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FRAMEWORK FOR THE DESIGN OF ELECTRONIC TEXTBOOKS



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FOREWORD

In 2011 the National Education Institute of the Republic of Slovenia initiated the project 'Criteria for the Design of Electronic Textbooks', which included the recommendations for the design of e-textbooks (Zmazek et al. 2011). Drawing on previous experience with the design of e-materials, the criteria for their evaluation (Appendix 1), and the examples of good practices, the recommendations present the fundamental characteristics of e-textbook design with regard to content, methodology, technology, users, organization and operationalization. The recommendations for the design of e-textbooks have been subsequently improved, and this thus publication presents the new framework for the design of e-textbooks. The publication is aimed at teachers, e-textbook designers, and also the wider, professional public.

1 INTRODUCTION

Textbooks occupy a central position in the education system and have been used since the establishment of the first schools. In the history of education, they have always played a unique role, one which varied in accordance with the social developments and the changes in the general and subject-specific theories of learning and teaching (Skela, 2008: 155). In the realm of teaching methodology, textbooks are placed among textual learning media. One of their characteristics is that they rely on didactic transformation to structure, transform and simplify scientific content (Kovač et al., 2005: 23). As teaching tools and learning resources, textbooks thus contribute to the effectiveness of teaching and independent learning (ibid. 20).

With the increasing use of information and communication technology (ICT) in education, the processes of teaching and learning and the role of textbooks in these processes are changing. The World Wide Web has become an inexhaustible source of information (see OECD 2007) that opens the door to virtual worlds and enables communication and cooperation without making it necessary for one to leave the classroom or some other learning setting (Freudenstein, 2003: 396). The media are thus not merely a tool or an aid for learning, but rather enable a different concept of learning than the one we are used to in printed media, traditional textbooks or school books. In line with this, the expression e-textbook has been introduced, which, in the broadest sense of the word, represents a textbook in the electronic form.

There are various definitions of the **e-textbook**; each depends on the development of technology, the changing needs and concepts in education, the expectations of teachers and learners, and the findings of researchers in the field. From a technical point of view, however, the notion of e-textbook is used to describe a textbook in electronic format that can be used on a computer and can be saved on data storage media such as CDs. According to this definition, an e-textbook is similar to an e-book, an e-book being an electronic version of a printed book which uses the advantages of the digital medium in the sense of becoming a digitized record and providing better and faster portability and accessibility. As such, an e-textbook can be defined as a digital learning resource and a teaching tool in the electronic form that completely replaces the printed medium but also requires some technical equipment to be used.

The concept of e-textbook has developed from the digitized record stage to such an extent that it now represents a complex digitized learning environment in which the textbook is only one of its components (Jung and Lim, 2009: 4). It not only includes digitized textbooks, workbooks, teacher's books, dictionaries, hyperlinks and databases, but also multimedia elements, learning management systems, and evaluation and authoring tools. E-textbooks designed in this way are now often referred to as digital textbooks (ibid.). Such textbooks are not traditional textbooks in a digital disguise; rather, they represent digital learning resources that are designed to encourage active

learning processes in a manner that is innovative, personalized and effective.

Diagram 1 illustrates the development of the e-textbook.

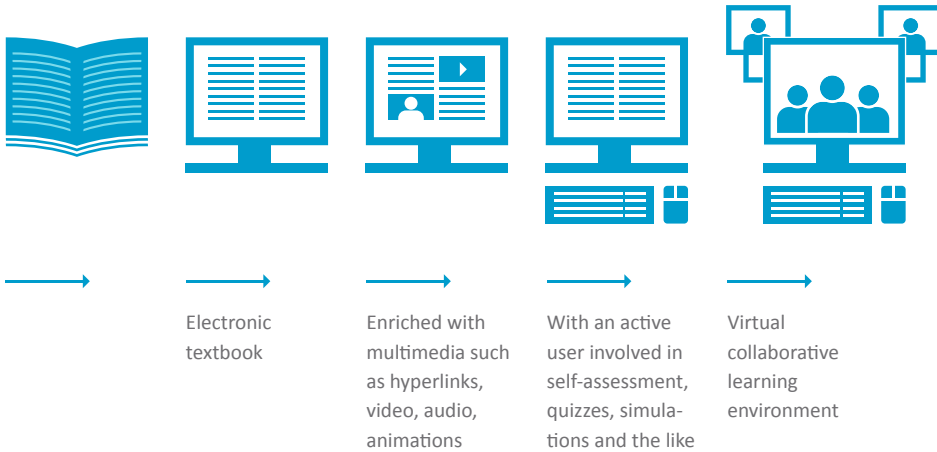


Diagram 1: The development path of the e-textbook

The main difference between the printed textbook and the e-textbook is in the digitalization of the entire learning environment that includes the traditional building blocks such as text and diagrams, as well as interactive and multimedia elements (Diagram 2). The most typical features of the e-textbook are enabled by systems that enable user management, communication, and evaluation of the learning process.

The e-textbook and the printed textbook do not differ only in the degree of interactivity or multimediality but also in their accessibility. E-textbooks are commonly available online, which means that learning is not constrained by time and place but depends only on internet access. Their dependence on the internet can be addressed by making them available locally, on computers without internet access or on mobile devices; this, however, technically limits their features – for instance, it prevents learner monitoring and assessment.

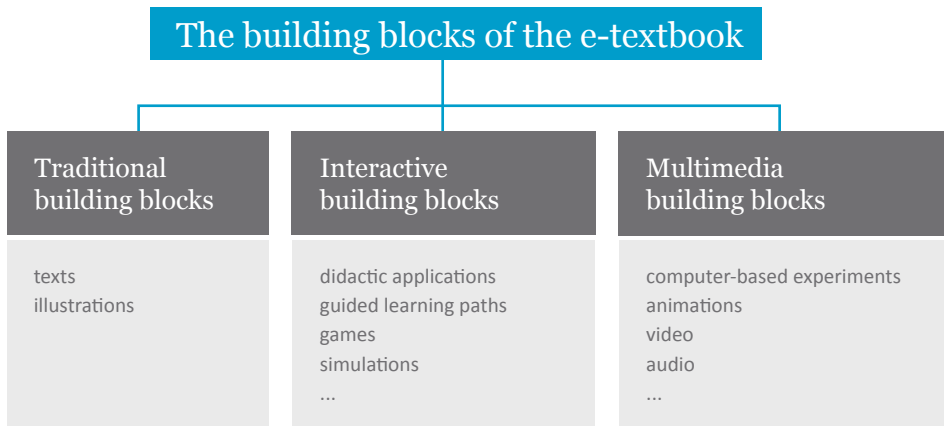


Diagram 2: The building blocks of the e-textbook

The findings of some studies on the use of e-textbooks show that the e-textbook as a digital learning environment improves the quality of teaching, learning and learning outcomes (OECD, 2009: 51). Since the e-textbook relies on multimedia and hypertext, it is branched, non-linear, and it encourages learning by discovery (see Knapp-Potthoff, 2003). The e-textbook is mostly intended for independent learning; it supports individualization and differentiation of the learning process, it systematically develops learners' learning strategies, and it aids learning. Learners themselves can determine the time, location, frequency and intensity of learning; their learning path is determined only by the material itself (Lahaei, 2003).

A good textbook is based on the concept of learner-centeredness, which does not emphasize the teacher's but the learner's activities in the process of building knowledge. These activities are taxonomically balanced if they enable the learner to remember, understand, apply, analyse, evaluate, and create in appropriate proportions. When analysing learning goals and tasks, the taxonomy of educational objectives can be utilized (Bloom, 1956; Krathwohl and Anderson, 2001).

In summary, the e-textbook can be defined as textbook material in a digital learning environment which retains the characteristics of the traditional (printed) textbook, but – in view of technological possibilities – also allows access to other learning resources, encourages active and collaborative learning, provides multiple paths to answers, and gives learners the option to monitor and assess their own learning progress.

In the following sections, the characteristics of e-textbooks are presented in more detail.

2 CHARACTERISTICS OF E-TEXTBOOKS

The quality of e-textbooks is addressed based on didactic, subject-specific, technological, and organizational criteria.

2.1 Didactic Criteria

In contrast to traditional textbooks, e-textbooks can significantly contribute to teaching and learning by promoting the active role of the learner (through their direct interaction with the textbook material), the development of generic competences, self-regulating processes, and individualization and differentiation of learning (Diagram 3).

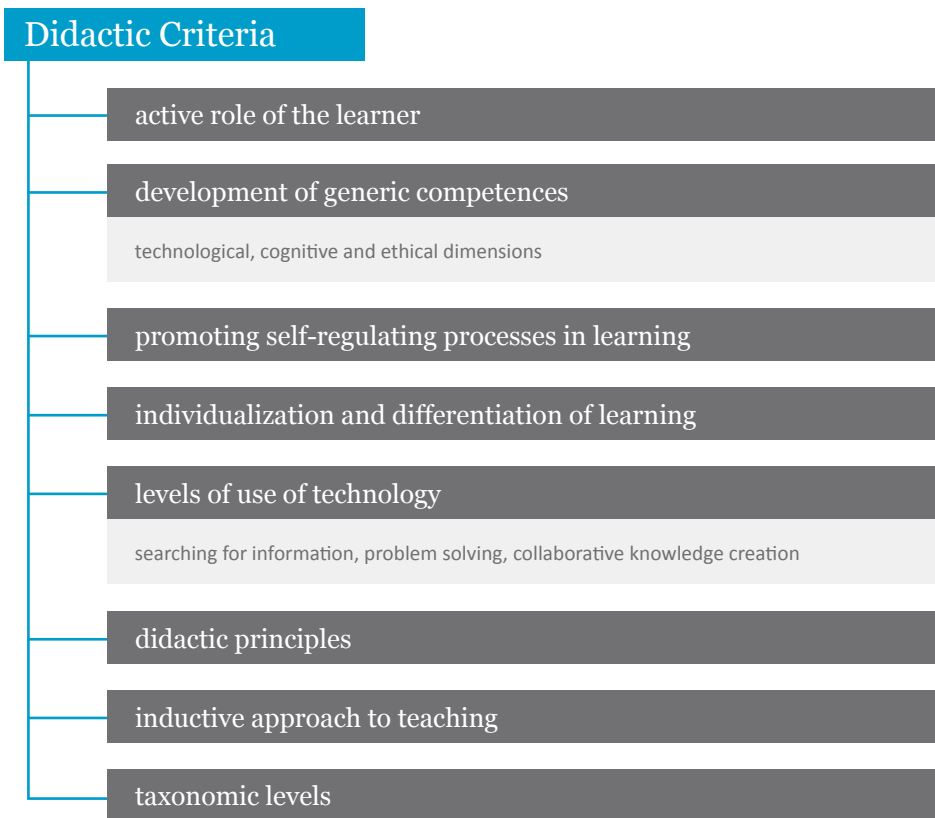


Diagram 3: The didactic criteria for the design of e-textbooks

A special characteristic of the e-textbook is also the fact that it promotes **individualization** of learning to a much greater extent than the printed textbook. The characteristics of individual, independent and self-directed learning are:

- Learning at your own pace;
- Free choice of learning content;
- Independent choice of learning paths;
- Free choice of assessment methods;
- Free choice of presentational forms of learning content.

When designing the **evaluation tasks** for specific technical and generic competences, **three dimensions** should be considered (Calvani et al., 2008):

- Technological dimension: the ability to solve problems; the ability to adjust to new technological challenges;
- Cognitive dimension: the ability to read, select, interpret and evaluate data and information, as well as taking into account its pertinence and reliability;
- Ethical dimension: the ability to interact with others constructively and responsibly, by protecting personal data and by responsibly using available technology.

Bearing in mind the principles of task design – i.e. the goal of evaluation, the type of evaluation, the consideration of taxonomic levels and the selection of appropriate activities (when so required, this includes software and tools) – **three levels of ICT use** should be considered:

- Searching for information;
- Problem solving;
- Collaborative knowledge creation.

The last of the three levels includes the ability to safely use the virtual space and to collaborate with others in an ethical manner.

As for printed textbooks, designing the content of e-textbooks should take into consideration the age of the target group, the level of proficiency, the type of educational programme, as well as **didactic principles** that require that knowledge be imparted in a gradual, systematic, clear, useful, active and individualized manner.

The e-textbook should rely mainly on the **inductive didactic approach** since such an approach encourages active learning by discovery. The inductive approach is based on concrete examples and problems related to specific practices. Solving problems by using this approach also involves the interpretation (acquisition) of general theoretical principles. The formulation of results in this approach arises only after the learner has (intuitively) grasped the concepts and results.

From a didactic perspective, the e-textbook contributes toward better didactic practices and toward a more effective implementation of teaching and learning if the learning objectives and activities follow the updated Bloom's **taxonomy** (Anderson in Krathwohl, 2001).

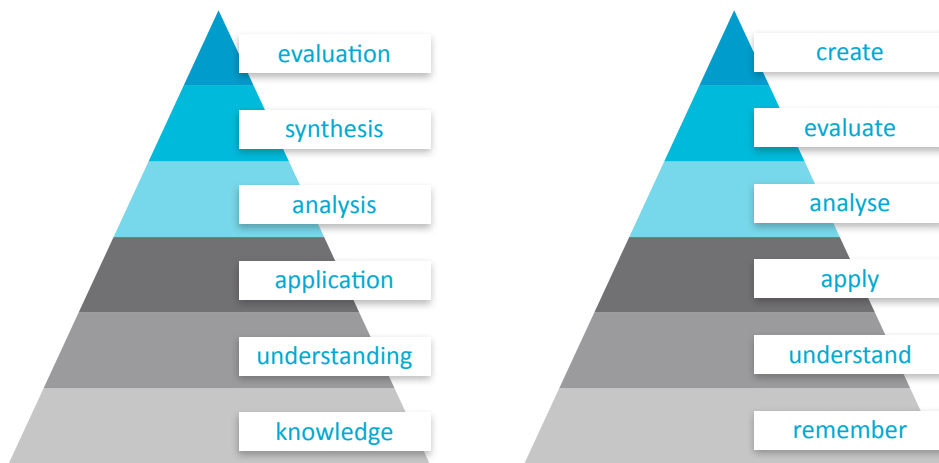


Diagram 4: The original (1956) and the revised Bloom's taxonomy (Anderson in Krathwohl, 2001: 67–68).

Bloom's taxonomy can be used at all levels and in all subjects. It enables the formation of various tasks (on individual taxonomic levels) which encourage learners to progress through the thought processes. In the continuation of this report, some possible activities and tools that can be used to design learning tasks are presented for each taxonomic level (Kreuh and Bačnik, 2011).

Remember: to recognize, identify and recall knowledge from long-term memory.

Examples of activities and tools: electronic knowledge assessment based on quizzes, searching for information, saving favourites, and categorizing by using online tools (e.g. Delicious, Digg) and social networks (e.g. Facebook, Google+, Twitter). This level entails the 'traditional' repetition and consolidation that are typically represented by exercise materials that contain a sufficiently large set of tasks (preferably using randomly generated data). An example of such a resource is 'Active Mathematics' (see Internet Source 1). Learners use such tasks to test their knowledge and consolidate it. The sets of various 'tests' can also help them determine the level of their knowledge. It is desirable that learners have the option of choosing the difficulty level since this enables differentiation.

Understand: to draw meaning from spoken, written or graphic messages so that it is interpreted, supported with examples, classified, summarized, inferred from, compared or explained.

Examples of activities and tools: writing a blog, commenting in forums, publishing a spoken text in the form of audio files or podcasts (e.g. by using NanoGong), creating mind maps (e.g. by using Xmind). E-textbooks offer environments that provide immersive experiences, e.g. through experimentation with interactive programs and simulations such as Java Applets and the like. In this manner, the complexity of learning objectives can be raised to the levels of application, analysis, evaluation and creation. An interactively designed textbook should require that the learner solve problems in ways that support the development of general and generic competences.

Apply: to execute or implement in order to apply.

Examples of activities and tools: creating shared documents (e.g. in Google Docs), collaborating in online educational games, preparing presentations using graphical tools, collaborating (e.g. by using Wikis or PBworks), producing sound recordings (podcasts) (e.g. by using NanoGong) and using communication tools (e.g. Skype, Adobe Connect or Vox). This level includes various tools and activities such as ready activities in the form of didactic applets and games.

Analyse: to ‘deconstruct’ the materials to their components; to identify the relationship they have to one another and to the whole structure; to discover the purpose by discriminating, organizing and adding.

Examples of activities and tools: compiling a report or a presentation by using different media, tables and diagrams.

Evaluate: to judge based on a set of criteria or standards and through testing and critical thinking.

Examples of activities and tools: commenting by using blogs, audio recordings (podcasts), creating presentations, posting using different tools and software (e.g. Wikis, tasks, forums, social networks, modelling).

Create: to join the elements into a meaningful whole; to change the elements to compose a new structure or form by generating, planning or producing.

Examples of activities and tools: making a movie (e.g. by using Movie Maker), creating a presentation, an advertisement or a photo story (e.g. by using slides or mind maps).

E-textbooks and printed textbooks differ also in the speed at which the content can be changed, updated or adapted for different users. In their life cycle, web-based solutions are likely to change in their content and functionality. To focus on learners and to provide them with a constantly improving user experience, e-textbook designers should monitor the continuous changes in user habits, page statistics, and user interactions on textbook pages. In contrast to the traditional media, the internet allows us to record and measure all user activities.

E-textbooks often contain various accompanying documents, which are mainly aimed at teachers and include, for instance, descriptions of didactic approaches and various textbook components. They may include information on different learning paths related to differentiation or diverse methodologies, forms of instruction, teaching aids, and so on. Such elements are recommended and necessary only when the use of the materials is not evident based on other elements.

2.2 Subject-Specific Criteria

The subject-specific criteria encompass knowledge about the content and the objectives of a subject or subject area. This also includes knowledge of general and subject-specific teaching methodology. The subject-specific criteria are closely related to and defined by the didactic criteria, which means that the two sets of criteria are difficult to separate. Nevertheless, the subject-specific aspect is highlighted here owing to its significant role in the design of textbooks.

The e-textbook should represent an overview of learners' knowledge, competences and skills that are required for a particular subject in a particular year or grade. It ensures the acquisition of the expected standards or achievements that are prerequisite for the enrolment in the next year of study.

These criteria thus take into account the adequacy and appropriateness of the e-textbook from the subject-specific perspective, which includes compliance of the materials with the objectives, standards of knowledge and content prescribed by curricular documents (see Appendix 2).

2.3 Technical Criteria

The technical criteria cover the technically appropriate and reasonable use of various textbook components (text, graphics, multimedia and interactive elements), learning managements systems, accessibility, digital standards, ease of use, etc.

The technical elements of e-textbooks that are not present in printed textbooks are interactivity and multimediality. It is recommended that e-textbooks have the highest possible degree of interactivity in the sense that they contain tasks that encourage communication between the learner and the textbook. The degree of interactivity depends on the number of feedback loops in the communication with the user. An example of basic interactivity includes the controls of the audio/video player in the e-textbook, while tasks that provide feedback on learners' answers count as examples of moderate interactivity. The elements with a high degree of interactivity include various didactic applications, simulations and games, guided learning paths, and also some tasks with randomly generated data and feedback on the solution. It goes without

saying that the elements with the highest degree of interactivity can be considered as high-quality didactic tools for learning and teaching that also promote self-learning and metacognition.

Multimedia elements that exploit the potential of the electronic medium can significantly improve the illustrative power of the e-textbook. Thus the e-textbook does not only contain bare text but rather text combined with appropriate and content related non-textual elements. The learner is offered a significant share of information and knowledge through visual material. Such non-verbal elements should have a complementary or symmetrical function; irrelevant and incoherent non-verbal elements should be avoided. The textbook should take into account the principles of spatial and temporal integration of textual and non-textual elements, as well as the modal principle (e.g. the learner has the option of selecting animation with the help of spoken or written text). Multimedia and interactive elements should complement the text and vice versa. The multisensory perception that e-textbooks allow should be used to reduce the amount of text that is typically found in traditional textbooks. In addition, it is necessary to ensure the quality of the product since poor multimedia elements can be distracting or can even dissuade learners from learning. Multimedia elements should meet the minimal technical requirements, which are usually agreed upon before the creation of e-materials. These elements are created using dedicated tools, many of which are available as high-quality open source tools.

In the continuation, **some current requirements for the creation of technically appropriate e-textbooks** are presented, even though many of these requirements are subject to constant change due to the rapid developments in the field.

- Operation on all operating systems and in all major web browsers.
- Local operation without an internet connection (some limitations may apply).
- Native screen resolution of 1024 x 768 pixels.
- Adaptive design that automatically adjusts to different screen resolutions.
- A table of contents (index) that is always visible, clearly presented, easily accessible and based on presenting the content in meaningful sections.
- High-quality multimedia elements:
 1. Bitmaps: the minimum size of bitmap images (photographs, illustrations, diagrams...) should be at least 640 x 480 pixels (at 72 dpi); the quality of bitmaps should not be lower than its basic pixel size (pictures should not be pixelated and the text, if present, should be legible);
 2. Video: a video player is used that is integrated into the content and independent of the operating system or browser; the player should have the same user interface (i.e. the control bar with the commands for forwarding, stopping... video playback) throughout the e-textbook; the minimum size of the video should be 320 x 240 pixels with the compression of 850 kb/s; the quality of the recording (audio, video) should not impede the message of the video;

3. Audio: bit rate of at least 96 kb/s is required; the sound should be clear (speaker, speech) and should have uniform levels throughout the textbook.
- The basic courseware for a single learning unit typically includes:
 1. a minimum of two interactive elements that aim at least at the moderate level of interactivity (including one feedback loop) and are related to the content of the e-materials;
 2. one multimedia element (sound, picture, video, animations...) related to the content of the e-materials and with a duration of at least 10 seconds;
 3. up to 2000 characters with spaces (and fewer at lower levels of education);
 4. the basic building block can be designed as a collection of single-screen webpages, but only when individual parts of the content are not interrelated (i.e. when it is not necessary to transition among them).

The technical criteria are also related to the availability of the e-textbook. The e-textbook should be available online and, with some limitations, also locally (on computers without internet connection).

The availability of e-textbooks online is an important aspect of the process of e-textbook design. It has been established that currently the most appropriate solution is that e-textbooks be made available on an internet portal which serves as a single entry point. The portal is modular, which means that it allows a simple addition of new subjects and that it can be easily upgraded. The portal is freely available and requires users to register and log in only when advanced functions are used (virtual classrooms, user experience analysis, improvements).

2.4 Organizational Criteria

Because e-textbooks are intended for widespread use, for both teaching and learning, at school and at home, and because they are used by students, pupils, teachers and parents, two elements are important from the organizational point of view: e-textbooks should be **clearly structured** and their content **easily accessible**. This can be achieved by using a menu structure that matches the one in curricular documents. It is also important that e-textbooks take into account the level of education and the age of the target group – the recommendations and the level of complexity should be adjusted accordingly.

The following is recommended.

- The content should be structured in accordance with the **thematic units** and the curricular documents, and should be accessible in the tree-structured menus (see examples in Internet Sources 2–5).
- **Each chapter** should represent a learning whole and contain an introduction, content-based units, and a summary.
- **The summaries** should allow the learner to revise the acquired knowledge.

- **A single-screen webpage** should include a complete activity; it should not require the user to leave the page. The page can cover the whole of material or only a part of it (a single-screen webpage without sliders is preferred if the dynamic and sequential activities are carried out in a limited field on the page (see Internet Source 6).
- The content should be easily **adaptable for different use scenarios**.
- The content should **comply with a standard for shareable learning content** (e.g. SCORM 1.2 or higher, Common Cartridge). The thematic units (or even smaller sections) should be divided into separate packages.

Diagram 5 presents the main organizational features of the e-textbook.

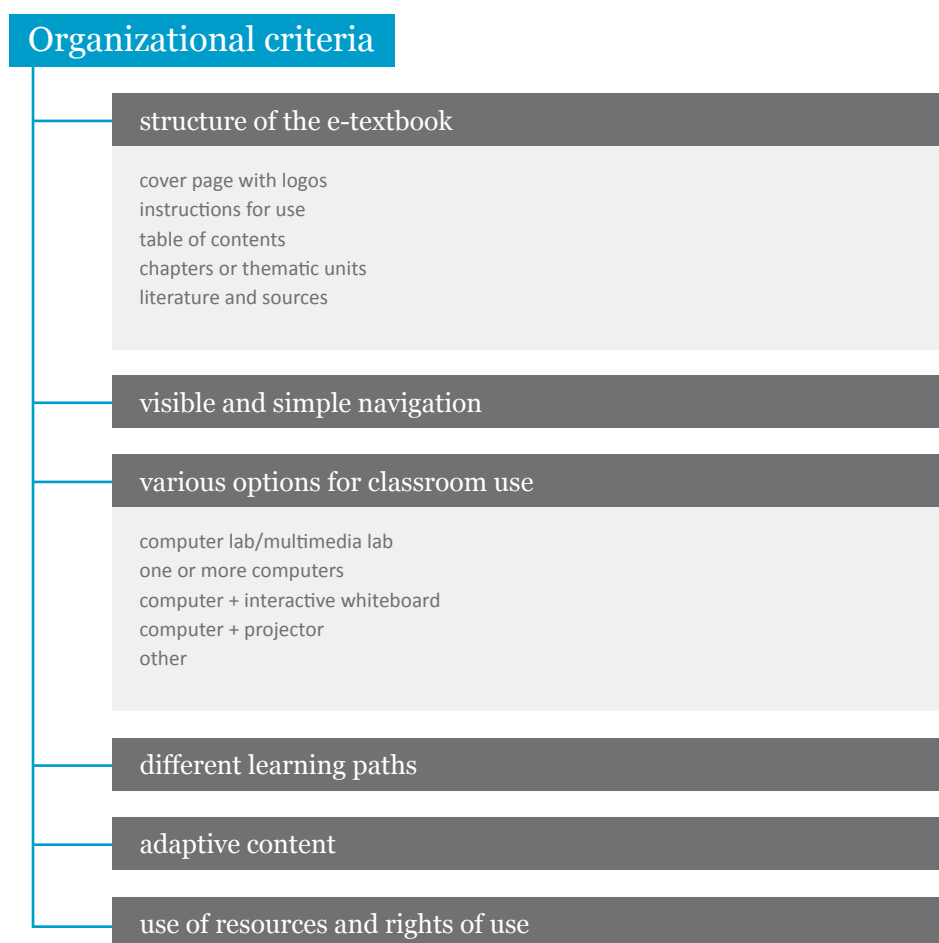


Diagram 5: The organizational criteria for the design of e-textbooks.

3 CONCLUSION

The project 'Criteria for the Design of Electronic Textbooks' resulted in the creation of the present document, as well as in three sets of e-materials being updated and upgraded into e-textbooks, which are currently in the process of accreditation. Their use in the classroom will be the final criterion for deciding on their appropriateness for teaching and learning.

The framework for the design of e-textbooks represents a fundamental concept for devising e-textbooks. However, the final appearance and the use of e-textbooks in the classroom largely depend on the creativity and innovativeness of their future authors. Hence, the training of all target groups, i.e., the creators and the users of e-textbooks, is a necessary part of the project. The subsequent monitoring of the use of e-textbooks in the classroom also plays an important role in finding new solutions and ideas in the creation of new e-learning materials.

LITERATURE

Anderson, L. in D. Krathwohl. (2001). *A taxonomy for learning, teaching, and assessing: a revision of Bloom's taxonomy of educational objectives*. New York: Addison Wesley Longman.

Bloom, S. B. (1956). *Taxonomy of Educational Objectives*. New York: David Mc Kay Company.

Calvani, A., A. Cartelli, A. Fini, A. Ranieri. (2008). Models and Instruments for Assessing Digital Competence at School. *Je-LKS 4* (3): 183–193.

Freudenstein, R. (2003). Unterrichtsmittel und Medien: Überblick. In: Bausch, Karl-Richard, Herbert Christ and Hans-Jürgen Krumm (eds.) (2003). *Handbuch Fremdsprachenunterricht*, 4th edition. Tübingen: A. Francke Verlag, 395–399.

Jung, S. and L. Kwang-Bin. (2009). Leading Future Education: Development of Digital Textbooks in Korea. In: *The 4th World Teachers' Day in Thailand and 12th UNESCO-APEID International Conference 'Quality Innovations for Teaching and Learning'*, 24–26 March 2009, Bangkok. Electronic source. Accessible at: http://www.unescobkk.org/fileadmin/user_upload/apeid/Conference/12thConference/paper/Sung-Moo_Jung_paper.pdf (5. 9. 2011).

Knapp-Potthoff, A. (2003). Lehr- und Lernmaterialien in Neuen Medien. In: Bausch, Karl-Richard, Herbert Christ and Hans-Jürgen Krumm (Eds.) (2003). *Handbuch Fremdsprachenunterricht*, 4th edition. Tübingen: A. Francke Verlag, 430–433.

Kovač, M, M. Kovač Šebart, J. Krek, D. Štefanc, T. Vidmar. (2005). *Učbeniki in družba znanja*. [Textbooks and Knowledge Society.] Ljubljana: Pedagoška fakulteta, Znanstveni inštitut Filozofske fakultete.

Kreuh, N. and A. Bačnik. (2011). Vrednotenje zmožnosti z uporabo IKT [Assessing competencies by using ICT]. In: Bačnik, A. et al. (Eds.) (2011). *Mednarodna konferenca Splet izobraževanja in raziskovanja z IKT – SIRIKT 2011, Kranjska Gora, 13.–16. april 2011. Zbornik vseh prispevkov*. Electronic source. Ljubljana: Miška, 764–769. Accessible at: http://prispevki.sirikt.si/datoteke/sirikt2011_zbornik.pdf (1. 9. 2011).

Lahaie, U. S. (2003). Materialien zum Selbstlernen. In: Bausch, Karl-Richard, Herbert Christ and Hans-Jürgen Krumm (Eds.) (2003). *Handbuch Fremdsprachenunterricht*, 4th edition. Tübingen: A. Francke Verlag, 413–416.

Mori, I. (2009). Vpliv kriterijev na kvaliteto e-gradiv. [The effect of the criteria on the quality of e-materials.] In: Orel, M. et al. (Eds.) (2009). *Mednarodna konferenca Splet izobraževanja in raziskovanja z IKT - SIRIKT 2009, Kranjska Gora, 15.-18. april 2009. Zbornik prispevkov.* Ljubljana: Arnes, 128–137. Accessible at: http://www.sirikt.si/fileadmin/sirikt/predstavitve/2009/ZBORNIK_Sirkt2009.pdf (9. 2. 2011).

Neuner, G. (2003). Lehrwerke. In: Bausch, Karl-Richard, Herbert Christ and Hans-Jürgen Krumm (Eds.) (2003). *Handbuch Fremdsprachenunterricht*, 4th edition. Tübingen: A. Francke Verlag, 399–402.

OECD. (2009). *Beyond Textbooks: Digital Learning Resources as Systematic Innovation in the Nordic Countries.* Paris: OECD Publishing.

OECD. (2007). *Giving Knowledge for Free. The Emergence of Open Educational Resources.* Paris: OECD Publishing. Electronic source. Accessible at: <http://www.oecd.org/dataoecd/35/7/38654317.pdf> (9. 2. 2011).

Skela, J. (2008). Vrednotenje učbenikov angleškega jezika z vidika kognitivne teorije učenja. [Evaluating textbooks for English from the perspective of Cognitive Learning Theory.] In: Skela, Janez (Ed.) (2008). *Učenje in poučevanje tujih jezikov na Slovenskem: pregled sodobne teorije in prakse.* Ljubljana: Tangram, 154–178.

Strokovna skupina za oblikovanje kriterijev za vrednotenje in ocenjevanje e-gradiv. (2009). *Obrazec za vrednotenje in ocenjevanje e-gradiv – končno poročilo in Obrazec za vrednotenje in ocenjevanje e-gradiv – izkušnjski vidik. [The form for the evaluation and assessment of e-materials – final report; The form for the evaluation and assessment of e-materials – experiential aspect.] Unpublished document. Zavod RS za šolstvo.*

Zmazek, B., A. Lipovec, I. Pesek, V. Zmazek, S. Šenveter, J. Regvat, K. Prnaver. (2011). Priporočila za izdelavo e-učbenikov. [Recommendations for the design of e-textbooks.] Unpublished document, part of the project Criteria for the Design of E-Textbooks. Zavod RS za šolstvo.

INTERNET SOURCES

[1] <http://am.fmf.uni-lj.si> (1. 9. 2011)

[2] <http://www.egradiva.si> (1. 9. 2011)

[3] <http://www.e-um.si> (1. 9. 2011)

[4] <http://www.demo.activemath.org> (1. 9. 2011)

[5] <http://www.kii2.ntf.uni-lj.si/e-kemija/mod/resource/> (1. 9. 2011)

[6] <http://www.yteach.com> (1. 9. 2011)

[7] List of e-resources: <http://skupnost.sio.si/mod/wiki/view.php?id=73919&page=Egradiva> (1. 9. 2011)

APPENDICES

- APPENDIX 1: The work of e-materials project consultants
- APPENDIX 2: The proposal of the evaluation form for official textbook accreditation

Appendix 1:

The work of e-materials project consultants

In the years 2009 and 2010, the Slovenian Ministry of Education and Sport decided, after a public tender, to support the development of e-learning materials. The project was co-financed by the European Structural Funds. The resulting materials include e-materials for primary, secondary and tertiary levels (Internet Source 7).

Following the development of e-learning materials, the need arose to improve and evaluate them. In order to do this, the Institute of Education established an expert group whose task was to design the criteria for the evaluation of e-materials (see Mori 2009). The group designed the form for the evaluation of e-materials, which guides the authors and users toward developing quality e-materials and toward more successful and efficient teaching and learning. The form consists of three parts: the description sheet, the consultant report, and the teacher report (to be completed after the materials have been used in the classroom).

The description sheet contains the basic details about the e-materials. **The consultant report** addresses the technical and user-related evaluation criteria as well as the content-related and didactic evaluation criteria. The technical and user-related criteria include the following: installation/preparation for use; adaptability, legibility and clarity of text; quality of multimedia elements; the level of interactivity; navigation; and support. The content-related and didactic criteria encompass the following: appropriateness related to the subject-specific criteria; compliance with curricular documents; appropriateness of e-learning materials for the target group; ability to facilitate the use of various modern teaching methods, teaching forms and learning styles; and compliance with fundamental pedagogical principles with regard to supporting the learning process, providing meaningful continuous and final feedback and offering various levels of difficulty. The third part of the form is the teacher report created after the materials have been used in the classroom. It represents the experiential aspect, which includes a numerical rating of technical, user-related, content-related and didactic criteria, as well as an assessment of learners' response to the materials. The numerical rating for each criterion is supplemented by written justifications.

Date: 20 April 2009

E-MATERIALS FINAL ASSESSMENT AND EVALUATION FORM

DESCRIPTION SHEET

(Filled out by the author or the publisher.)

Date:

a) Title of e-material:

Accessible at the web address:

b) Subject area:

c) Authors:

d) Publisher:

e) Consultant:

f) Type of e-materials:

- Software, simulations, exercises, applets, video, webpages
- Distance learning
- Interactive whiteboard software
- Other

g) Level:

- Pre-school
- Primary school: **a)** 1st cycle **b)** 2nd cycle **c)** 3rd cycle
- Secondary education: **a)** High-school **b)** Vocational and secondary technical education
- Higher education
- University education
- Adult education
- Life-long learning
- Music education
- Special needs education
- Other

h) Intended use:

- To deal with new learning content
- To consolidate and revise
- To assess and grade
- For self-study
- To support the teacher in the classroom
- Other

i) Summary of the review in about 100 words and the reviewer's signature.
(Written by the reviewer.)

REPORT

(Filled out by the consultant.)

Instructions: In the evaluation of e-materials a four-point grading scale is used by circling one of the listed answers: 1 means the lowest level of quality and 4 the highest level of quality. NA (not applicable) should be circled when the materials are such that it is impossible to rate them using the given descriptive criteria. *The notes below the table provide further explanations of the 2nd, 3rd, 4th and 5th descriptive criteria from the technical and user-related section.

Date of report:

TECHNICAL AND USER-RELATED CRITERIA					
1. Installation/preparation for use (simplicity/complexity of installation – can it be successfully carried out by a layperson?, duration of installation, automatic installation process, registration, compatibility, list of required hardware and software)	1	2	3	4	NA
2. Adaptability* (the option of choosing components, tasks, difficulty, speed)	1	2	3	4	NA
3. Legibility and clarity of text* (graphics, use of colours, contrasts...)	1	2	3	4	NA
4. Quality of multimedia elements*					
• images (illustrations, photographs, mapping or other cartographic content)	1	2	3	4	NA
• audio recordings	1	2	3	4	NA
• video recordings	1	2	3	4	NA
• animations and simulations	1	2	3	4	NA
5. Level of interactivity*					
• passive (no interactivity)					
• low (one-way communication)					
• moderate (one feedback loop)	1	2	3	4	NA
• high (multiple feedback loops or an unlimited number of feedback loops)					
6. Navigation (allows clear navigation and orientation – do I always know where I am when I move from one menu item to the other?)	1	2	3	4	NA
7. Support during use (availability of help during use)	1	2	3	4	NA
CONTENT-RELATED AND DIDACTIC CRITERIA					
1. E-materials comply with the standards in the subject area.			YES	NO	
2. Compliance of e-learning materials with curricular documents (are the learning content and learning objectives consistent with the expected results?)			YES	NO	
3. Appropriateness of the e-learning materials for the target group	1	2	3	4	NA
4. The e-materials allow the use of various teaching methods, forms, and learning styles (i.e. teachers can choose and use various learning methods, forms, and learning styles)	1	2	3	4	NA

5. The e-materials adhere to the basic pedagogical principles with regard to supporting the learning process (clarity, examples, gradualism, individualization and differentiation...)	1	2	3	4	NA
6. E-materials include meaningful continuous and final feedback	1	2	3	4	NA
7. E-materials include a variety of difficulty levels	1	2	3	4	NA
THE PROPOSED E-MATERIALS ARE:					
APPROPRIATE (provide a qualitative review):					
NOT APPROPRIATE (explain the reason):					

Date of report:

Notes

2. Adaptability

- Compatibility with various systems:** Do the e-materials open and work in the three main internet browsers (Firefox, Explorer and Safari)? Is a SCORM file of the materials available? If the materials are meant to be used on interactive whiteboards, do they work on the interactive whiteboards provided by manufacturers that were selected in a tender issued by the Ministry of Education and Sport? How do the e-materials work on various screen resolutions (small and big)?
- Adaptability of content:** Can teachers add, remove and change the functionality of the components included in the e-materials? Can teachers change the content and learning paths? Can teachers copy the text? If the e-materials are meant for an LMS environment (e.g. e-classrooms such as Moodle, Echo...), the following should also be rated: With regard to assessment materials, can teachers add questions to tests? Can teachers upload files for the learners? Can learners upload files for the teacher?

3. Legibility and clarity of text (graphics, use of colours, contrast...)

Is the font size appropriate? Are longer texts structured and divided (by page breaks) into shorter units that are appropriate for reading online? Do longer texts include introductions and highlighted main ideas?

The rule-of-thumb is one paragraph, one idea. Is the font style (size, emphasis, italics, colours...) uniform in all chapters and helpful in guiding the reader through the content? Is the text consistently organised? Are the links clear and meaningful? Is the information sufficiently visual? Do the texts make sensible use of bullet points and tables? Are the headings unambiguous and clear? Are times and dates provided in absolute rather than in relative terms (e.g. 'in the year 2008' instead of 'this year')?

4. Quality of multimedia elements

- **Images** (illustrations, photographs, mapping or other cartographic content). Note the image size (small, medium, large, the possibility of increasing to full-screen), colour quality, graininess when zoomed in, liveliness and composition.
- **Audio recordings.** Is the clarity of audio recordings/speech appropriate for classroom use?
- **Video recordings.** What is the quality of video recordings – mobile, amateur, professional? Is the recording edited; is it equipped with background music; does it include voiceover narration? Is the lighting appropriate?
- **Animations and simulations.** What is the quality of illustration in animations like? How well are the topics in the animations or simulations presented – do they contribute to understanding the topic? Have the authors fully exploited the possibilities offered by this medium? How many variables can be changed in simulations (1, 2 to 3, more than 3)?

5. Level of interactivity

- **Passive (no interactivity):** a traditional HTML webpage; the user clicks on content and moves around it but cannot manipulate it; the webpage responds to all users in the same way.
Examples: independent text, pictures with text, pictures, gif animations, video, sound, etc.
- **Low (one-way communication):** simple animations that cannot be manipulated in any other way than by controlling their flow (stop, forward, back, speed); some text under the button; a drawing area; matching; circling; no feedback is provided.
- **Moderate (one feedback loop):** simple interactive elements.
Example: tests of the types 'Yes/No', 'A-B-C', 'Fill in the gap'... that include some type of feedback (correct/wrong, the correct answer is provided, the number of correct answers is given, a grade is displayed...).

- **High (multiple feedback loops or an unlimited number of feedback loops):** the interactive elements are complex.
Example: simulations that allow users to change one or more variables; drawing diagrams; questions on several levels (the activity changes depending on the answer provided by the user); dynamically generated tasks (the task data is randomly generated and thus different for each user).

Sources for the form above:

- Kolenc-Kolnik, Karmen. 2007. Mnenje o izobraževalni vrednosti spletnega e-učnega gradiva. [Report on the educational value of online e-learning materials.] Filozofska fakulteta Maribor, 2007.
- Razvojna skupina za vzpostavitev načina ocenjevanja kakovosti e-gradiv [Development group for the establishment of a method to evaluate the quality of e-materials.] (Vladimir Batagelj et al.). 2005. Tipi elektronskih gradiv, njihov opis in ocena kakovosti. [Types of electronic materials, their description and the evaluation of their quality.]
- Strokovna skupina za IKT na ZRSŠ. [Expert Group for the ICT at the National Institute of Education.] 2007. Obrazca za ocenjevanje e-gradiv. [Forms for the evaluation of e-materials.]
- Mori, Ivanka. 2005. Učinki uporabe računalnika pri obravnavi naravoslovne teme. [The effects of using computers in the treatment of science topics.] MA Thesis, Pedagoška fakulteta Ljubljana.
- Policy Innovation Committee by the Swiss Agency for ICT in Education.

Sample Form: E-materials Evaluation and Assessment Form – Experiential Aspect (Expert Group 2009)

Date: 20 April 2009

E-MATERIALS EVALUATION AND ASSESSMENT FORM – EXPERIENTIAL ASPECT

REPORT

(Filled out by the teacher after using the e-material in the classroom.)

Date:

Name and surname:

School:

Title of e-materials:

I have tested: a) The whole of the e-materials.

b) A unit of the e-materials entitled:

Accessible at the web address:

My experience with e-materials:

Circle how often you use e-materials in the classroom.

a) never

b) occasionally

c) regularly

1. Technical and user-related criteria

Rate your experience with the use of the e-materials in the classroom from a technical, user-related point of view.

(The e-materials include legible and clear text, graphics, use of colours, contrasts... Audio and video recordings, animations and simulations work smoothly. Pictures, illustrations, photographs, mapping and other cartographic features are clear. The materials are interactive; they allow movement from one menu item to the other, so that I always know where I am. I can always get help when using the materials.)

Circle a number from 1 to 5; 1 means poor, and 5 means excellent.

1 2 3 4 5

Please justify your decision.

2. Content-related and didactic criteria

Rate your experience with the use of the e-materials in the classroom from a content-related, didactic point of view.

(E-materials comply with the standards in the subject area and in the curricular documents. They are appropriate for the target group and allow the use of various modern teaching methods, forms and learning styles. They adhere to the basic pedagogical principles with regard to supporting the learning process: clarity, examples, gradualism, individualization, differentiation... The e-materials include meaningful continuous and final feedback, as well as a variety of difficulty levels.)

Circle a number from 1 to 5; 1 means poor, and 5 means excellent.

1 2 3 4 5

Please justify your decision.

3. Learners' responses

Rate learners' responses to the e-materials. What did they learn using the e-materials?

Circle a number from 1 to 5; 1 means poor, and 5 means excellent.

1 2 3 4 5

Sources for the form above:

- Kolenc-Kolnik, Karmen. 2007. Mnenje o izobraževalni vrednosti spletnega e-učnega gradiva. [Report on the educational value of online e-learning material.] Filozofska fakulteta Maribor, 2007.
- Razvojna skupina za vzpostavitev načina ocenjevanja kakovosti e-gradiv [Development group for the establishment of a method to evaluate the quality of e-materials.] (Vladimir Batagelj et al.). 2005. Tipi elektronskih gradiv, njihov opis in ocena kakovosti. [Types of electronic materials, their description and the evaluation of their quality.]
- Strokovna skupina za IKT na ZRSŠ. [Expert Group for the ICT at the National Institute of Education.] 2007. Obrazca za ocenjevanje e-gradiv. [Forms for the evaluation of e-materials.]

- Mori, Ivanka. 2005. Učinki uporabe računalnika pri obravnavi naravoslovne teme. [The effects of using computers in the treatment of science topics.] MA Thesis, Pedagoška fakulteta Ljubljana.
- Policy Innovation Committee by the Swiss Agency for ICT in Education.
- European Schoolnet. 2005. Quality criteria.
- Quality principles for digital learning resources, Becta, 2007, <http://www.becta.org.uk>

Appendix 2:

The proposal of the evaluation form for official textbook accreditation

Date of report:
E-textbook title (web address):
Author:
Subject:
Level:
Year:
The proposed textbook is: A. Appropriate. B. Conditionally appropriate. C. Inappropriate.
Qualitative review with specific suggestions for improvements:

Reviewer's signature:

DETAILED ASSESSMENT OF ELEMENTS REQUIRED IN E-TEXTBOOKS			
	Fundamental characteristics	Appropriate	
1.	The e-textbooks contains:		
	the knowledge acquisition component (obligatory)	YES	NO
	the revision and consolidation component (obligatory)	YES	NO
	the additional learning activities component (obligatory)	YES	NO
	the didactization component (recommended)	YES	NO
2.	The revision and consolidation component		
	quantity of tasks	YES	NO
	tests	YES	NO
3.	Uniform graphic design	YES	NO
4.	Content divided into thematic units	YES	NO
5.	Summaries provided for individual units	YES	NO
6.	Adaptability of content	YES	NO
7.	Standard for shareable learning content	YES	NO
8.	Ensuring user experience	YES	NO
MINIMAL TECHNICAL AND USER-RELATED REQUIREMENTS			
9.	Compatibility	YES	NO
10.	Screen resolution	YES	NO
11.	Table of contents	YES	NO
12.	Interactivity in the e-textbook		
	share of interactive elements	YES	NO
	level of interactive elements	YES	NO
13.	Quality requirements for audio and video		
	bitmap picture	YES	NO
	video	YES	NO
	audio	YES	NO
14.	Quantity requirements		
	number of interactive elements	YES	NO
	number of multimedia elements	YES	NO
	number of characters	YES	NO
MINIMAL CONTENT-RELATED AND DIDACTIC REQUIREMENTS			
15.	Methodological adequacy	YES	NO
16.	Curricular compliance	YES	NO
17.	Learning principle	YES	NO
18.	Differentiation principle	YES	NO
19.	Linguistic appropriateness	YES	NO

DETAILED NOTES

1. Components of e-textbooks. Obligatory components include: acquisition of knowledge, revision and consolidation, and additional learning activities. The component of knowledge acquisition consists of materials and summaries. The component of revision and consolidation includes assessment and testing tasks and various activities. The component for additional learning activities encompasses various learning aids and activities such as ready activities in the form of didactic applets and games. The didactization component contains various support documents mainly aimed at teachers (e.g. descriptions of didactic approaches and features of various components in the e-textbook). Various learning paths can be suggested with regard to differentiation, variety in methodology, forms of teaching, learning aids, etc. This last element is recommended but not obligatory. It should be present, however, when didactization is not evident from other components.

2. Revision and consolidation component: This element of the e-textbook is represented by exercise materials containing appropriately extensive sets of tasks (generated data is recommended). Based on these tasks, users can test and consolidate their knowledge. Furthermore, sets of tests (also using generated data) should enable them also to evaluate their knowledge. It is recommended that learners can choose the difficulty level, as this ensures differentiation.

3. Uniform graphic design: The e-textbook has a uniformly designed appearance and user interface. This means that the titles, summaries, important facts, audio and video components, additional content and other visual elements are uniform throughout the materials.

4. Division into thematic units: The content is structured into thematic units and accessible in the tree menu. The tree menu mirrors the structure of curricular documents (for teachers).

5. Summaries: Each thematic unit contains a summary, which allows users to revise the acquired knowledge.

6. Adaptability of content: E-textbook content can be easily corrected and adapted (typically, the materials are created using open source tools).

7. Standard for shareable learning content: The content complies with a standard for shareable learning content (e.g. SCORM 1.2 or higher, Common Cartridge). The thematic units (or even smaller sections) are provided as separate packages.

8. Ensuring user experience: E-textbooks are subject to continuous monitoring of user habits, page statistics, and interactions on textbook pages. Users have the option of sub-

mitting their e-mail address, so they can be contacted with regard to their comments. The person responsible for comment monitoring regularly monitors user comments. They diligently collect comments containing error reports and check these errors.

9. Ensuring user experience: E-textbooks are subject to continuous monitoring of user habits, page statistics, and interactions on textbook pages. Users have the option of submitting their e-mail address, so they can be contacted with regard to their comments. The person responsible for comment monitoring regularly monitors user comments. They diligently collect comments containing error reports and check these errors.

10. Screen resolution: the minimal screen resolution is 1024 x 768 pixels; pages automatically adjust to the screen resolution of the device.

11. Table of contents: The table of contents is always visible, clear and easily accessible. It is based on the division of content into thematic units.

12. Interactivity in the e-textbook: The materials should strive for high levels of interactivity, i.e., for multiple feedback loops in the communication with the learner. According to our definitions, controlling audio/video players in the e-textbook represents a low level of interactivity. The moderate level provides users with feedback based on their answers. And a high level of interactivity includes multiple interactions between the user and the system. It goes without saying that the elements with the highest degree of interactivity can be considered as high-quality didactic tools for learning and teaching. They include various didactic Java applets, games, guided learning paths, as well as some tasks that include randomly generated data and feedback on the solution.

13. Quality requirements for audio/video elements:

- Bitmaps. The minimum size of bitmap images (photographs, illustrations, diagrams...) is at least 640 x 480 pixels (at 72 dpi): the quality of bitmaps should not be lower than their basic pixel size (pictures should not be pixelated and the text, if present, should be legible).
- Video. The video player is integrated into the content and independent of the operating system or browser; the player has a uniform user interface (control bar with the relevant commands) throughout the e-textbook. The minimum size of the video is at least at 320 x 240 pixels with the compression of at least 850 kb/s; the quality of the recording (audio, video) should not impede the message of the video.
- Audio. The bit rate is at least 96 kb/s; the sound is clear (speaker, speech) and has uniform levels throughout the textbook.

14. **Quantity requirements**

- The number of interactive elements. The basic courseware for a single learning unit on average includes a minimum of two interactive elements that aim minimally at the moderate level of interactivity and are related to the content of the e-materials.
- The number of multimedia elements. The basic building block (material) representing a complete learning unit on average contains one multimedia element (sound, picture, video, animations...), which is related to the content of the e-materials and has a duration of at least 10 seconds.
- The number of characters. The basic building block (materials) representing a complete learning unit on average contains about 2000 characters with spaces (the lower number of characters expected in the first two cycles of primary education is replaced by a proportionally higher number of other elements). When individual parts are not interrelated (i.e. when it is not necessary to transition among them), the materials can be designed as a collection of single-screen webpages.

15. Methodological adequacy. The e-textbook is methodologically appropriate and complies with the standards in the subject area with respect to general and subject-specific teaching methodology. This aspect includes the principles that require knowledge to be imparted in a gradual, systematic, clear and useful way that also takes into account the developmental stage (age) of the learner. In this section, special emphasis is also placed on the importance of legibility and clarity of texts.

16. Curricular compliance. The e-textbook complies with the learning objectives, standards and achievements set out in curricular documents. The content of the e-textbook enables teachers to cover all fundamental objectives of the curriculum.

17. Learning principle. The e-textbook appropriately complies with the learning principle when it enables active learning, provides feedback (continuous and final), supports the inductive approach, reliably guides the learner through individual units, and provides an immersive experience.

18. Differentiation principle. The e-textbook follows the differentiation principle when it contains differentiated learning objectives and tasks, and offers a proportional selection of tasks at different difficulty levels. It also has to be adaptable for learners with special needs. In addition, an appropriate amount of multimedia or other elements should take into account learners' cultural environment and the principle of multi-sensory learning.

19. Linguistic appropriateness. Texts should be linguistically appropriate, aimed at the correct target population, legible and clear (e.g. font size, structure, organization of longer texts into smaller units appropriate for online reading, highlighted main ideas, unambiguous headings, meaningful and systematic structure...).



FRAMEWORK FOR THE DESIGN OF ELECTRONIC TEXTBOOKS

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