EUROPEAN DEFENCE AGENCY

7 August 2020

METHODOLOGY FOR DEVELOPING CYBER DEFENCE TRAINING COURSES

CONTENTS

_Toc47611613

1. Preface and purpose of this methodology

The European Defence Agency (EDA) is an intergovernmental agency of the Council of the European Union that works to support the Member States and the Council in their effort to improve European defence capabilities. Cyber defence comprises measures to respond to cyber incidents or attacks and, as one dimension of cybersecurity devoted to defending military information infrastructures proactively, is one of the priorities in the EDA Capability Development Plan (CDP).

Cyber defence Education, Training and Exercises (ETE) is a critical element of cyber defence as agreed by Member States in the Cyber Defence Strategic Context Case. In support of this, EDA has with Member States developed a programme of cyber defence ETE that seeks to strengthen training and learning at all levels. In addition to that, EDA cooperates with the European Security and Defence College (ESDC) Education, Training, Exercises and Evaluation (ETEE) platform for the integration of developed courses into the ETEE platform.

Within the context, EDA has also developed a pilot course scheme methodology to use for the development of cyber defence training courses. This methodology is designed to guide pilot course developers through a standardised process of how to plan, deliver and evaluate cyber defence training courses.

RAND Europe and Vedette Consulting developed this guide as part of the EDA framework contract 18.CAT.OP.205. The methodology builds upon the pilot course methodology originally developed through EDA Framework Contract on Developing Cyber Defence Capabilities for the Military (frameCyberCAP) (12.CAP.OP.332) and further refined through the delivery of a pilot course on Cybersecurity and Cyber Defence for Senior Decision Makers in 2018 (17.CAT.NP1.323).

2. Introduction to the development of pilot training courses

This methodology guide is designed to assist the development, delivery and evaluation of cyber defence (CD) pilot courses in the context of the European Union Common Security and Defence Policy (CSDP). The methodology documents the process and good practice for each of the steps involved in developing pilot training courses and provides an easily navigated overview of decisions to be taken in each of those steps and what information is required to make those decisions.

The methodology features three main sections that together cover the tasks required across the full lifecycle of a pilot course: Analysis; Design, development and delivery; and Evaluation. As shown in Table 2.1, each section includes several components necessary for successful execution.

Table 2.1 Components of pilot course training design

	Component	Description
Analysis	Target audience and their characteristics	Who is learning?
	Needs and rationale	Why are they learning?
Design, development and delivery	Aims and objectives	Towards which goals are they learning?
	Content	What are they learning?
	Learning activities	How are they learning?
	Teacher role	How is the teacher facilitating their learning?
	Materials and resources	With what are they learning?
	Location	Where are they learning?
	Time	When are they learning?
	Assessment	How is their learning assessed?
Evaluation	Evaluation	How did the delivery of the pilot course go?
	Revision	What could be improved or refined?

Across the three sections, the methodology guide uses coloured boxes, figures and tables to highlight aspects of different pilot course development steps.

Blue boxes, figures and tables
Blue boxes and figures provide essential background or contextual information necessary to design and develop pilot courses.

Green boxes and figures

Green boxes and figures explain essential concepts in pilot course development, as well as providing guiding questions to explore critical steps in designing and developing training.

Orange boxes, figures and tables

Orange boxes, figures and tables provide practical examples of the output of pilot course design and development steps.

3. Analysis of pilot course requirements

The starting point for the design of any CD pilot course is the fundamental question of why the training is required. This involves analysis of the pilot course target audience, their characteristics and training needs, as well as the overarching rationale for the course.

The starting point for the design of any CD pilot course is the fundamental question of why the training is required. This involves analysis of the pilot course target audience, their characteristics and training needs, as well as the overarching rationale for the course.

	Component	Description
Analysis	Target audience and their characteristics	Who is learning?
	Needs and rationale	Why are they learning?

Four overarching questions can guide the analysis of training requirements:

1. Who is the target audience for the training? *(i.e. who is the training for?)*
2. What function does the target audience currently have? *(i.e. what is their role or occupation?)*
3. What are the gaps between what the training audience knows and what they need to know to carry out their function? (*i.e. do they acquire additional knowledge or practice to carry out their work?*)
4. Would a new training course help solve those gaps? *(Noting that additional training may not always be the best way to address the gaps).*

This chapter will explain how to identify a training target audience, understand their characteristics, identify training needs, and articulate the rationale for a CD pilot course.

3.1 Identify the target audiences

The first step in the development of a pilot course is to define the target audience for the envisioned training (*i.e. who is the training for?*). A clear description of the target audience will help to design the pilot course in several ways:

- A clear target audience facilitates the identification of training needs and pilot course rationale.
- An understanding of the training audience characteristics helps ensure that interventions are scoped and scaled at the right level, as well as appropriate to the trainees' requirements.

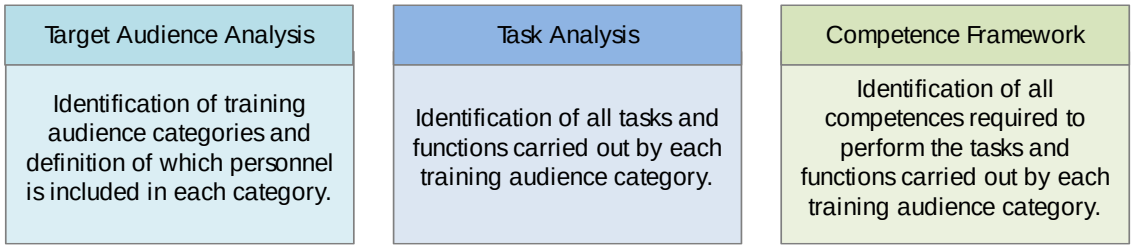
A Target Audience Analysis (TAA) performed as a part of a wider Training Needs Analysis (TNA) can be used to identify the appropriate target audience for a pilot course.

A **Training Needs Analysis (TNA**) is the process by which an organisation identifies the training and development needs of its employees so that they can do their job effectively.

A Task Analysis is typically done at the beginning of a TNA to ensure that it is clear what is done by individuals within each Target Audience category. A formally defined competence framework or taxonomy may further assist the identification of competences required to perform specific tasks or functions carried out by that audience.

Figure 3.1 provides an overview of the objectives and relationships between a Target Audience Analysis, Task Analysis and Competence Frameworks.

Figure 3.1 Overview of the relationship between TAA, TNA, tasks and competences



Source: EDA (2014).

Within the context of CSDP, EDA has developed standardised target audience categories with associated tasks and required competences. All pilot courses should therefore ideally use this framework for CSDP CD training to ensure coherence in approach.

Table 3.1 Overview of CSDP CD Target Audience categories

Category	Component
ICT Users	All military and civilian personnel that interact with networked digital data through officially provided and/or privately-owned ICT. Everyone is, in one way or another, part of ensuring the confidentiality, integrity and availability of information that they engage with (if to differing degrees and requiring different levels of knowledge/skill).
Senior Decision Makers	This category encompasses all of the senior military and civilian personnel who are required to make decisions that should be informed by CD considerations.
C4 Practitioners	This category encompasses junior and middle-ranking military and civilian personnel who have generalist or non-CD specialist roles. Such personnel are not directly required to implement CD measures, but may still oversee, work closely with, or support those who do. They often have to make routine decisions in which CD should be a key consideration. Their roles also entail the provision of CD-informed advice to, and the development of CD-informed plans for, Senior Decision Makers.
CD Specialists	This category encompasses military and civilian personnel working in CD-specific roles who are required to undertake relatively narrowly bounded and/or technically complex CD activities.

Source: EDA (2014).

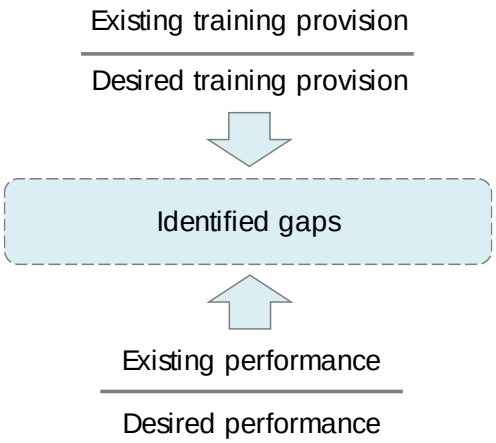
To support this analysis, EDA can provide the full EDA CSDP competence framework and latest versions of the associated documentation upon request by pMS. For the sake of brevity, this methodology guide uses Senior Decision Makers as an example training audience category, which is used throughout the document to give practical examples of key steps in the development of pilot courses.

3.2 Identify the training needs

Once the training audience has been identified, and its characteristics, expected tasks and competence requirements are known, the next step in designing a pilot course involves identifying the training needs of the target audience (*i.e. what is their role or occupation and do they need to acquire new knowledge to carry out their work?*).

A training gap can be of two types: a gap in terms of the difference between current training provision and desired training provision, or, the difference between desired performance and current performance. Within the context of cyber defence training related to CSDP, the focus is most often on differences between current training provision and desired training provision.

Figure 3.1 Two ways of identifying a particular training gap



An inventory of currently available training compared to the required or desired training may uncover potential gaps in training provision. This type of inventory or gap analysis can be *structured* (e.g. through formal surveys or questionnaires distributed to managers or potential trainees) or *semi-structured* (e.g. through brainstorming sessions, facilitated discussions, or workshops).

Performance-based gaps may be more challenging to identify. The identification of performance-based gaps typically requires a performance baseline, or the use of standardised performance assessment criteria tailored to the relevant target audience. A competence framework may help pilot course developers to understand where performance gaps currently exist.

A **Competence Framework** defines the knowledge, skills, and attributes needed for people within an organisation. All roles or categories of professionals will have its own set of competences required to perform the job effectively.

Bloom's types of cognitive learning are often used to structure competence frameworks.[1] This methodology follows the EDA CSDP CD Competence Framework, which uses a simplified version of Bloom's taxonomy with four categories: Understand, Apply, Analyse and Evaluate, as shown in **Error! Reference source not found.**.[2]

These categories are ordered from simple to complex and from concrete to abstract. They are also structured in a cumulative hierarchy, meaning that mastery of each simpler category is a prerequisite to mastery of the next, more complex one.

Figure 3.3 Types of cognitive learning in the EDA CSDP CD Competence Framework

Understand (Exhibit a sound understanding of previously learned material by recalling appropriate facts, terms and concepts)	**Apply** (Effectively apply an understanding of appropriate facts, terms and concepts in both familiar and new situations)	**Analyse** (Categorise information, identify motives, discern causality, make inferences and find evidence with which to address hypotheses)	**Evaluate** (Express and justify opinions by making sound judgments about the utility of information, the validity of ideas or the quality of work, based on an appropriate set of criteria)

Source: EDA (2014).

Error! Reference source not found. provides a practical example of competence descriptions for the Senior Decision Maker training audience category.

Table 3.2 Example of competence description

Task	Understand	Apply	Analyse	Evaluate
Provide CD-informed advice to political leaders on foreseen and impending CSDP Military Crisis Management Operations (CMO)	Understand how CD-informed advice is provided to political leaders regarding foreseen and impending CSDP Military CMO	Contribute to the formulation of CD-informed advice to political leaders regarding foreseen and impending CSDP Military CMO	Formulate CD-informed advice to political leaders regarding foreseen and impending CSDP Military CMO	Provide CD-informed advice to political leaders regarding foreseen and impending CSDP Military CMO

Source: EDA (2014).

Analysis or comparison of competences currently displayed by the target audience with competences expected of the role may therefore reveal training needs. For example, Senior Decision Makers may be expected to display competence to the level of 'evaluate' when providing CD-informed advice to political leaders on foreseen and impending CSDP Military Crisis Management Operations (CMO). Senior Decision Makers who do not display the expected level of competence may, therefore, require additional training.

[1] Bloom's taxonomy is a hierarchical ordering of cognitive skills that can help course developers and students structure and engage in training. Bloom's six categories of cognitive learning include: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. See e.g. Bloom et al. (1956).
[2] EDA (2014).

Box 1 Example of training gap for Senior Decision Makers in the context of CSDP CMO planning

No current training for this audience on this topic has been identified in the Training Needs Analysis. Cyber defence is currently not well embedded within the planning process for CSDP CMO. Senior decision makers have a role in ensuring this happens effectively.

Source: EDA (2015).

3.3 Articulate the pilot course rationale

Once a gap has been identified, it is essential to consider if a new training course would help address the particular gap in question (noting that additional training may not always be the best way to solve the gaps). If a training course is a feasible way forward, the box below features a selection of guiding questions that may help conceptualise the rationale for the pilot course. Note that these questions should be used to facilitate discussion and do not necessarily need to be answered at this stage of the design process.

Box 2 Guiding questions to explore pilot course rationale

- What information or content do we want participants to learn from the training?
- What do we want them to do with that information?
- What skills or competencies do we want them to gain, develop, expand, or improve?
- What kind of higher-level thinking do we want them to engage in?
- How do we expect participants to demonstrate what they have learned and how well they have learned it?
- What should participants know and be able to do when they finish the training?
- How do we think they will be able to use the information and skills that they develop?
- If someone asks the participants what they learned from your training, how would we like them to answer?

Source: MSB (2012).

The finalised pilot course rationale should consist of a concise paragraph that provides the overarching justification for the training.

Box 3 Example statement of pilot course rationale for senior decision makers

As the role of cyber defence is evolving in the context of CSDP CMO, senior decision makers may be unaware of their specific roles and responsibilities in this domain. This target audience may have had cyber defence responsibilities previously in their careers (either as C4 practitioners or cyber defence specialists), and it is crucial that they understand where their roles and responsibilities are now different.

Source: EDA (2015).

3.4 Analysis of target audience characteristics

Before starting to design a pilot course, it may also be worthwhile considering the particular characteristics of the training target audience to guide the development process. Training audiences may have different characteristics such as previous education, job experience and training backgrounds, which may in turn influence, for example, what types of learning activity would be most suitable. A deeper characterisation of the training audience may as such help ensure that the design and development of the pilot course is fit-for-purpose and well suited to the envisioned participants.

Training audience characteristics are typically categorised as being cognitive, physiological or social in nature, as illustrated in Table 3.3.

Table 3.1 Overview of learner characteristics:

Cognitive characteristics	Physiological characteristics	Social characteristics
Cognitive learning style	Affective characteristics	Feelings toward authority
General aptitudes	Age	Relationships with peers
General world knowledge	Anxiety level	Tendencies toward cooperation or competition
Language development level	Attitude toward learning	
Learning strategies	Attitude toward the subject matter	
Level of visual literacy, ability to learn from graphics	General health	
Prior knowledge	Interests	
Reading level	Motivation	
	Sensory perception	

Source: EDA (2015).

Adult learners, and particularly experienced professionals, also have several specific characteristics that may be useful to consider when conceptualising CD pilot courses for CSDP. Adults often bring a great deal of experience and knowledge to training and are motivated by information or tasks that they find meaningful and relevant to their roles. However, adult learners may also be concerned about their professional image when participating in training (and conducting training in a multinational setting may add further political and institutional pressure in this regard), or come across as impatient if they perceive that the training is not adding value given the other professional and personal demands on their time.

Adults learn best when…	Methods to meet adult learner needs
They feel valued and respected for the experiences and perspectives they bring to the training situation.	Elicit participants' experiences and perspectives through a variety of stimulating activities.
The learning experience is active rather than passive.	Actively engage participants in their learning experience through discussion and a variety of activities.
The learning experience fills their immediate needs.	Identify participants' needs; develop training concepts and learning objectives to these identified needs.
They accept responsibility for their learning.	Make sure that training content and skills are directly relevant to participants' experiences so that they will want to learn.
Their learning is self-directed and meaningful to them.	Involve participants in deciding on the content and skills for the training.
Their learning experience addresses ideas, feelings, and actions.	Use multiple training methods that address knowledge, attitudes and skills.
New material relates to what participants already know.	Use training methods that enable participants to establish this relationship and integrate new material.
The learning environment is conducive to learning.	Take measures to ensure that the physical and social environment (training space) is safe, comfortable and enjoyable.
Learning is applied immediately.	Provide opportunities for participants to apply the new information and skills they have learned.
Learning is reinforced.	Use training methods that allow participants to practice new skills and receive prompt, reinforcing feedback.
Learning occurs in small groups.	Use training methods that encourage participants to explore feelings, attitudes and skills with other learners.
The trainer values participants' contributions.	Encourage participants to share their expertise and experiences with others in training.

Source: MSB (2012).

It is unlikely that the pilot course can accommodate all training audience characteristics and the needs of every individual learner. However, it is nevertheless useful to consider in which ways these characteristics may influence the training design and content. Table 3.4 provides an overview of training aspects that could be informed by the target audience's key characteristics.

Table 3.2 Key training aspects informed by the target audience characteristics

Training structure	Delivery considerations	Contextual considerations
Amount of structure Medium Grouping of trainees Response mode (oral, written, exercise, workshop, on-line etc.) Type of feedback given after practice items	Speed of presentation (pace) Techniques for gaining and focusing attention and frequency of these techniques Level of concreteness/ abstraction Size of instructional chunks Amount of time allowed Amount and type of learning guidance	Context of the examples and practice items Number and difficulty of examples and practice Terminology used

Source: EDA (2015).

CD course developers should therefore keep these training audience characteristics and their implications in mind throughout the steps to design, development and deliver any pilot course. Building on the analysis of requirements phase, as set out in this section of the methodology report, the following chapter explains the subsequent design, development and delivery phase in more detail.

4. Design, development and delivery of pilot course

Course design refers to the planning and structuring of training to achieve specific instructional goals, and the course design process includes the following activities:

Design, development and delivery	Aims and objectives	Towards which goals are they learning?
	Content	What are they learning?
	Learning activities	How are they learning?
	Teacher role	How is the teacher facilitating their learning?
	Materials and resources	With what are they learning?
	Location	Where are they learning?
	Time	When are they learning?
	Assessment	How is their learning assessed?

The following sections describe each of these activities in further detail.

4.1 Identify learning aims and objectives

The core of designing a pilot course curriculum is identifying the learning objectives (LOs) that the training should achieve. These are statements that describe what participants should be able to do as a result of completing the training. LOs form the basis for *what* is to be learned (in terms of knowledge and/or skills), *how well* it is to be performed, and *under what conditions* it is to be performed.

LOs often use types of cognitive learning to describe what needs to be learned. As with the competence descriptions in Chapter 3, this methodology follows the EDA CSDP CD Competence Framework, which uses a simplified version of Bloom's taxonomy with its four categories: Understand, Apply, Analyse and Evaluate.[3] LOs should be specific, performance-based and aimed at producing results that are observable or measurable. Therefore, LOs use **action verbs** that reflect the desired performance or behaviour after the training. **Error! Reference source not found.** shows an overview of action verbs matched to the four types of cognitive learning and **Error! Reference source not found.** features some example LOs for a CD pilot course for Senior Decision Makers.

[3] EDA (2014).

Table 4.1 Example action verbs to formulate learning objectives

Understand	Apply	Analyse	Evaluate
Convert Describe Discuss Estimate Explain Express Identify Restate Translate	Apply Compute Demonstrate Employ Illustrate Interpret Operate Operationalise Perform Practice Relate Use	Appraise Categorise Classify Compare Critique Differentiate Distinguish Inspect Judge Monitor Research Review Select Solve	Assess Compare Estimate Evaluate Judge Measure Revise Score Test Value

Source: EDA (2015); MSB (2012).

Box 4 Example LOs for a CD pilot course for Senior Decision Makers

1. Understand the complexity of cyber defence, the variety of the threats faced, the main principles to apply and the numerous measures that can be implemented.
2. Understand and apply appropriate aspects of Strategic Threat Assessment to Cyber, within a broader Operational Risk Management approach.
3. Be able to shape appropriate Cyber Defence Objectives to inform detailed planning, including Cyber Vulnerability and Cyber Risk Assessment.
4. Be able to direct application of appropriate CD controls, judge the adequacy of draft contingency plans, and make sound accreditation decisions.

Source: EDA (2015).

Well-formulated LOs can then be used to help decide which content needs to be developed to deliver the pilot course and achieve the LOs.

4.2 Identify content and relevant learning activities

The LOs should inform what kinds of content that must be taught and learned in the pilot course. The box below shows questions that CD course developers can consider helping identify the appropriate learning content.

Box 5 Guiding questions to identify training course content

- What should trainees already know or be able to do (prior knowledge and skills)?
- What kinds of content must be learned?
- In what size segments should the content be presented?
- Should information be presented (i.e. theory), or should the content be embedded within an activity (i.e. practice)?
- In what sequence should the content be presented?

Source: EDA (2015).

These types of questions should enable CD course developers to identify the appropriate training activities and the methods for the pilot course being designed. Box 6 shows example learning activities and methods related to their LO.

Box 6 Example content identification based on LOs

LO: Identify the complexity of the cyber defence, the variety of the threats, the main principles to apply and the numerous measures that can be implemented.

Session 1: Refresher on cyber defence
Method: Presentation, with practical examples

The primary purpose of this module is to act as a refresher on the topics that senior decision makers are likely to have encountered earlier in their careers with regards to cyber defence and provide an opportunity to apply them in their new context. Furthermore, the module aims to refresh knowledge of concepts that are likely to have changed since the participants last learnt about them (e.g. the threat landscape, EU doctrine, etc.), such that they can with confidence apply these foundational concepts in the rest of the modules.

Module sessions:
- What is cyberspace?
- What is cybersecurity?
- Establishing cybersecurity needs
- The threat landscape
- Implementing (defensive) cyber defence
- State of the art of EU cyber defence
- Some challenges for senior decision makers

Source: EDA (2015).

Based on the LOs and envisaged training content, course designers should then identify the relevant training activities – i.e. things trainees will do to learn. Training activities can take many different forms including, for example, lectures, discussion, exercises and case studies. Helpfully, types of training activities can also be associated with types of learning to facilitate the choice of training activity, as illustrated in Table 4.2. An example learning activity description based on an LO can be found in Box 7.

Table 4.2 Types of training activities for selected cognitive learning levels

Understand	Lectures Question-and-answer Presentations Small group discussions Exercises/tests Review sessions Teaching others Independent study Web-based instruction Didactic questions	**Analyse**	Exercises Case studies Critical incidents Essays Journal critiques, article discussion Panel discussions Mapping Audio/visuals Question-and-answer Brainstorming Problem-solving Troubleshooting Role-playing
Apply	Drills and practice Demonstrations Role-playing Simulations Cooperative learning Field observations Audio/visuals Hands-on experience Labs Case studies Live/video demonstration Teaching others Guided practice	**Evaluate**	Case studies Projects Simulations Panel discussions Comparison activities Audio/visuals Critical review Self and group assessment/reflection Reflective writing Multi-media activities Computer-based tutorials Asynchronous online forum

Source: EDA (2014).

Box 7 Example learning activities based on LOs/training content

LO: Identify the complexity of the cyber defence, the variety of the threats, the main principles to apply and the numerous measures that can be implemented.

Training activities: In a face-to-face engagement, deliver a presentation including practical examples both from the military and civilian sectors assisted by PowerPoint.

Source: EDA (2015).

4.3 Define the teach role

In addition to the training activities, the role of the teacher should be defined to enable the best possible training delivery and achievement of LOs. A generic training course can be seen to comprise nine interrelated events in which the trainer has various roles and may engage the trainees through different activities, as illustrated in Table 4.3.

Table 4.3 Overview of training events and the associated teacher role

Event	Function	Examples activities
Gain attention	To focus participants' attention on the task.	Ice breaker activities, current news, case studies, shocking examples, sounds, graphics, games, etc.
Inform trainees of objectives	To inform participants about the purpose of the lesson or activity.	Include learning objectives in lectures, slides, instructions for activities, etc.
Stimulate recall of prior learning	To allow participants to build on their previous knowledge or skills.	Recall event from previous activities, relate previous information to current theory or practice.
Present the content	To allow participants to access the content and materials they will be learning.	Lectures, readings, activities, multimedia, etc.
Provide learning guidance	To assist how to use learning strategies effectively.	Guided activities, instructions, timelines, expectations, instruct to make concept mappings, etc.
Elicit performance (practice).	To allow participants to apply knowledge and skills learned.	In group or individual projects, written activities, practical/hands-on activities, etc.
Provide feedback	Informative feedback to allow participants to consider information about the appropriateness of their responses during practice.	Show what has been done correctly and what to improve and why. Use rubrics,
Assess performance	To allow participants to see areas or competences they have not yet mastered or whether they have achieved the goals.	Exams, quizzes, games, projects, practical exercises, on-line assessment tools, etc.
Enhance retention and transfer to the job	To allow participants to apply what has been learned to the personal context or a variety of circumstances. Continuum near transfer (similar situations) to far transfer (unfamiliar situations).	Provide opportunities to relate work to the personal context or other work context.

Source: EDA (2015).

It is essential to consider the role of the trainer for each of the pilot course training sessions, as the trainer may perform different functions depending on the content of the training.

Box 8 Example trainer role description in pilot course plan

Aims and objectives *(i.e. toward which goals are they learning)*

Enable senior decision makers in EU Member States and EU structures to better tackle the challenges associated with cyber defence as part of the planning of EU CSDP CMO.

Content (i.e. w*hat are they learning?)*

Their role as senior decision makers in operational planning, taking into account cyber defence.

Learning activities *(i.e. how are they learning?)*

One day intervention, overnight stay, evening speaker, networking event, interactive, adult-learning.

Teacher role *(how is the teacher facilitating their learning?)*

Educator, facilitator and user of real-life examples.

Source: EDA (2015).

4.4 Develop training materials

Once the overall design of the CD pilot training course has been set, suitable training materials and resources can be identified and developed. This includes designing and developing training materials appropriate for the chosen learning activities and methods. These training materials must also be designed to enable trainees to meet the stated LOs. Their development is therefore often the most time-consuming step when developing a pilot course, and this typically involves several people and multiple rounds of review, quality assurance and revision to ensure all outputs are fit-for-purpose.

This process covers all materials necessary for the training course, including pilot course documentation (e.g. curriculum and course descriptions), as well as supporting material for individual training sessions for both the trainers and the trainees. The training materials should encompass the inputs that are essential to learning, which include:

- Advance preparation
- Presentation or demonstration
- Application or practice
- Feedback
- Interaction
- Testing

Table 4.4 provides an overview of training inputs and associated example training material.

Table 4.4 Training inputs and example training material

Training input	Example training material
Advance preparation	Course outline including content, learning activities, directions, and timeframes. Student manual including reference handbooks, content and activities. Trainer guides: instructional specifications for the instructor/teacher during training preparation and execution. They outline the specific training steps that must be provided to satisfy the training plan. It is best structured as a series of outline lessons, providing key points for the instructor to stress, some sample questions to ask, appropriate timings, other instructional tips, etc.
Presentation or demonstration.	Easily understandable presentation notes with support materials for each session (e.g. PowerPoint, overheads, participant worksheets, and handouts). Participant opportunities for building on what they have previously learned.
Application or practice	Question banks and some sample tests; e.g. in a numbered sequence with guidance on where and when they should be used during the course. Participant opportunities for building on what they have previously learned.
Feedback	Feedback forms or questionnaires.
Interaction	Active learning exercises (e.g. role plays, group discussions, case studies, brainstorming, and skills practice) providing opportunities for participants to clarify, question, apply, and consolidate new knowledge and skills.
Testing	Exams, quizzes, games, projects, practical exercises, on-line assessment tools, etc.

Source: EDA (2015).

The box below shows questions that CD pilot course developers can consider when evaluating the appropriateness of different potential options for training material.

Box 9 Guiding questions for selection of training material

Practicality:

- Is the intended material practical? (e.g. available, cost-efficient, time efficient, and readily understood by the instructor)
- Is the material appropriate for the number of available trainers?

Student appropriateness:

- Is the material suitable for the experience level and interest of the trainees?
- Is the material suitable for the characteristics of the target audience? (e.g. group size, computer literacy, etc.)
- Will the material allow the trainees to answer the relevant assessment exercises?

Instructional appropriateness:

- Is the material appropriate to achieve the planned learning objectives?
- Is the material suitable for the planned learning activities and methods?
    - Will the material allow the trainer to present the proposed lesson efficiently and effectively?

Source: MSB (2012), EDA (2015).

4.5 Identify the logistics of the pilot delivery

In addition to the design and content of the pilot course, it is also necessary to consider the logistics of how the pilot course will be delivered in practice. Notably, it is especially useful to reflect on the duration and location of the training. Box 10 features a set of guiding questions that the trainer can contemplate in the design phase in this regard. Decisions on the appropriate training timing and duration will also depend on the resources available to deliver the pilot course.

Box 10 Guiding questions for the timing of the training course

- When are trainees learning?
- What is the optimal number of training days?
- Should the training be held in one day or spread across multiple days?
- How much time is needed for each learning activity?
- Is there a particular date or day of the week that is best suited for the training?

Concerning location, the pilot course delivery can take place in a physical or virtual environment (or combine a mix of the two). Physical, virtual or mixed training environments offer different advantages and disadvantages, as illustrated in **Error! Reference source not found.**.

Table 4.5 Three types of training environments and their advantages and disadvantages

Training environment	Description
Physical location (e.g. classroom)	Bringing the trainees to instruction in a physical location (e.g. auditorium, classroom, lab, etc.), which provides direct access to trainers and learning resources. A physical location allows for trainees to interact with each other and enables the teacher to resolve queries and questions in person.
Virtual location (e.g. online training platform)	The use of a virtual environment enables trainees to attend training remotely, reducing travels costs and time away from their day-to-day work. The virtual environment can also allow direct engagement with trainers and other trainees using text chat or video link. Additionally, a virtual training environment can also let trainees access the training on-demand at their convenience. However, a lack of in-person engagement may reduce the level of engagement between trainees and opportunities for professional networking.
Mixed environment (e.g. using a combination of classroom and online training)	The use of a mixed environment can bridge the benefits of physical and virtual training while alleviating some of the disadvantages with the respective approaches. However, a mixed environment may be challenging and relatively expensive to implement practically.

Source: EDA (2015).

Additionally, it may also be worth to consider some additional aspects of the chosen training location, as shown in Box 11.

Box 4 Additional logistics consideration

- How are trainees registering for the pilot course?
- How are trainees accessing relevant pre-training information (e.g. schedules, pre-readings, etc.)
- How are trainees accessing the training location?
- Do trainees require on-site accommodation?
- Have suitable arrangements been made for food and refreshments?
- Does the training location have all facilities required? (e.g. computers, projection equipment, whiteboards, etc.)

4.6 Develop assessment approach

An assessment exercise can be used in the CD pilot course to test the extent to which trainees have or have not met the stated LOs. However, the inclusion of an assessment is not mandatory, and some senior professionals may even be reluctant to undergo formal assessments as part of a pilot course. Course developers should carefully consider the choice of assessment.

There are two general assessment approaches to consider:

- **Knowledge or cognitive assessments**, typically including written questions in various formats.
- **Performance or skills-based assessments**, typically entailing practical tests of relevant skills in relevant and realistic scenarios.

Error! Reference source not found. features an overview of the main advantages and disadvantages of different assessment types.

Table 4.6 Overview of advantages and disadvantages of assessment types

Assessment approach	Assessment type	Advantages	Disadvantages
Knowledge or cognitive assessment	Objective-response items, e.g.: - Multiple choice questions - Binary questions (yes/no; true/false) - Matching or resequencing questions	Easy to mark/can be electronically marked Enables the testing of a range of skills Provides structure for answering	Difficult to write Tests limited aspects of the syllabus Not good at testing higher-order skills (e.g. problem-solving or subject mastery)
	Short answer and extended-response questions or essays	Relatively easy to set Better at testing higher-order skills, e.g. synthesis, evaluation Learners have the opportunity to define the scope of the response	Less useful for testing knowledge directly Subject to construct-irrelevant variance (e.g. writing skills) Marking is more subjective
Performance or skills-based assessments	Checklist assessment	Authentic mode of assessment Clear connection to learning objectives	Challenging to write marking schemes for and to assess consistently Issues related to manageability, with regards to time, space, etc.
	Rating-scale or rubric assessment	Authentic mode of assessment Clear connection to learning objectives Enables evaluation of how skilfully the trainee can perform objectives	Challenging to write marking schemes for and to assess consistently Issues related to manageability, with regards to time, space, etc. Marking is more subjective

Source: EDA (2015).

When formulating assessment questions, it is essential first to identify the topic and knowledge, understanding or skills that the question will assess. The assessment question should be easy to understand and linked to one of the pilot course's LOs. It may also be helpful to consider the possible correct or minimally acceptable answers to evaluate the appropriateness of the assessment question.

Box 12 features additional guiding questions to consider when evaluating assessment questions.

Box 12 Guiding questions when evaluating assessment questions

- Will trainees understand this question/task?
- Does the question adequately indicate what trainees need to do?
- Has all the necessary information been provided?
- Is the wording precise and the question laid out clearly?
- Will trainees know what kind of an answer is expected?
- Is there anything about the question that may distract or mislead the trainees?
- Is the marking scheme detailed enough?

Source: EDA (2015).

4.7 Example of pilot course overview

To summarise the steps taken to develop a CD pilot course and to illustrate the logic of the pilot course methodology, Table 4.7 provides an example pilot course overview that provides short descriptions for each of the steps described so far in this report. These descriptions would form the foundation for the pilot course and its associated curriculum and materials.

The EDA CD TEXP platform hosts full examples of pilot course documentation and associated curricula, training materials, and evaluations that are available to relevant pMS points of contact.

Table 4.7 Example pilot course overview

Curriculum component	Description	Approach / rationale
Target audience	Why are they learning?	No current training for this audience on this topic as identified in EDA Pan-European Cyber Defence Training Needs Analysis.
Rationale	Toward which goals are they learning?	Enable senior decision makers in EU Member States and EU structures to better tackle the challenges associated with cyber defence as part of the planning of EU CSDP CMO.
Aims and objectives	What are they learning?	Their role as senior decision makers in operational planning taking into account cyber defence.
Content	How are they learning?	One day intervention with an overnight stay and evening speaker. This will provide interactive adult-learning and networking opportunities.
Learning activities	How is the teacher facilitating their learning?	Educator, facilitator and user of real-life examples.
Teacher role	With what are they learning?	Presentations, pen and paper.
Material and resources	With whom are they learning?	Senior decision makers (1* and above) from MS and EU structures with a (past, current or future) role in CSDP CMO.
Location	Where are they learning?	At EDA premises in Brussels, Belgium.
Time	When are they learning?	16-17 September 2014.
Assessment	How is their learning assessed?	Through a paper-based evaluation distributed at the end of the pilot course.

Soure: EDA (2015).

5. Evaluation and revision of pilot course

Designing a training course should ideally be an iterative process of continuous improvement, building on relevant metrics and feedback from previous cycles of delivery.

Evaluation	Evaluation	How did the delivery of the pilot course go?
	Revision	What could be improved or refined?

As such, any CD training course and its constituent components (e.g. curriculum, training materials, etc.) should be evaluated and improved throughout the training's lifecycle, preferably every two years. A continuous evaluation and revision approach will make it easier to ensure that the training is up to date and fit-for-purpose, as well as that learning objectives are reachable and implemented in the best way. This chapter thereby builds on the guidance provided on the analysis (Chapter 3) and design, development and delivery (Chapter 4) phases to ensure relevant indicators of a pilot course's effectiveness are captured and exploited to drive continuous improvement to the benefit of both trainer and trainee alike.

5.1 Evaluate the pilot course

The most obvious and frequent kind of evaluation takes place – either formally or informally – immediately after the training has been delivered (i.e. hot feedback). However, training evaluation can also involve longer-term, follow-up evaluations that seek to measure how trainees have used their learnings in their professional roles (i.e. focused on training outcomes).

The most commonly used approach for evaluation is the Kirkpatrick Model, which identifies four levels of learning and sets out identifiable metrics at each level:[4]

1. **Reaction**, which seeks to evaluate to what degree participants react favourably to the training.
2. **Learning**, which seeks to evaluate the degree to which participants acquire the intended knowledge, skills, attitudes, confidence and commitment based on participation in the course.
3. **Behaviour**, which seeks to evaluate the degree to which participants apply what they have learned during training when they are back on the job.
4. **Results,** which seeks to evaluate the degree to which targeted outcomes occur as a result of the training event and subsequent reinforcement.

The Kirkpatrick Model shows that it is beneficial to evaluate training courses across the four levels to fully understand the learning and behaviour outcomes on trainees. However, most training and pilot course evaluations are confined to levels 1 and 2, as collecting data for levels 3 and 4 is frequently challenging and time-consuming – especially if evaluation needs are not considered earlier on at the design phase, thus making it harder to capture and analyse relevant data on training performance.

At level 1 and 2 evaluation focuses on outcome measures (i.e. which learning objectives have been achieved and what knowledge, skills and competences have the trainee learned as a result of the training). Such evaluations are typically performed shortly after completing the training course, either through a paper-based or online

[4] See e.g. Kirkpatrick (1975).

questionnaire. Evaluations are particularly useful to conduct for pilot courses, as it allows for the opportunity for trainees to have their views reflected in a formative and summative way in the fine-tuning of the training course and broader curriculum for subsequent rounds of delivery.

Box 13 and Box 14 provide examples of both types of evaluation questions.

Box 13 Example evaluation questions tied to learning objectives

My participation in the cyber defence training for SDM has provided me increased insight into the cyber defence concepts relevant to my role as a senior decision maker:
Strongly disagree / Disagree / Neutral / Agree / Strongly agree

My participation in the cyber defence training for SDM will enable me to better tackle challenges associated with cyber defence planning for CSDP CMO:
Strongly disagree / Disagree / Neutral / Agree / Strongly agree

Source: EDA (2015).

Box 14 Example evaluation questions for pilot course refinement

Please provide your overall level of satisfaction with the pilot training course:
(1 [lowest] - 6 [highest])

Please give us feedback on the duration of the course:
(Too short / About right / Too long)

How did you find the balance between training methods (e.g. lecture, discussion and use of scenarios)?
(Too much discussion / About right / Too much lecturing)

Source: EDA (2015).

The outcomes of the evaluation will allow for reflection on the pilot course and enable the development of recommendations for future iterations of the training, as well as possible refinements to the CD pilot course design, content and delivery.

Annex A: Acronyms and definitions list

Acronym	Definition
CD	Cyber defence
CDP	Capability development plan
CMO	Crisis management operations
CSDP	Common security and defence policy
EDA	European Defence Agency
ETE	Education and training
EU	European Union
ICT	Information communications technology
LO	Learning objective
SDM	Senior decision maker
TAA	Training audience analysis
TEXP	Training and Exercise Coordination Platform
TNA	Training needs analysis

Annex B: References

Bloom, Benjamin S. "Taxonomy of educational objectives. Vol. 1: Cognitive domain." New York: McKay (1956): 20-24.

EDA. 2014. Cyber Defence Training Needs Analysis. Framework project on developing Cyber Defence Capabilities for the Military (frameCyberCAP) 12.CAP.OP.332.

——. 2015. CSPD CMO Cyber Defence Curriculum for Senior Decisionmakers. Framework project on developing cyber defence capabilities for the military (frameCyberCAP) 12.CAP.OP.332.

Kirkpatrick. 1975. Evaluating training programs. Tata McGraw-Hill Education.

MSB. 2012. Training Material Development Guide. As of 1 June 2019: https://www.msb.se/en/Products/Publications/Publications-from-the-MSB/Training-Material-Development-Guide/