-house, or will they have to be found elsewhere?	
	Is information about the course's topic available on the Internet? Is it easily accessible?	
	Are there any materials on the topic that have already been written/created? Perhaps a different course that was used in the organization before?	
	Are there Subject Matter Experts (SMEs) within the organization that can help you work on the course by sharing their knowledge and expertise?	
	Will the said Subject Matter Experts be available to assist you with preparing the course?	

5.7 Checklist for evaluation criteria analysis

☑	Questions to ask	Answers
	How exactly the students will be graded after the completion of the course? Will you use small timed tests that will be graded, or will the effectiveness of the course measured by the practical skills the learners acquire after completing it and the corresponding increase in productivity?	
	If you plan to assign grades to learners, what will be the passing grade, and will a learner be able to pass a failed test again to improve their result?	

5.8 Checklist for design

☑	Questions to ask	Answers
	Is the design based on needs assessment?	
	Are the objectives reflected in course design?	
	Is the structure clear and helpful for students and trainers?	
	Was the design subject to review and approval?	
	Are the assessments considered in design?	
	Are there inputs needed by Development phase?	

5.9 Checklist for content development

Aspect	☑	Requirement	Answer
Feedback		Content is based on results of previous ADDIE phases	
		Initial feedback was gathered on a basis of rapid prototypes of content	
		Feedback was gathered for every content section	
		Tests were performed by a proper team	
		Content contains activities and assessments appropriate for the delivery mode, learning objectives, and course specifics	

		Tests covered accessibility and inclusiveness/non-discrimination	
		Tests covered grammar and spelling	
		Tests covered overall structure of the content	
		Tests covered consistency in look and feel of the content	
		(where appropriate) Tests covered navigation and technical aspects	
		Training pilot was performed to get real-life feedback	
Technology		Technology selected supports inclusiveness and is easy for the end users	
		Technology selected facilitates engaging users	
		Technology selected allows providing users needed content in a proper moment and in a convenient way (e.g. models needed for training) are available for download in advance, additional materials are available during the training, some extra content for students is available after the training.	
Content		Content was creating common and consistent templates	
		"Nice to know" vs "Need to know" analysis was performed	
		Content was analysed regarding potential of enhancing performance	
		Blocks of lecture are mixed with activities bosting engagement and knowledge recall	
		Content contains industry case(s)	
		Content contains high quality media supporting learning	
		Licensing for all materials used was checked	
		All citations are properly attributed	

5.10 Template for evaluation of trainings

WP and task:	
Training title:	
Main author/editor (Institution, Person):	
Date of production:	
Evaluator (Institution, Person):	
Date of evaluation:	

Training format: (Online/On-site)	
Training nature: (Theoretical/Applicative/Both)	
Training planned duration:	
Thematic(s):	
Target group(s):	
Summary and learning objectives:	

1/ Project objectives and requirements			
Question	**Answer**	**Comments**	**Recommendations**
Is the training compliant with the project requirements?	☐ Yes ☐ No ☐ Partially		
Is the training compliant with the WP objectives and correctly dealing with the application form expectations?	☐ Yes ☐ No ☐ Partially		
2/ Content of the training			
Question	**Answer**	**Comments**	**Recommendations**

Is the chosen format of the training the most appropriate notably regarding the target group(s)?	☐ Yes ☐ No		
Is the planned duration of the training the most appropriate?	☐ Yes ☐ No		
Does the training content contain materials (models etc.) to be offered to participants in advance e.g. via web page	☐ Yes ☐ No		
Is (Are) the aimed target group(s) of the training well concerned by the produced content?	☐ Yes ☐ No ☐ Partially		
Is (Are) the subject matter(s) appropriate regarding Industry 4.0 stakes and challenges?	☐ Yes ☐ No ☐ Partially		
Is the training sufficiently well realized to remain relevant in the long run?	☐ Yes ☐ No ☐ Partially		
Could the training nature be qualified as innovative? (i.e. originality of the approach, covered topic(s)…)	☐ Yes ☐ No ☐ Partially		
Quality of the writing	☐ Good ☐ Bad ☐ Needed changes		
3/ Conclusions			
Question	**Answer**	**Comments**	**Recommendations**

Main positive points developed and offered by the training			
Main weaknesses of the training			
Is the training ready to be shared and used? If no, please specify the necessary changes	☐ Yes ☐ No		

5.11 Template for post-training evaluation

Training title:	
Date of training:	
Training location:	
Date of evaluation:	
Training format: (Online/On-site)	
Training nature: (Theoretical/Applicative/Both)	
Training duration:	
Thematic(s):	

1/ Are you satisfied …							
	Not satisfied	**Rather not satisfied**	**Neutral**	**Rather satisfied**	**Really satisfied**	**Comments**	**Recommendations**
By the topic(s) of the training?							
By the format of the training?							

By the duration of the training?							
By the teaching method of the training?							
By the equipment resources used and available?							
By the relevance of the subject matter(s) and industrial knowledge brought by the teacher regarding Industry 4.0?							
By the availability of additional							
By the quality of the writing?							

2/ Conclusions

Question	**Answer**	**Comments**	**Recommendations**
Main positive points of the training			
Main weaknesses of the training			
Do you consider the training valuable regarding your initial expectations?	☐ Yes ☐ No ☐ Partially		
Would you recommend the training?	☐ Yes ☐ No		