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Quality standards for digital textbooks and auxiliary digital educational materials



Institute for Textbooks and Teaching Aids
PODGORICA

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for every child

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TEXTBOOKS AND AUXILIARY DIGITAL
EDUCATIONAL MATERIALS



Institute for Textbooks and Teaching Aids
PODGORICA, 2023.



for every child

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INTRODUCTION

*An education isn't how much you have committed to memory, or even how much you know.
It's being able to differentiate between what you know and what you don't.*

Anatole France

The material in front of you is primarily intended for experts who evaluate the quality of digital editions of textbooks and instructional materials. It was created within the **“Improving the quality of digital textbooks and instructional materials”** programme jointly implemented by the Institute for Textbooks and Teaching Aids and the UNICEF office in Podgorica. Its primary goal is to serve as an instrument for objective assessment of the quality of digital editions of textbooks and instructional materials.

As expected, in addition to the evaluation of digital editions, this material can be used for other purposes:

- ▶ In the process of creating digital textbooks and instructional materials;
- ▶ It can serve as a guide for authors and publishers on the parameters they should take into account;
- ▶ It can help teachers in choosing digital materials for teaching/learning;
- ▶ University students on teacher training programmes can get acquainted with the specifics of printed and digital resources for teaching/learning;
- ▶ Researchers in the field of education can find this material an incentive to elaborate and further explore the role of digital resources in teaching/learning; other stakeholders interested in innovation in education can also benefit from this material.

Although we are two decades into the twenty-first century and experiencing the mass application of information and communication technologies (hereinafter: ICT) in all areas of life, they have not yet found their true place in education. ICT was expected to contribute to a major revolution in teaching and learning. However, looking at the findings of scientific research and practice, this has not yet happened. During the two years of the COVID-19 pandemic, there were occasional shifts to full online teaching all over the world. Analyses of the effects of this type of education indicated, on average, weaker effects of this teaching compared to traditional in-person instruction in the classroom. Numerous scientific research works around the world are trying to figure out why this is the case.

Exploiting the advantages of ICT in education while avoiding the Scylla and Charybdis of their negative effects remains a great challenge. Therefore, developing Quality Standards for Digital Textbooks and Auxiliary Digital Educational Materials (hereinafter: Standards) has been a quite demanding task. On the one hand, the conditions under which the advantages of the digital environment in teaching/learning can be best exploited are still not sufficiently researched, while on the other hand – due to the already uncritical and reckless use of ICT in practice there is a lack of awareness of the problems we are solving in education and the new problems that are arising. The present Standards seek to distinguish what we (currently) know

about the workings of digital media from what we do not know and thus help the meaningful and effective use of ICT in teaching.

The work on the Standards stems from the authors' research on active learning/teaching in schools as an instrument for developing quality education. It relies on a number of theoretical and empirical research works on textbooks and learning/teaching in an online environment, while good practical experiences related to these issues have been built into it. The Literature section (part A) lists the key works that served as the basis for creating quality standards for digital textbooks and instructional materials, as well as those that served to develop the theoretical framework and empirical elaboration. It is followed by a list of the other works used to develop this material (part B).

We will consider that we have done a good job if this material encourages readers to think, draws them into dialogue with the text, and opens up new questions and problems and its primary purpose of evaluating digital editions of textbooks and auxiliary digital educational materials (ADEMs).

The development of Quality Standards for Digital Textbooks and Auxiliary Digital Educational Materials was supported by the EU DG NEAR and the UNICEF Regional Office for Europe and Central Asia, as part of the Regional Project for Mitigating the Impact of COVID 19 on the Lives of Children and Families in the Western Balkans and Turkey.

Key terms

Digital content	Any content presented in digital form that can be used in teaching/learning
Digital textbook	A specific genre of a book in digital form that represents a single, accurate, modern, coherent whole, whose primary role is developmental and formative, i.e. the textbook must support learning of the given content and enable the independent construction of students' knowledge, respecting their characteristics (age, cognitive capacities and prior knowledge)
Auxiliary digital educational materials (ADEM)	Any didactically designed digital content (text, video, audio, or a combination of these elements) which cannot be used independently but serves as a supplement to a textbook or teaching process with the aim of achieving specific learning objectives.

1. THE DIGITAL TEXTBOOK AND ITS FEATURES

1.1. What is a digital textbook?

Learning is a process of the active construction of a learner's knowledge that takes place through asymmetric interaction with a more competent partner, teacher, peer, book, or source of knowledge (the competent partner is built into the book or other source of knowledge). The process of learning requires a partner, i.e. a mediator, so learning is often discussed as the *co-construction of knowledge*.¹ **The role of the textbook** is to **support the building** of its user's **knowledge** with its content and pedagogical apparatus, that is, **to create situations that will encourage and support the learning of a given content² and enable students to build it independently**. The digital textbook must be constructed in such a way as to serve as the more competent partner in learning – the one who places its means and possibilities at the service of the process of learning certain content.

The primary role of the textbook is to be **developmental and formative**;³ it must encourage the development and building of knowledge. This shifts the focus from the content of the textbook (which remains very important, but is not enough in itself) to *the process of learning* certain content. The digital edition of the textbook uses the means and possibilities of the digital media to better guide and support the learning of the selected content and realize the textbook's developmental and formative roles. This means that *each of the specificities of digital media must be considered in relation to the promotion of learning*, in terms of its possibilities, but also limitations or potential risks that may hinder learning.

The textbook must represent an **accurate, modern, coherent single unit in which all parts and aspects are harmonized and connected in such a way that they form a logical unit that is adapted to the age, cognitive capacities and prior knowledge of the students**. A digital textbook cannot be a collection or compilation of video or audio recordings, animations, or other digital content – not all digital content is considered a digital textbook. **Auxiliary digital educational materials** (hereinafter: ADEMs) are all didactically designed teaching aids used

1 This is why we use the terms teaching/learning in parallel. By doing so, we highlight the complementarity of the two processes – what takes place in one process shapes the activities in the other, making it impossible to separate them.

2 This approach has been incorporated into the methodology and philosophy of the subject programmes in Montenegro since 2002.

3 Ivić, I., Pešikan, A. & Antić, S. (2013). *Textbook Quality – A Guide to Textbook Standards*. New Revised Edition. Eckert. Expertise 2. Georg Eckert Institute. Göttingen: V&R Unipress, <www.gei.de/en/publications/eckert-expertise/ee-single-volume/news/detail/News/ivan-ivic-ana-pesikan-slobodanka-antic-eds-textbook-quality-a-guide-to-textbook-standards.html>.

in school as a supplement to a printed textbook or teaching to achieve the specific objective of teaching/learning (acquiring knowledge, developing the skills, attitudes or values of students). ADEMs are made as textual, video or audio materials in digital form, and most often represent a combination of these elements. Unlike textbooks, ADEMs cannot *be used on their own and are not sufficient* (either individually or together) to effectively respond to all objectives of a given subject. All materials that are made available to students at school – whether basic or auxiliary ones and in whatever form (pictures, videos, sound, etc.) – must be didactically shaped and harmonized with the teaching/learning objectives pertaining to a particular subject, level and profile of education. **This means that the assessment of the quality of ADEMs is based on the same indicators used to determine the quality of digital textbooks.**

Based on previous research, there is no evidence that online learning is superior (as a learning medium) to traditional classroom learning. The transition to fully online teaching during the COVID-19 pandemic pointed to serious pedagogical challenges: a lack of digital skills in students and teachers; an abundance of insufficiently structured content and information on the web; a lack of motivation of students towards school work and learning; a lack of social and cognitive presence of teachers; a lack of socio-emotional exchange in teaching; the impact of adequate space and working/learning conditions on students; far greater demands for self-regulated learning in students; lack of external institutional supports in learning, and the like (e.g. Ferry, Griffons & Guzzo, 2020; Anderson, 2021). The closure of schools during the pandemic negatively affected the learning of students around the world (Anderson, 2021; Tabore, 2021; Pešikan, Niemi & Devetak, 2021), leading to, among other things, the following: a decrease in the existing knowledge of students and a great loss in school efficiency,⁴ which has been illustrated by terms such as “*covid slide*” or “*losses in learning*”; an increase in students’ non-involvement (absenteeism is approximately twice as high as before the school closures); an increase in the digital divide between students, i.e. a greater impact from the socio-cultural and economic status of the student’s family on their achievement; and a reduction in the equity of the education system.⁵

The dynamics of ICT development have far surpassed the dynamics of research into the nature of the learning process in the online environment. In order to explore whether ICT can really transform the education process, we cannot examine the technology alone. We need to also examine the nature of the learning process in the digital environment and how to encourage its development. Therefore, it is necessary to shift the focus from ICT (what new technologies can do) to the question of **HOW technology must be applied in order to achieve the goals of education** (CEO Forum, 2001, p. 3). **The environment in which learning takes place is not what crucially affects the quality of learning.** It is a combination of effort, invested time, type of curriculum and teaching/learning methods applied online (Bernard et al., 2004; Clark, 1994; Ni, 2013). Therefore, the massive shift by various educational institutions to online learning/teaching is not entirely justified and should be performed with a little more caution and thoughtfulness (Figlio, Rush & Yin, 2013) if we want to make it more effective.

4 According to the World Bank analysis, this represents a loss of three to nine months per school year (Pešikan, Niemi & Devetak, 2021).

5 The effects of the pandemic are much greater among socio-culturally vulnerable groups of children and young people (poor, racial and ethnic minority students, children with disabilities, children in rural areas, children without parental care, migrants), which further decreased the achievements in these groups of students.

SPECIFIC FEATURES OF A DIGITAL TEXTBOOK: POTENTIALS AND RISKS FOR THE QUALITY OF LEARNING

FEATURE	POTENTIALS	RISKS
Multimedia	Dynamic presentation of multiple points of view, viewing the same phenomenon from different angles with the support of different means (text, sound recordings, videos, animations and/or combinations and simulations)	Cognitive overload The “intermittent attention” phenomenon The risk of making the layout too confusing, not distinguishing between what is important and what is essential for a given lesson and additional elements aimed at supplementing or increasing interest in the content
Interactivity	Allows interaction of students with the presented content (e.g. reacting to the material, providing answers, choosing, receiving feedback, etc.) Interaction with the digital mediator – teacher	/
Branched structure	Adapting the textbook to the characteristics and nature of the content presented and the characteristics of the students themselves Allows personalization of learning and educational experience for all students	Effective only if students have developed the ability of autonomous, self-regulated learning Prior training and support from the teacher are needed since, without it, it can do more harm than good
Navigation features	Facilitates navigation through the branched structure of the digital textbook	Scrolling interferes with the reading process due to spatial instability, which can negatively affect the reader’s mental picturing of the text and comprehension The effectiveness of a particular type of navigation depends on the prior knowledge of the student

1.2. Specific features of a digital textbook: potentials and risks for the quality of learning

The key problem with technology in education, and even with the creation of digital textbooks, is the requirement that technology be used thoughtfully and skilfully. In the beginning, the main problem was unequal access to information technologies and insufficient ownership of equipment and internet connection, while today it is the **effective use of new technologies for the purpose of learning and teaching**. The main difference between a printed and a digital textbook is not in the content of the textbook and its didactic properties, but in the nature of the media through which the content is offered (mediated). It has been said that the main role of textbooks is developmental and formative and that we must consider each of the specifics of digital media in relation to whether it encourages learning, what its possibilities are for supporting the learning process and under what conditions, as well as whether there are limitations or risks that can interfere with learning.

Multimedia or multiple representations means that, in addition to static elements, the digital textbook (text, image, illustration) uses the possibilities of: a) dynamic presentation of content through sound, video, animation and/or a combination of these forms of dynamic presentation of the content; and b) simulations (experiment, specific procedure, etc.). Multiple representations are a good support for learning, allowing:

- ▶ presentation of multiple points of view, viewing the same phenomenon from different angles. Some content becomes “more solid” and more obvious when the text is supported by other means (audio-visual recordings, simulations, animations, etc.);
- ▶ hypermedia can present multiple representations of complex material and thus help students to understand it.

In order for multimedia to support learning, it is necessary to avoid the risks it carries:

- ▶ With printed textbooks, there is a danger that each lesson will be an “isolated island”, i.e. that the content being learned will not be interconnected. With digital textbooks, there is a specific risk that multimedia can lead to a phenomenon called “**intermittent attention**”. Numerous possibilities of presenting content that serves as learning aids can easily become a negative factor because too much competitive content leads to cognitive overload and makes it difficult to process information deeply, that is, to learn with understanding. The cognitive processing during learning makes our mind focused on processing all sensory stimuli that have an effect on us (inputs), while human capacities for simultaneous processing of information in the visual and auditory channels are limited. **Different types of presentations** (text, hyperlinks, video clips, illustrations, and various available content) **will compete for attention and space in the student’s cognitive processing**, so a wide range of different presentations can be an obstacle to in-depth learning and lead to the cognitive overload of students with sensory inputs.
- ▶ The vast possibilities of presenting the content also carry the risk of overcrowding the layout and making it too confusing, i.e. obscuring the difference between the essential, basic content of the lesson and additional data and interesting things. In its way of presenting the content, its organization and structuring, the digital textbook *must keep the “thread” in the presentation of the material* to help effective cognitive processing

of content – i.e. quality learning depends on the coherence of the digital textbook. Research on the impact of the pandemic has indicated that one of the sources of problems in learning in the online environment has been the abundance of insufficiently structured content and information on the web. Insufficiently good and clear organization of information will make cognitive processing more difficult, and therefore a digital textbook must be intentionally selective in the application of multimedia.

- ▶ In order for students to benefit from multimedia, they must have developed digital information and reading literacy. Traditional literacy competencies represent the gateway to successfully entering the world of novel forms of literacy. Many nurture a romantic notion of only the positive aspects of learning using new media, forgetting about the key role of more fundamental forms of literacy, basic reading and writing competencies, and cultural capital (Warschauer, 2007). **Inadequate reading ability**, especially in children from poor, low-educated and socially marginalized groups, **practically eliminates the possibility of practicing digital literacy**. For a fair share of children who do not have basic functional literacy, multimedia becomes a crutch to avoid reading and using texts rather than a means of spreading knowledge. Multimedia literacy refers to competency in using multimedia representations and the ability to interpret, edit and create content that utilizes images, photographs, video, animation, music, sounds, texts and typography (Warschauer, 2007). **Reading and writing skills and basic cultural literacy strongly mediate students' ability to use the internet** to find and use information or to create meaningful multimedia content, whether in or out of school (Warschauer, 2007).

Reading skills are a significant predictor of understanding digital texts (e.g. Coiro, 2011), directly influencing the understanding of digital texts and indirectly through navigation strategy. When navigating through digital texts, students can use the *coherence selection strategy* or *interest navigation strategy* (Sullivan & Puntambekar, 2015). When using the coherence strategy in selecting the content, readers on the one hand choose sources of information that are semantically or conceptually related to each other. On the other hand, students who make a selection based on their interests choose to read texts based on what interests them. Using the coherence approach leads to better integration of knowledge and a better understanding of concepts in the field and their interrelationships, which further contributes to better learning outcomes (Salmerón, Cañas, Kintsch & Fajardo, 2005; Salmerón, Kintsch & Cañas, 2006). Therefore, if one wants to emphasize understanding of relationships between concepts and build a system of knowledge in the field, then the use of coherence strategy should be encouraged when navigating through a digital text (see the section on navigation features of textbooks).

Interactivity refers to the student's ability to influence the content, for example, to change parameters in a digital simulation of an experiment, to determine the course of reviewing content in a virtual museum visit, to decide whether to use certain digital tools (dictionary, calculator, index, additional content, etc.). Interactivity lies at the heart of the concept of online learning and relates to:

1. Interacting with others
 - 1.1. With the *user* (student); building a *learning community* that includes communication
 - 1.2. With others who are using the very same material, giving the opportunity to involve more users and a teacher in some activities.
2. Interacting with content, i.e. learning material
 - 2.1. Possibility of *interaction with the presented content* (e.g. a student can react to the material, provide answers, choose, receive feedback on what has been done, etc.)

2.2. *Interaction with the “digital mediator – teacher”*, meaning that the teacher is “projected” into that digital material (*teacher presence*, Garrison et al., 2001) as a person who guides the student through the content and the material, directs their attention, points out, gives comments, etc. This does not mean that this must take the form of human guidance through the given material (although it can), but rather that all the principles of effective learning, adequate organization and structure of materials, effective teaching design, discussion facilitation, direct teaching, etc. are applied.

The branched structure of textbooks allows the adaptation of a textbook to the nature of the content presented in it, as well as the possibility of adapting the textbook to students of different characteristics, giving the opportunity to students to approach the textbook in different ways, to choose the path that suits them best. This feature of the digital textbook allows for greater individualization of teaching, **personalization of learning and educational experience** for all students regardless of their characteristics, including:

- ▶ Initial assessments of each student’s knowledge, skills and learning style;
- ▶ A multitude of interactive materials and high-quality learning activities;
- ▶ An individualized learning plan;
- ▶ Built-in continuous monitoring and provision of timely and adequate feedback to the student;
- ▶ Built-in appropriate human interaction – when interacting with a digital mediator, a teacher is required.

The ability of autonomous, self-regulated learning (which serves as a prerequisite for personalized learning) will be critical in the digital future, but, paradoxically, **to develop this autonomy, solid instruction and teacher support are needed, as well as live teaching for students**. At the same time, overemphasizing students’ independence, especially without prior instruction and preparation, can do more harm than good to students.

The branched structure of a digital textbook includes navigation. **Navigation features** of a digital textbook and user interface affect the quality of learning. Individual learner characteristics and text characteristics have been found to play a significant role in the comprehension of multiple digital texts (Hsieh-Yee, 2001; Lazonder & Rouet, 2008; Xie & Joo, 2012). Navigation is a critical design-related issue in hypermedia learning systems, as it influences how students can develop their learning strategies. Reading from paper and reading from the screen are processes that differ. When it comes to the use of digital textbooks, navigation itself can be a problem since the action of scrolling is known to hamper the process of reading by imposing spatial instability, which may negatively affect the reader’s mental representation of the text and, by implication, comprehension (Mangen et al., 2013: 65).

Hypermedia differs from other forms of computer-assisted teaching in that it allows non-linear access to large amounts of information and allows students to have greater control over navigation, as well as the freedom to use and follow the information in line with their needs. However, not all students can manage the high level of control offered by hypermedia systems (Lawless & Kulikowich, 1998; Shapiro, 1999; Lazonder et al., 2000; Last et al., 2001). Some students may become lost or disoriented in such systems (Nielsen, 2000), and numerous studies show that **learners’ prior knowledge** is an important factor influencing the degree of disorientation that students experience in hypermedia systems. **Disorientation** means that users do not know where they are, do not remember where they were before or how they found themselves on that website, and that they are unsure where they can find the information they need (Kim & Hirtle, 1995; Last et al., 2001). Students lacking prior knowledge of the topic show more problems with disorientation than those with more prior knowledge. They

experience more difficulty finding the information they need and tend to make more additional notes, indicating that they cannot remember where they were before. These students lack a conceptual structure of the field that would help them orient their interaction within the hypermedia system; they cannot rely on previous knowledge that would help them determine the structure of the content. Therefore, students with less prior knowledge in the field need to be provided with more content structure and additional navigation-related support to reduce disorientation problems and support their development of a structural representation of the knowledge that is being learned. Those with more prior knowledge already have a mental representation of the concepts in the field they are exploring and have fewer problems with disorientation in hypermedia learning systems, as their deep level of understanding of the subject allows them to structure the content (McDonald & Stevenson, 1998).

We can summarize the findings of previous research on the navigation features of digital textbooks:

- 1. Additional support:** students with greater prior knowledge can rely on their prior knowledge, so there is no need to provide additional support to them. Beginners with little or no prior knowledge of the content have more problems with disorientation in the multitude of digital materials. Therefore, they need additional support and find it useful, especially when it comes to the use of *visual clues*.
- 2. Content structure:** Students with prior knowledge in the field can structure the content and enjoy flexible learning pathways. Students who do not have sufficient prior knowledge lack a conceptual structure of the content, so they need to be provided with a greater degree of the structure of the content (e.g. hierarchical maps and a structured overview of the contents) to reduce disorientation, overcome the lack of conceptual structure and support their development of the structural representation of knowledge that is being acquired.
- 3. Navigation tools:** Students with different levels of prior knowledge need different types of support with navigation (Shin et al., 1994; McDonald & Stevenson, 1998a, 1998b; Calisir & Gurel, 2003). Those without sufficient prior knowledge lack an understanding of the content, so menus and advanced content organizers (such as interactive content overview maps) are offered to help integrate knowledge, as they provide information on the content structure and semantic links between the texts and concepts presented in separate but related texts (Vörös, Rouet & Pléh, 2011). Students with good prior knowledge have a deep level of understanding of the content, so they can benefit more from navigation tools that allow finding specific information, such as search engines. They are better suited to more flexible approaches (Shapiro, 1999).

User interfaces play an important role in preventing and solving the above problems in designing hypermedia learning systems:

- ▶ *Where are they?* Research suggests that it is important to keep users aware of where they are in the global and local structures of the system. Their current location can be shown on two levels: (a) in relation to the learning system as a whole – by means of “leaving traces along the way to be able to find a way back”, marking students’ navigation paths, such as listing the topic and subtopics of the pages they visit; and (b) in relation to specific topics by means of highlighting the area where the current page is located, using different colours or different fonts and sizes. It would be useful to provide visual aids for students to help them know where they are, e.g. the active sitemap can highlight the user’s current location, as well as visualize their path through the website.

- ▶ *Where have they been?* This question is usually answered by giving different colours to the visited links, to give students information about where they have been. Knowing which links lead to previously visited pages is useful because it helps them learn the structure of the system and prevents them from wasting time by going to the same page multiple times (Nielsen, 2000). There are other options, such as checking or ticking pages that they have visited (Chen & Macredie, 2002).
- ▶ *Where can they go?* An efficient user interface must help users decide which path best suits their needs. One way is to keep beginners on the right track by hiding links to pages that the user is not yet ready to understand. By doing this, beginners are limited to using a subset of the available content before moving on to more advanced levels. In addition, tags that clearly indicate the role of a particular page can help beginners successfully decide on the appropriate, logically coherent way to learn a given content.

Main messages. The basic role of textbooks is to mediate the learning process and make learning effective, so the distinctive features of digital textbooks must be viewed in this context: whether they contribute to the quality of learning or stand in its way. When assessing the quality of a digital textbook, the basic question is not whether all the features of the digital medium have been used, but rather **how these potentials have been used in order to help the textbook fulfil its role more efficiently**, whether the use of digital media **provides a favourable environment for learning and student development**. There is a lot of information on the internet and very little knowledge, so the head has to acquire knowledge with the help of educational resources. The ability to **transform information into knowledge** with the help of new technologies can be considered a critical factor that contributes to wealth and power in today's world, at both the individual and national levels.

GENERAL PRINCIPLES IN CREATING DIGITAL TEXTBOOKS

1	A digital textbook is a textbook: the quality is key, not the medium in which the content is presented.
2	The textbook has a developmental and formative role.
3	Understanding the nature of the learning process is essential to creating digital textbooks.
4	The goal of a digital textbook is to build a system of knowledge from a certain discipline/subject area.
5	Reading literacy (reading strategies and in-depth reading) represents the basis of effective use of digital textbooks.
6	Even the best textbook is not enough without the mediation of a teacher.
7	It is important to keep in mind which teaching/learning problem we are trying to solve by introducing digital textbooks.

2.

GENERAL PRINCIPLES IN CREATING DIGITAL TEXTBOOKS

- 1. A digital textbook is a textbook: the quality is key, not the medium in which the content is presented.** Each textbook must fulfil its basic function and all the quality standards of a good textbook, regardless of the medium in which it is provided. The key is the quality, which needs to be supported by the advantages of the media in which the textbook was made. Encouraging learning is not an “either-or approach” but a thoughtful and purposeful combination of printed and digital editions of textbooks and ADEMs in accordance with the nature of the content and teaching/learning objectives to be realized and the characteristics of the students who will use it.
- 2. The textbook is not a collection and presentation of programme content, but has a developmental and formative role.** With the accelerated development of technique and technology in the twenty-first century, there has been an “explosion of knowledge”. Therefore it is impossible to cover and convey to students all the various contents during schooling. It is necessary to transfer key knowledge in the field, but the way the textbook mediates the material must enable the development of competencies for acquiring and building knowledge and a positive attitude towards lifelong learning, which is a *conditio sine qua non* of modern life and work. The textbook does not present the contents of a certain subject **but rather creates situations for learning the offered content** that will initiate and facilitate learning. That is why we need to understand how a person learns in order to construct a good textbook.
- 3. A necessary precondition for creating digital textbook editions is to understand the nature of the learning process and cognitive information processing.** Cognitive information processing includes *two separate channels for visual/image and auditory/verbal processing* (Mayer, 2011). The first channel is used to process the sounds in the working memory and forms a verbal model, while the second is used for image processing, which creates an image model. Both models are integrated into one coherent structure that integrates prior knowledge and remains stored in the long-term memory. The human mind focuses on the processing *of all the sensory inputs that reach us*. The student is actively involved in processing all sensory inputs (information) and strives to build coherent mental models. However, **there is a limited amount of information students can process on each of the channels, so different types of presentations will compete for their attention and space in their cognitive processing**. This is very important to keep in mind when creating and evaluating digital textbooks because, due to the greater and more diverse

possibilities in mediating content, there is a greater risk of disrupting the learning process, either by overloading cognitive processing with a wide range of possibilities or by letting the rich offer hamper the process of distinguishing the essential from the irrelevant.

4. **The goal of a digital textbook is to build a system of knowledge from a certain discipline.** Thanks to its whole, i.e. all its structural components: content, manner of its presentation, didactic apparatus and graphic solutions, the textbook should strive to build a *system of knowledge* from a particular field. The system implies that there is a new quality, a new whole, a union and not a mixture (using chemical terms), where the whole is more than the sum of its parts. Each element in the system has its place and specific function, and if one element changes, the others change as well. Thus, a textbook cannot be constructed by mechanically adding or omitting certain units. There is a difference between a digital textbook and digital educational materials, such as open educational resources (OER). The set of OER materials is not a digital textbook but rather a collection of free, available materials that can be used in teaching and learning if they are adequately aligned with the objectives and outcomes of a particular programme.⁶ OER materials cannot meet such objectives on their own. Due to the construction of the knowledge system, the textbook must make a *vertical connection between* the contents of the same subject and competencies that are developed on it (relying on the previously acquired content and heralding the future content), as well as a *cross-cutting connection* with the relevant contents of other subjects studied in the same year. In building a knowledge system, the textbook must *connect the material with real life* to make it easier for students to understand and apply the material.
5. **Reading literacy (reading strategies and in-depth reading) represents the basis of the effective use of digital textbooks.** Good functional literacy is the basis for digital literacy. A digital textbook primarily requires developed reading literacy and reading comprehension (for the way this competency is defined through six levels of reading literacy in PISA, see Appendix 1). The reader tries to find connections in the text and combine small units with larger ones to develop hypotheses and draw conclusions during reading. Also, the reader is expected to correct text that is not coherent and put additional effort into comprehension, which makes reading more difficult. The reader's prior knowledge is central to understanding the text. The reader must connect the message of the text with their prior knowledge, thus reinforcing inference and deep studious learning. It is not possible to start using digital textbooks effectively until the student has mastered the competency of reading, especially because of navigation, which can make it difficult to read the text and the greater need for self-regulated learning. In addition to reading literacy, the use of digital textbooks implies diversity and *information literacy; computer or digital literacy; metacognitive abilities and the ability to self-regulate learning* (see Appendix 2).

Information literacy implies the ability of a person: to recognize when they need information and which information they need; to determine all possible sources of information and choose the best one; to locate sources (intellectually and physical and be able to access them and find information in them; to use the information they have discovered and to be able to extract relevant information; to organize

6 OERs can primarily be used in higher education to develop tailor-made materials for students (in addition to or instead of textbooks), as they are tailored to the age and objectives of higher education (independent use of original resources and linking them to teaching/learning).

information collected from multiple sources and to present it efficiently using various means and methods; to respect ethical standards in the use of information, intellectual rights in the mediation of information, and academic integrity in the use of information.

Digital literacy implies the ability to use a wide range of technological means of communication (e-mail, video conferencing, the World Wide Web, social networks, etc.). Digital literacy includes information literacy but is always linked to digital resources and technology. Digital literacy alone is not enough to engage in learning from digital textbooks – the **competency to use digital literacy for teaching and learning purposes is necessary**, which differs from the knowledge of digital tools, software and the internet (Dabbagh & Kitsantas, 2005). Global research findings indicate that one of the main problems related to schooling during the COVID-19 pandemic was that most teachers and students were unable to effectively use their digital competencies for teaching and learning (Korhonen et al., 2021). In order to emphasize the difference between digital literacy itself and its use for pedagogical purposes, certain authors distinguish between “digitization” and “digitalization” and talk about **“digipedagogical competency”** (Korhonen et al., 2021). Digitization represents a technical process of translating information into a digital form, while digitalization refers to changes in the manner of using digital technology in work (Tilson, Lyytinen & Sørensen, 2010). Digitization in the educational context requires a shift in thinking from the technological to the educational domain (Vivitsou, 2019), so digipedagogical competencies represent the ability of teachers to adapt and innovate the use of technology in *pedagogically meaningful* ways (Korhonen et al., 2021; Korhonen & Lavonen, 2017). Such competencies include: the teacher’s knowledge of the technological pedagogical content; the ability to apply this knowledge in different situations (Mishra & Koehler, 2006); the willingness to use this knowledge and skills to support learning; support for student collaboration and interaction (Kopcha, 2012); the teacher’s knowledge of digitization; the teacher’s beliefs about the benefits of digitalization for teaching and its social impact (Ertmer et al., 2014). The way one uses digital technology for the benefit of teaching/learning quality becomes a key success factor in the field of education (Korhonen et al., 2021).

Learning from digital materials requires students’ greater motivation and self-regulation compared to learning in a classroom context (see Dabbagh & Bannan Ritland, 2005; Dabbagh & Kitsantas, 2004; 2005; Moore & Kearsley, 2005), while individual differences among students shape the way technology will be used in learning (Azevedo, 2005; Hartley & Bendixen, 2001). **Metacognition** represents the ability to learn persistently and organize one’s own learning, both individually and in a group, including efficient time and information management, self-regulated, autonomous and intentional learning necessary for personal and professional advancement (Pešikan and Lalović, 2017: 28). It includes awareness of one’s own learning process, understanding and controlling one’s own thinking and learning process, identifying the available opportunities and possessing the ability to overcome obstacles in order to make learning successful. Thanks to this competency, the learners can choose the learning method and learning environment that suits them best and adapt them in accordance with their learning needs. **Self-regulation** is the ability to effectively use cognitive strategies and monitor their application (Zeidner, Boekaerts & Pintrich, 2000; Zimmerman, 2002). Many teachers do not teach their students how to learn independently, and many wrongly think that self-regulation is an intrinsic skill (Williamson, 2015). Digital environments

require students to have a high degree of self-regulation in order to be successful at school (Hartley & Bendixen, 2001; Valenta et al., 2001; Dabbagh & Kitsantas, 2004), so digital textbooks must support the development of self-regulated learning (for example, through the type of navigation they provide).

- 6. Even the best textbook is not sufficient without the mediation of a teacher.** Research findings related to learning during the time of the COVID-19 pandemic⁷ show that students benefit less if teaching depends mainly on online resources. Reading and instructions given on the internet have proven ineffective in teaching children how to learn and deal with teaching content. Learning in the online environment will be effective only in cases when it is actively taught in the classroom by teachers. Although it sounds paradoxical, people develop the ability to work autonomously, either online or offline, **through the process of instruction or mentoring** by others (Warschauer, 2007). Previous research findings indicate the importance of preparing for the use of digital content. Digital resources have gained added value where teachers have worked with students in the classrooms, teaching them how to collect, analyse, interpret and discuss data before going online. In other words, *the central figure and basic characteristic that enables efficient use of digital content is a teacher who is dedicated to working with students through face-to-face communication, actively teaching and mentoring students, especially in the early stages, and preparing them for online learning.* Without these aspects, teaching can leave students without a “rudder” to navigate, which may be particularly detrimental to at-risk students, such as those with learning disabilities, insufficient literacy levels, insufficient language skills, or insufficient prior knowledge. Such students are least able to cope with digital environments because these environments place a cognitive burden on the learner (Feldon, 2004; Kalyuga et al., 2003).

The potential educational benefits of integrating technology into teaching/learning directly depend on several factors at the school and teacher levels: professional development of teachers; availability of resources and technical support in its implementation; support from the school administration for the integration of ICT in teaching; teacher training for the application of ICT in teaching/learning; readiness of teachers to integrate technology into teaching; teachers’ beliefs and attitudes about the impact of technology on student learning and classroom activities (Inan and Lowther, 2010; Lowther et al., 2008; Murphy et al., 2007; Penuel, 2006; Dawson et al., 2008; Rutledge et al., 2007).

- 7. Identifying the reasons for the introduction of digital textbooks.** The following question needs to be asked when introducing digital textbooks: what is the main motive for their creation? Is it: an economic motive, that is – cheaper textbook production; a political one – a huge percentage of the population is included in the education system (students, teachers, professional associates, parents, textbook publishers, researchers, etc.), and these people are also voters; a practical one – the easier dissemination of textbooks; increasing the equity of education – availability of quality materials to all categories of students, especially those from socially deprived groups; is it motivated by sheer need due to specific circumstances – such as schooling during the COVID-19 pandemic; because it is fashionable – everyone does it, so must we; or for specific pedagogical reasons, such as the possibility of more frequent, easier and less costly changes in content (especially in rapidly changing propulsive areas), or there is a general effort

7 See, for example: CEPS Journal Special Issue: Education in the Covid-19 Era, 2021, <www.cepsj.si/index.php/cepsj/issue/view/45>.

to achieve better teaching/learning effects and better education? Due to the developmental and formative role of textbooks as a learning resource, the central question that should be asked before the creation of digital textbooks is: **What specific problem(s) in teaching/learning are the digital textbooks trying to solve?** If we expect positive effects on learning, what is it that we are relying on, which most likely guarantees the expected positive impact on learning? In addition, **there are prerequisites and factors that need to be considered in a given context** (school, teacher and local levels) **that may support or hinder** the effective application of technology in teaching (see previous items).

QUALITY STANDARDS FOR DIGITAL TEXTBOOKS AND ADEMS

STANDARD CATEGORY	STANDARDS
A. Textbooks and the curriculum	<ol style="list-style-type: none"> 1. The textbook contributes to achieving the general goals of education. 2. The textbook is harmonized with the goals and outcomes of the curriculum. 3. The content of the textbook is up-to-date and adequately presented. 4. The scope of the textbook is adequate; there is a balance between depth and breadth in the processing of the content of the subject.
B. The structure and didactic organization of the textbook content	<ol style="list-style-type: none"> 5. The textbook has instructions for use. 6. The content of the textbook is clearly organized. 7. The content of the textbook is coherent. 8. Keywords, terms and unknown words are highlighted in the text.
C. Learning and the textbook	<ol style="list-style-type: none"> 9. The textbook represents a model of successful learning by leading and guiding students in the learning process. 10. The textbook offers various learning activities that are in line with the objectives and outcomes of the subject and the developmental opportunities, competencies and knowledge of students. 11. Students can follow their own progress and check their achievements.
D. The language of the textbook	<ol style="list-style-type: none"> 12. The textbook is written in accordance with the grammar and spelling norms of the standard literary language. 13. The textbook is adjusted to the age and language abilities of the students.
E. Pedagogical use of digital functions	<ol style="list-style-type: none"> 14. Interactive activities and multimedia content encourage and facilitate learning. 15. There is an appropriate balance between text and multimedia content and/or interactive activities.
F. Technical and functional requirements	<ol style="list-style-type: none"> 16. The digital textbook must be compatible with computer devices and modern operating systems. 17. All hyperlinks are valid, and copyright is observed. 18. The digital textbook is easy and simple for students to use. 19. Other technical-technological characteristics of the digital textbook function properly.

3.

QUALITY STANDARDS FOR TEXTBOOKS AND AUXILIARY DIGITAL EDUCATIONAL MATERIALS

This section presents the quality standards for textbooks and their indicators, based on which the standard is operationalized (concretized), and its realization is assessed (methodological instructions for assessing the realization of the standard are given in the next chapter). The standards are divided into six major categories:

- A.** Textbooks and the curriculum
- B.** The structure and didactic organization of the textbook content
- C.** Learning and the textbook
- D.** The language of the textbook
- E.** Pedagogical use of digital functions
- F.** Technical and functional requirements

A. TEXTBOOKS AND THE CURRICULUM

1. THE TEXTBOOK CONTRIBUTES TO ACHIEVING THE GENERAL GOALS OF EDUCATION

- 1.1. The textbook is harmonized with the general goals and principles of education and upbringing and contributes to achieving the goals of a certain level and profile of education.
- 1.2. The textbook contributes to the development of key twenty-first-century competencies, primarily those that are in line with the epistemological nature of the content and objectives of the subject.
- 1.3. The textbook and all its structural components support the development of basic social values defined in the general goals of education and upbringing (equality, freedom, justice, honesty, tolerance, cooperation, non-discrimination, etc.).
 - 1.3.1. Positive values and attitudes are nurtured through textbooks of all subjects.
 - 1.3.2. The entire value-related contents in the textbook are in accordance with the nature and objectives of the subject.
 - 1.3.3. The value-related messages in the textbook are consistent and coherent and contribute to building a holistic value system.

2. THE TEXTBOOK IS HARMONIZED WITH THE OBJECTIVES AND OUTCOMES OF THE CURRICULUM

- 2.1. All aspects of the textbook – its content, the organization of the content, and its didactic design – are harmonized with the objectives of the curriculum.
- 2.2. The textbook and all its aspects and components contribute to achieving the outcomes of the curriculum.

3. THE CONTENT OF THE TEXTBOOK IS UP-TO-DATE AND ADEQUATELY PRESENTED

- 3.1. The content of the textbook is sufficient so that one can learn the basic content provided by the curriculum, while the learning objectives of the subject can be realized (without the use of additional materials).
- 3.2. The content of the textbook is optimal and rational for achieving the goals of a given subject within a given year of learning and teaching.
- 3.3. The content of the textbook includes knowledge and skills that form the basic literacy for a given subject within a particular grade or educational cycle.

- 3.4. The textbook's content reflects accurate, modern, generally accepted scientific knowledge relevant to the subject's objectives and the year of study and teaching.
- 3.5. The content of the textbook reflects the nature of knowledge, methodology of work, way of thinking and acting in a given discipline.
- 3.6. The content of the textbook is presented in such a way that, where appropriate, there are more perspectives and balanced views on the issues that are addressed.
- 3.7. The content and illustrations of the textbooks do not contain any form of distortion (such as excessive generalization or stereotyping) or discrimination (of different cultural, social or religious systems and values), either explicitly or implicitly.
- 3.8. Sources of information are marked in the textbook in an intellectually appropriate way (academic integrity).
- 3.9. The textbook provides suggestions for selected materials or web pages for further reading and study (preferably with a short annotation) in order to encourage students to read larger amounts of material on their own.
- 3.10. The content of the textbook and the way of its presentation are in accordance with the students' cognitive level and their prior knowledge.
- 3.11. Interdisciplinary topics and competencies are incorporated into the content of the textbook in accordance with the nature of the subject, its content and objectives.

4. THE SCOPE OF THE TEXTBOOK IS ADEQUATE; THERE IS A BALANCE BETWEEN DEPTH AND BREADTH IN THE PROCESSING OF THE CONTENT OF THE SUBJECT

- 4.1. The content is extensive and studious enough to allow students to understand and acquire it, but it does not go into too much detail regarding the purpose and objectives of learning a given subject.
- 4.2. It is quite clear in the textbook which content is basic and which is considered supplementary and accompanying.
- 4.3. Supplementary content that does not form the basic corpus of the material must be adequately denoted and this denotation is consistently used throughout the textbook.

B. THE STRUCTURE AND DIDACTIC ORGANIZATION OF THE TEXTBOOK CONTENT

5. THE TEXTBOOK HAS INSTRUCTIONS FOR USE

- 5.1. The guide for using the textbook is found at the beginning – it is clear, simple and adapted to the students' age and educational experience.
- 5.2. The beginning of the textbook can feature an overview of the learning objectives of the subject.

6. THE CONTENT OF THE TEXTBOOK IS CLEARLY ORGANIZED

- 6.1. The textbook has a clear logical structure and organization of thematic units (chapters, topics, modules) and their elements (lessons, blocks, learning units).
- 6.2. The structure and organization of the textbook content are clearly shown in the contents section of the book.
- 6.3. The contents section is organized according to a clear principle (hierarchical, chronological, logical, problematic, etc.) and can be found at the beginning of the textbook.
- 6.4. The structure of the textbook is artistically and graphically denoted and this denotation is consistently applied throughout the textbook.

7. THE CONTENT OF THE TEXTBOOK IS COHERENT

- 7.1. The order in which the content is presented is appropriate and logical, and the ideas are logically connected and coherent.
- 7.2. The textbook establishes meaningful connections between individual parts of the material and ensures their integration (summaries, main messages of the lesson, maps of concepts, linking content, etc.).
- 7.3. The thematic learning unit (lessons, blocks, topics, etc.) can be flexibly linked to form alternative paths (trajectories) of learning and meet students' different needs and competencies.
- 7.4. The textbook features a vertical connection between the content; it relies on previously learned material in the given subject and refers to learning content from the grades to come.
- 7.5. The textbook features a horizontal connection of the material with other contents that are taught in the same class at that level of study.

- 7.6. The content of the textbook is connected with real life, in line with the objectives of the subject and the competencies of students.
- 7.7. In accordance with the nature of the subject, the content of the textbook is related to the extracurricular knowledge and experiences of students, taking into account the life experiences of students and the specifics of the environment students come from (socio-cultural and economic background).

8. KEYWORDS, CONCEPTS AND UNKNOWN WORDS ARE HIGHLIGHTED IN THE TEXT

- 8.1. Keywords and unknown words are adequately explained whenever they appear for the first time.
- 8.2. The labelling of unknown words, keywords and terms has been consistently carried out throughout the book and explained in the textbook user guide.
- 8.3. An index of unknown words and an index of terms are given in the textbook.

C. LEARNING AND THE TEXTBOOK

9. THE TEXTBOOK REPRESENTS A MODEL OF SUCCESSFUL LEARNING, BY LEADING AND GUIDING STUDENTS IN THE LEARNING PROCESS

- 9.1. In the way of presenting the content, the textbook offers a model of how to think and work with the given content in a given area.
- 9.2. The textbook supports the development of the students' ability to learn by giving the necessary instructions, comments and explanations, as well as drawing attention to how to work with the given content, and not just what needs to be learned from the content.
- 9.3. The textbook demonstrates techniques and strategies of intellectual work (how to learn, "learning to learn", how to prepare a report, how to present data, etc.).
- 9.4. The textbook supports the students' construction of a system of concepts by continually establishing connections between its content and between key concepts. The links between related topics and/or concepts are explicitly and clearly stated.
- 9.5. New concepts are built on old ones; there is continuity in the development of concepts in order to facilitate a smooth transition between different stages of learning, marks and number of years of learning a particular subject.
- 9.6. There are appropriate examples in the textbook that are relevant to the learning objectives and correspond to the student's experience.

10. THE TEXTBOOK OFFERS VARIOUS LEARNING ACTIVITIES THAT ARE IN LINE WITH THE OBJECTIVES AND OUTCOMES OF THE SUBJECT AND THE DEVELOPMENTAL OPPORTUNITIES, COMPETENCIES AND KNOWLEDGE OF STUDENTS

- 10.1. The questions, assignments and tasks are in line with the nature of the subject and are relevant to achieving the objectives and learning outcomes of the given subject.
- 10.2. The questions, assignments and tasks are located in different places in the textbook, depending on their purpose (activation of prior knowledge, connecting old and new knowledge, the way the text points out problems, checking comprehension or summarizing what has been learned).
- 10.3. The questions, assignments and tasks are diverse:
 - 10.3.1. The textbook uses questions, assignments and tasks that stimulate cognitive processes of different levels of complexity and difficulty, from reproduction and understanding, through connection, application and analysis, to assessment, evaluation and synthesis, and the creation of new ones.

- 10.3.2. Higher-level cognitive skills, which require analysis, assessment, evaluation and critical thinking, judgment making and similar skills are gradually and progressively included in the textbook, taking into account the students' abilities and developmental needs.
- 10.3.3. The forms of tasks (essay assignments, open-ended short-term assignments, multiple-choice assignments, complements, matching, interpretive assignments, etc.) are selected according to the purpose (formative or summative assessment) and objectives of the assessment, as well as the nature of the content of a given subject.
- 10.3.4. Deep processing of information, as well as critical and creative thinking, are encouraged by involving students in structured problems of smaller scope and providing them with more open-ended tasks (without offered answers), as well as further reading. Students' ability to express themselves and their functional reading literacy are developed in various subject areas through these tasks.
- 10.3.5. Learning tasks and activities are meaningful for students and motivate them to work.
- 10.3.6. The textbook uses authentic tasks, ones that are encountered in real life. Where necessary, such tasks encourage the use of authentic materials and resources that exist in the local community.
- 10.3.7. There is a correspondence between the scope and level of activities and their effects in the textbook (there are no activities that are demanding, require time, effort or resources, while their effect is small and insufficiently relevant to the goals and outcomes of teaching/learning).
- 10.3.8. Textbook learning activities are suitable for students from different backgrounds and different experiences (the textbook is not only close to a certain category of students, e.g. urban-centric or rural-centric).
- 10.4. There are clear and detailed instructions for working on tasks.
- 10.5. Learning activities contribute to the development of key twenty-first-century competencies in students (critical thinking, creative thinking, problem solving, information literacy, digital literacy, learning to learn, development of lifelong learning skills, etc.) in line with the nature of the subject and its objectives.

11. STUDENTS CAN FOLLOW THEIR OWN PROGRESS AND CHECK THEIR ACHIEVEMENTS

- 11.1. The textbook provides the student with conditions and opportunities to continuously monitor the course and the pace of their own progress in acquiring the material.
- 11.2. Students' achievements in learning activities comprise the basis for providing feedback on how well the student is learning and how effective the learning process is, as well as the basis for receiving instructions for further learning.
- 11.3. The textbook also includes formative assessment, which encourages the development of students' metacognitive skills (insight into their own learning, analysis, evaluation, monitoring and improving their own learning), and whose goal is to monitor the learning process and improve student achievement.

D. THE LANGUAGE OF THE TEXTBOOK

12. THE TEXTBOOK IS WRITTEN IN ACCORDANCE WITH THE GRAMMAR AND SPELLING NORMS OF THE STANDARD LITERARY LANGUAGE

13. THE TEXTBOOK IS ADJUSTED TO THE AGE AND LANGUAGE ABILITIES OF THE STUDENTS

- 13.1. The length of the sentences and the length of the text are in accordance with the age-related abilities of students. Sentences should be somewhat longer and more developed than those typical of children of the given age, but not too long and complex.
- 13.2. The level of the complexity of the language is proportional to the language ability of the students for whom the textbook is intended.
- 13.3. Technical terms are introduced progressively and used consistently in the textbook. All technical terms are explained and appropriately defined when introduced for the first time and then consistently used throughout the textbook in different contexts.
- 13.4. Terms and concepts that are similar or identical to those in some other subjects (disciplines) are further explained, and their definitions in different subjects are compared.
- 13.5. The text is divided into meaningful and coherent passages (paragraphs) to help students process the textual content.

E. PEDAGOGICAL USE OF DIGITAL FUNCTIONS

14. INTERACTIVE ACTIVITIES AND MULTIMEDIA CONTENT ENCOURAGE AND FACILITATE LEARNING

- 14.1. The basic and the accompanying, i.e. additional, contents in the textbook can be easily distinguished.
- 14.2. Multimedia, interactive activities and digital tools support learning with understanding thanks to their quantity and scope and focus on the central issues of each learning unit (lesson, chapter, block, module); they do not overload students with the main content.
- 14.3. The branching structure of the textbook is used to adapt the textbook to the nature of the content and different characteristics of students, i.e. it allows students to access the textbook in different ways, choosing the way that suits them best.
- 14.4. All digital contents are didactically shaped, regardless of the form in which they are given (visuals, videos, sound recordings, etc.); they are high-quality in technical terms and edited for learning purposes.
- 14.5. Multimedia presentation of content is adapted to students' developmental and cognitive capacities.
- 14.6. Feedback is built into the textbook and, when necessary, there is appropriate human interaction.
- 14.7. An appropriate interface is provided for access to the dictionary, index of terms, index of authors and other components of the textbook.

15. THERE IS AN APPROPRIATE BALANCE BETWEEN TEXT AND MULTIMEDIA CONTENT AND/OR INTERACTIVE ACTIVITIES

- 15.1. All the structural components (text, interactive activities, multimedia content) are harmonized with each other and aimed at achieving learning goals.
- 15.2. The interactive activities, multimedia content and text are appropriately and consistently highlighted in the textbook.

F. TECHNICAL AND FUNCTIONAL REQUIREMENTS

16. THE DIGITAL TEXTBOOK MUST BE COMPATIBLE WITH COMPUTER DEVICES AND MODERN OPERATING SYSTEMS

- 16.1. The digital textbook must be compatible with many commonly used computer devices and many commonly used modern operating systems.
- 16.2. The digital textbook can be used with several free modern browsers or e-readers. If digital rights management (DRM) tools are used, textbook users must be provided with the necessary software or plug-in free-of-charge.

17. ALL HYPERLINKS ARE VALID AND COPYRIGHT IS OBSERVED

18. THE DIGITAL TEXTBOOK IS EASY AND SIMPLE FOR STUDENTS TO USE

- 18.1. Navigating through the textbook is simple, logical and understandable, adapted to the age and competencies of the students who use it.
- 18.2. The layout of the content is consistent and intuitive and easy to navigate.
- 18.3. Common font types are used with font sizes adapted to the students' age or their specific characteristics.
- 18.4. The content fits into one page for easy reading.
- 18.5. There is no need to install an additional plug-in to play video and audio clips.
- 18.6. Students have access to free online dictionaries and tools to facilitate learning, such as notes, annotation, marking and highlighting tools.
- 18.7. In addition to video and audio material, relevant content can be downloaded to the student's computer for offline reading using free browsers or e-readers.
- 18.8. Appropriate interface and navigation and search functions are available, such as a contents section, contents with links, *location of the current page*, as well as buttons to go to the next page or return to the previous page, a hypertext search function, index search and keyword search, etc.

19. THE OTHER TECHNICAL-TECHNOLOGICAL CHARACTERISTICS OF THE DIGITAL TEXTBOOK FUNCTION PROPERLY

4.

METHODOLOGICAL GUIDE FOR THE APPLICATION OF STANDARDS AND QUALITY ASSESSMENT OF DIGITAL EDITIONS OF TEXTBOOKS AND AUXILIARY DIGITAL EDUCATIONAL MATERIALS

When performing quality control of digital textbooks and auxiliary digital educational materials (hereinafter: ADEMs) it is necessary to answer questions that can be classified into six basic groups and which relate to:

- I. The concept of ADEMs
- II. The content of the digital textbook and the ADEMs
- III. Support for the student in using and learning from digital textbooks and the ADEMs
- IV. The technical properties of the digital textbook and the ADEMs
- V. The competencies necessary for the use of the digital textbook and the ADEMs
- VI. The accessibility of the digital textbook and the ADEMs to children with special educational needs

Questions from the second group which relate to the content of the digital textbook and ADEMs can be further divided into three subgroups and relate to:

- II.1. Selection and preparation of the learning content in the digital textbook and ADEMs,
- II.2. Presentation and organization of learning content in the digital textbook and ADEMs,
- II.3. Presentation and organization of learning content in the digital textbook.

The majority of the questions above relate to both the digital textbook and the ADEMs. However, given that the textbook is **more comprehensive** in relation to the auxiliary materials (the textbook refers to all the programme objectives and outcomes, while auxiliary materials refer only to some), the number of questions to consider when performing the quality

control of digital textbooks is higher, and these issues are covered by item II.3. These are issues related to *the presentation and organization of learning content in the digital textbook*. However, in the case where the ADEMs consist of several related units, modules, lessons or the like, said questions (organization of these units as a whole) become relevant for assessing the quality of ADEMs.

On the other hand, due to the specific role they play (as they refer only to some programme objectives and outcomes), ADEMs must have a clearly *defined role and conditions of use in teaching*. When it comes to the textbook, these questions are not asked, because the textbook is used throughout the school year and facilitates the achievement of all the programme objectives and outcomes. ADEMs are used during a part of a class or several classes and serve to achieve individual objectives and outcomes of the programme. The quality of the use of these additional materials depends on their **usefulness in the learning process**. It is justified to use certain materials together with the textbook only *when certain learning objectives can be achieved more efficiently with their help*, e.g. if they allow a better understanding of the content, better systematization of knowledge, testing or development of certain skills, abilities, etc. These issues are also covered in the Concept of ADEMs .

Key questions related to quality control of digital textbooks and auxiliary digital educational materials

1. QUESTIONS RELATING TO THE CONCEPT OF AUXILIARY DIGITAL EDUCATIONAL MATERIALS

- ▶ Do the ADEMs have a precisely defined role and conditions of use in teaching?
- ▶ Do the ADEMs contain the necessary elements of learning: learning content and didactic apparatus?

2. QUESTIONS RELATING TO THE CONTENT IN THE DIGITAL TEXTBOOK AND AUXILIARY DIGITAL EDUCATIONAL MATERIAL

1. Questions relating to the selection and preparation of learning content in the digital textbook and ADEM

- ▶ Does the learning content in the digital textbook or ADEM reflect the specifics of learning in a given field of knowledge?
- ▶ Is the content of the digital textbook sufficient to achieve the intended programme objectives and outcomes, or the objectives and outcomes envisaged by the ADEM?
- ▶ Is the content of the digital textbook or ADEM adapted to the students' cognitive level, prior knowledge and experience?
- ▶ Do students have enough time to learn the intended content?
- ▶ Is the content of the digital textbook or ADEM intended for different categories of students?
- ▶ Does the digital textbook or ADEM affirm exclusively positive social values (equality, justice, tolerance, mutual respect, etc.)?

2. Questions relating to the presentation and organization of learning content in the digital textbook and ADEM

- ▶ Is the learning content in the digital textbook or in the ADEM logically organized and clearly presented?
- ▶ Is the language used in the digital textbook or ADEM appropriate for students?
- ▶ Does the visual content in the digital textbook or ADEM serve the function of better understanding the content?
- ▶ Does the auditory content in the digital textbook or ADEM contribute to achieving the goals of learning/teaching?

- ▶ Does the audio-visual content of the digital textbook and/or ADEM help better understand the content that is taught?
- ▶ Are the use and combination of individual forms of content presentation in the digital textbook and/or ADEM adequate in relation to learning objectives and adapted to students' information-processing abilities?
- ▶ Are the pages/screens of the digital textbook or ADEM clear, well-organized and consistently implemented?

3. Questions relating to the presentation of learning content and its organization in the textbook

- ▶ Does the digital textbook represent a unique, logically connected, coherent whole?
- ▶ Is the entire content of the digital textbook visible and accessible to the student?
- ▶ Is there a possibility in the digital textbook to navigate through the learning contents and search the horizontal and vertical connections in the content of the textbook?
- ▶ Does the digital textbook offer models for arranging and systematizing knowledge?

3. QUESTIONS RELATING TO SUPPORT TO THE STUDENT IN LEARNING AND USING A DIGITAL TEXTBOOK AND AUXILIARY DIGITAL EDUCATIONAL MATERIAL

- ▶ Does the digital textbook or ADEM allow easy use and provide support for their use?
- ▶ Does the digital textbook or ADEM encourage active learning and the development of cognitive skills and abilities?
- ▶ Does the digital textbook or ADEM encourage the development of social skills?

4. QUESTIONS RELATING TO THE TECHNICAL PROPERTIES OF DIGITAL TEXTBOOKS AND AUXILIARY DIGITAL EDUCATIONAL MATERIALS

- ▶ Is the presentation and organization of content on different digital devices good and clear so that changing the device does not negatively affect the learning process?

5. QUESTIONS RELATING TO THE COMPETENCIES REQUIRED FOR THE USE OF A DIGITAL TEXTBOOK AND AUXILIARY DIGITAL EDUCATIONAL MATERIAL

- ▶ Does the digital textbook or ADEM require specific additional skills (competencies) for students and teachers to use them?

6. QUESTIONS RELATING TO THE ADAPTATION OF DIGITAL TEXTBOOKS AND AUXILIARY DIGITAL EDUCATIONAL MATERIALS FOR STUDENTS WITH SPECIAL EDUCATION NEEDS

- ▶ Is the digital textbook or ADEM equally accessible to all students?

Quality indicators and possible mistakes in digital textbooks and auxiliary digital educational materials

The aims of quality control are twofold: to *eliminate the observed shortcomings* and/or *poor solutions* in order to obtain a functional digital textbook or ADEM that ensures the achievement of the programme goals and outcomes, and to *prevent non-functional educational materials from entering the educational process*, that is, a digital textbook or ADEM that does not ensure the achievement of the programme objectives and outcomes.

This part of the material covers:

1. The qualities of the digital textbook and ADEM;
2. The subject of analysis in the process of quality control of the digital textbook and ADEM;
3. The quality indicators of the digital textbook and ADEM;
4. Possible mistakes in the development and structure of the digital textbook and ADEM.

The section related to the qualities of the digital textbook and ADEM responds to the key quality control questions that have been asked. The responses stem from quality standards – the responses therefore represent their further operationalization and elaboration regarding what the digital textbook and ADEM should look like to ensure the achievement of the programme objectives and outcomes. In addition to the qualities of the digital textbook and ADEM, the **subject of analysis is also listed**. It highlights the individual components of a digital textbook or ADEM that need to be considered during the evaluation of the quality of a digital textbook or ADEM. **Quality indicators** describe the expected features of a digital textbook or ADEM, while **mistakes** indicate shortcomings in the development and structure of a digital textbook or ADEM. As regards mistakes, it is important to note that these are possible or potential mistakes that may occur as a result of uncritical use of the possibilities provided by digital media. This type of mistake occurs when more attention is paid to the possibilities provided by the digital medium than to the **nature of the learning process** and **the possibilities of the students**. *The possibilities of digital media must be adapted to the needs of students and used in the function of learning, and not the other way around.*

1. QUESTIONS RELATING TO THE CONCEPT OF AUXILIARY DIGITAL EDUCATIONAL MATERIALS⁸

AUXILIARY DIGITAL EDUCATIONAL MATERIALS HAVE A PRECISELY ESTABLISHED ROLE AND CONDITIONS OF USE IN TEACHING

⁸ These qualities apply exclusively to ADEMs. When it comes to textbooks, this question is not asked in principle. The textbook is used throughout the school year and should enable the efficient achievement of all objectives and outcomes of the subject.

Unlike a textbook, which is sufficient for achievement of all the programme objectives and outcomes and which is used throughout the teaching process, ADEMs must have an established role and conditions of use in teaching, i.e. defined learning objectives and learning outcomes, as well as the timeframe and method of their use in the teaching process.

The subject of analysis: objectives, outcomes, the timeframe of the use of ADEMs in teaching.

To determine: Do the ADEMs have a precisely defined role and conditions of use in teaching?

Quality indicators:

Auxiliary digital educational materials have:⁹

- ▶ Established learning goals (understanding of concepts, knowledge systematization and connection, development of certain abilities, skills, attitudes, values, etc.);
- ▶ Certain content related to one or more programme outcomes;
- ▶ An established timeframe for its use in teaching (it is used in one part of the class, during the entire class, in a number of classes, etc.);
- ▶ A defined relationship with the textbook (the ADEMs justify their application in teaching only if it provides what the textbook cannot achieve or if it better ensures the achievement of certain programme objectives/outcomes).

Possible mistakes:

- ▶ ADEMs do not have established objectives, outcomes and a timeframe for their use in the teaching process.
- ▶ ADEMs do not have a specific role or do not contribute in relation to the textbook (they contain what is already given in the textbook, they do not contribute to more efficient achievement of the programme objectives (better comprehension, systematization, skills development, etc.).

AUXILIARY DIGITAL EDUCATIONAL MATERIALS CONTAIN THE NECESSARY LEARNING ELEMENTS: CONTENT AND DIDACTIC APPARATUS

Like digital textbooks, ADEMs have learning content and must include didactic apparatus to support the development (construction) of the students' knowledge. If these elements are not functionally interconnected in the ADEMs, the materials will not contribute to achieving the objectives of the curriculum.

The subject of analysis: elements of an ADEM.

Determine: Does the ADEM contain the necessary elements of learning: learning content and didactic apparatus?

Quality indicators:

- ▶ The ADEM contains the necessary elements of learning: learning content and didactic apparatus.

⁹ In order to assess this quality, the ADEMs must be accompanied by material which precisely defines the role and conditions of using ADEMs in the teaching process.

- ▶ All the ADEM elements have a clearly defined function (e.g. they ensure understanding of the content, initiate learning activities, and allow checking of what has been learned).
- ▶ Learning content and didactic apparatus in the ADEM are functionally interconnected (e.g. depending on their function, the tasks are used in different places: at the beginning of learning – to engage students’ prior knowledge; during learning – to initiate learning activities; at the end – to check what has been learned).

Possible mistakes:

- ▶ The ADEM contains only the learning content (film, presentation, etc.), without elements that encourage and guide the learning process (questions, assignments, tasks, etc.).
- ▶ The ADEM contains elements that are not relevant to the learning objectives (games, puzzles, quizzes, etc. that waste the students’ time and cognitive capacity and do not contribute to achieving the learning objectives).
- ▶ The ADEM learning content and didactic apparatus are not functionally interconnected (e.g. questions, assignments and tasks are complementary to the content, rather than supporting the learning of the given content).

2. QUESTIONS RELATING TO THE CONTENT OF THE DIGITAL TEXTBOOK AND AUXILIARY DIGITAL EDUCATIONAL MATERIAL

2.1. Questions relating to the selection and preparation of learning content in the digital textbook or ADEM

THE LEARNING CONTENT IN THE DIGITAL TEXTBOOK AND ADEM IS UP-TO-DATE, ACCURATE AND REPRESENTS THE NATURE OF THE SUBJECT

The learning content in the digital textbook or ADEM is up-to-date, accurate and represents the nature of the subject and the specifics of learning in a particular field of knowledge (e.g. language, mathematics and biology).

To determine: Does the learning content in the digital textbook or ADEM reflect the specifics of learning in a given field of knowledge?

The subject of analysis: learning content in the digital textbook and ADEM (basic text).

Quality indicators:

- ▶ Learning content in the digital textbook and ADEM:
- ▶ The learning content represents generally accepted and up-to-date scientific knowledge, that is properly interpreted and relevant to the objectives of the subject and the year of its learning and teaching.

- ▶ The learning content represents the nature of knowledge and the “spirit” of a given discipline, methodology, way of thinking and acting in a given discipline.

Possible mistakes:

- ▶ The learning content in the digital textbook or ADEM is incorrect, there are substantial errors, it is unscientific, or there was a distortion of content and loss in its precision/accuracy in an attempt to simplify the presentation to students.
- ▶ Careless and indiscriminate use of learning content found on the internet, where up-to-date, accurate and scientific information is often inaccurate, unscientific or distorted.

THE LEARNING CONTENT IN THE DIGITAL TEXTBOOK AND ADEM MAKES IT POSSIBLE TO ACHIEVE THE PROGRAMME OBJECTIVES AND OUTCOMES

Unlike a textbook that includes the necessary content to achieve all the objectives and outcomes of the programme, the ADEM includes content that is necessary to achieve the goals and outcomes envisaged by the ADEM.

The subject of analysis: Learning content in the digital textbook or ADEM (basic text).

Determine: Is the content of the digital textbook or ADEM sufficient to achieve the intended objectives and outcomes of the programme or the objectives and outcomes envisaged by the ADEM?

Quality indicators:

- ▶ The content of the digital textbook is relevant and sufficient to ensure the realization of all the objectives/outcomes of the programme.
- ▶ The content of the ADEM is harmonized with the programme (the ADEM covers the realization of one or more objectives/outcomes of the programme).

Possible mistakes:

- ▶ The content of the digital textbook or ADEM is insufficient or inadequate to achieve the intended objectives and outcomes of the programme.
- ▶ The content of the ADEM is not harmonized with the programme (the content does not cover any of the intended objectives/outcomes of the programme).

LEARNING CONTENT IN THE DIGITAL TEXTBOOK AND ADEM IS ADAPTED TO THE STUDENTS' AGE

Learning content and the way it is presented in the textbook or ADEM must be adapted to the students' cognitive development, prior knowledge and experiences in order to adequately respond to their learning needs.

The subject of analysis: The basic text (appropriateness).

To determine: Is the content of the digital textbook or ADEM adapted to the students' cognitive level, prior knowledge and experience?

Quality indicators:

- ▶ The learning content in the digital textbook or ADEM:
- ▶ represents a novel content adapted to the age and prior knowledge of the students for whom it is intended (the content is not absolutely unknown nor completely familiar to students, but rather represents an optimal learning challenge);
- ▶ is adapted to the cognitive level of the students.

Possible mistakes:

- ▶ The learning content in the digital textbook or ADEM does not represent well-measured, new content to students; it does not rely on their previous knowledge and does not introduce new material gradually.
- ▶ The way the content is presented is too simple for students (below their developmental capabilities) or too complex and difficult (far above their developmental capabilities).

THE QUANTITY OF THE CONTENT IN THE DIGITAL TEXTBOOK AND ADEM IS ADJUSTED TO THE TIME AVAILABLE FOR LEARNING

When a digital textbook or ADEM contains an inappropriate quantity of new information relative to the time available for learning, the likelihood of mechanical learning increases. When time is limited and there is a lot of content to learn, students usually shorten the time they take to think about the content and proceed to learn it without sufficient understanding.

The subject of analysis: The amount of new information for learning in relation to the time available for learning.

To determine: Do students have enough time to learn the intended content?

Quality indicators:

The quantity of new information in the digital textbook or ADEM is well-measured in relation to the time given to the students to learn (harmonized with the curriculum).

Possible mistakes:

- ▶ Lessons (thematic units) in the digital textbook or ADEM contain too much information in relation to the time planned for their learning (the material is too extensive).
- ▶ The digital textbook and ADEM offer too many automatic connections and links (links to all the available information from a particular area), which leads to overloading students with information and losing the fundamental and essential aspects of the given content.

THE CONTENT OF THE DIGITAL TEXTBOOK AND ADEM RESPECTS STUDENTS' INDIVIDUAL DIFFERENCES

The digital textbook or ADEM uses the possibilities of digital media to meet the individual differences and specific needs of students, to further motivate them to learn and work, and support learning with understanding.

The subject of analysis: Additional content, web addresses, etc.

To determine: Is there content in the digital textbook or ADEM intended for different categories of students?

Quality indicators:

- ▶ In the digital textbook or ADEM:
- ▶ there is a differentiation of content between the compulsory and optional content, that is intended for students with different abilities and different interests;
- ▶ the additional content has a clearly marked function it should fulfil (to facilitate understanding, expand knowledge, meet different interests, etc.);
- ▶ additional content is carefully incorporated into the basic text so that it does not interrupt students and overload him/her and does not disturb the students' attention while acquiring the basic content.

Possible mistakes:

- ▶ There is no clear differentiation of content into mandatory and supplementary/additional.
- ▶ The function of supplementary content that can be intended for students with learning difficulties, highly interested and gifted students is not clearly indicated (instructions such as: if this is not clear enough, you can find additional clarification here...; if you want additional information about this, please see...; if you are interested in the content, you will find more about it here..., etc.).
- ▶ Excessive indiscriminate inclusion of additional content in the digital textbook or ADEM (content that is not carefully selected or content without a clear objective and method of use).
- ▶ Additional contents are realized in such a way as to interrupt the presentation of the basic text, divert the students' focus from the basic topic, and distract and interrupt the students' attention during learning.

THE DIGITAL TEXTBOOK AND ADEM AFFIRM POSITIVE SOCIAL VALUES

The digital textbook and ADEM affirm only common and generally accepted positive social values through the content of the text and the way of its presentation (implicit messages of the text, choice of illustrations and content that they present, etc.)

The subject of analysis: Explicit and implicit messages in texts, illustrations, or examples.

To determine: Are only positive social values (equality, equity, tolerance, mutual respect, etc.) affirmed by the digital textbook or ADEM?

Quality indicators:

- ▶ In all structural components of the digital textbook and ADEM (text, illustrations, visual content, graphic organizers, examples, attachments, etc.):

- ▶ the messages that affirm basic social values are explicitly incorporated: equality, freedom, justice, honesty, respect for others, openness, tolerance, cooperation, solidarity, non-discrimination and the like;
- ▶ there are no unacceptable messages and biases in terms of values, such as over-generalizations or stereotyping, or discrimination based on certain characteristics (gender, age, place of residence, racial, ethnic, national, religious, cultural, health, social status, occupation, etc.);
- ▶ for socially sensitive content, more perspectives and balanced views on the issues being addressed are offered.

Possible mistakes:

- ▶ Use of content that is inappropriate in terms of values and ethics, that is discriminatory and contains unjustified distortions; or the tendentious omission of certain aspects of the content;
- ▶ Careless and indiscriminate use of content from the internet that may be morally and ethically inappropriate.

2.2. Questions relating to the presentation and organization of learning content in the digital textbooks and auxiliary digital educational materials

THE CONTENT IS LOGICALLY ORGANIZED AND CLEARLY PRESENTED IN THE DIGITAL TEXTBOOK AND ADEM

A good logical structure and clarity are very important for understanding the content, because poorly laid out and unorganized content makes learning difficult. The manner of presenting the content in the digital textbook or ADEM influences the development of students' strategies and intellectual work techniques.

The subject of observation: Learning content, its logical organization.

Determine: Is the learning content in a digital textbook or ADEM logically organized and clearly presented?

Quality indicators:

In the digital textbook or ADEM:

- ▶ longer texts are divided into smaller logical units (organized around basic ideas, key concepts, etc.);
- ▶ ideas are presented logically, according to a certain principle (general-specific; rule-example; causes-consequences; questions-answers, etc.);
- ▶ means of denotation (headings, boldface, framing, etc.) are used for better understanding, easier navigation and quick retrieval of important information in the text;
- ▶ metacognitive elements, which show the relation to the content, imitate the process of thinking about the content, the way of concluding, checking comprehension, etc. are embedded into the text; spatial arrangement and margins (white spaces) in the text ensure its clarity;

- ▶ the fonts that are used are simple and easy to read and adapted to the age of the students (as a rule, a larger font is used for younger ages, while overly stylized or ornate fonts or using too many types of fonts in the text is avoided for all ages);
- ▶ in addition to the text, the student has access to tools for working with the text (e.g. denotations for denoting parts of the text, the possibility to select parts of the text, the possibility to insert one's own comments, questions, etc.).

Special requirements:

- ▶ The possibility of changing the font type and font size is important for the visually impaired.
- ▶ The text background (colour, texture, etc.) must not reduce the readability of the text.
- ▶ Changing the text e-reader must not affect the visibility and readability of the text.

Possible errors:

- ▶ Long texts, lengthy lines of text without logical smaller units.
- ▶ One cannot recognize the logical thread around which the ideas being presented are organized.
- ▶ The means of denotation in the text are used too much or too little.
- ▶ The content is given in the form of exhaustive lists without logical and meaningful connections that contribute to the comprehension of the text.
- ▶ The content is not clear and well-arranged.
- ▶ The font styles and/or font size are inadequate.
- ▶ The tools for working on the text are not easily accessible to the student.

THE DIGITAL TEXTBOOK AND ADEM ARE WRITTEN IN STANDARD LITERARY LANGUAGE AND ADAPTED TO STUDENTS

The language of the digital textbook and ADEM must be a standard literary language, except in cases where it is part of the content or objectives of the subject (literary texts written in a dialect, linking content with extracurricular knowledge and experience, etc.). **The language is clear and age-appropriate, with all lesser-known words and terms explained, taking into account that each subject should enrich the students' vocabulary and support the development of their functional literacy.**

The subject of analysis: The language of the textbook; explanations of lesser-known words and expressions, dictionary, etc.

Determine: Is the language used in the digital textbook and ADEM appropriate for students?

Quality indicators:

In the digital textbook or ADEM:

- ▶ only standard literary language is used, except in cases where this is justified by the content or objectives of the subject;
- ▶ the length of the text and the length of the sentences are adapted to the students' age and encourage the development of their language skills;

- ▶ technical terms and unfamiliar words are clearly marked in the text and explained as soon as they first appear in the text, in the margins, or in the dictionary next to the text or in the hyperlink.

Possible mistakes:

- ▶ In order to get closer to students, digital textbooks and ADEM use popular “street” jargon (slang) even when this is not justified by the objectives of the subject.
- ▶ Technical terms and unfamiliar words in the text are not marked, or the way they have been marked varies in different parts of the text.
- ▶ No explanations of unfamiliar words and terms are provided in the given section, the textbook or the ADEM where they were first used.
- ▶ Excessive use of hypertext, too many links that disrupt the continuity of reading, and unnecessary marking of a large number of words (which disrupts reading and makes it difficult to follow the meaning of the text).
- ▶ Inadequate or insufficiently clear explanations of unknown words and expressions, or inadequate explanations that do not allow distinguishing of related terms and concepts.

THE VISUAL CONTENT IN THE DIGITAL TEXTBOOK AND ADEM CONTRIBUTES TO THE UNDERSTANDING OF THE TEXT

Visual content (illustrations, images, diagrams, graphs, tables, etc.) can serve as a standalone carrier of content or an additional means to clarify and better understand the ideas expressed in the text. Visual contents must be functionally connected with the text; in the text itself, students must be explicitly referred to visual contents, and it is necessary that questions, tasks and assignments also refer to them because, otherwise, students will skip them in learning. Visual content has a strong emotional potential to convey certain messages or values.

The subject of analysis: Visual content and its functional connection with the text.

To determine: Does the visual content in a digital textbook or ADEM function to help the students better understand the content?

Quality indicators:

The visual content (images, illustrations, graphics, diagrams, tables, charts, cartoons, etc.) in a digital textbook or ADEM:

- ▶ is of good quality, sufficient size, precision and clarity in order to see clearly what it displays, and has aesthetic qualities;
- ▶ has a clear function, and its purpose can be: *decorative* (it has only an aesthetic role); *representational* (it serves to show what something looks like, to illustrate a certain phenomenon – a portrait, machine imaging, artistic paintings, an image of an event, etc.); *non-representational* (it serves to communicate a certain idea in another symbolic way – a table, graph, histogram, drawing, diagram, etc. and thus make it clearer to students);
- ▶ is located next to the text to which it refers;
- ▶ is explicitly pointed to by the text is located next to it so that the student is directed to it;

- ▶ must be accompanied by an *annotation* (a title and description of what is shown; if downloaded – where it was downloaded from, who the author is, its location, time of creation, etc.); within the annotation, questions and tasks can be given that return the student to the text and check their comprehension.

Special requirements:

- ▶ There is the possibility to change the image size (for students with poor vision).
- ▶ The readability of the image does not change with the change of reader (computer screen, mobile, etc.).

Possible mistakes:

- ▶ Poor quality of the display of visual content, so it is not clear what is being shown (too dense, unclear markings, inaccurate display, lack of necessary parts, etc.).
- ▶ The advantages of translating parts of the content into visual symbolic representations that increase the possibility of understanding the text are not used.
- ▶ Non-functional use of visual aids (use of images, illustrations, vignettes, etc.) only for decorative purposes.
- ▶ The text does not refer the student to visual representations.
- ▶ Visual content is not located next to the text that refers to it.
- ▶ There are no annotations below the illustrations and other visual content.
- ▶ Visual content is not used in questions, tasks and assignments.

AUDITORY CONTENT IN THE DIGITAL TEXTBOOK AND ADEM IS FUNCTIONALLY RELATED TO LEARNING OBJECTIVES

Digital textbooks and ADEMs allow the inclusion of auditory content that supports the realization of the objectives in all subjects, which is especially needed in teaching language and music culture. Listening to the narrator or music is necessary to achieve the affective objectives of teaching (e.g. experiencing music compositions or poetry). Auditory content may include feedback on the quality of something the student has done or further clarification, pointing to something, or referring to other content.

The subject of observation: Auditory content (its quality and functionality).

Determine: Does the auditory content in the digital textbook or ADEM serve the function of achieving the objectives of learning/teaching?

Quality indicators:

- ▶ Auditory content in the digital textbook or ADEM is of good quality (clear, clean, without noise, mixing of sounds or background noise);
- ▶ The narrator's voice is pleasant; the narrator speaks clearly and intelligibly, with good diction and adequate rhythm and speed of reading (pauses are made in appropriate, logical places) and expressive, with emotions when it is in line with the nature and objectives of the subject;
- ▶ The narrator's language corresponds to the norms of standard literary language, except in cases when deviations are provided by the curriculum.

Special requirements:

- ▶ There is a possibility to control the sound playback (stop, repeat, etc.).
- ▶ There is a possibility to control the volume (this is important for all students, especially for the hard of hearing).
- ▶ There is an alternative textual representation of auditory content (this is important for the hard of hearing).

Possible mistakes:

- ▶ Poor quality of implementation of auditory content.
- ▶ The possibilities of auditory content are not used in interactive episodes in the digital textbook or ADEM.

DYNAMIC AUDIO-VISUAL CONTENT IN THE DIGITAL TEXTBOOK AND ADEM IS USED IN THE FUNCTION OF BETTER UNDERSTANDING THE CONTENT

Unlike static content (textual and visual content), dynamic content (e.g. film, video, process simulations) allows students to see changes and hear accompanying explanations of the events, processes and phenomena observed, helping them make references and links to other content.

The subject of analysis: Audio-visual materials (simulations, film, video materials, etc.).

To determine: Is the audio-visual content in the digital textbook or ADEM used to better understand the content that is being learned?

Quality indicators:

- ▶ In a digital textbook or ADEM the audio-visual content:
- ▶ must be of a high quality with good picture and sound synchronization;
- ▶ refers to objects that are not located in a natural or cultural environment, or when for some reason such objects are not directly accessible to students (sea depths, etc.);
- ▶ refers to processes (changes) that are too fast, too slow or impossible to observe with the naked eye;
- ▶ shows various types of simulations (experiments, certain phenomena, processes, etc.).

Special requirements:

- ▶ There is a possibility of controlling the display (stopping, reviewing, controlling the volume, etc.).
- ▶ For those who are hard of hearing, there is the possibility of volume control and appropriate subtitling (which can be turned off if necessary).
- ▶ There is an audio description of the film (e.g. for the visually impaired), which can be switched off if necessary.
- ▶ The quality of the display (video and audio, subtitling, etc.) does not change with the change of the means for its reproduction.

Possible mistakes:

- ▶ Poor quality of audio-visual content.
- ▶ Indiscriminate use of audio-visual materials, congestion of thematic units (lessons, chapters, blocks) with audio-visual materials.
- ▶ Unnecessary or inadequate use of audio, video, 3D displays, etc. in order to present the content that students experienced themselves or the content available in their immediate environment, which they can see and analyse themselves).

CHOOSING AND COMBINING DIFFERENT WAYS OF PRESENTING CONTENT IN THE DIGITAL TEXTBOOK AND ADEM SERVES THE FUNCTION OF LEARNING

Digital textbooks or ADEM should target the specific advantages of certain means of expression, since non-functional or excessive use of different ways of presenting content does not contribute to learning, but rather hinders it (burdening and congesting students' cognitive capacities).

The subject of analysis: Functionality and rationality of using different means of expression in a digital textbook or ADEM.

To determine: Are the use and combination of individual ways of presenting content in a digital textbook or ADEM appropriate to the learning objectives and adapted to the students' ability to process information?

Quality indicators:

- ▶ In a digital textbook or ADEM:
- ▶ individual means of expression and ways of presenting content are used rationally and in a planned manner;
- ▶ the use of a certain means of expression depends on its functionality in relation to the learning objective;
- ▶ when combining several means of expression at the same time, the cognitive load of students is taken into account, since the working memory has limited capacity (seven \pm two elements), so there is a risk of its over-saturation (congestion of working memory).

Possible mistakes:

- ▶ The comparative advantages of certain means of expression are not used (e.g. text is used in a case where a certain phenomenon can be better represented by a diagram, illustration or film, or else an illustration, film, etc. are used in a case when it is more suitable or sufficient to explain a phenomenon by means of text).
- ▶ Non-functional use of certain means of expression (use of a certain means of expression due to its appeal, not its functionality in learning).
- ▶ Overloading students with information. When creating multimedia content, it is necessary to carefully choose the communication channel or the way the content are combined to make it most effective in relation to the learning objective, because excessive and non-functional use of multiple communication channels leads to their congestion and complicates information processing and learning.

- ▶ The primary channel of information transmission is not clearly delineated from secondary ones.
- ▶ The “*strategy of interrupting*” learning due to frequent “jumping” from one content to another, and instructing students to collect parts of content from different sources, which leads to reduced concentration, hampers deeper learning and longer – i.e. more persistent – dealing with the content, making the learning superficial, while the learned content is quickly lost.

SCREEN DESIGN (SPATIAL ARRANGEMENT OF LEARNING ELEMENTS ON THE SCREEN) IN THE DIGITAL TEXTBOOK AND ADEM FACILITATES LEARNING

If the screen on which the elements of content are presented is not clear and well-arranged and is not consistently organized (if it is chaotic), the student is forced to adapt to new and unexpected learning conditions with each new screen.

The subject of analysis: Screen layout (clear and well arranged, clear distinction of learning elements, consistent use of a certain screen organization).

To determine: Are the pages/screens of the digital textbook or ADEM clear, well-organized and consistently implemented?

Quality indicators:

In a digital textbook or ADEM:

- ▶ the layout of the screen is clear; it contains an optimal number of elements (neither cluttered nor empty) and allows the necessary information to be found quickly and easily;
- ▶ all the elements needed for learning are spatially interconnected and remain in the student’s field of view;
- ▶ the subject of learning (basic content) and additional, auxiliary content are clearly visible and delimited on the screen;
- ▶ care is taken that the auxiliary content on the screen does not interrupt or interfere with the viewing of the basic content;
- ▶ the organization of the screen is consistent, i.e. the arrangement of the elements on the screen is consistent and predictable or expected (certain items on the screen, such as the menu and browser, are constantly in the same place).

Possible mistakes:

Due to the fact that digital textbooks allow greater possibilities of using different structural elements (basic text, maps, graphs, schemes, links with various attachments, simulations, tests, etc.), as well as the possibility of combining different types of records (text, audio and video), **problems with unclear, undifferentiated and inconsistently applied pages can be very pronounced**. Therefore, when evaluating a digital textbook or ADEM, it is necessary to check whether the pages/screens of the textbook are clear, differentiated and consistently applied. Some of the possible mistakes are as follows:

- ▶ The screen is crowded, and the layout of elements is not clear; it contains a large number of different elements (e.g. text, images, additional texts, animations, simulations, audio and/or video, etc.).
- ▶ The layout of the page/screen is inconsistent and certain elements of content appear inconsistent in different parts of the screen.
- ▶ The screen is undifferentiated, that is, the basic text (subject of learning) and the additional, supplementary or auxiliary contents are not clearly (obviously) delineated (the student is forced to search for the basic, most important information).

2.3. Questions relating to the presentation of learning content and its organization in the textbook¹⁰

THE DIGITAL TEXTBOOK CONSTITUTES A UNIQUE, COHERENT AND LOGICALLY WELL-ROUNDED UNIT

Although the content of a digital textbook is composed of parts and thematic units (lessons, topics, modules, blocks, etc.), it represents a unique, logically coherent, interconnected unit.

The subject of analysis: Logical organization of thematic units (lessons, topics, modules, blocks) in a digital textbook.

To determine: Does the digital textbook represent a unique, logically connected, coherent whole?

Quality indicators:

- ▶ The textbook has a clear, logical structure and organization of content (chapters–lessons–subheadings within lessons, etc.).
- ▶ Within the textbook, there is a connection between the elements of content; various contents of individual lessons are logically connected to each other and interconnected.
- ▶ There is a cross-cutting connection with the contents of other subjects taught in the same class.
- ▶ Different structuring of content is possible (nonlinear, non-sequential or multi-sequential), which means that textbooks covering different subjects could differ in their structure (to reflect the properties of the content of the discipline presented in the textbook).

Possible mistakes:

- ▶ Some of the thematic units represent a kind of “isolated island” without a clear connection with other lessons in terms of content and logic.
- ▶ The textbook has no substantive and logical connection with the content of the same subject in previous thematic units or previous years of study and/or with related contents in other subjects.

¹⁰ The questions from this group refer, first of all, to the digital textbook, which is a functional unit composed of elements, thematic units (lessons, blocks, modules). In cases where the ADEM consists of several related units (analogous to a printed textbook containing several lessons), these questions are also used to assess its quality.

- ▶ The comparative possibilities of digital media are not used when organizing the entire textbook content. There are two types of mistakes pertaining to this segment:
- ▶ a digital textbook that does not take advantage of digital media, which *is linear in nature and resembles a printed one* (e.g. a PDF edition with some added images, animations and tasks, etc.); and
- ▶ a digital textbook that *does not have any recognizable structure*, and appears as a set of “scattered” learning contents deprived of an embedded learning guide (students are left on their own to wander through the textbook content) – this kind of textbook utilizes the possibilities of digital media, but fails to take into account the learner and the nature of the learning process (school learning is a guided process).
- ▶ All textbooks for various subjects are equally structured, regardless of the nature of their content and the goals and outcomes of the subject.

THE ENTIRE CONTENT OF THE DIGITAL TEXTBOOK IS VISIBLE AND AVAILABLE TO THE STUDENT AT ANY MOMENT

A textbook with clear content, and a well-designed and consistently implemented system of headings and subheadings contributes to the effective acquisition of organized knowledge. The specific nature of a digital textbook is that it is visible and accessible only part by part (page by page of the screen) – it is not physically bound into one whole which can be handled easily. This makes it difficult to see the entire content of the textbook. **It is necessary to ensure that the student has at least some insight into the entire content** (e.g. permanent menu/contents bar on the screen, which facilitates navigation through the textbook), **the components of its structure and the relations between them, because it increases the likelihood of learning with understanding.**

The subject of observation: headings, subheadings, an overview of textbook content, index of terms, etc.

To determine: Is the entire content of the digital textbook visible and accessible to the student?

Quality indicators:

- ▶ The logical structure of the textbook content is adequately marked in artistic and graphical terms and consistently implemented throughout the textbook (colour, shape, choice and size of font and/or background have the function of signalling the type of component).
- ▶ An overview of the textbook content is available to the student – an interactive textbook map is displayed on the screen and allows navigation through the textbook content at any time.
- ▶ The organization and manner of marking and using individual parts of the textbook are explained to the students at the beginning of the textbook.

Possible mistakes:

- ▶ The student is not provided with an insight into the entire content of the textbook.
- ▶ There are no instructions for students that explain the organization of the content, and the way of marking and using certain parts.
- ▶ The logical structure of the textbook content is not adequately marked in artistic and graphical terms or consistently implemented throughout the textbook.

NAVIGATION THROUGH THE DIGITAL TEXTBOOK CONTENT AND ACCESS TO SOURCES OF KNOWLEDGE OUTSIDE THE TEXTBOOK IS PROVIDED

Knowledge is interconnected, and the task of the textbook is to guide and direct the movement of students through the contents of the textbook and selected other sources of knowledge, as well as to ensure the vertical and horizontal connection of knowledge, thus helping to build comprehensive and well-structured knowledge. Navigation in the textbook is simple, established according to different criteria (topics, page numbers, names of segments, etc.) and should make it easier to use the content.

The subject of analysis: Links (automatic links between individual textbook contents).

To determine: Does the digital textbook allow navigation through the learning content and is there a possibility for students to explore horizontal and vertical connections in the textbook content?

Quality indicators:

A digital textbook incorporates links between elements of knowledge that:

- ▶ enable easy movement within the lesson and between lessons, between individual parts of the content within the textbook, movement between the content of that and another textbook;
- ▶ make other relevant sources of knowledge available to the student;
- ▶ are gradually introduced, so the student first has an insight into the basic, most important connections, and then that network of mutual relations is systematically expanded, gradually developed and made more elaborate;
- ▶ systematically guide students when searching and selecting content, enabling them to move autonomously through the textbook based on the connections built into the content.

Possible mistakes:

- ▶ There are two possible mistakes related to inadequate use of the system of movement through the content of the digital textbook:
 - a) There is no guidance in moving through the content of the textbook, which can result in students finding themselves lost in the structure of the content.
 - b) There are too many interconnections that make it difficult for the students to move through the textbook, because it is difficult to find their way in the multitude of offers and they may lack the support to choose the right path.
- ▶ There is no planned guiding of students through links in the textbook on the basis of the links built in the content (which emphasizes the logical connection of the content), but the students are left to move through the content on their own, following their own associations.

THE DIGITAL TEXTBOOK OFFERS MODELS FOR CONNECTING AND SYSTEMATIZING KNOWLEDGE FOR STUDENTS

In addition to being a model of well-organized and structured knowledge, the digital textbook should also offer models of connecting, systematizing and structuring knowledge to students.

The subject of observation: Various ways of systematizing knowledge (tables, spreadsheets, schemes, summaries, key messages, concept maps, etc.).

To determine: Does the digital textbook offer models for editing and systematizing knowledge to the students?

Quality indicators:

There are various types of systematization of knowledge in the digital textbook which aim to teach students to notice and highlight that which is essential, and to connect and systematize the acquired knowledge, and thus the textbook helps them develop strategies and techniques of intellectual work. Content can be arranged:

- ▶ hierarchically (superior terms include subordinate terms);
- ▶ radially (terms expand radially from the centre, from basic terms to the corresponding terms);
- ▶ temporally (facts are arranged in chronological order);
- ▶ logically (terms are arranged according to certain criteria);
- ▶ causally (information is arranged according to cause-and-effect relations), etc.

Possible mistakes:

- ▶ There are no units in the textbook for systematizing knowledge.
- ▶ Only one type of systematization of knowledge is used throughout the entire digital textbook, regardless of the fact that the contents differ in terms of their characteristics.
- ▶ Inconsistent use of systematization of units, without any rules – the kind of systematization of knowledge appears randomly in the textbook.

3. QUESTIONS RELATING TO SUPPORT FOR STUDENTS IN LEARNING AND USING THE DIGITAL TEXTBOOK AND AUXILIARY DIGITAL EDUCATIONAL MATERIAL

THE DIGITAL TEXTBOOK AND ADEM ALLOW THE STUDENT TO USE THE LEARNING MATERIAL QUICKLY AND EFFICIENTLY

A digital textbook or ADEM contains organizational components that allow the student to find the information they need quickly and easily.

The subject of observation: An overview of the content of the textbook (interactive textbook map), instructions for using the textbook, index of terms, index of authors, menu with auxiliary tools, etc.

Determine: Does the digital textbook or ADEM make it easy to use and does it provide support when using it?

Quality indicators:

The digital textbook and ADEM contain:

- ▶ simple instructions on how to use them and the role of the individual elements of the textbook;
- ▶ a clear interactive map of textbook content (a content overview);
- ▶ the ability to search for content by key terms, authors and the like;
- ▶ a clear menu with available auxiliary processing tools (drawing tools, writing tools, calculator, etc.).

Possible mistakes:

- ▶ The digital textbook and ADEM do not contain instructions for their use or other organizational components that would facilitate their use and finding the necessary content.
- ▶ The digital textbook and ADEM do not allow intuitive movement through the material; using them is too complicated or demanding, making the learning difficult.

THE DIGITAL TEXTBOOK AND ADEM ENCOURAGE STUDENTS TO ENGAGE IN ACTIVE LEARNING AND DEVELOPMENT OF COGNITIVE SKILLS AND ABILITIES

In order to support the realization of the goals set in the curriculum, the textbook encourages students to actively learn and independently construct knowledge. Questions, instructions and tasks are the main ways to activate students in learning from a digital textbook or ADEM.

The subject of observation: Questions, instructions and tasks.

To determine: Do the digital textbooks and ADEMs encourage active learning with understanding and development of cognitive skills and abilities?

Quality indicators:

- ▶ The digital textbook and ADEM contain questions, assignments and tasks that monitor and elaborate the learning content and guide and encourage students' activities.
- ▶ Questions, assignments and tasks are located in different places in relation to the content depending on their function:
 - a) *at the beginning of the lesson presentation*, where their role is to connect the new material with the previously learned material, to activate the relevant prior knowledge and experiences of students;
 - b) *during the presentation of the content* – in the text itself and/or below the visual content, where they imitate the flow of thought and encourage active reading with understanding;
 - c) *at the end of the lesson*, where they aim to highlight what is important in the lesson and check the degree of understanding of the material and to what degree the material has been learned;

d) *at the end of larger units (chapters, topics, modules) or at the end of the entire textbook, where they are used to check to what extent the material has been learned.*

Questions, assignments and tasks can be:

- a)** *an integral part of the lesson (topics, chapters, modules), where their primary function is to stimulate the learning process, monitor progress and develop metacognitive competencies (assessment for learning and assessment as learning);*
 - b)** *in the form of independent evaluative components, whose role is to assess to what extent the material has been learned, i.e. summative assessment (tests, quizzes, problem tasks, project tasks, etc.).*
- ▶ Questions, assignments and tasks must be varied in their difficulty and complexity. They need to include different cognitive processes (reproduction of material, understanding, application, analysis, evaluation or creation of new material, synthesis) in accordance with the ages of the students and the goals and outcomes of the subject.
 - ▶ Questions, assignments and tasks encourage the development of key twenty-first-century competencies: social competencies, problem-solving competencies, decision-making skills, development of critical and creative thinking, development of competency to learn and metacognitive competencies (insight into self-functioning, monitoring and correcting the flow of thinking), entrepreneurial competencies, information (digital) literacy, responsibility for the development of healthy lifestyles, one's own health, the health of others and care for the environment.
 - ▶ Questions, assignments, and tasks need to be varied in form (essay assignments, multiple-choice assignments, pairing assignments, short open-ended assignments, interpretive assignments), depending on the objectives of the lesson, the subject, and must not bore the students.
 - ▶ Questions, assignments and tasks must be consistently marked and applied throughout the digital textbook and ADEM.
 - ▶ There are detailed and clear instructions to the students for all the questions, assignments and tasks, in terms of what needs to be done in the task and the stated criteria for a well-done task.
 - ▶ There is a balance between questions and tasks whose purpose is to learn, practice or check what has been done, with priority given to learning tasks.
 - ▶ Whenever this is in line with the objectives of the lesson or subject, the student receives adequate and timely feedback on how they have performed, and/or instructions on what deserves their further attention and what needs to be (re)learned – which is enabled by the interactivity of the digital textbooks or ADEMs.

Possible mistakes:

- ▶ The digital textbook and ADEM do not contain questions, assignments and tasks as part of lessons or larger units.
- ▶ Questions, assignments and tasks are not clearly and consistently marked and applied throughout the digital textbook and ADEM.
- ▶ Questions, assignments and tasks are found only at the end of the lesson (block, topic, chapter, module) and their only function is to assess the extent to what the material has been learned (summative assessment).

- ▶ Questions, assignments and tasks are predominantly set at one cognitive level (e.g. questions related to the reproduction of material with understanding dominate or only problem tasks or critical thinking tasks are given).
- ▶ Questions, assignments and tasks are mostly uniform in their character.
- ▶ In addition to questions, assignments and tasks, there are no detailed and clear instructions to the student on what needs to be done and what a well-done task should look like.
- ▶ Questions, assignments and tasks are meaningless for the student, because:
 - a) *they are not well formulated in linguistic terms;*
 - b) *they are intellectually imprecise* (the students do not understand what they are being asked to do);
 - c) *they are not relevant* to the learning objectives of the given subject (they waste the students' time and energy);
 - d) *they are quasi-activating* (the students spend time and effort on a trivial outcome);
 - e) *they are too easy* for students, have no effect and are unnecessary;
 - f) *they are unrealistic:* the students cannot complete them, either because they are too complex for the students' age or require a higher level of foreknowledge and life experience, or there are no real conditions allowing the completion of the task (it requires too many resources, time, activities for which there is no support in the child's environment), or are not adapted to the socio-cultural environment.
- ▶ There is no built-in, timely feedback on questions, assignments or tasks aimed at learning, and no use of interactive capabilities of the digital media.

THE DIGITAL TEXTBOOK AND ADEM ENCOURAGE THE DEVELOPMENT OF THE SOCIAL SKILLS OF STUDENTS

The textbook is not an appropriate medium for the development of social skills. However, it can contribute to the development of social competencies through tasks that require cooperative learning in pairs, groups, or teams, either with peers or with the teacher.

The subject of observation: Questions, assignments, tasks.

To determine: Do the digital textbooks and ADEMs encourage the development of social skills?

Quality indicators:

The digital textbook and ADEM contain:

- ▶ tasks that are performed cooperatively, by joint contribution, through cooperation with other students (in pairs, small groups or teams, where roles and responsibilities are shared) or with the teacher;
- ▶ tasks that involve debate or discussion, with valid argumentation, through which the ability to conclude, think critically, and formulate valid arguments and counter-arguments develops; tasks that develop the ability to communicate constructively and tolerate diversity, while respecting the other and the different; tasks that develop assertiveness and presentation skills, as well as the skill of speaking in front of others, persuasiveness, etc.;

- ▶ questions, assignments or tasks that encourage the building of a learning community through group work;
- ▶ tasks that direct the student towards volunteer work in the community in accordance with their age, competencies and preferences (helping others, volunteering in community organizations, participation in local social actions, school-decorating projects, problem solving at school, etc.).

Possible mistakes:

- ▶ A lack of questions, assignments and tasks that encourage cooperative learning.
- ▶ The digital textbook or ADEM contains tasks intended exclusively for students' individual work.
- ▶ Not using the interactivity of digital media to share and communicate with others, peers or teachers, to develop a learning community.
- ▶ Expecting students to engage with questions, assignments and tasks that are not appropriate for their age, knowledge and experience (e.g. students of lower grades of primary school being expected to organize a Red Cross branch in their building).
- ▶ Questions, assignments and tasks require students to engage in trivial or banal activities.

4. QUESTIONS RELATING TO THE TECHNICAL PROPERTIES OF DIGITAL TEXTBOOKS AND AUXILIARY DIGITAL EDUCATIONAL MATERIALS

CHANGING THE E-READER DOES NOT AFFECT THE CLARITY OF THE CONTENT AND ITS ORGANIZATION IN THE DIGITAL TEXTBOOK AND ADEM, OR THE EFFECTIVENESS OF LEARNING

The digital textbook and ADEM can be used on a number of digital technical devices (computers, mobile phones, tablets, etc.), meaning that the learning from digital textbooks is also influenced by the characteristics of the device on which the textbook is used.

The subject of observation: Presentation of content on various digital devices (mobile phone, tablet, computer).

To determine: Is the presentation and organization of content on different digital devices good and clear, so that changing the device does not negatively affect the learning process?

Quality indicators:

When used on various digital devices (tablet, computer, etc.):

- ▶ the basic look, layout, and structure of the learning elements on the page remain unchanged;
- ▶ the readability and layout of the text remain unchanged;
- ▶ organizational components provide all the necessary information for learning;
- ▶ loading of the content is complete and fast.

Possible mistakes:

- ▶ The digital textbook or ADEM is made only for a specific type of digital device, which undermines the right of children and young people from lower socio-economic strata to participate equally in teaching and violates the equity of the system and access to quality learning for all students
- ▶ When changing the digital device, the quality of the content presentation is diminished and thus disrupts the learning process.

5. QUESTIONS RELATING TO THE COMPETENCIES REQUIRED FOR THE USE OF A DIGITAL TEXTBOOK AND AUXILIARY DIGITAL EDUCATIONAL MATERIAL

THE USE OF A DIGITAL TEXTBOOK AND ADEM DOES NOT REQUIRE SPECIAL ABILITY AND LONGER TRAINING FROM STUDENTS AND TEACHERS

In addition to general digital literacy, The digital textbook and ADEM do not require special skills, longer preparation or special training for their use. The textbook and ADEM support the development of students' ability to use digital competencies for teaching and learning purposes.

The subject of observation: Requirements for the use of digital textbooks or ADEMs.

Determine: Do digital textbooks and ADEMs require students to have specific additional skills (competencies) to use them?

Quality indicators:¹¹

The digital textbook and ADEM require students to have basic digital literacy skills, which are further developed and raised through the use of textbooks or ADEMs; the skill of using digital competencies for the purpose of learning and teaching is particularly developed.

Possible mistakes:

- ▶ Students do not have the basic digital competencies they need to use a digital textbook or ADEM.
- ▶ The digital textbook and ADEM require special longer training of students to use them.

11 Issues relating to the competencies required for the use of digital textbooks and ADEMs are discussed in more detail in the section “General principles in the development of digital textbooks”, item 5.

6. QUESTIONS RELATING TO THE ADAPTATION OF DIGITAL TEXTBOOKS AND AUXILIARY DIGITAL EDUCATIONAL MATERIALS FOR STUDENTS WITH SPECIAL NEEDS

THE USE OF THE DIGITAL TEXTBOOK AND ADEM IS ADAPTED TO ALL STUDENTS REGARDLESS OF THEIR CHARACTERISTICS

The digital textbook and ADEM must be equally accessible and suitable for use by all students, regardless of their special educational needs and possible obstacles and difficulties in development and learning.

The subject of observation: Accessibility of information in a digital textbook or ADEM to persons with special educational needs.

To determine: Are the digital textbooks and/or ADEMs equally accessible to all students?

Quality indicators:¹²

The digital textbook and ADEM integrate elements that ensure the accessibility of information to students who have poor **eyesight**:

- ▶ the ability to change the size of the font, image, etc.;
- ▶ very good sound quality;
- ▶ an auditory alternative to the textual content;
- ▶ an auditory description of the graphical content;
- ▶ an auditory description of the film;
- ▶ sufficient contrast of the foreground (e.g. text) and background;
- ▶ the image retains the necessary information when viewed without colour;
- ▶ the possibility of stopping and re-listening.

The digital textbook or ADEM integrates elements that provide access to information for students who are hard of **hearing**:

- ▶ very good visual quality of the textbook or ADEM;
- ▶ the ability to change the volume;
- ▶ a textual alternative to the auditory content (without loss of important information);
- ▶ the use of subtitles for audio-visual content;
- ▶ the possibility of stopping and re-listening.

12 The method of adapting textbooks to students with special educational needs, especially students with visual and auditory difficulties, is described in more detail in “Special requirements”, especially in relation to issues of presenting and organizing learning content in digital textbooks and ADEMs.

Overview of the issues related to the quality of digital textbooks and ADEMs

I. ISSUES RELATING TO THE CONCEPT OF DIGITAL TEXTBOOKS AND AUXILIARY DIGITAL EDUCATIONAL MATERIALS

- ▶ ADEMs have a precisely defined role and conditions related to their use in teaching
- ▶ ADEMs and digital textbooks contain all the necessary elements for learning: content and didactic apparatus.

II. ISSUES RELATING TO THE CONTENT IN DIGITAL TEXTBOOKS AND AUXILIARY DIGITAL EDUCATIONAL MATERIALS

1. Issues relating to the selection and editing of the learning content

- ▶ The learning content is up-to-date, accurate and representative in the subject area;
- ▶ The learning content is relevant to fulfilling the programme goals and outcomes;
- ▶ The learning content is relevant to the age of the students;
- ▶ The scope of the learning content is aligned with the time allotted for its learning;
- ▶ Individual differences, different possibilities and students' interests are taken into account;
- ▶ The prior knowledge and extracurricular experiences of students are taken into account;
- ▶ Positive social values are affirmed.

2. Issues relating to the presentation and organization of the learning content:

- ▶ The textual content is logically organized and clearly presented;
- ▶ The textual content is presented to students in an understandable language;
- ▶ The visual content (illustrations) contributes to comprehension of the text;
- ▶ The auditory content is functionally linked to the learning objectives;
- ▶ Dynamic audio-visual content is used in the function of better understanding phenomena, processes, cause-and-effect links, etc.;
- ▶ The selection and combination of certain forms of presenting the content depends on the students' cognitive capacities;
- ▶ The spatial arrangement of learning elements on the screen (the design of the screen) facilitates learning.

3. Issues relating to the presentation and organization of the learning content in a digital textbook (the educational material as a whole):
 - ▶ The digital textbook forms a unique, coherent and logically rounded whole;
 - ▶ The entire content of the digital textbook is visible and accessible to the student at all times;
 - ▶ There is the possibility of navigating through the content, as well as the possibility of accessing sources of knowledge outside the textbook;
 - ▶ The digital textbook offers the student the best models for arranging and systematizing knowledge.

III. ISSUES RELATING TO SUPPORTING STUDENTS IN USING AND LEARNING FROM DIGITAL TEXTBOOKS AND ADEMs

4. The materials provide the student with support during their use and the ability to quickly find the necessary information.
 - ▶ They encourage the students to learn actively and with understanding.
 - ▶ They encourage the student to actively connect knowledge.
 - ▶ They encourage the development of thinking and higher forms of learning (reasoning, problem solving, creative and critical thinking, etc.).
 - ▶ They encourage the development of social skills in students.
 - ▶ They provide the opportunity of checking the knowledge and providing the students with a realistic picture of their progress.

IV. ISSUES RELATING TO THE TECHNICAL PROPERTIES OF DIGITAL TEXTBOOKS AND ADEMs

- ▶ The “readability” of the textual, visual and audio-visual contents and their organization on the screen of the digital textbooks and ADEMs remain unchanged in terms of the essential elements when a change of e-reader occurs.

V. ISSUES RELATING TO THE COMPETENCIES NEEDED FOR USING AND LEARNING FROM DIGITAL TEXTBOOKS AND ADEMs

- ▶ The use of and learning from digital textbooks and ADEMs do not require of the students and teachers additional abilities and longer training for use.

VI. ISSUES RELATING TO THE USE OF DIGITAL TEXTBOOKS AND ADEMs BY STUDENTS WITH SPECIAL NEEDS

- ▶ Digital textbooks and ADEMs provide information that is equally accessible to all students.

A final reflection

Despite the availability of a number of other resources, especially digital ones, textbooks remain needed in education. Digital technology has not changed their nature but has only provided a new context (medium) and new requirements for textbooks to play their main role of **facilitating the learning process**. If they are of good quality, textbooks are one of the fastest ways to improve the quality of education, as they can be quickly made available to all schools and students. The importance of textbooks (and teaching as a whole) is often overlooked or minimized by overemphasizing the possibilities of modern information and communication technologies (ICT) without an essential understanding of the true power of digital media and its use in education. A serious and challenging question of how to make good use of the benefits of ICT and avoid pitfalls and misconceptions in their use remains. Research so far has been focused more on what ICT can do and far less on *how* ICT can help *solve specific teaching and learning problems*. There is still not enough experience in the world in the application of digital textbooks, much less systematic, methodologically well-founded research on their use and the implications of such use. The foundations for examining the value of digital textbooks are the existing knowledge and centuries of experience with the use of printed textbooks, extensive research on them, as well as the theoretical framework and findings of modern research on the impact of digital technologies on our mental processes (learning, memory, thinking, perception, and socio-affective processes). The development of these standards of quality of digital textbooks started from all the available knowledge, and they are embedded into this attempt to improve the quality of learning from digital textbooks. That is why the development of quality standards for digital textbooks represents a step forward and not only a practical but also a conceptual novelty.

Although the standards are assessed individually, when assessing the quality of a textbook it is necessary to keep in mind the textbook as a whole, and how it contributes to learning and achieving the learning objectives/teaching a given subject. The purpose of the standard and procedure for assessing the quality of digital textbooks and ADEMs is not to “catch” errors in the textbooks, i.e. to show all the shortcomings and mistakes that exist in the material, but only *to eliminate those that cause serious damage*, those that can lead to a failure to fulfil the basic function of the textbook – to allow quality learning from it. Quality standards are not a measure of the ideal, not even the optimal textbook; they represent the lower limit of quality, the “bar” that every textbook must jump over, the limit below which they should never go. Occasionally, we hear remarks that standards stifle the creativity of the authors. That is simply not true. When food quality is controlled, there are standards of what may or may not be present in food and to what extent. This in no way jeopardizes the diversity of preparation, offer, packaging and presentation of food to customers. On the contrary, quality standards guide and facilitate the creation of textbooks and serve as a logical framework for their development. Standards allow us to qualify the offered material as a textbook, while there is full freedom in the ways and approaches of its production, plenty of room for the author’s creativity, and a variety of solutions that can facilitate and enrich teaching/learning.

We hope that our quality standards for digital textbooks and ADEMs will support the development and selection of good textbooks and also encourage teams of authors to compete in the design and implementation of this extremely complex and demanding genre of textbooks.

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APPENDICES

Appendix 1. PISA reading literacy levels

Summary description of the seven levels of reading proficiency in PISA 2015

Level	Lower score limit	Characteristics of tasks
6	698	Tasks at this level usually require the reader to draw detailed and precise conclusions, and compare and contrast ideas. They require a full and detailed understanding of one or several texts and may include the integration of information from more than one text. Tasks may require the reader to deal with ideas unknown to them, while conflicting information is conspicuously given, and this may require them to generate abstract categories for their interpretations. Tasks that require <i>good thinking and evaluation</i> may require the reader to make assumptions or critically evaluate a complex text on an unknown topic, taking into account multiple criteria or perspectives, thus demonstrating a sophisticated understanding of the ideas behind the text. The main condition for the approach to solving tasks at this level is the ability to accurately analyse and pay very good attention to details that are deeply embedded within or across texts and potentially obscured by competing information.
5	626	Tasks at this level include searching for information and requiring the reader to find and connect into a meaningful whole several pieces of information that are deeply embedded in the text, while the reader must conclude which of the information in the text is relevant. Reflective tasks (thinking tasks) require a critical assessment or hypothesis, assumption, and reliance on specific knowledge. Both interpretive and reflective tasks require a complete and detailed understanding of a text whose content or form is not known to the student. For all aspects of reading, tasks at this level usually involve dealing with concepts that are contrary to expectations.
4	553	Tasks at this level include searching for information and requiring the reader to find and connect into a meaningful whole several pieces of information that are deeply embedded in the text. Some tasks at this level require an interpretation of the meaning of nuances in the language of a part of the text, taking into account the text as a whole. Other interpretive tasks require understanding and application of categories in an unknown context. Reflective tasks (thinking tasks) at this level require the readers to use formally acquired or widely-known knowledge to make assumptions or critically evaluate the text. Readers must demonstrate (show) an accurate comprehension of long or complex texts whose content or form can be unknown to them.

3	480	<p>Tasks at this level require the reader to find pieces of information that must meet multiple conditions and, in some cases, to recognize the relationships between them. Interpretive tasks at this level require the reader to integrate several parts of the text in order to identify the main idea, reason and relations or construe the meaning of a word or phrase. When comparing, contrasting, or categorizing information, readers must take into consideration many features. The required information is often not even highlighted or there is a lot of conflicting information; or there are other obstacles in the text, such as ideas that are contrary to expectations or negatively worded. Reflective tasks (thinking tasks) at this level may require linking information, comparing and explaining it, or may require the reader to evaluate a feature of the text. Some reflective tasks require the reader to demonstrate a good understanding of a text dealing with familiar, everyday knowledge. Some tasks do not require a detailed understanding of the text, but the reader should rely on lesser-known knowledge.</p>
2	407	<p>Some tasks at this level require the reader to find one or more pieces of data, while some data may need to be obtained by concluding and fulfilling several conditions. Other tasks require recognition of the main idea in the text, understanding the relationship or construing meaning in the part of the text where the information is not highlighted, so the reader must come to the main idea by means of inference. Tasks at this level may include comparisons or contrasts, but only on the basis of a single property or dimension in the text. Typical reflective tasks (requiring reflection) at this level require the reader to make a comparison or several connections between the text and outside knowledge, by drawing on personal experience and attitudes.</p>
1a	335	<p>Tasks at this level require the reader to find one or several pieces of explicitly stated information, recognize the main topic or the author's purpose in a piece of text about a familiar topic, or make a simple connection between the information in the text and usual, everyday knowledge. The information that is needed is highlighted in the text, and there is little conflicting information, if any. The reader is instructed to consider the relevant factors in the task and in the text.</p>
1b	262	<p>Tasks at this level require the reader to scan for and locate one piece of explicitly stated information that is prominently placed in a short, syntactically simple text with a familiar context and form of text, such as a narrative or a simple list. The text usually provides support to the reader by repeating information, providing pictures or using familiar symbols. The amount of competing information is reduced to a minimum. Regarding tasks requiring interpretation, the reader may be asked to make simple connections between adjacent pieces of information.</p>

Appendix 2. Key twenty-first-century competencies

Pešikan, A., & Lalović, Z. (2017). *Obrazovanje za život (Education for Life)*.

UNICEF, Podgorica <www.unicef.org/montenegro/Obrazovanje_za_zivot.pdf>.

COMPETENCY		DESCRIPTION
Socio-emotional skills	1.1. Self-awareness	The ability to accurately identify, recognize and assess one's own and others' emotions, interests and values and their impact on behaviour; the accurate assessment of one's own and others' strengths and weaknesses, advantages and limitations, having a justified sense of self-confidence and optimism; responsibility, and an understanding of the obligation to engage in ethical, safe and legal conduct.
	1.2. Self-regulation	The ability to regulate one's emotions, thoughts and behaviour in different situations, appropriate emotional expression, controlled expression and management of one's own emotions in stressful situations, impulse control, perseverance even when obstacles appear; setting personal goals and learning objectives and working with dedication and motivation to achieve them, monitoring the progress towards achieving them; showing perseverance.
	1.3. Social awareness	The ability to assume the perspective of another person, ability to understand someone else's position, someone else's opinion and emotions; empathy with others from different backgrounds and cultures; understanding social and ethical norms in behaviour; respecting differences, having an awareness of one's own national identity and the identity of others, valuing and respecting individual and group differences, perceiving differences as a force in the world around us; respecting others believing that others deserve to be treated kindly and with compassion.
	1.4. Social skills	Mastery of social skills, ability to communicate clearly and effectively, both verbally and non-verbally, the ability to engage in active listening, waiting in line, cooperating effectively, negotiating and resolving conflicts constructively by respecting the needs of all involved; seeking and offering help when needed; showing resistance to inappropriate external pressures, rejecting provocations and effectively avoiding unwanted, unsafe and unethical conduct; acting ethically in decision making, respecting the principles and standards of morality, religion, law and professional conduct; being a proactive citizen who actively participates in decision making (e.g. voting) and other socially relevant activities.
	1.5. Responsible decision making	The ability to analyse the situation, set goals, solve problems by making a decision upon considering all the relevant factors, the ability to formulate arguments for and against possible decisions, weigh the arguments, predict the possible consequences of the decision, and evaluate and reflect on the decision; showing respect for ethics and social norms in decision making and taking responsibility for the decision made and its consequences.

2. Problem solving	2.1. Rješavanje problema	The ability to seek and establish new relations and connections between the elements of the situation, when they are not provided directly, they cannot be deduced from the observation, nor are they contained in one's previous experience, but can be reached through insight (cognitively recognizing relationships). Implying the ability to cope with uncertain and insufficiently clear and structured situations; identifying the problem (recognizing, accurately locating and defining the problem), finding methods and techniques for its successful solution, disciplined consideration of alternatives, and responsible and goal-oriented action, which includes overcoming obstacles persistently.
	2.2. Razvoj sposobnosti za mala istraživanja	
3. Critical thinking		Includes information selection and evaluation strategies, evaluative reasoning, finding flaws, inconsistencies and errors in the logic of certain ideas, assumptions, conclusions, claims or theories to create new or complement existing thoughts, ideas, assumptions, conclusions or theories; distinguishing facts from personal interpretations and opinions; searching for arguments, the ability to spot and find arguments; the ability to recognize the point of view of an author that is not explicitly given; understanding the indirect and implicit messages of the text, understanding the context in interpreting the message.
4. Creativity & innovation		The ability to create new, original and noteworthy ideas; openness to new ideas, effective development and application of new ideas, as well as mediation in relation to others; developing an innovative and creative idea in a form that can have an impact and be accepted in a given environment; applying innovations, showing perseverance in presenting and promoting new ideas.
5. Information literacy		Most definitions emphasize that being information-literate means that a person is able to recognize when and what information is needed, determine all the possible sources of information, and choose the source that is best; locating sources (intellectually and physically), being able to access them and find information in them; being able to use the found information (by reading, listening, observing, touching) and being able to extract the relevant information; the ability to organize the information collected from multiple sources and present it efficiently using various means and methods, and adapting it to the characteristics of the audience to which it is presented; respecting ethical standards in the use of information (respect for intellectual property rights in the transmission of information and knowledge).
6. Information and communication (ICT) literacy	6.1. Developing ICT skills and tools	Understanding the characteristics of a computer, its capabilities and applications, and the ability to apply this knowledge for skilled and productive use of a computer system; the ability to use a wide range of technological means of communication (e-mail, video conferencing, the World Wide Web, social networks, etc.); ICT literacy includes information literacy but is always related to digital resources and technology; it also includes <i>media literacy</i> as the ability to send and analyse media messages and other media skills.
	6.2. Application of ICT in other areas of learning and work	

7. Learning to learn & metacognition		The ability to learn persistently, to organize one's own learning, both individually and in a group, which includes efficient time and information management, self-regulated, autonomous, intentional learning necessary for personal and professional progress; it includes awareness of one's own learning process, understanding and controlling one's own thinking and learning processes (metacognitive competency), identifying the available opportunities, and being able to overcome obstacles in order to make learning successful.
8. Working skills, entrepreneurship & productivity		Includes values and virtues necessary for responsible and conscientious performance of work, diligence, perseverance in work despite obstacles, conscientiousness, a sense of initiative, a sense of fair play, honesty, conduct aligned with ethical principles, acceptance of responsibility, solidarity, collected and constructive reacting in stressful situations; ability to engage in correct and ethical cooperation in a team; adherence to professional standards and patterns of behaviour; the ability to change; responsible and competent <i>leadership</i> , entrepreneurship.
9. Responsible attitude towards health and the environment	9.1. Taking care of one's own health, the health of others and the development of healthy lifestyles	Developing a responsible attitude towards one's own health and the health of others; care for hygiene, the personal hygiene of others and the environment; nurturing and practicing physical activities; developing awareness of healthy eating and good dietary habits and their practice; participation in various recreational physical activities; participation in the promotion of healthy lifestyles; nurturing a housing culture; resistance to pressures to consume tobacco, alcohol, and drugs; nurturing a healthy, safe environment.
	9.2. Developing environmental awareness and environmentally responsible behaviour	Development of awareness and responsible behaviour towards nature and the environment; awareness of the need for local action to protect, remediate and improve the quality of the environment; involvement in organized local actions or actions of a wider scope of that kind.