

A Certification Framework for E-Commerce Digital Competencies

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Abstract

In this paper, we introduce a comprehensive certification framework for digital competencies. This framework delineates the regulations, processes, and administration necessary for executing certification of a particular subset of competencies within the DigComp framework. It stipulates distinct requisites for the methodology employed, assessment instruments, evaluation criteria, and procedures for awarding certificates. The framework encompasses the enhancement of fundamental skills, particularly digital competencies, as well as involving digitally disenfranchised demographics with technology. It can be used to evaluate and certify varying degrees of digital proficiency and to instruct individuals in utilizing essential business-to-consumer e-commerce functionalities.

Keywords

Certification System, DigComp, Electronic Commerce

1. Introduction

Digital competencies are of paramount importance for the prosperity of e-commerce enterprises. In the contemporary digital era, online shopping has experienced a surge in popularity, resulting in the continual emergence of e-commerce businesses [1]. Conventional consumers reap numerous advantages from online shopping, such as reduced prices, abundant vendors, and access to products without geographical limitations, among other benefits. Despite infrastructure and resources, a substantial segment of the global population lacks the fundamental digital competencies required to engage with the e-commerce landscape effectively. In addition to consumers, e-commerce companies necessitate employees who possess advanced skills and an understanding of their clients' competencies, thereby having the ability to interact with the e-commerce process [2].

Digital frameworks, including DigComp, were devised to offer a structured, widely accepted approach to identifying the skills essential for achieving digital literacy. The DigComp framework is an exhaustive model for digital competence and proves highly advantageous for e-commerce businesses and individuals desiring to partake in the digital economy [3].

DigComp is valuable for devising successful digital literacy programs, as it provides a systematic approach to cultivating digital competence for e-commerce, encompassing all facets of the required digital competencies, such as knowledge, skills, attitudes, and values. It also guarantees a high level of consistency across various functions for training employees and consumers. For employees, this ensures alignment with shared objectives and the integration of digital competence throughout the organization [4]. For consumers, it ensures the ability to fully exploit online experiences provided by e-commerce businesses. By employing the DigComp framework, e-commerce businesses can discern skill gaps and areas for enhancement. Training program designers can concentrate their efforts on areas that will yield the most substantial impact on critical digital competencies [5]. By augmenting digital competence, e-commerce businesses can increase efficiency and effectiveness, as can consumers. The potential to foster innovation must not be disregarded [6]. The DigComp framework can facilitate businesses in becoming more innovative by nurturing a culture of continuous learning and improvement. By developing digital competence across the organization, businesses can motivate employees to investigate new ideas and technologies and pinpoint opportunities for innovation. Conversely, consumers who have undergone DigComp-based training can utilize innovative features, thereby participating in the rapidly evolving online shopping experience.

To enable trainees (both employees and consumers) to acquire competencies, a training certification system is necessitated. Such a system constitutes a process or program designed to evaluate and certify the skills and knowledge of individuals who have completed a specific training course or program. Typically issued by a recognized authority in the relevant domain, the certification denotes that the individual has met particular standards and possesses a certain level of proficiency in the subject matter. In this paper, a certification system for essential digital competencies is introduced, applicable to e-commerce employees and consumers. Utilizing DigComp as a foundation, it offers a mapping of skills to competencies (dimension 2 of DigComp) and proficiency levels (dimension 3 of DigComp). The framework maps competencies to general skills that can be employed to derive examples of use, which, in turn, enable the creation of tests suitable for an array of learning scenarios. In this certification system, trainees are presented with multiple-choice questions featuring several correct and incorrect answers. Correct answers are mapped to proficiency levels and assigned a score reflecting the level's advancement (*i.e.*, higher levels receive greater scores than lower levels). This approach necessitates the design of questions with answers corresponding to all levels, a method already employed by other DigComp-related projects, as referenced in the JRC DigComp into an Action Guide [4].

Consequently, it is feasible to design questions that are proficiency level-specific, facilitating a fine-grained certification of skills. This paper's contribution is the introduction of a novel, adaptable framework for certification, which is based on a formal competence framework.

The structure of the paper is organized as follows: Section 2 presents the DIGCOMP framework. Section 3 outlines the architecture and internal interdependencies of the proposed certification framework, while Section 4 elaborates on the certification tools. Examples of implementation are provided in Sections 5, 6, and 7.

2. The DigComp Framework

The Digital Competence Framework (DigComp) is a set of standards and guidelines that describe the digital competencies that individuals should possess to function effectively in a digital society. It is constantly evolving and updated to reflect changes in the digital landscape and the skills needed to navigate it. The European Commission published the latest version of the DCF, the Digital Competence Framework 2.2 in 2022 [4].

- The DIGCOMP framework is organized into five key areas of digital competence.
- Information and Data Literacy: this area covers the ability to search, locate, evaluate, and use digital information effectively and ethically.
- Communication and Collaboration: this area covers the ability to use digital tools and platforms to communicate, collaborate, and work effectively with others.
- Digital Content Creation: this area covers the ability to create, edit, and share digital content, including text, images, audio, and video.
- Safety: this area covers the ability to identify and mitigate digital risks and threats, including cyberbullying, cybercrime, and online privacy concerns.
- Problem-Solving: this area covers the ability to use digital tools and technologies to solve complex problems and make informed decisions.

DigComp contributes to several aspects of education, training and designing services for the users. It is used for clarifying what Digital competencies are, via a common vocabulary. The framework provides a clear and concise definition of the digital competencies that individuals should possess to function effectively in a digital society. This helps educators, employers, and policymakers to understand and communicate what digital skills are necessary for success. DigComp also provides formal guidance for educators to develop digital skills among students. Teachers can use the framework to design digital education curricula, assess students' digital skills, and help students develop their digital competencies [7]. The contribution of the framework to employers must also be noted. It can help employers to identify the digital skills and competencies needed for various job roles. This can help employers to recruit and train employees who have the necessary digital competencies to perform their jobs

effectively. Finally, the framework helps to reduce the digital divide, which is the gap between those who have access to digital technology and those who do not. By defining the digital competencies that are necessary for success in a digital society, DigComp can help to ensure that everyone has equal access to the digital skills they need [4].

3. The Certification Framework

3.1. Structure

The framework identifies the skills involved in the certification system. It provides a mapping of the skills to competencies (dimension 2 of DIGCOMP) and to Proficiency Levels (dimension 3 of DIGCOMP).

3.2. Framework Dimensions

DigComp 2.2 is used as a basis for designing this framework and as such, it follows the same structure.

1) Dimension 1: Competence Areas

This dimension uses 3 out of 5 Competence areas described in DIGCOMP, namely:

- Competence area 1: information and data literacy
- Competence area 2: communication and collaboration
- Competence area 3: digital content creation

2) Dimension 2: Competencies

This dimension uses 7 out of 13 DigComp Competence descriptors for the 3 Competence Areas covered, namely:

Competence Area 1: Information and data literacy

1.1 Browsing, searching, filtering data, information and digital content

1.2 Evaluating data, information and digital content

1.3 Managing data, information and digital content

Competence Area 2: Communication and collaboration

2.1 Interacting through digital technologies

2.2 Sharing through digital technologies

2.3 Engaging in citizenship through digital technologies

Competence Area 3: Digital content creation

3.1 Developing digital content

There is also a partial use of descriptors from Competence Areas 2 and 3.

3) Dimension 3: Proficiency Levels

Four (4) out of the eight (8) proficiency levels of DigComp are used, namely:

Foundation level, including:

- Level 1: Basic level with guidance
- Level 2: Basic level with autonomy

Intermediate level, including:

- Level 3: Well-defined, routine tasks
- Level 4: Tasks, well-defined and non-routine problems

4) Dimension 4: Knowledge, skills and attitudes applicable to each Competence

This dimension includes ecommerce specific skills that are based on DigComp but are more targeted to the ecommerce scope.

5) Dimension 5: Examples of use

Examples of use are e-commerce-specific.

3.3. Design Methodology

The operation of the certification framework requires the design of questions that assess the skills of every Competence Area and Competence included in DigComp, as they were detailed in the previous section. Digital skills can be either generic or related to using ecommerce applications or methods. Both categories of skills need to be mapped to the specific competencies of DigComp. There is a one to many (1 – N) relationship between Competence and skills.

Moreover, skills are Proficiency Level—specific; that is, a skill is mapped not only to a Competence but also to a specific Proficiency Level. These skills are called PL-Skills (Proficiency Level Skills). PL-Skills are the generic digital skills which the trainees of e-commerce are going to acquire during a training programme.

Examples of use are presented for the certification of e-commerce skills. They are derived based on skills and are e-commerce specific. There is generally a many-to-one (N – 1) relationship between mastery and examples of use. From the standards of use, e-commerce-specific skills are derived. These are also included in the skills which e-commerce trainees are intended to acquire during the programme. Generic and e-commerce-specific skills are complementary. The Examples of use, along with the PL-Skills are used to derive questions and answers for the certification tools. The skills are described using the specific terms of each Competence and PL, having in mind the goals of each Competence. Terms such as “identify”, “find”, “explain” and others that appear in the descriptors of Competence in DIGCOMP are used to describe the skills and then to derive examples of use.

Skills are different at each Proficiency Level of each Competence. The descriptors provided by DigComp are quite general and they permit design flexibility. However, this also means a lack of practicality. The structure design differentiates the skills between each PL of a Competence in as clear a way as possible. The differentiation of skills between levels 1 and 2 (foundation level) is based largely on the assistance a trainee needs to perform a task. This is directly and clearly incorporated into the examples of use and the answers that correspond to PL 1 vs. the one that corresponds to PL 2 of a question that assess the knowledge of the skill.

Questions need to be designed to uniformly assess each Competence covering as many PL-Skills as possible and all the e-commerce skills. Answers to Test-I (multiple choice quiz for the trainee) are designed to rate multiple Proficiency

Levels using the same question. Thus, questions of Test I are multi-levelled. This requires not only a micro-but also a macro-management of each Competence. Answers need to cover all PLs (micro-management related to skills) while questions need to cover groups of skills that are relative to each other, and they are also multi-levelled (they correspond to different PLs). These skills are called HL-skills and their goal is to help design questions that fit to different PLs. This is needed because answers to each question do cover all PLs.

HL-skills are internal to the design process of the certification framework. Questions conceptually group the assessment of skills from different PLs based on the semantic resemblance of the descriptors corresponding to each PL. Grouping is performed at a Competence level only. The semantic resemblance is expressed in the descriptors when the same clause is used for completing tasks and the only difference is the type of the action, e.g. “identify” for PLs 1 and, “explain” for PL 3 and “illustrate” for PL 4.

The process of mapping dimensions to each other requires the analysis of each Competence Area into competencies. This is provided by DigComp. The next step is to process each Competence separately as follows: based on the descriptors of each PL, a set of HL-Skills is derived. They are used to design the first version of the questions of the certification tools. In parallel, HL-Skills and descriptors are used to derive the PL-Skills for the specific Level of Proficiency Level of the Competence. From each PL-Skill (or wherever possible, from multiple PL-Skills), the next step designs Examples of Use that are e-commerce specific. By using PL-Skills and Examples of Use, the process 1) refines the questions previously designed to produce the minimum set of questions that cover most skills with the best possible quality of answers and 2) designs the answers for each question. Questions can be generic or e-commerce-specific, focusing more on the latter. This process is repeated for every Competence included in the certification framework. The design of the mapping between dimensions and the production of the certification tools is depicted in **Figure 1**.

Some of the High-Level Skills (HL-Skills) presented in **Table 1** are used for designing an initial version of the questions of the certification tools. They are loosely formed groups of PL-Skills. They express mainly functional tasks to permit the design of practical questions (questions that assess the skills of a trainee in a specific context). They are mostly used in the design of Test II questions where the trainee must be given a particular task in a specific context (scenario) to perform and be rated by the trainer. Specific scenarios define, in a concrete way, the goals to be achieved and at the same time allow the trainee to focus on what is assessed and not on secondary tasks that are not under assessment. This guided certification method reduces the workload of both the trainee and the trainer. Furthermore, it reduces the bias introduced by the distraction of the trainee by secondary tasks. Test I questions are more detailed (since the set of PL-skills is larger than that of the HL-skills), so HL-skills are used for refining the questions and calibration between Test I and Test II questions.

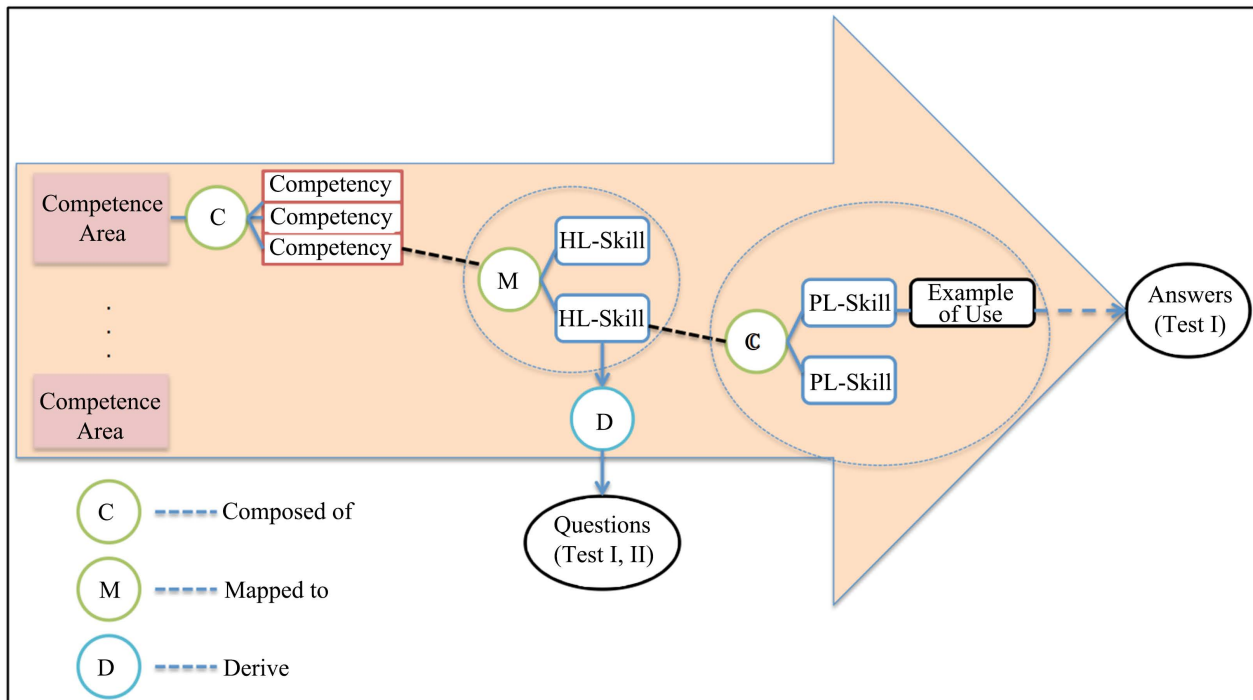


Figure 1. Structure of the framework.

Table 1. Mapping of high-level, e-commerce-specific skills.

| Mapping | Competence | High Level Skills |
|--|------------|---|
| 1.1: Browsing, searching and filtering data, information and digital content | | 1.1.1 Define shopping and information needs |
| | | 1.1.2 Access an eshop meta Search Engine |
| | | 1.1.3 Search using keywords |
| | | 1.1.4 Broaden, narrow or refine a search |
| | | 1.1.5 Search for items in an eshop |
| | | 1.1.6 Access eshop items and relevant information and content and navigate between them |
| 1.3: Managing data, information and digital content | | 1.3.1 Open and save content |
| | | 1.3.2 Organise and store content at an ebasket |
| 2.1: Interacting through digital technologies | | 2.1.1 Join apps for on-line shopping |
| | | 2.1.2 Create a profile in an eshop |
| | | 2.1.3 Add a comment for a product on an eshop |
| | | 2.1.4 Be aware of on-line risks, code of conduct when shopping |
| | | 2.1.5 Organise/manage on line communities |
| 2.2: Sharing through digital technologies | | 2.2.1 Able to share large amount files via digital technologies |
| | | 2.2.2 Able to share resources |
| | | 2.2.3 Modify multi recourses and make the appropriate attribution |
| 2.3: Engaging in citizenship through digital technologies | | 2.3.1 Find information and services for engaging in online customer rights groups |
| | | 2.3.2 Publish information relevant to online shopping issues |
| | | 2.3.3 Register in e-services for shopping rights citizenship |
| | | 2.3.4 Use digital services to inform other people about shopping |
| 3.1 Developing digital content | | 3.1.1 Create basic content (image, audio, video) and upload it to an e-commerce site |
| | | 3.1.2 Edit basic content (image, audio, video, text) |
| | | 3.1.3 Combine basic media files to produce a multimedia presentation for an e-commerce site |

4. Certification Tools and Grading

4.1. Certification Test I

The goal of this certification tool is to provide detailed information on the Proficiency Level of the trainee by assessing a wide range of PL-Skills according to the mapping of the LCCF. It is a multiple-choice test including questions that are grouped by DigComp's competencies. Trainees can only give one answer to the multiple-choice questions.

Answers are designed so as to reflect different digital PLs. A question has answers corresponding to all PLs (one for each level) plus answers that are false. Thus, by choosing a specific answer, the trainee is mapped to a PL and awarded specific points (Figure 2).

Ideally, a scoring strategy should correctly measure the knowledge of the trainee, but trainees may attempt (unconsciously or consciously) to guess answers rather than admit ignorance. Thus, the interplay between the scoring strategy and the student's strategy must be considered. To this end, two additional false answers are added to each question. The score for choosing a false answer is 0. This highlights a need to distinguish between guessing and giving wrong answers in good faith.

This question design strategy has several advantages. Partial knowledge is credited and scoring somewhat straightforward and thus the transformation to a grade on scale for a specific Competence is direct. This means that there is no need to apply calibration as in the case of questions corresponding only to one PL. Furthermore, by assigning all PLs to one question, the test is more compact and less questions are needed in total for the certification. Having in mind the large number of skills identified in the framework and the use of two certification tools (Test I and Test II), this is a significant parameter. Finally, it must be

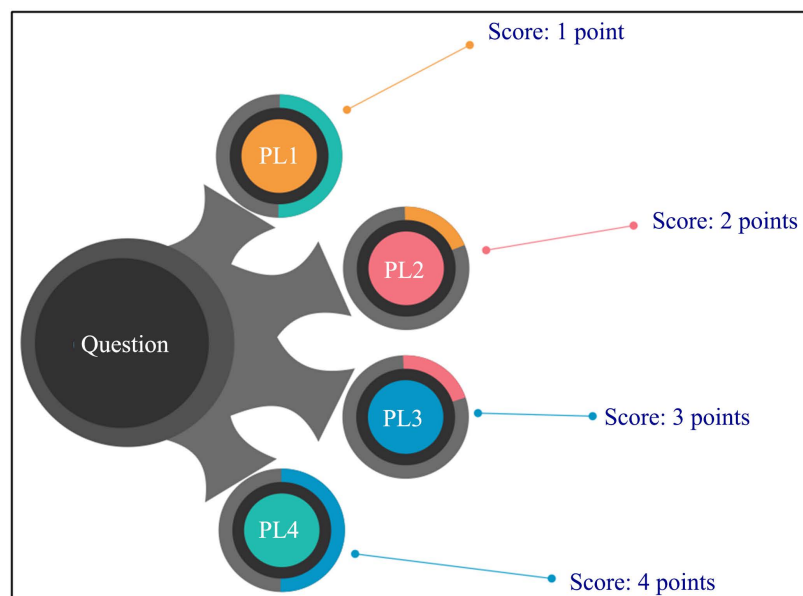


Figure 2. Awarding of points.

noted that the scale used is independent of the number and type of questions used in the assessment tools. If a median score was to be used, then calibration should take place to calculate the exact range of each PL for a specific set of questions. If questions were to be changed, the calibration process should be repeated. It is obvious that when calibration is involved (that is, testing with at least 100 participants to derive the ranges) for each specific set of questions the effort of certifying becomes large.

The main disadvantage of using the median method is the need to design answers for each PL. This is a difficult task since the burden of designing different questions for each PL is shifted to designing different answers for each PL. This method is more easily applied to observation tests. When the number of PLs is large, designing answers get more difficult. This obstacle can be overcome by designing questions that correspond to similar PLs (as defined in DigComp 1 vs. 2.1): Foundation Level (PLs 1/2), Intermediate Level (PLs 3/4), Advanced Level (PLs 4/5) and Highly Specialized (PLs 7/8). This is a two-dimensional organization of both questions and answers.

The score of a Competence C which is certified by k questions q_k is calculated as follows:

$$Score(C) = \sum_{i=1}^k score(q_i)$$

where

$$score(q_i) = \begin{cases} 1, & \text{if answer is PL1} \\ 2, & \text{if answer is PL2} \\ 3, & \text{if answer is PL3} \\ 4, & \text{if answer is PL4} \\ 0, & \text{if answer is false} \end{cases}$$

Thus the maximum points awarded to an answer are 4 points and the minimum, 0 points. If there are k questions assigned to a Competence then the maximum points awarded are $k * 4$ and the minimum, 0 points.

Each Competence is generally assessed by the same number of questions. A minimum of 4 questions and a maximum of 8 questions per Competence are used in e-commerce. There are six (6) possible answers in each question: four options correspond to the four PLs and two options to false answers.

4.2. Certification Test II

This is an observation test where the trainee is asked to perform simple tasks. Each task is assessed by one question. Tasks correspond to PL-skills of various PLs. The trainer observes the reaction of the trainee and assesses the way that the latter executes a task. There are various ways of executing a task, organized into patterns of behaviour. These patterns are, similarly to the answers to the questions of Test I, mapped to each one of the 4 PLs. The trainer selects the pattern (thus, the Proficiency Level) of the behaviour (the closest one) the trainee has exhibited when executing a task and a score is assigned. Scores range from 1 (for

PL 1 related behaviour to 4 - PL 4 related behaviour). A score is derived for each question. Competence score is calculated in the same way as in Test I and using a predefined scale, it is translated into a PL for the whole Competence. There is thus conformity between the design principles of Test I and Test 2.

For the successful execution of Test II, the trainer needs to be well informed about the differences between Proficiency Levels in DIGCOMP. He must also be able to distinguish between different patterns of behaviour (ways of executing the task) to successfully select the pattern that is closer to the one the trainee actually exhibited. In order to help the trainer in this task, each question contains a brief description of the scenario and context of the task to be performed by the trainee. These scenarios must be designed and tested for practicality (that is, whether they can be performed at some degree even by a Proficiency Level 1 trainee). In contrast to Test I questions, Test II questions are not theoretic but require execution in real conditions.

A question of Test II gives exactly four choices to the trainer. One of the choices is standard and corresponds to Proficiency Level 1 behaviour: "Can do with assistance". The other three choices depend on the Competence and skills under assessment (Figure 3).

4.3. Grading

The scoring strategy assigns a numeric score to a Competence, but this must be transformed into a grade on some scale so as to derive a decision about the Proficiency Level. The basic idea behind this transformation is that a threshold of more than 50% of the maximum score (>50%) of a Proficiency Level must be obtained for the Competence to be assigned at that level.

The maximum score of a Proficiency Level i in a set of k questions assigned to a Competence is calculated by the product:

$$MaxScore(i) = k * i, \text{ with } i = 1, 2, 3, 4$$

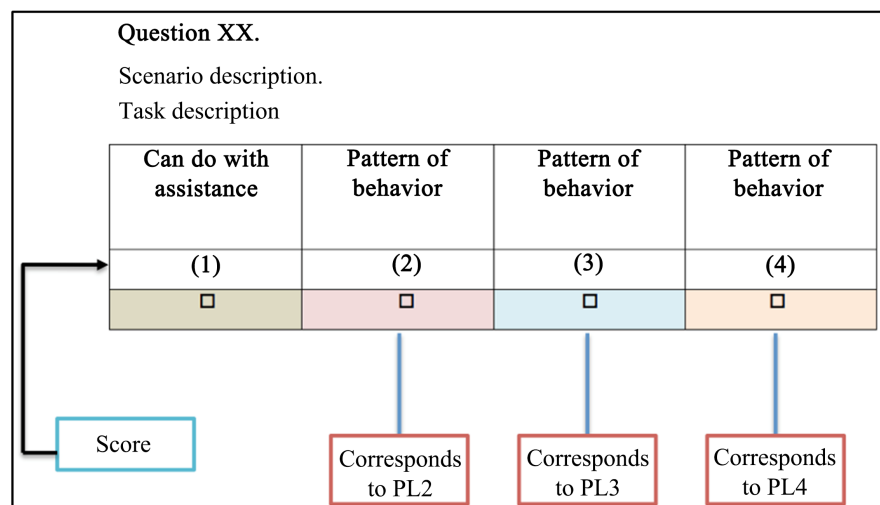


Figure 3. Structure of test II.

This result is easily calculated since an answer that corresponds to Proficiency Level i is awarded with a score of i points (Table 2).

The threshold of 50% for each level produces a range of values for transforming a Competence score to a Proficiency Level.

The upper limit of the range of level i of a Competence C that is certified by k questions, (where k is an odd number) is:

$$UpLimit(C_i) = \left\lceil \frac{k}{2} \right\rceil i + \left\lfloor \frac{k}{2} \right\rfloor (i+1)$$

The upper limit of the range of level i of a Competence C that is certified by k questions, (where k is an even number) is:

$$UpLimit(C_i) = \frac{k}{2}i + \frac{k}{2}(i+1) - 1$$

For Test I, the minimum score value of a Competence is zero and the maximum is $k * 4$ (Table 3).

For Test II, the minimum score value of a Competence is k and the maximum is $k * 4$ since there are no answers awarding 0 points (Table 4).

The threshold for odd numbers practically means that if more than 50% (>50%) of the answers correspond to level i , then the certificate is awarded to

Table 2. Maximum score for a set of k questions assessing a competence.

| Proficiency Level | Max Score of PL |
|-------------------|-----------------|
| 1 | $k * 1$ |
| 2 | $k * 2$ |
| 3 | $k * 3$ |
| 4 | $k * 4$ |

Table 3. Range of values for calculating the PL level from a competence test (Test I).

| Proficiency Level (i) | Range |
|---------------------------|------------------------------------|
| 1 | $[0, Uplimit(C_1)]$ |
| 2 | $[Uplimit(C_1) + 1, Uplimit(C_2)]$ |
| 3 | $[Uplimit(C_2) + 1, Uplimit(C_3)]$ |
| 4 | $[Uplimit(C_3) + 1, k * 4]$ |

Table 4. Range of values for calculating the PL level from a competence test (Test I).

| Proficiency Level (i) | Range |
|---------------------------|------------------------------------|
| 1 | $[0, Uplimit(C_1)]$ |
| 2 | $[Uplimit(C_1) + 1, Uplimit(C_2)]$ |
| 3 | $[Uplimit(C_2) + 1, Uplimit(C_3)]$ |
| 4 | $[Uplimit(C_3) + 1, k * 4]$ |

that Proficiency Level. An assumption is made that within the assessment of a Competence, responses usually vary between neighbouring levels (e.g. between Level 1 and 2 or level 2 and 3 etc.). Significant PL variations in answers constitute outlier cases which are difficult to manage.

The threshold for odd numbers practically means that, in the worst case, where half of the answers correspond to level i and the other half to level $i + 1$, the largest level prevails.

The method presented above deals better with marginal cases (as described above) than the more simplistic one of dividing the $0 - k + 4$ range to four equal intervals (0% - 25%, 26% - 50%, 51% - 75% and 76% - 100%) or even the modified four-level Danish scale (0% - 22.5%, 23% - 50%, 51% - 77%, 78% - 100%). Cases of outliers cannot be managed well by any method. For example, when a trainee chooses answers corresponding to all five levels within a Competence, a specific PL cannot be easily derived. In this case, the median is calculated. Outliers are caused when a trainee answers questions randomly (the presence of false answers significantly reduces the appearance of such outliers) or when the questions are not designed correctly. The presence of outliers is more probable to appear in Test I than in Test II (the latter is conducted by an expert and is thus considered more reliable).

The Score Mapping to PL certification table for the 41 questions of the e-commerce Test I is presented along with the Skills-Questions-Answers matrix. The matrix also contains the points awarded for each answer to a question.

The score mapping to the level certification table for the set of 31 questions related to e-commerce Test II is presented within the test, after the questions assessing Competence.

4.4. Proficiency Level Awarding

Each one of the tests produces a result for each Competence, used to derive the final Proficiency Level. If the results of both tests for a specific Competence are in agreement, then the Certificate is awarded for the standard PL derived. If the results are in disagreement, then the result of Test II prevails, and the corresponding PL is derived as final.

The reason for choosing the result of Test II over the one of Test I is that, generally, controlled assessments with the participation of experts are more reliable than multiple-choice questions quizzes. Furthermore, it is not safe to combine the results of both tests because a different number of questions may assess Competence in Test I than in Test II. The range of values for calculating the final Proficiency Level will also differ, not only because of the number of questions but because of the different minimum values of the 1st range (Table 3 and Table 4 in Section 4.3).

5. Examples of Usage Scenarios

Usage scenarios are practical questions mapped to Proficiency levels and PL

Skills, set to assess the certification level of a trainee. They may vary depending on the focus of the certification and are written according to the guidelines of DigComp.

5.1. Examples for the Foundation Level

Some examples of skills and usage scenarios related to the competence “browsing, searching, filtering data, information and digital content mapping” (1.1) for the Foundation PL, are presented in **Table 5**.

5.2. Examples for the Intermediate Level

At the Intermediate Proficiency level, the examples become more complicated, following the increased complexity of the relevant skills. Usually, more than one example of use is needed to depict this complexity. The difference from the Foundation level lays on the ability of the trainee to perform tasks individually, without the help of an expert. Some examples of skills and usage scenarios related to the competence “browsing, searching, filtering data, information and digital content mapping” (1.1) for the Intermediate PF, are presented in **Table 6**.

6. The Skills-Questions-Answers Matrix

Table 7 presents the matrix for the DigComp descriptors: Competence 1.1 “browsing, searching, filtering data, information and digital content mapping” (1.1), for the descriptors:

Table 5. Range of values for calculating the proficiency level (foundation) from a competence test score (Test I).

| Proficiency Level | Descriptor | PL-Skills | Examples of Use |
|-------------------|--|---|--|
| Foundation | To be able to Identify my e-shopping needs | Identify appropriate information sources Know what an eshop is and identify the services it may offer | With the help of a Web expert, I can: - Identify a meta search engine to use for online shopping |
| | To be able to find data, information and content through a simple search in eshops | - Identify keywords that describe the product I need - Find data by performing simple keyword search on text search engine | With the help of a Web expert I can: - Use a one keyword text search to find details about a specific type of product |
| | To be able to find how to access these data, information and content and navigate between them | Understand the basic structure of eshop product catalogue | With the help of a Web expert I can: - Navigate through search results and go back and forth |

Table 6. Range of values for calculating the proficiency level (Intermediate) from a competence test score (Test I).

| Proficiency Level | Descriptor | PL-Skills | Examples of Use |
|-------------------|---|--|--|
| Intermediate | To be able to explain my online buying needs | Use different search engines or specific e-commerce portals Identify most keywords that describe the information I need | On my own I can: - Name the e-commerce meta-search engines - Identify most keywords that describe the type of the produce I want to buy online |
| | To be able to perform well-defined and routine searches to find data, information and content in eshops | Can access an eshop directly (<i>i.e.</i> by typing the web address) | By myself I can: - Directly access a search engine or a blog |
| | To be able to explain how to access and navigate an eshop | - Access a specific site from a list of search results - Access a resource from a list within an eshop - Access a video describing a product I want to buy | By myself I can: - Access a specific e-commerce site from a list of search results - Access a specific product from a list of search results using filters |

Table 7. A skills-questions-answers matrix for competence 1.1 of DIGCOMP.

| <i>Skills</i> | <i>Questions</i> | <i>Answers (with score)</i> |
|--|--|---|
| - Can use a search engine to find data through a simple search | You need to select a specific search engine in your tablet. | Firefox or Internet Explorer [0] Google [1] Google or Yahoo! [2] |
| - Can use a search engine to find data through a simple search in digital environments | Which application allows you to gain access to an e-commerce web site? | There are many search engines to choose from such Google, Bing, AOL etc. [3] Depending on the type of information I looking for I choose different search engines [4] Instagram [0] |

- Identify my information needs (1 & 2)
- Explain my information needs (3)
- Illustrate Information needs (4)

It is possible for questions to be tailored along with the respective answers' list to serve different training purposes. The number of available answers should be at least four. On another example, **Table 8** depicts the matrix for the descriptors:

- Find data, information and content through a simple search in digital environments (1 and 2)
- Perform well-defined and routine searches to find data, information, and content in digital environments (3)
- Organize the searches of data, information, and content in digital environments (4)

7. TEST II Examples

Test II is a more accurate certification tool than Test I. For each Competence, the trainee is asked to perform a sequence of actions. The trainer marks the ability of the trainee to complete the task and the degree of independence in carrying out the activities.

For each Competence, a number of questions have been prepared. The total number of questions is 37. The questions have been grouped into 6 different groups, one for each Competence of DigComp. Only one (1) answer from the available options must be selected. The points corresponding to each answer (denoted in parenthesis right below the answer) must be summed at the end of the group of questions. A table depicting the ranges corresponding to the certificate level of the trainee can be used to derive the result.

An example for certifying the level for Competence 1.1: browsing, searching and filtering data, information and digital content, follows. In this example, the trainee is assessed on a specific task, namely "to articulate information needs, to search for data, information and content in digital environments, to access them and to navigate between them. To create and update personal search strategies". More specifically, the trainee is asked to visit an online shop and search for smartphones. A series of questions are posed:

- 1) Access an online shop

Table 8. Another skills-questions-answers matrix for competence 1.1 of DigComp.

| <i>Skills</i> | <i>Questions</i> | <i>Answers (with score)</i> |
|--|---|---|
| - Identify keywords that describe the information I need | You want to search for smart phones coloured red, with a dual SIM. Which keywords are you going to use? | 1) I need to use the "Smart Phone" keyword [2] |
| - Find data by performing simple keyword search on text search engines on an e-commerce web site | | 2) "Smart Phone" AND "Dual Sim" [3] |
| - Can adjust search according to specific needs | | 3) "Smart Phone" AND "Dual Sim" AND "red" [4] |
| | | 4) I need help to decide [1] |
| | | 5) "*" and "dual sim" [0] |
| | | 6) I access a web page directly by typing a web address [0] |

6. Access by category the user comments for the top result.

| Can do with assistance | Understands where it generally is but needs help to locate it | Can access the correct page. | Accesses the user comments by category. |
|--------------------------|---|------------------------------|---|
| (1) | (2) | (3) | (4) |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Figure 4. Example question of test II.

- 2) Access the search engine of the online shop
- 3) Use correct keywords for searching
- 4) Access the details of three products from the result list
- 5) Update search to find products between a specific price range
- 6) Access the user comments by category, for the top result

Each question is presented using a standard format (see **Figure 3**), for example as depicted in **Figure 4**.

8. Conclusions

In this paper, a new E-Commerce training Certification System was presented based on DigComp. The system comprises a Framework that maps Competence Areas/Competences to digital and E-Commerce-specific skills and describes how questions and answers for the two certification tests are derived. Seven Competencies from Competence Areas 1, 2 and 3 are used. The system also contains a grading system for mapping the points gathered from the test to a DigComp certification level. Complete tests that include questions and assessment tasks.

The framework provides comprehensive skill mapping by mapping Competence Areas/Competences to digital and eCommerce-specific skills, ensuring that the certification covers all relevant aspects of the eCommerce domain. This comprehensive approach ensures that certified individuals have the necessary knowledge and skills to excel in the eCommerce industry. By concentrating on key competencies, the certification system ensures that learners gain a deep understanding of crucial aspects of eCommerce, such as customer interaction, digital marketing, data analysis, and cybersecurity. The certification system includes complete tests with questions and assessment tasks, providing a standardized method for evaluating learners' digital competencies in eCommerce. This standardization makes the certification more reliable and valuable for both the learners and potential employers. The grading system maps the points gathered from the test to a DigComp certification level, allowing for differentiation among candidates based on their performance. This feature enables potential employers to gauge an individual's proficiency in eCommerce skills, helping them make informed hiring decisions.

Future research directions include the inclusion of soft skills, such as communication, leadership, problem-solving, and collaboration, into the certification

framework. Soft skills are increasingly important in the eCommerce industry, and their integration can help create well-rounded professionals who can excel in a variety of roles and contexts. Investigation for expanding the range of competency areas covered by the certification framework is also another direction for future research. To this end, additional aspects of eCommerce, such as international trade, sustainability, and accessibility may be included. This can help create a more comprehensive and holistic certification system that reflects the diverse challenges and opportunities within the industry.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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