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ICT FOUNDATIONS OF THE PEDAGOGICAL PROFESSION

Forgó Sándor – Antal Péter

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The ICT foundations of the pedagogical profession

Forgó Sándor – Antal Péter

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1. INTRODUCTION

1.1 OBJECTIVES, COMPETENCES, COURSE COMPLETION CRITERIA

1.1.1 Objective

Upon completion of the course students should possess instruction and information technology literacy with special attention to the methodological foundations of the application of instruction and info-communical systems and the services available at the worldwide web. In connection with the given *professional discipline* students should be capable of searching and retrieving information in an efficient manner, along with effectively partaking in multiple network-based communication schemes. Students will also be able to process data and information electronically, in addition to creating, modifying, and disseminating digital content. Furthermore, students should master the criteria for the creation, design, and evaluation of educational materials and electronic texts as well.

1.1.2 Competences

- The development of competences required for life long learning.

Content knowledge

- Familiarity with the methodological foundation of the application of the instruction and information and communication technology device system. Effective utilizing of services available on the world wide web along with offering adequate and constructive responses to the related questions.

Attitudes

- Students are capable of the informed and sophisticated use of electronic instruction and info-communication systems in their lives and during the fulfilment of professional tasks.

Skills

- The evaluation of multimedia based electronic texts. The compilation of presentable electronic educational texts from relevant sources via the use of a thematic plan and script.

Instruction methodology:

– lecture, practice, on-line project work

1.1.3 Course completion criteria

Theoretical knowledge:

– Passing a test focusing on the acquired theoretical background

Practical exercises:

– The use of community bookmarks with the help of the Delicious and DIIGO applications
– On-line, off-line evaluation of multimedia-based electronic instructional material connected with the respective subject content of the SDK (Sulinet Digital Knowledge Base). http://tudasbazis.sulinet.hu
– Creation of multimedia-based, interactive, electronic and non-linear educational material or media product in off-line and on-line versions.

Project task

– The use of the MOODLE learning management system, the application of social media-based network-facilitated online learning formats, the use of forums, community bookmarks, and document sharing pages.
– Activity within the MOODLE framework

- Each topic is evaluated on the electronic surface.
- In the forum option of Lesson 5 students should discuss the modification of teaching roles. Recommended text: Varga, Miklósné. Varga Miklósné: A pedagógusszerepek átalakulása napjainkban (The transformation of teacher roles nowadays) http://www.ofi.hu/tudastar/pedagogusszerepek
- Bedő Ferenc: A tanuláselméletek és az informatika. A pedagógiatörténet tanuláselméletei. (Learning theories and informatics. Didactic theories during the evolution of pedagogical history) http://w3.enternet.hu/infokt/publikacio/k1/k1.htm

1.2 COURSE CONTENT

The text titled *The ICT Foundations of the Pedagogical Profession* consists of 4 main modules. After the Introduction describing the course requirements and the learner work forms Module I focuses on the instruction technology and information and communication technology-based correlations of electronic media. Module II deals with the conceptual system of electronic learning, the process of designing e-learning texts, and questions related to the media genre along with the e-Learning standards. Module III titled Digital contents in offline and online environments provides information of the handling of digital contents, on creative media technologies and the online pedagogical knowledge bases. Module IV discusses the concept of electronic learning environment, the tools and methods of in-class computer use along with innovative ICT solutions (interactive board, CMPC, tablet machine, smart phone).

Topics of the course text

1. Introduction: course requirements, learning work forms /Sándor Forgó/

Module I. Instruction technology and ICT connections of electronic media /Sándor Forgó/

2. Traditional and new media systems, relevant methodological questions of use. /Sándor Forgó/

3. Instruction technology of ICT devices. /András Nádasi, Sándor Forgó/

4. The evaluation and qualification of multimedia-based electronic educational materials and devices. /Sándor Forgó /

5. Illustrations, demonstrations of educational materials. The electronic publication. /Sándor Forgó/

Module II Electronic learning /Sándor Forgó/

6. The conceptual system of of e-Learning methodology. The online community media. /Sándor Forgó/

7. The process of designing e-Learning texts and the questions of the media genre. e-Learning standards, standardized e-Learning texts. /Sándor Forgó, Péter Antal/

Module III. Digital contents in online and offline environments /AP/

8. Processing digital contents, creative media technologies. (Péter Antal)

9. Online pedagogical knowledge bases. (Searching and retrieval of information on the Internet. Digitalized pedagogical information sources, SDK, MozaBook) / Péter Antal /

Module IV. Electronic learning spaces / Péter Antal /

10. Practical issues of the preparation of ICT materials (software: Lynx, WordWall, Smart Notebook, class management systems, digital tables, CMPC, iBook) / Péter Antal/

11. Devices and methods of in-class computer use (interactive table, CMPC, tablet, smart phone) / Péter Antal /

12. ICT innovations: ePortfolio, ePresentation, e-Book, iPad innovatíve projects / Péter Antal /

V. SUPPLEMENTS

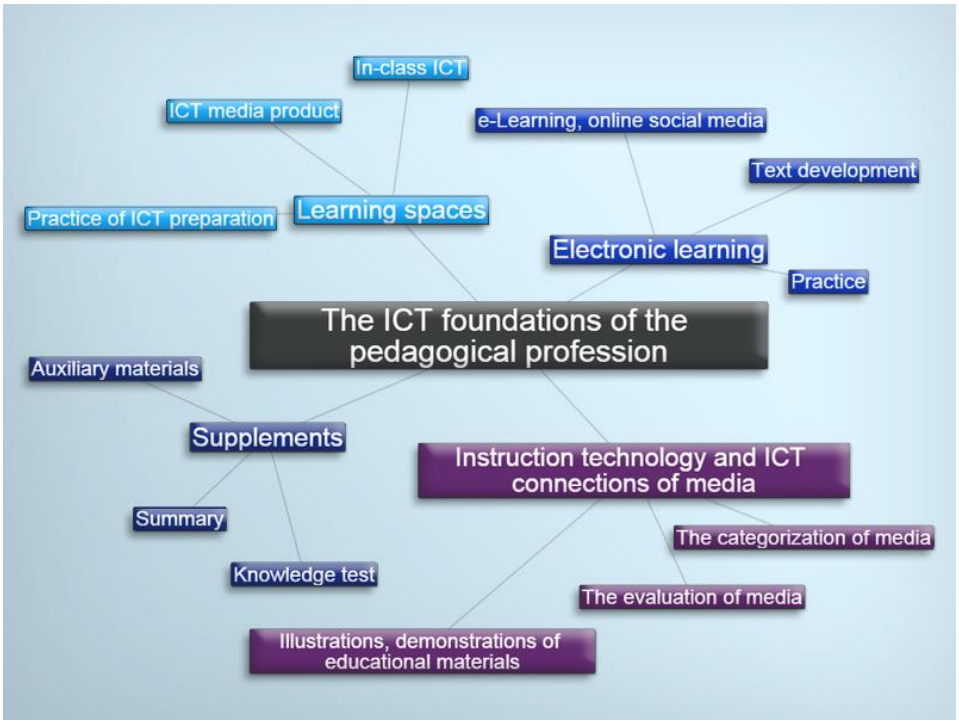

Figure 1: Conceptual map of the course

1.3 LEARNING SUPPORT, LEARNING INSTRUCTIONS

Regardless of the training format, traditional or open, distance learning or e-learning schemes students are required to *acquire information independently* to a large extent. While face to face or electronic consultations could pose a challenge, in case of problems entailing academic progress students can turn to their instructor or tutor either by e-mail or traditional communication forms.

The course material is available both in hard copy and in online electronic format. Printed materials assist traditional knowledge acquisition, online texts support electronic learning.

Student are encouraged to use online devices, monitor the fulfilment of tasks with the help of learning support options provided by the MOODLE system and take part in the forum shared wiki editing fuctions.

One result of the course should be a digital bookmark facilitating professional information exchange, social communication (Facebook, Twitter) channels, content sharing pages, presentation and document file sharing pages (Slideshare, Issue Scribid)!

Students should process the given topics and the relevant theoretical information in groups of 3 or 6. Presentations are scheduled on the first week in a thematic and chronological framework. Presentations should be 10-15 minutes followed by a 5-10 minutes discussion period. The presentations are evaluated by the (http://www.doodle.com/), online evaluation system Each group is expected to have 2-3 relevant questions, critical observations, connected examples, and illustrations. (In addition to the hard copy and the uploaded version of the presentations a written script of 1-2 pages length has to be prepared as well).

By the end of the course students are expected to produce professionaly credible, aesthetically demanding, and systematically justified multimedia applications, which include artistic elements and meet pedagogical, psychological, ergonomic, and communication requirements. Students should also develop thorough familiarity with the conceptual system and evaluation criteria of multimedia.

It is recommended that before starting the course study as many instructional multimedia products and presentations as possible and write down your experiences. This will help you in the future when you design your own products and presentations. (Additional course tasks include the evaluation of a multimedia product and the synopsis of a student designed multimedia production.)

Compulsory reading

Kis-Tóth L. (szerk..): A tanári mesterség IKT alapelemei (Basic ICT components of the teaching profession). eLearning tananyag. http://www.ektf.hu/infokomm

Forgó Sándor (szerk.): A pedagógusmesterség IKT alapjai.(ICT foundations of the teaching profession) Líceum kiadó 2014 (tervezet)

Kulcsár Zsolt: Az integratív e-Learning felé (Towards integrative e-Learning) 2008. URL: http://mek.oszk.hu/06600/06695/06695.pdf

OLLÉ János, PAPP-DANKA Adrienn, LÉVAI Dóra, TÓTH-MÓZER Szilvia, VIRÁNYI Anita (2012): *Oktatás-informatikai módszerek. Tanítás és*

tanulás az információs társadalomban. (Educational informatics methodology, teaching and learning in the information society)ELTE Eötvös Kiadó, Budapest.

FORGÓ S.:A multimédiás oktatóprogramok, minőségének szerepe a MÉDIA kompetenciák kialakításában.(The role of the quality of multimedia instruction programs in the formation of MEDIA competences) ÚPSz, 2001. július – augusztus. 69-78. o

Recommended readings:

BENEDEK András (szerk.): *Digitális pedagógia*. (Digital pedagogy) Tanulás IKT környezetben. (Learning with ICT) TYPOTEX, Budapest, 2008. http://epa.oszk.hu/00000/00035/00135/pdf/EPA00035_upsz_20090 8-09_091-096.pdf

FORGÓ Sándor: Az új média és az elektronikus tanulás.(New media and the electronic learning) In: Új Pedagógiai Szemle, 2008. 8–9. 91-97.

KOMENCZI Bertalan: Európai Iskolai Hálózat: bejárat az európai virtuális oktatási térbe (European school network: access into the European virtual instructional space) ÚPSz, 2000/5.

KOVÁCS Ilma: Az elektronikus tanulás. (Electronic learning)Holnap Kiadó Budapest 2007.

NÁDASI A.: Taneszközök az információs társadalomban. (Educational materials in the information society) OPKM, Budapest, 2002

Module I. Instruction technology and ICT connections of electronic media

2. THE CATEGORIZATION OF TRADITIONAL AND NEW MEDIA SYSTEMS, METHODOLOGICAL ASPECTS OF USE

2.1 OBJECTIVES AND COMPETENCES

Introduction of the main features of traditional and new media systems, with special emphasis on the groupings of educational materials.

Students will acquire an understanding of the conceptual system and the respective criteria of multimedia while becoming familiar with the levels of media competence and developing an ability to distinguish between the educational functions of traditional and new media systems.

2.2 COURSE MATERIAL

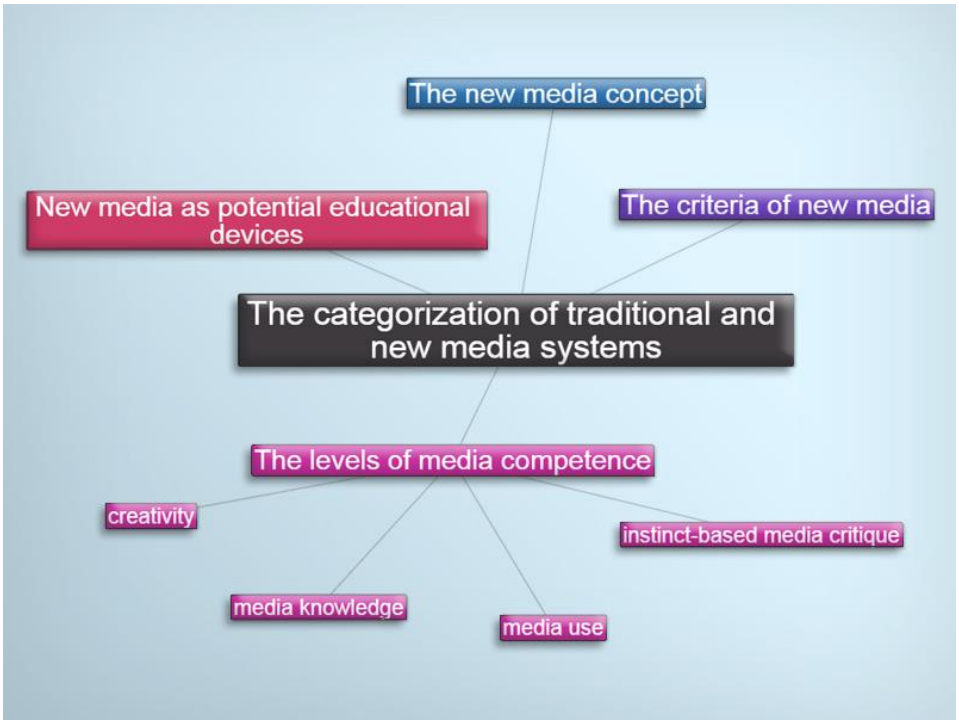

Figure 2 Conceptual map to Lesson 2

2.2.1 The grouping of educational materials

Schramm developed a chronological taxonomy of the four generations of educational materials:[1]

1. Generation One includes **objects** and items found in the **real world** (models, unique documents, boards, manuscripts) and used for educational purposes since the earliest of times. The use of these materials does not require any technological device or support.

2. **Printed educational materials** make up the second generation. While the preparation and dissemination of such texts requires machines, the materials themselves are self-sufficient, namely the conveyance or presentation of information does not require a separate device. This group includes books, textbooks, workbooks, reading books, photographs, and multiplied drawings.

3. The third generation includes **audiovisual devices requiring external devices** (overhead or slide projector, radio, tape recorder, television) for the presentation of the given information carriers (sound recordings, films, overhead slides, and traditional slides and videos).

4. The fourth generation entails equipment related to **programmed instruction** capable of managing the learning process. Accordingly the various instructional machines utilizing a connection between machine and individual help independent knowledge acquisition. Such educational materials include programmed textbooks, language laboratories, and instruction packages.

Nádasi, one of the leading Hungarian researchers, presents an integrated summary of the variety of experimental, demonstration, audiovisual, printed, and digital educational materials and systems. [2]

Vid. Categorical system of educational materials (Tompa 1997) [3]

5. The fifth generation (Szűcs)[4] contains educational materials capable of establishing interactive connections. Consequently, the

[1] Schramm, Wilbur Lang (1964): Mass media and National Development Stanford, Stanford University Press vö. 141-143 vö. Tompa Im. URL books.google.com idézi (Petriné Feyér Judit, 2003)

[2] Nádasi András: Tartalomszabályozás – a pedagógiai rendszer és a taneszköz rendszerek (Content regulation, pedagogical system and educational device systems) Könyv és nevelés 2010 4. sz. 29-39. [elektronikus dokumentum] http://olvasas.opkm.hu/portal/felso_menusor/konyv_es_neveles/tartalomszabalyozas

[3] Tompa Klára taneszköz szócikke és osztályozási rendszere a Pedagógiai Lexikonban (Keraban Kiadó, 1997. Budapest) (entry in the Pedagogical Encyclopedia written by Klára Tompa) Klára Tompa on educational materials and categorisation systems)

[4] Szűcs, P.: Technológiai fejlődés és az oktatástechnika értelmezésének változása. In: Benedek András-Nováky Erzsébet - Szűcs Pál: (Technological developments and the changing interpretation of the instruction technology concept)Technológiai fejlődés az oktatásban című kiadványban. Tankönyvkiadó, Budapest, 1986.

programs and extended **network structure** of computers facilitate the establishment of an interactive learning environment engaging a set of perceptory organs while compelling action.

While our previous survey of the taxonomy of educational materials extended until today's most dynamic options, that is network-based applications, we have not yet covered the concept of new media. At any rate we could mention the 6th group of educational devices established by Miklós Magyar as a potential exception.

It would be interesting to note that during the first half of the 1990s CD-based educational materials appeared on the market and along with the already available traditional instruction packages[5] formed early versions of blended learning schemes.

AS TOMPA asserts: "such programs were incorporated into the pedagogical, instruction technological jargon in the middle of the 1970s referring to a group of information carriers including slides, films, video, tapes, work books, models, mock-ups, or dioramas and learner's experimental sets which were integrated as separate units into the instruction package …"[6] Actually, the instruction packages of the earlier stages of distance learning programs were closely connected to the first three generations of Schramm's taxonomy.

2.2.2 The multimedia concept[7]

Multimedia, as an interdisciplinary concept, has been a subject to a variety of scholarly inquiry encompassing the following fields: computer technology, informatics, pedagogy-instruction technology, communication and information theory, psychology and ergonomy, visual and motion picture culture. The term itself reflects the diversity of human perception. The simultaneous impact engaging several perceptory channels, a historic device for demonstration, gained its full interactive potential with the evolution of computer technology. The success of the present learning effort can be assisted by surveying a variety of instructional

[5] Following TOMPA: "A system of a variety of educational materials (audiovisual, printed, electronic, multimedia, etc.) promoting the achievement of exactly established learning objectives via a structured thematic architecture facilitating performance evaluation and self-evaluation as well" URL: http://human.kando.hu/pedlex/lexicon/O2.xml/oktatocsomag.html

[6] TOMPA Klára: *Az elektronikus médiumok integráló lehetőségei*. (Integrating options of electronic media) URL: http://www.oki.hu/oldal.php?tipus=cikk&kod=testveri-Tompa-mediumok

[7] Forgó Sándor: Az elektronikus tanítás eszközei és módszerei. (Devices and methods of electronic learning) In: Elektronikus tananyagfejlesztés (szerk.: Czeglédi L.): Líceum Kiadó, Eger, 2011. pp. 41-64

multimedia products. The expression, multimedia, is a collective term referring to new products and services in the field of computer technology, broadcasting and media along with the media use during the knowledge acquisition and learning process. The constant development of science leads to a dramatic increase of new information and presents the need for understanding a rising number of correlations.Consequently, novel demonstration methods can facilitate the mastery of new and strange concepts. Since due to spatial and temporal restrictions real sensory experience is difficult to attain, symbols, figurer, pictures, and motion picture can provide adequate substitution. Simultaneous use of such options along with written, verbally, and medially presented information is rather difficult as many attempts appear to lack systematic planning or planned integration.

Multimedia, as a conceptual system conjoining the fields of computer technology, informatics, and instruction technology appeared in the 1990s. Originally it was considered an umbrella term for information carriers engaging seveal perceptual organs. With time it was viewed as a complex set of systemized, technical media (information carriers and disseminators) usable both by teacher and learner. In this regard the instruction package was seen as a multimedia system..

Individual learning systems realizing the principles of programmed learning and various methods of computerised instruction established the regulated learning technology and methodological conditions for interactive media communication.

2.2.3 What should we call multimedia?

We consider as multimedia such technology, which facilitates computer assisted communication and interaction via a complex interactive media system while integrating visual (data, text, slide, figures, animation, motion picture) and audio (speech, music, noise) presentational forms.

A unique processing surface for the variety of presentation forms is provided by the computer. Interactive multimedia helps a given user to cover a range of options extending from real time simulations to the virtual worlds on demand Thus multimedia can function as a device of individual and independent manipulation.

In case of media not depending on time information comprises a series of unique elements or non-temporal components (picture, text). The content of a given figure, graph, or text remains constant regardless of the time (a few seconds, one hundred years) of processing.Thus texts and still images (tables, graphs, and pictures) can be regarded non-temporal media.

Non-temporal media:

- Still images (figures, photographs, diagrams, icons, symbols, pictograms, logos)
- Texts (textual units, letters, numbers, written signs)

Process-based media change with time. Consequently, a motion picture displays a constantly changing image or an audio recording releases continuously modified sound sequences. Thus these types of media are *temporal.* Process type media include motion picture and digitalised signs of sound waves.

Temporal media include:

- Audio medium
- Video medium
- Animation, (two or three dimensions)
  - Frame animation refers to a micro-animation displayed within a given frame.
  - Object animation entails movement of textual and picture-based components in a predetermined direction.

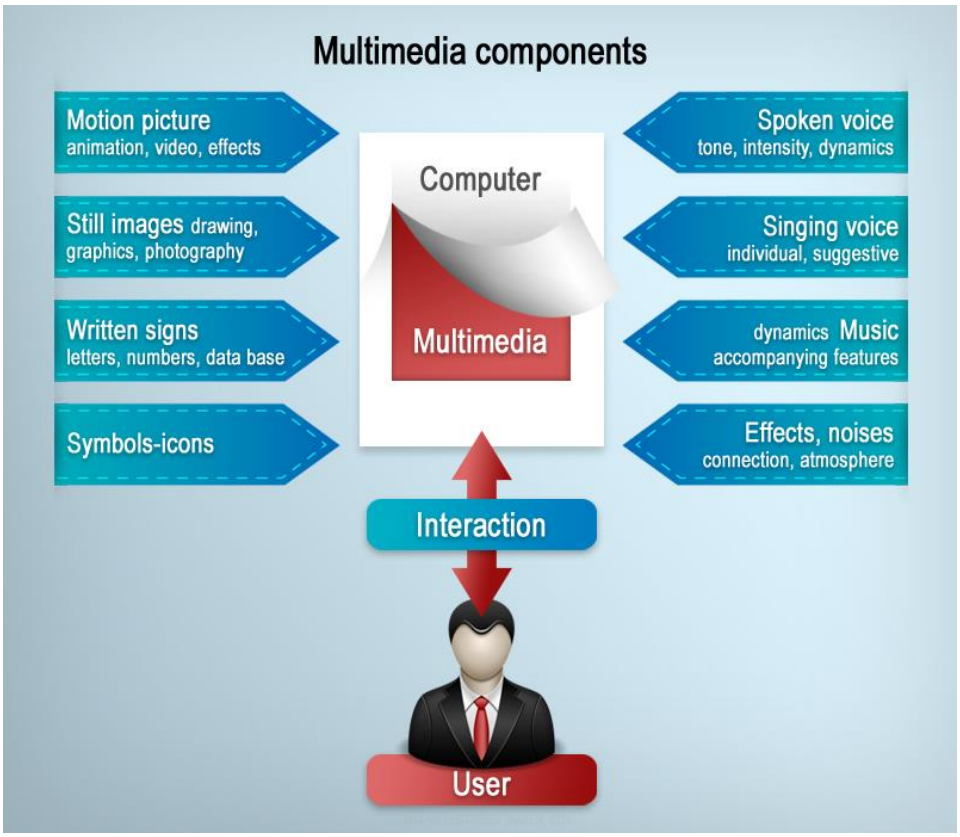

Figure 3 Multimedia components

Thus the primary meaning of multimedia is not the broadcasting of information via a variety of channels, but the presentation of different contents via visual and audio means. We should take special care to provide the most diverse illustration for texts in order to avoide monomedial, single channel information transfer!

We define interactivity as the option and experience of interference whose opposite is *structuring* or being intentionally compiled. The essence of *interactivity* is the user's option of selecting the next step within the given program. Thus within a context of pre-established links the user can freely roam and he is practically in charge of the retrieval process as well.

Moreover, it functions as a device of orientation and information provision facilitating selection between interactive and program provision series at a given electronic surface.[8]

2.2.4 The criteria of multimedia

The computers provide a unique processing surface to the variety of presentation forms. Interactive multimedia help the user to progress on demand from real time simulation to virtual worlds.

The main characteristics and features of multimedia

Various media are accessible on their own. This means that a given input medium cannot be connected with another as during processing the two cannot be treated separately. In other words if we are working with a video clip without the original sound, but the picture is digitalized with sound, the given media cannot be considered independent.

Computerized support facilitates the establishment of temporal, spatial, and content-based connections, in other words interactivity and branch based programming structure among the respective components.

Since a learning environment based upon multimedia or the Internet requires high capacity hardware, the MPC standards on a scale of 1-5 offer adequate support. Fast processing, storing, presentation, and forwarding of information units require high power processors complemented with multimedia command features, large size operative and optical storage, sound cards and connected speakers, microphones, and headphones.

A *diverse medium set* is technically the combination of media.Verbal and picture based coding guarantees variety and a multiplicity of illustration options facilitating the success of the information recording or learning process.

According to the brain-hemisphere specialization model of information processing simultaneous impact *engaging several perceptory organs* at the same time is manifested in the following manner: the left hemisphere is involved in processing verbal or auditive information, while the right hemisphere functions as the centre of visually coded information Consequently, overly verbal or excessively visual information leads to excess burden on one brain hemisphere, while the other one is technically running on empty.

[8] Forgó Sándor: *A multimédiás oktatóprogramok minőségének szerepe a médiakompetenciák kialakításában*. (Thre role of the quality of multimedia-based instruction programs in the development of media competences) URL: http://www.ofi.hu/tudastar/multimedias (Letöltés: 2014. 05. 18.)

The heterogeneously coded educational material balances or equalizes the given brain functions. Thus a wide variety of media should be used in packages created for local and global consumption as well.

The *interactive aspects* and respective navigation features enable the user to carry on a dialogue with the system during which he can influence system operation, trigger effects, and retrieve content related information. Interactivity means that it is the user, who decides upon the direction of further steps and operations within the multimedia framework while freely roaming and controlling the retrieval process. Interactivity within a framework of pre-arranged connections can be achieved via hot buttons and fields and various navigational components.

Non-linearity means that a chosen detail becomes accessible immediately instead of going through all previous sections. Non-linearity helps fast retrieval of content as the target information can be obtained without checking previous content. The user can examine relevant issues at a depth or thoroughness level of his or her own choice. As a result of digitalization the computer plays a crucial role in the production, processing, and recording of information while word processors, graphic editing programs, data base processors, along with statistical processing and presentation programs accelerate information production and dissemination. Sound is added to still and moving pictures leading to the creation of a composite media form, the multimedia.

The two links listed below provide examples on Hungarian multimedia products:

1. (http://www.ehumana.hu) The Encyclopedia Humana association has produced a large amount of multimedia CDs focusing on history.
2. The János Neumann Digital Library and Multimedia Centre maintains records of CD-ROMs published in Hungary. (http://www.neumann-haz.hu/cdrom_diszkografia/)

2.2.5 Levels of media competence

One can handle or process media not only instinctively, but in a planned, conscious manner. The lowest level of competence entails an ability to express one's opinion on a given media product, while the highest level indicates creative media use based upon understanding. We list the various levels of media competence below:

Instinctive media critique – This is the level of the receiver, includes the viewing of a given product or programme without user interference while viewers form their opinions.

Media knowledge – Users in possession of genre and form-language related information perform content analysis while selecting the most effective media relevant to the content of pictorial messages.

Media use – Problem free application of media based upon familiarity with the respective devices.

Media creativity – Students are capable of expressing themselves based upon their familiarity with electronic publishing and with the directing function of electronic productions.

In the early stage of the development of computer technology the need for the production of effective and high quality software arose. According to Magdolna Raffai software has to fulfil the following criteria: *reliability, propriety, effectiveness, appropriate level of integrity, and usability*.[9]

2.2.6 The new media

The concept of new media[10]

NEW MEDIA systems facilitating bidirectional communication are utilizing digital technology superseding the monodirectional, analog mass communication approach. **New media**[11] *implying a fundamental change in information access, consumption, and use is defined as a comprehensive type of media based upon digital network communication. New media includes multimedia and interactive media type content, and novel forms of individual and community action forms as well.*

Richard Bailey explaining the new media concept identifies three major eras in the development of media communication.[12]

- 1870–1980 the era of **Mass media** (printed press and electronic broadcasting)
- 1990s: the era dominated by digitally coded **Masses of media**
- 2000 – the era of individual or **Me media** (weblogs)

[9] Raffai Magdolna: *Az informatika fél évszázada*. (Fifty years in the history of informatics) Springer Hungarica, Gyomaendrőd,1997

[10] Forgó Sándor: Az elektronikus tanítás eszközei és módszerei (Devices and methods for electronic learning). In: Elektronikus tananyagfejlesztés (szerk.: Czeglédi L.): Líceum Kiadó, Eger, 2011. pp. 41-64

[11] Szakadát István: Új média, hálózati kommunikáció. (New media, network communication) In: *Bevezetés a szociológiába*. Szerk. S. Nagy Katalin. Budapest, BME, 2006

[12] Bailey, Richard: PR and new media. URL: http://prbooks.pbwiki.com/PR-and-new-media (Letöltés: 2011. 05. 18.)

- 2003 – **We media**[13] network-based media emphasizing the community aspect (BOWMAN and WILLIS)

Bailey R. describes not only the digital Mass media, but the **Masses of Media.** As a sign of individualization[14] the blogosphere ushers in the era of **personal media** or Me media, and the **community oriented** We media[15] emphasizes the network and social orientation of new media. The We Media collective media system offers a complementary addition to the individual Me Media. Today one needs no qualification to function as a cinematographer, editor, or even publisher on the Internet. The **We media**, a social and community oriented communication form has existed since 2004.

This evolutionary taxonomy corresponds with the fifth generation of Schramm's categorization of educational materials (Szűcs)[16]. Accordingly such educational materials capable of facilitating interactive connections belong in this category, which make continuous feedback between learner and computer possible. Consequently the computer network and the related network structure create an interactive learning environment engaging several perceptory organs while motivating action.

- ***New media* includes not only online solutions utilizing network multimedia and interactive (individual and community) action forms, but interactive television approaches based upon mobil phone (cellular) and digital broadcasting.**

Consequently, in addition to media convergence reflecting the combination of mass and telecommunication technologies, media diversification promoting the propagation and expansion of mass communication media (social media) is applicable as well. Thus previous users equipped with network competence can create their own information – user (consumer) generated content (UGC).

Interactive Television refers to an interactive mode of television-based learning combining the options provided by computer technology and

[13] BOWMAN, Shayne – WILLIS, Chris (2003): *We Media.* Media Center at The American Press Institute. Stanford California, http://www.campbelllaird.com

[14] BAILEY, Richard: PR and new media [elektronikus dokumentum] http://prbooks.pbwiki.com/PR-and-new-media

[15] Bowman, Shayne – Willis, Chris (2003): *We Media.* Media Center at The American Press Institute. Stanford California, http://www.campbelllaird.com)

[16] SZŰCS, P.: Technológiai fejlődés és az oktatástechnika értelmezésének változása (Technological development and the changes in the interpretation of instruction technology). In: Benedek András – Nováky Erzsébet – Szűcs Pál: Technológiai fejlődés az oktatásban című kiadványban. Tankönyvkiadó, Budapest, 1986.

digital television into an interactive framework. Moreover, pedagogical and methodological options utilizing mobile (cellular, handy) communication devices (skill, aptitude[17]) enhance not only formal, but informal and non-formal learning schemes as well.

These devices requiring only a minimal level of ICT competence can become crucially important among people threatened with social exclusion, individuals not integrated into the educational system, not participating in traditional instruction or training schemes, being unemployed or over employed, or even homeless.[18]

2.2.7 Convergent media as potential educational materials

3. Sándor Forgó: New media, technology and learning URL

Today in the era of media convergence we listen to the radio or watch television on the Internet, prepare content, or share information with others. Modern communication devices are capable of integrating the most important channels of direct communication for the receiver.

These media had maintained effective connections with the educational sphere focusing on the learning process. The emergence of media convergence and media diversification compels both pedagogy and andragogy to seek methods to improve the efficiency of the media's effort for the support of education.

Furthermore, the scope of media consumption has broadened as well. As the MacBride report (1983) states that heretofore separate functions (orientation, information acquisition, debate, socialization, culture, education, entertainment) cannot be clearly separated from each other as there are several overlaps in the process. The commingling of the *information and entertainment* functions led to the *infotainment* concept,

[17] Balázs Géza: Az új média retorikája(The rhetorics of new media). In: *Vigilia*, 68. évf. 1. sz. (2003), p. 13.
Skill or aptitude is defined by Balázs in the following manner: *"The new media option emerged simultaneously with the informatics revolution. Today we do not exactly know, what type of device this will be. It is expected to be a skill connected with the television screen comparable to those needed by television sets and computers implying the union between tele and mass communication and the options provided by large size computer data bases." Az informatikai forradalommal együtt kibontakozott az új média lehetősége. Ma még nem tudjuk, hogy milyen eszköz lesz ez; föltehetőleg a televíziókészülékhez és a számítógéphez hasonlatos képernyős készség, amelyet a tele- és a tömegkommunikáció egyesülése, és az óriási méretű számítógépes adatbázisok lehetősége teremt meg."*

[18] Benedek András: Mobiltanulás és az egész életen át megszerezhető tudás. (Life long learning and knowledge obtainable throughout one's life span) *Világosság*, 48. évf. 9. sz. (2007), p. 25.

later to be complemented with the idea of *edutaining* combining the *education* and entertainment functions.[19]

The increasing prevalence of social media applications facilitates the expansion of instructional content (info-teaching) via network based info-communication devices providing a foundation of network-based learning.

Figure 4: The connection of media, education, and information with content.

The novel, bottom up and network-based paradigm of electronic learning has enjoyed popularity among young people for a number of years. We should immediately reconsider the suitability of the new media system and the e-Learning 2.0 solutions for solving the social and educational policy related issues of life long learning.

[19] Gálik Mihály: Médiagazdaságtan, (Media economics) Aula, 2003 (p. 21.) http://mediapedia.hu/tomegkommunikacio

Moreover, answers have to be given to such questions as the eligibility of the web 2.0-based e-Learning approach (entailing flexibility, irregular, autonomous arrangements) for being in the mainstream of pedagogical methodology research and applications. Or should research results achieved by students disseminated on the web be relegated to the level of pseudo science or guerrilla pedagogy?

This task has to be performed by pedagogy professionals and researchers as the increased use and propagation of media and differentially applicable media systems is a shared interest of everyone involved in or connected with the education sphere. (Forgó 2009)

2.3 SUMMARY, QUESTIONS

2.3.1 Summary

The chapter has provided an overview of traditional and new media systems. Students became familiar with the taxonomy of educational materials, the conceptual system of new media, the levels of media competence and the respective criteria. Equipped with the respective information students become capable of distinguishing between the functions of traditional and new media systems.

2.3.2 Self-test questions

- Describe the main aspects of the categorization of educational materials!
- Describe the concept of multimedia!
- What is the definition of multimedia?
- Describe the criteria of multimedia?
- Introduce the levels of media competence!
- What does the term media competence mean?
- Explain the meaning of the term info-education and its connection with network based learning.
- Describe the types of new media and their potential educational functions!

3. THE INSTRUCTION TECHNOLOGY OF ICT DEVICES

3.1 OBJECTIVES

The chapter provides an overview of the history of ICT devices, the evolution of various perspectives utilizing McLuhan's technological deterministic approach, and will discuss the concept of electronic learning.

Students will become familiar with the basic principles of instruction technology and the respective models. Such knowledge will foster a creative use of crucial components of the instruction system model.

Contents:

1. Preceding events
2. McLuhan's impact
   2.1. e-Learning, a promising manifestation of ICT

The instruction technology of ICT devices

3. Basic principles of instruction technology and the respective models
   3.1. Crucial components of the instruction system model
   3.2. The instruction development system model

3.2 COURSE MATERIAL

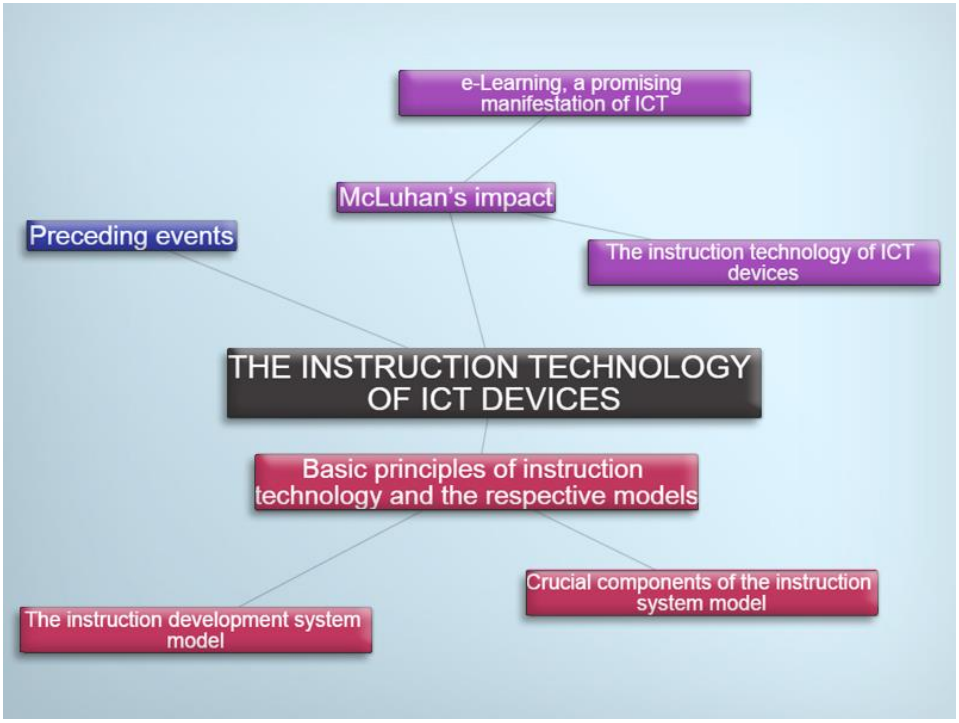

Figure 5: Conceptual map to Lesson 3

3.2.1 Preceding events[20]

During the turbulent 20th century the pedagogical practice of Hungarian education committed to the preservation of European values for more than 1000 years was influenced by a variety of factors including the explosive rate of scientific progress, social transformation, and the emergence of audiovisual, later electronic media, especially the computer. In the introductory section to a film catalogue Edison wrote the following in 1909: "Textbooks will soon become obsolete in schools, children will be educated through their eyes. All aspects of human knowledge can be taught with the help of motion picture and within 10

[20] Nádasi András: Az új oktatástechnológia és az oktatásfejlesztés digitális eszköz-rendszere. (The digital device system of new instruction technology and instruction development) Vö. http://okt.ektf.hu/data/nadasia/file/tananyag/oktataselmelet/1_tananyag5.html

years our school system will be radically changed."[21] Marshall McLuhan [22] recognized the acceleration of this tendency in 1962, and according to one of his rarely quoted comments:"While the Gutenberg Galaxy was theoretically eliminated by the discovery of the curved space, in practice the telegraph had already undermined its dominance two generations earlier." It is well known, that until the age of telegraph, not including the ancient smoke and sound signals, serious message could not have passed faster than the speed of the given messenger.

Tamás Schüttler offered a reflection to McLuhan's views in the New Pedagogical Review (Új Pedagógiai Szemle) in 2001:"The era which gave birth to McLuhan's prophecy was dominated by the television. Psychological and sociological research called attention to the challenge posed by the electronically broadcast image to the reading process. McLuhan outlined the transformation and impoverishment of the post-typographic or electronic human superseding the typographic human. He believed that the post-typographic man attaining information related to the world and culture from picture-based messages loses such information construction and imagination functions, which are formed and grown via the interpretation of symbolic signs and letters as texts. McLuhan and his followers in the media-psychological and sociological school emphasized the cultural and anthropological role of book printing over its significance in general culture as they asserted that the thinking, the respective psychological operations, and the resulting characteristic self image of humans socialized via reading printed texts had a fundamental impact on the value system and cultural preference canon of the middle class. McLuhan's vision of the fading galaxy of printed culture triggered an alarm at the late 1960s and early 1970s as social critics recognized a fundamental danger in the rise of the mass human socialized on pictorial images. Such person would be fully exposed to all manipulation and his thinking and value system would be defined by mass culture. Consequently, as a result of such cultural socialization he would lose his autonomy and would place a subsequently lower value on democracy and participation in social and political affairs."

3.2.2 McLuhan's impact

After three or four decades, however, it became clear that McLuhan's dystopic vision was not fully realised. "The typographic man gaining information via linear reading did not disappear and the number of

[21] Rohonyi, A. (1982) Oktatás és technológia - A pedagógiai technológia kialakulása. OOK, Veszprém (Instruction and technology- The evolution of pedagogical technology)

[22] Vö. http://en.wikipedia.org/wiki/Marshall_McLuhan

published books between 1980 and 2000 tripled." Yet during said time several generations emerged who can be manipulated to a greater extent than any previous generation. The vulnerability of these people to intellectual and social manipulation is due to the lack of reading, or obtaining intellectual nourishment from a written text. At the same time the electronic picture-based communication expanded the world. According McLuhan's media theory all devices are extensions of the individual. During the thousand year mechanical evolution we expanded our own body in physical space, while as a result of a century of electronic achievements we can currently expand our nervous systerm thereby eliminating the spatial and temporal barriers at least in a temporal sense. We are likely to achieve the final state of human extension when the creative processes of knowledge acquisition include the whole spectrum of human society both on community and enterprise level surpassing the level of the present media-based extension of nerves and sensory organs The computer capable of processing media on a shared Internet-based platform and the interactive multimedia sources blazed new trails in education McLuhan could not have been familiar with, yet he predicted them correctly.

Benő Csapó[23] provided the following appraisal of the educational use of the interactive and feedback capability of the key devices of information and communication technology, the computer and the Internet: "Similarly to complex systems exposed to a variety of external influences, in education the respective goals cannot be realised without feedback and regulation procedures.As feedback is the essential component of the learning process the need for such options at various points and levels of the education system is undisputable. Most of the problems and malfunctions are caused by the lack of feedback. The application of information and communication technology devices can provide a major contribution to the improvement of the system via supplying a wealth of previously unavailable reliable and accurate feed-back related information in the fastest time possible.

Computers can provide the feedback options needed in teacher-student interaction. An instruction program capable of sound analyis can function as a language teacher with more accuracy, persistence, and patience than its human counterpart in correcting pronounciation errors. The feedback option of an appropriately sophisticated instruction program can test the depth and quality of the understanding of the text, moreover it can recommend means and materials of remedial instruction. The early instruction programs, considered primitive and beginning stage

[23] In: Magyar Tudomány, 2003/12

with contemporary standards, have demonstrated the reinforcement capability of instant feedback and the computer addiction impacting mostly young people is partly brought on by the sense of satisfaction provided by the immediate response of the machine.

While the computer is not necessary better than the help provided by the teacher, it is going to be more accessible than personal help from a given instructor. One of the greatest problems of formal mass instruction is the inability to cope with the inherent diversity of the student population, thus education efforts targeted at the average student do not provide the optimal benefits for everyone. The limited capacity of the teacher was the primary factor preventing the personalization or individualization of the instruction process. The application of the achievements of information and communication technology enables students to learn at their own pace, focus on self-determined problem areas and receive the answers they need for the given problems and questions.

ICT applications facilitate the elaboration of larger scale feedback processes. The previously mentioned research efforts provide a sound scientific foundation for the production of standards, the establishment of norms, and the identification of the respective discrepancies via the provision of error signs by information technology devices. Thus interactive or adaptive testing via computers can be a time and nerve saving option in case of large number of students and the collected substantial amount of student-related data can help in determining the efficiency of the given system. Such technologies are expected to become part of everday use, and the data provided by these plainer approaches are indispensable for the improvement of the given system.”

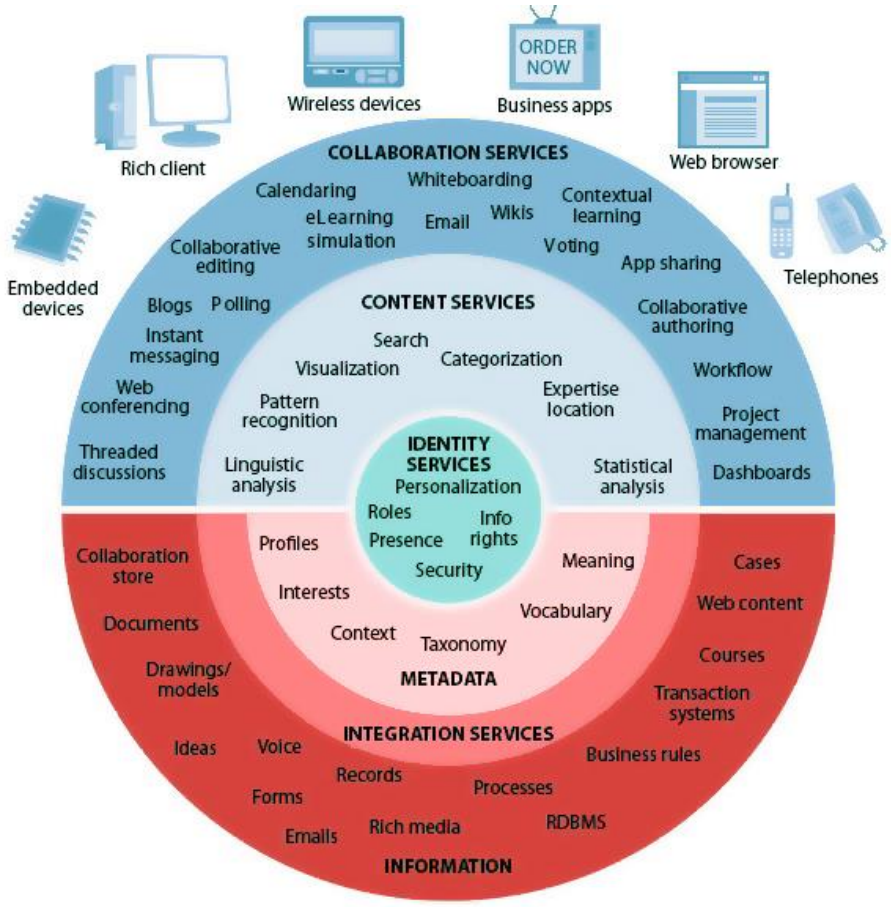

Figure 6: The crucial ICT components of the work place in the New Millenium

Several relatively exact predictions both domestically and internationally have been made concerning the impact of ICT in the labour market. Researchers of the Forrester Research Inc.[24] (Connie Moore and Erica Rugullies, 2005.) are convinced that the digital technology-based mediatised and informatised work place would have significant impact on education as well. They predict that ICT will not only be applied by planners and developers, but operatives as well. ICT use

[24] EuroDidac 2006 – Budapest. P. Z. Perjes előadása. Elhangzott a „European Knowledge Economy Forum and Exhibition" keretében.(Lecture by P. Z. Perjes) The Information Workplace Will Redefine the World of Work – At Last! by Connie Moore and Erica Rugullies. Forrester Research Inc. 2005.

becomes more widespread among white collar and blue collar occupations in addition to thosed employed by the information industry.The technologies described on Figure 6 have permeated the economic, service, and cultural sphere reinforcing the need and legitimacy of digital literacy. Our students, the new generation of the information society graduate to a multimedia world based upon Internet facilitated cooperation placing premium value on knowledge management and ICT prowess.

The worlwide popularity of school computer-based programs and the rapidly changing technological environment radically alters the methodology of teaching and learning, the text, and eventually the role and work of the teacher. The fast development of information and communication technologies challenges the traditional framework of education. The literal modernisation of the education process should be coupled with the preservation of traditional values while improving the school system.

The issues related to ICT were one of the prioritised themes at the 6th National Conference on Pedagogical Sciences held in 2006.[25] „We can safely conclude that the upcoming changes will be determined by the modern technologies, especially the information and communication technology-based approaches. It is no exaggeration that all current social phenomena and the respective changes are brought about by the explosive growth of information and communication technology. The two most important aspects are the increased role of learning in the business sphere and the fast propagation of networks. These changes convert the traditional enterprise into a learning organisation in which knowledge flow prevails over material flow. Physical work will be pushed into the background and will be replaced by knowledge intensive activities. Thus technology as a result of a higher level added value will have a reciprocal effect on society and increases the esteem of knowledge producing the respective equipment. The subsequent virtualization and de-materialisation of production will lead to a higher appreciation of human connection networks and the attendant communication ability. Instead of mass production the mass propagation of personalized production can be expected. The modification of the concept of time and space brings

[25] Köpeczi-Bócz Tamás: Személyre szabott e-tanulási tananyagok és módszerek.(Personalized e-Learning texts and methods) A VI. Neveléstudományi Konferencia „E-tanulás alapú kooperatív pedagógiai módszerek a tanulóközpontú tanítás szolgálatában” c. szekciójában elhangzott előadás. (Presentation at the session titled e-Learning-based Cooperative Pedagogical Methods Promoting Learner-centred Teaching during the 6th National Conference on Pedagogical Sciences, Budapest, 2006.)

about the ‘just in time’revolution. Businesses have to be flexible while promoting learning and the formation of networks if they want to be successful in this world. ”

Consequently, the significant impact of information and communication technology on reading, education, and leisure is hardly disputed. While we assign priority to the human factor, that is, the individual and the community over technology, the given learning environment along with its achitectural and informatics-related arrangement will play a dominant role as well.

A somewhat simplifed approach to ascertain the extent of ICT penetration is reflected in **Table One**. The chart ranking countries according to access to computers at school, (not at home, or in the family) shows that Hungary is in the middle of this category. While computer availability figures related to Hungarian schools could be cause for encouragement (according to OECD data a computer is provided for 9 student per class), the situation is not as optimal as it appears. The realization of certain educational goals depends on the capability of a given computer to run an application needed by the particular subject, in other words calling for Internet connection or multimedia presentation options. A better indicator would be the school-based availability of computers produced within the last three years. In this case the ratio is 30 to 1, meaning one such relatively modern computer is assigned for a whole class.

Table One: The number of students per computer at the higher sections of secondary schools in the OECD countries

Country	The average of the best equipped (25%) schools	Median	The average of the worst equipped (25%) schools
Australia	4	5	7
Austria	5	7	15
Belgium	7	11	18
Czech Republic	9	15	28
United States	4	5	7
United Kingdom	6	8	9
Finland	6	8	11
France	6	11	15
Greece	14	28	83

Country	The average of the best equipped (25%) schools	Median	The average of the worst equipped (25%) schools
Iceland	7	10	13
Íreland	10	14	19
Japan	7	12	18
Korea	4	9	13
Poland	8	26	45
Luxembourg	8	9	11
Hungary	5	9	15
Mexico	12	23	59
Germany	14	22	31
Norway	4	6	9
Italy	7	12	19
Portugal	20	36	100
Spain	14	21	29
Switzerland	6	9	16
Sweden	7	8	10
New Zealand	5	6	8
Country average	8	13	24

Source: Education at a Glance, 2002. Note: Data is provided by the PISA inquiry

One of the most significant indicators is the speed of Internet access. It is positive that all Hungarian public education institutions have Internet access. The average speed of 800 kbyte/sec faciltates an online connection for one computer in every classroom in which the attachment of a projector can make multimedia presentations possible.

The most important developments in instruction technology focused on content and service. Such improvements can lead to changes in quality only if the new technologies support individual learning and supplementary activities become more accessible as well. The limited hours of libraries are basically eliminated by the Internet. Informational data bases, specialized information portals, web pages of research institutes and departments make previously unattainable research results publicly accessible. The Sulinet digital data base is a special content-based development helping public education. Functioning as a digital

library it provides information and accessibility to content material in a continuously increasing number of subjects along with presenting opportunities for methodological improvement.

e-Learning provides a framework for the integrated application of new information and communication technology, the use of structured, interactive multimedia resources and computer assisted modern instruction technology utilizing constructive learning methods. While e-Learning has penetrated adult education, primarily vocational training and higher education, it makes its presence felt in public education as well.

The introductory section of a book treating the issue of e-Teaching for those entering the teaching profession lists the following arguments:[26] ”The knowledge-based information society emergent in Hungary requires a paradigm leading to the loosening of the formal frameworks of the education process. Instead of directly providing knowledge skill development is prioritised, the ability to obtain information becomes more important than primary knowledge itself and in addition to meeting the requirements of graduate training plausible conditions are provided for realizing the objectives of life-long learning as well.”

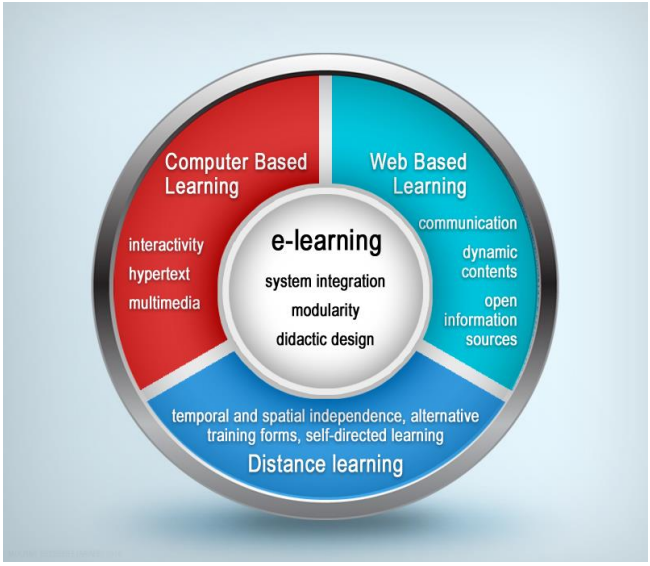

Figure 7: The connections of e-Learning

[26] Kőfalvi Tamás: e-tanulás – információs és kommunikációs technológiák felhasználása az oktatásban.(e-Learning-the use of information and communication technology in instruction) Nemzeti Tankönyvkiadó, 2006.

e-Learning, a promising manifestation of ICT

Instruction technology utilizing any manifestations of information and communication technology including CMI (computer managed instruction), CAL (computer assisted learning) SDT (an approach emphasizing learning objects) or any framework system of e-learning impact the full spectrum of the teaching and learning process changing the respective methods, organisation forms, and even texts both theoretically and in a practical sense. Thus the teaching profession incorporates new competences leading to world wide reforms in teacher training programs. While curricular improvements are needed the given problem cannot be solved by the introduction of new subjects alone.

While we are convinced that the solution is in the hands of the teachers, the fast changing technological environment, the quality expectations related to education and the necessity of life long learning pose a formidable challenge to traditional instruction. Personalized, temporally and spatially independent learning efforts can only be formally implemented without the participation of teachers.We should strive for the reconceptualization of pedagogical practice while preserving heretofore successful methods and devices and promoting the functional application of ICT.

3.2.3 Basic principles and models of instruction technology

The roots of instrution technology[27] are found in research performed by Burrhus Frideric Skinner, the noted behaviourist psychology professor

[27] Since its inception instruction technology has been considered innovative, modern, and progressive. Instruction technology professionals systematically searched for evidence and arguments against traditional instruction. Debates at the beginning of the 1970s emphasized that the ambiguous terminology frustrates communication even within the discipline. Consequently, responding to the call of the Association for Educational Communication and Technology the U.S. Office of Education and the National Center for Education Statistics published a handbook with the aim of defining the crucial terms and creating a unified professional terminology. Said publication titled *Handbook of Standard Terminology* (1975.) defines over 1500 terms. Its main objective is making learning easier via the systematic disclosure, development, arrangement, application, and management of learning resources. Additional objectives include the elaboration and development of instructional systems, the identification of existing and available learning resources, and providing access for students to such resources, along with the management of the required procedures and human resources. While this is not an exhaustive list, the Dictionary of Education views instruction technology as ”the application of scientific principles for the design and implementation of instruction systems with special emphasis on exact and measurable objectives, the prevalence of learner centered education over subject centredness, the recognition of the capability of educational theories to augment practice along with the wide spread educational use of audiovisual media.”

at Harvard University in the 1950.[28] In Hungary the discipline started to take root in the 1960s due to the efforts of didactics expert and educational researcher Árpád Kiss (1907–1979)[29]

The formation and development of the discipline is greatly determined by the emergence of the visual demonstration method, the learning-psychology assisted programmed learning schemes, the increasing use of audiovisual illustrations,[30] the spread of mass media and computer assisted instruction. The pioneers of instruction technology at first used the achievements of behaviourism whose tenets had been elaborated in the first decades of the twentieth century. The cognitive revolution launched in the 1950 opened up new vistas. J. Bruner's intensive research into instruction technology broke with the behaviorist school. His writings and views on perception, learning, and the process of cognition during childhood led to significant changes in educational philosophies and to the inception of pedagogical reforms while modernizing the theoretical and practical aspects of curriculum development efforts. R. M. Gagne[31] is a psychologist, and one of the best-known educational researchers. He laid down the foundation of Instructional Design and has a comprehensive view of learning theories.

- The next definition incorporates both ICT and e-Learning in its framework: "Instruction technology entails the application of scientific principles for the design and implementation of educational systems prioritising exact and measurable objectives,

[28] Burrhus F. Skinner: A tanítás technológiája. A fordítás az eredetivel egybevetette és a jegyzeteket írta Kiss Árpád. (The technology of teaching) Gondolat, 1973.

[29] Kiss Árpád: A tanulás programozása. (The programming of learning) Tankönyvkiadó, Budapest, 1973. 367 l.

[30] According to a definition by the Encyclopaedia on Pedagogy: Demonstration entails the practical implementation of the illustration principle. It is an educational procedure pertaining both to the teacher and learner facilitating sensory perception via the use of illustration equipment and the observation of real objects and phenomena. Demonstration or illustration requiring the active participation of students impacts sensory organs facilitating the formation of exact and clear images on objects and phenomena of the external world, the disclosure of correlation and the main tendencies between objects and phenomena, the maintenance of close connection between sensory cognition and abstract thinking, thereby promoting a deeper understanding and longer term retention of knowledge and information.
Source: http://okt.ektf.hu/data/nadasia/file/tananyag/oktataselmelet/1_tananyag4.html, www.pedlexikon.hu
Vö. In: Tompa Klára (1995): A korszerű oktatástechnológia jellemzői. (The main characteristics of modern instruction technology) In: Oktatáselméleti kérdések a szakképzésben (Szerk.: Benedek A.). Műszaki Könyvkiadó. Budapest, 1995. 63–86. p.

[31] GAGNÉ, R. M., BRIGGS, L. J. (1974). Principles of Instructional Design. Holt, Rinehart and Winston, New York, 212-213 l

> the prevalence of learner–centredness over subject centredness, the recognition of educational theories' capabilty of supporting practical implementation and wide spread use of audiovisual and electronic media in addition to traditional educational devices." Research into and debates on the concept and interpretation of instructional technology are greatly impacted by Lumsdaine's identification of the two types of the discipline,[32] the hardware and software approach respectively (Lumsdaine, 1964.). Instruction technology entails the application of an engineering perspective and methodology, in other words the mechanization or machinization of education with the final objective of improving itts *efficiency*. This also means that special devices fully satisfying instructional demands have to be developed. The theoretical and practical aspects of this activity are summarised by the discipline of *instruction technology*. The improvement of efficiency meant not only increased productivity, but reduction of costs as well.

Instruction technology entails the conscious and deliberate use of scientific and other organized forms of information for the purpose of guaranteeing the effectiveness of the education process. The discipline places great emphasis on the elaboration of instructional objectives, the compatibilty of the course material to the learner's preferences, and the frequency and objectivity of evaluation. The scientific foundation primarily includes the achevements of behavioural sciences. Instead of the dual interpretation Davies[33] recommended a third approach, one based upon systemization. Accordingly with the use of the two already existing approaches and the inclusion of new elements a novel instruction technology can be elaborated. This approach can be described as "the application of optimal strategies including modern organisation theory complementing the given teaching and learning resources in order to achieve pedagogical objectives" (Davies, 1972.). Furthermore, inspired

[32] Lumsdaine, A. A., Glaser, R. (1960). Teaching Machines and Programmed Learning: A Source Book. Department of Audiovisual Instruction, National Education Association, Washington, D. C. cf.
Lumsdaine, A. A., (1964). Educational technology, programmed learning and instructional science. In: HILGARD, E. R. (1964). Theores of Learning and Instruction, 63rd National Society for the Study of Education (NSSE) Yearbook Part I., University of Chicago Press, Chicago, Illinois

[33] Davies, I. K. (1971). The Management of Learning. McGraw-Hill Book Company, London. 256 l. (1976). Objectives in Curriculum Design. McGraw-Hill Book, Maidenhead England. 77 l.

by Bruner[34] Davies asserts that instruction technology will lead to a new instructional theory. This prescriptive and normative approach will facilitate:

- the optimal management of a learning environment in which the fulfilment of previously determined objectives is guaranteed
- the formation of course material sequence and structure facilitating problem free learning
- the distinction between the efficiency of the given instructional strategies along with identifying and recommending educational media to be used on demand both by teachers and students.

We believe that instruction technology models and instructional design and development efforts *share a crucial foundation, system-orientation.* Consequently, the efffects and activities motivating learning are regarded as functionally connected specific components of a dynamic system serving identical pedagogical goals. Consequently, we can avoid placing an excessive or insufficient emphasis on audiovisual electronic media, the role of ICT or the importance of the content or structure of the given educational materials as compared to other parts of the system. Most models constructed by educational researchers have shared characteristics.

Table Two: Defining features of the instructional system model

LEARNER CHARACTERISTICS	LEARNING RESOURCES	DEVELOPMENT FUNCTIONS	INSTRUCTION MANAGEMENT
Personality	Content	Research	Organisation
Pre-existing knowledge	Materials	Planning	Staff
Motivation level	Devices	Production	
Skills	Methods	Evaluation	
Style	Environment	Supply	
	Instructors	Application	

The *differentiated educational objective and criteria system* means the elaboration of the system of operational goals in addition to the general objectives. Said goals will be presented in a taxonomical framework

[34] Bruner, J. R.: Toward a Theory of Instruction. Harvard University Press, Cambridge, Massachusetts. 1966.

facilitating the selection of instructional strategies, methods, and media, process design, and the preparation of a performance evaluation system.

Formative evaluation or the application of cybernetic feedback in order to provide continuous learning support and process regulation assures the optimalization of system components and the improvement of the operation of the system.

Learner and learning centredness. On the one hand this means the acceptance and adaptation of one of the pedagogical annd psychological theories pertaining to the learning process and its application to a given target population. The exploration of the age specific features, actually pre-existing knowledge, learning motivations and styles of learners is one of the foundations of the process design effort.

Designing the teaching and learning process This effort refers to the elaboration of the content, sequence, and management system of the activities of students and teachers (Until now, the Gagné-type approach including evoking attention-motivation-informing students on the specific expectations-reviewing the required preliminary knowledge-presenting new material-promoting student activity-feedback-promoting recording and transfer processes-performance evaluation was used most frequently).

Developed instructional strategies and media The extent of development or elaboration entails awareness of the usability indicators of the full range of strategies and of media along with making decisions relevant to the given objectives, course materials, or learner groups. In other words this is the media selection stage.

Criteria-based performance evaluation. This stage includes the assessment of student performance according to an objective and criteria system derived from needs analysis instead of responding to subjective and local norms.

Presently information technology provides a tremendous boost to instruction technology especially by the Internet, the interactive multimedia, and the constructive learning paradigm. The next phase of instructional research utilizes the achievements of cognitive psychology. Cognitive psychology became the leading approach in the 1960s after the decline of the behaviourist school. Its focus is on the processes of human cognition including such aspects as language, perception, sensory perception, thinking, decision making or problem solving. The respective methodology retained the strictness of behavioural objectivism, but it provides room for explaining such directly unobservable concepts as mental representation.

The starting premise of discussing the information and communication technology analysis of the teaching profession is a consensus fostered

by previous educational innovations. Achievements of contemporary technology, the new information and communication technologies and the media, especially computerised network and mutlimedia based telecommunications systems are not primarily designed to satisfy pedagogical demands.

The determination of instruction oriented applications and the continuous identification of opportunities are tasks yet to be solved by instruction technology.[35]

All teaching, learning, and school-related activities should benefit the learner. Consequently, during the design and implementation of any instructional system component potentially including expectation, objective, course material, learning task, methods, educational device, media, control, evaluation or an intentional pedagogical effect the features of the given learner or learner group and the institutionalized learning process *have to be taken into consideration. These are essential design parameters* treated separately during the instruction and media development programs.

Learning in schools takes place in communities. During the learning support processes relating to community, or differentiated work or individual learning a variety of established, non media-dependent, technology, procedure, or method (feedback, group organisation, explanation, discussion) can be used along with educational device and resource-based activities including textbook reading, writing in exercise books, performing experiments, computerised simulation, audiovisual demonstration, and the use of multimedia programs. *Instruction technology should not exclusively utilise new media based solutions in public education.*

Instruction technology research has to contribute to the development of support systems and new information disseminating and skill development course materials for evaluating the efficiency of media and media combinations along with the determination of criteria for optimal learning.

The role of ICT competence is well illustrated in an instruction development and content providing system model functioning as a system oriented dynamic model for pedagogical practice. The components, operation, and connection of the model provide adequate support for instruction design, development, and learning management at curricular, course, topic, and competence development levels alike.

[35] Nádasi A.: http://okt.ektf.hu/data/nadasia/file/tananyag/oktataselmelet/1_tananyag5.html

National level instructional design and regulation: Such criteria including the requirements for high school graduation, the registers of textbooks and educational devices, school building, infrastructural standards apply not only to teachers and maintainers of schools, butparents and students as well. A prioritised task is teaching the use of digital knowledge centres.

Instructor skills and aptitudes required for pedagogical process design due to the increasing role of local programs and curricula have enjoyed increasing significance. Tthe collection and interinstitutional exchange of thematically arranged programs and multimedia resources available on the Internet anticipate interaction entailing not only retrievability but an uploading capability as well. In addition to the selection of educational material or media the didactical and specialised methodological design and digital compilation of information carriers requires new knowledge and skills.

The management of daily, concrete teaching and learning processes can be supported by training session arrangement and methodological models, the recommendations for printed materials and books facilitating independent learning and differentiation, and the provision of on-line interactive audiovisual media materials.

In addition to the classic, community-based methods, educational devices, and learning resources the management, organisation, and the maintenance of ICT based independent and cooperative learning efforts along with an informatics-based learning environment and continuous motivation for knowledge transfer requires new pedagogical skills and competences.

Th instruction development system model

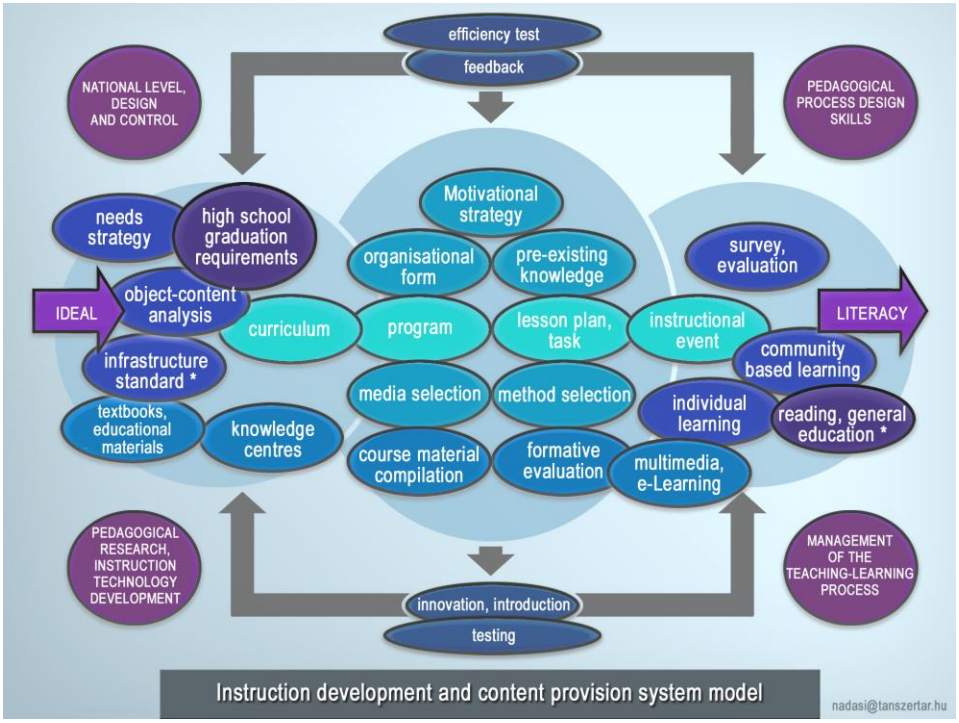

Figure 8 Instruction development system model

A frequent problem is identifying instructional technology with devices used within the educational process, most often the computer. We must also accept that the general acceptance and pedagogical benefits of ICT and the subsequent legitimacy of the approach is dependent upon theoretically and experimentally justified teaching knowledge and skills based on credible arguments, along with the development of an adequate school infrastructure. The most important components of the learning environment are educational devices, or as they have recently been called, learning resources.

3.3 SUMMARY, QUESTIONS

3.3.1 Summary

The chapter introduced the historical development of ICT devices and the attendant technologically deterministic perspectives inspired by

McLuhan's research. Students were also familiarised with the various interpretations of the concept of e-Learning.

The text helped in the understanding of the basic instructional technology principles facilitating the creative use of the defining components of the instructional system model.

3.3.2 Self-test questions

- Describe the landmarks in the development of ICT.
- Describe the impact of McLuhan's media concept!
- Describe the conceptual system of e-Learning as a manifestation of ICT!
- What kind of basic instruction technology principles and models are you familiar with?
- Name the defining components of the instructional system model.

4. THE EVALUATION AND QUALIFICATION OF MULTIMEDIA-BASED ELECTRONIC EDUCATIONAL MATERIALS AND ELECTRONIC DEVICES

4.1 OBJECTIVES AND COMPETENCES

Students will develop a theoretical base of the evaluation and qualification principles indispensable for the design of electronic educational materials. Readers will be familiarised with the differing evaluation criteria of electronic products, the functions of the e-Learning framework system, and the expectations pertaining to instructional software and electronic texts. The chapter will help in the development of a variety of skills for the evaluation of electronic educational materials.

4.2 COURSE MATERIAL

CONTENT:

4. The evaluation and qualification of multimedia-based electronic educational materials and electronic devices.

4.2.1 Evaluation forms of electronic productions
Qualification options
Library evaluation criteria
The evaluation and qualification of multimedia based electronic educational materials

4.2.2 Instruction software expectations concerning elecronic educational materials

4.2.3 Functions of the e-Learning framework system

4.2.4 Quality assurance of courses
The foundations of synthesis-based quality assurance systems
On course evaluations

4.2.5 Synthesis based e-learning evaluation system
Quality assurance criteria
Evaluation of e-learning courses, educational materials, and services

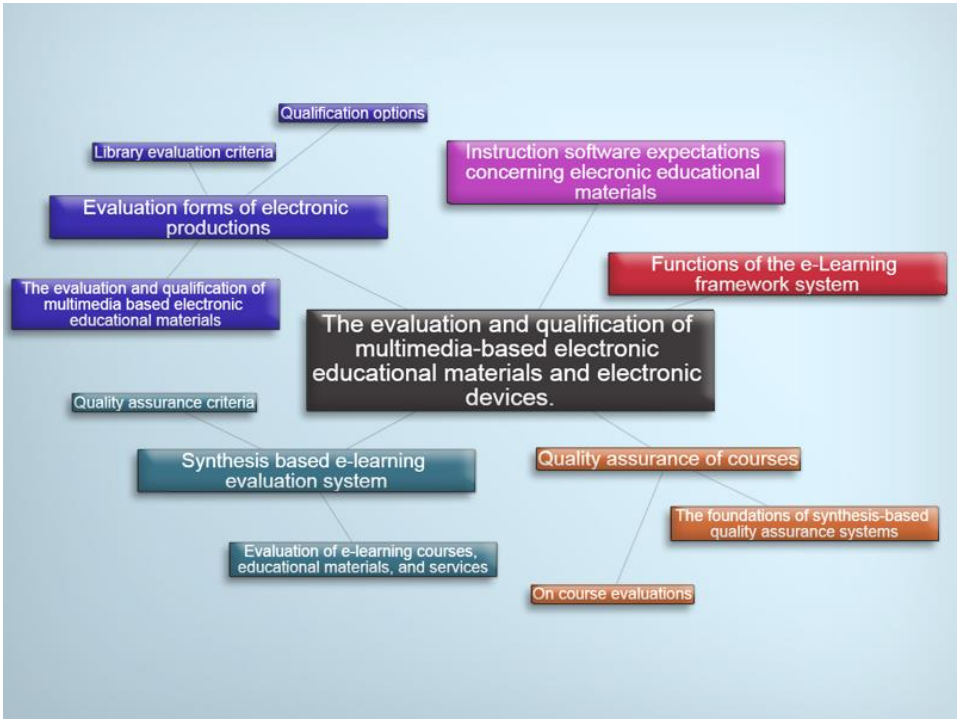

Figure 9 Conceptual map to Lesson 4

4.2.1 Evaluation forms of electronic productions

4. Essay, Sándor Forgó : **The role of the quality of multimedia instruction programs in the development of media competences** , ÚJ PEDAGÓGIAI SZEMLE (New Pedagogical Review) 12: (7-8) pp. 69-77. URL:

Qualification options[36]

Multimediality, or multimedialization is not only a promotional concept of mobile communication devices, but of local and network-based learning as well. Due to the info-communicational extension of learning technologies one of the key components of e-Learning texts along with interaction is the attractive presentation. Multimedia guaranteeing

[36] Forrás: Forgó Sándor: A multimédiás oktatóprogramok minőségének szerepe a média-kompetenciák kialakításában.(The role fo the quality of multimedia instruction programs in the development of media competences) In: *Új pedagógiai szemle*, 51. évf. 7/8. sz. (2001), p. 69-78. URL: URL: http://www.ofi.hu/tudastar/multimedias (Letöltés: 2014. 05. 18.)

interactivity can primarily be used in home-based learning and to a lesser extent in small group contexts. While such approach is not ideal for large lecture halls, multimedia presentations can liven up lectures by bringing heretofore not shown events, processes, and experiments closer to listeners thereby improving the efficiency of the presentation. Consequently an appropriately selected interactive multimedia program can greatly improve the efficiency of the learning process via the simultaneous presentation of traditional still images, picture, sound and electronic images. Multimedia productions require significant preparation time and expensive equipment. Consequently, one should consider whether the investment will be profitable or should strive for achieving the same level of efficiency with different methods.

One would think that familiarity with traditional media would be sufficient in creating multimedia productions to be combined with electronic presentation options meeting contemporary editing and speech requirements. The evaluation of multimedia products requires a thorough knowledge of communication, the respective pedagogical expectations, the specific features of the given media along with the respective design, ergonomic and application criteria. At the same time a message has to be designed by taking the expected or potential behavioral response of the user or learner into consideration. The evaluation of productions is usually performed along a multifaceted criteria system.[37]

According to Kárpáti multimedia-based instructional materials should be evaluated according to a complex criteria system. The qualification process should include the evaluation of content, the applied technology and pedagogical methods along with the aesthetic and implementation criteria. These requirements surpass the expertise of the usual textbook and software review panels. The complexity of quality and the respective comprehensive criteria warrants the establishment of a new qualification organisation and a new evaluation standard as well.Although no quality assurance standards have been developed for multimedia-based instructional devices, both the ISO and the TQM standard family contains useful guidelines.. According to McFarlane[38] quality assurance systems

[37] Izsó Lajos: *Multimédia oktatási anyagok kidolgozásának és alkalmazásának pedagógiai, pszichológiai és ergonómiai alapjai*. (Pedagogical, psychological, and ergonomic foundations of the elaboration and application of multimedia-based educational materials) BME Távoktatási Központ, 1998. p. 77.
Kárpáti Andrea: *Oktatási szoftverek minőségének vizsgálata*. (Assessing the quality of instructional software) URL:
http://www.ofi.hu/tudastar/oktatasi-szoftverek) (Letöltés: 2014. 05. 18.)

[38] McFarlane, Angela: *Educational use of ICT*. OECD/CERI ICT Project Area 1. Kézirat. Paris, OECD, 1999

must meet or respond to the following requirements or inquiries respectively:

- Reflect the main features of the device and the diversity of the production genres
- The qualification should promote the appropriate educational use of the given device.
- How does the given software promote training or further training and what kind of services does it offer?
- Before starting the evaluation process, the given criteria have to be qualifed as well.
- Is the evaluation system flexible enough?
- Do the criteria include broad educational goals or rigid requirements?
- Can the evaluation criteria be used in the design stage and are they suitable for orienting consumers?

The evaluation system should be capable of influencing the various macro and micro levels of public education in the form of publications, dissemination of the results on the web, or the maintenance of personal connections with educational policy decision makers, teachers, students and all other target groups.[39]

Izsó in his work titled ”Determining features of the quality of instructional multimedia” emphasizes that relatively few well documented research results are available.[40] He calls attention to essays written by Barker and King.[41] The respective criteria system includes the following conditions:[42]

- securing interest*
- interactivity*
- personalization capacity*
- proper rate of integrated media
- ways of interaction

[39] Cf. Kárpáti Andrea: *Oktatási szoftverek minőségének vizsgálata (Examining the quality of instructional software)*

[40] Izsó Lajos: *INTERFACE. MM felhasználói szempontú minősítésére szolgáló tesztelő környezet*. (Testing environment for the user oriented qualification of multimedia) URL: http://tutor.nok.bme.hu/mmo/4/interfac.htm (Letöltés: 2011. 05. 18.)

[41] Barker, Philip – King, Terry: Evaluating Interactive Multimedia Courseware – a Methodology. In: *Computers education*, vol. 21, no. 4. (1993), p. 307-319.

[42] Criteria marked with a star are considered generally applicable, while the rest is valid in case of specific product categories.

- quality of interaction*
- the quality of the user surface*
- compliance with learning styles*
- control and evaluation techniques
- integrated intelligence
- appropriateness of devices supporting supplementary learning
- suitability for individual or group use

The evaluation of multimedia devices has been a subject of several scholarly publications in Hungary. There seems to be an agreement that the given software should be evaluated in the development stage and before the product enters the market.Hungarian researchers also focus on the behaviour of users along with traditional checklist type evaluational processes.[43]

Library evaluation criteria

László Drótos developed a multifaceted criteria system for the librarian profession.[44] His work titled “Library wish list for CD-ROM publications” includes six criteria groups (form, technology, implementation procedures, documentation, downloading to processing surface, and printing options) not only acclaimed by the librarian profession, but by educators as well.

The evaluation and qualification of mutimedia-based electronic educational materials

In the upcoming section we would like to provide information for developers and users of educational media regarding the evaluation criteria. We should apply such criteria to professionally authentic, aesthetically demanding and system oriented productions potentially including artistic components meeting pedagogical, psychological, ergonomic, and communication-related expectations.

Our main objective is promoting the distinction of multimedia products reflecting commercial (entertaining, disseminating scientific results) and professional, scientifically sound standards.

The assessment of the efficiency of a given multimedia instructional program poses methodological challenges. as multimedia-based

[43] Kárpáti A. im.

[44] Drótos László: *Könyvtári kívánságlista CD-ROM kiadványokhoz*. (Library wish list for CD-ROM publications) 1998. URL: http://www.bibl.u-szeged.hu/mke_eksz/cdrom/jocd.html (Letöltés: 2014. 05. 18.)

instruction means a radical change from the traditional learning environments.. Modern educational methods respond to requirements of the knowledge based society. The criteria system prioritises pedagogical and media science aspects. While it cannot aim at full comprehensiveness, it can be suitable for the evaluation of pedagogical multimedia. We review the most important criteria below:

Evaluation criteria for multimedia productions

I. THEEXPRESSION OF THE MESSAGE. Professional accuracy credibility, authenticity, intelligibility, conciseness of content

II. SYSTEM ORIENTED DESIGN (ANALYSIS, PLANNING) To what extent does the program meet the given objectives, is it suitable for differing learning styles, are self-test options included?

III. STRUCTURE. The appropriateness and transparency of the content, logical and arrangement structure.

IV. NAVIGATION. Does the program include navigation components, do the navigational components support user orientation?, are subject and name indexes provided?

V. COMMUNICATION-INTERACTION. Action-reaction (waiting time) interruption features, the principle of chat maintenance

VI. PEDAGOGICAL-DIDACTIC ASPECTS Does the elaboration level facilitate the realization of learning objectives, or provide adequate motivation, promote interest and self-activity?

VII. PSYCHOLOGICAL, ERGONOMIC CONSIDERATIONS. Is the program adjusted tothe capabilities and aptitudes of the user,does it provide a sense of success, can a cognitive map be formed on the course material, is the selection of colour and form compatible with content?

VIII. VISUAL AND AUDITIVE FEATURES OF MULTIMEDIA COMPONENTS. Excessive use of text, or the dominance of textual parts undermines or weakens the multimedia side of a given production. The other extreme, presenting everything in picture form, eliminates the need for abstraction, or the prevalence of sound makes the production similar to a CD. It is important that each media component strengthens the other, instead of weakening or eliminating the respective effects. Sound elements must be coordinated with the given pictures and the appropriate shifts between various media improve production quality

Textual parts: simplicity, readability, sequencing, conciseness, limited eye strain.

- *Number, data base*: retrieval speed, transparency, indication of progress

Still images: level of composedness, conscious selection of colour, highlighting features (pictorial emphasis) Is the tone appropriate, is the picture under or overexposed, is the picture sharp enough? Sharpness or dullness can be caused by genre-based or technological factors,that is depth sharpness or motion-related sharpness. Other issues: is the definition or the picture size optimal for study purposes, are the colour depth and definition adequate, are there objects on the picture distracting viewer attention, are picture editing and adjustment appropriate? (remote camera position or close-ups limit the description potential).

Icons, symbols, logos: simplicity, intelligibility of production, extent of essence highlighting capability.

- *3D descriptions:* spatial complexity, presentation, dimensional effects and materiality of the modular object.
- *Animation:* continuity, steadiness, realistic nature, and dynamics of movement.
- *Active surfaces:* consistent placement, continuous and justified presence
- *Auditive information:* intelligibility of text, adequacy and elimination options for musical elements in the background

  Possibility of error: Due to automation background noise can become louder, the sound recording contains an echo most often manifested as an empty, hollow tone known as the hangar effect. The voice of the presenter is dull because of an inappropriate microphone, or in case using several microphones the subordinated voice becomes dominant as the voices of side line presenters, or those in a secondary role support the voice of the lead character. Conversely, too loud background or accompanying music tends to dominate over speech.

  Motion picture: composition, picture editing, sharpness, lighting, steadiness of camera movement

  Unnecessary camera movement can promote a feeling of ambiguity or uncertainty, shaking picture can be caused by a lack of camera support, or its inappropriate structure. Incorrect frame/sec value indicates discontinuities, interruptions in the digitalized video clip.

IX. TECHNOLOGICAL IMPLEMENTATION. Noise, improper definition, elements disturbing communication.

X. COMPLEMENTARY ELEMENTS (installation, cover text, content description). Printed instructions for general or pedagogical purpose increase the value of the multimedia production.

XI. ON-LINE OPTIONS The availability of user friendly service package, telephone assistance, on-line options for forwarding and updating information

XII SUBJECTIVE EVALUATION. The individual evaluation aspects contain comprehensive yet personal observations leading to recommendations for the purchase or rejection of the given product, in other words whether the evaluator recommends the acquisition of the multimedia product or not.

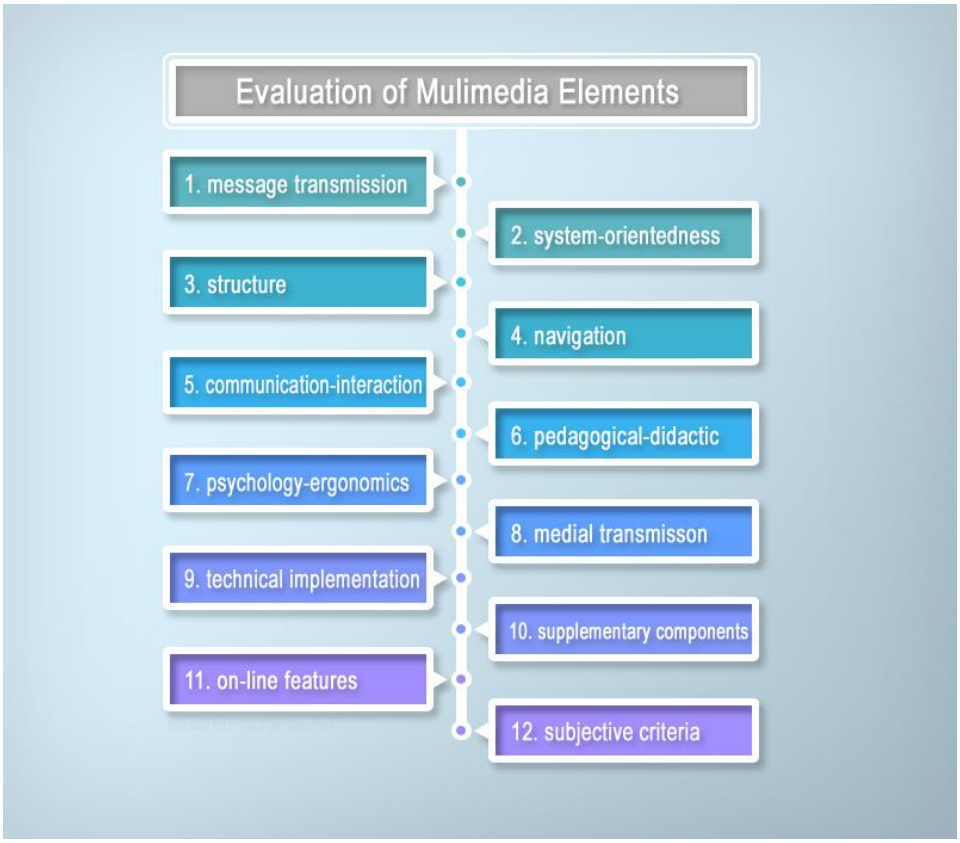

Figure 10 Evaluation criteria of multimedia products (Forgó 2001)

4.2.2 Expectations concerning instructional software and electronic educational materials

Since during electronic learning the teacher can control or manage the learning process only from a distance or in a pre-determined manner, the instruction software has to provide for a wide spectrum of traditional teaching tasks. This includes grabbing the students' attention, maintaining their interest at an appropriate level, reviewing certain parts of the text at certain intervals, including electronic testing options etc.

In order to promote compliance with expectations the development and design of electronic materials should meet a variety of criteria.

The structure and architecture of the educational material: The given educational material should have an appropriately elaborated structure for the presentation of information, the introduction of the objective and requirement system, lead students in an interactive manner, provide sample questions and other practice opportunities while enable students to gain a clear picture of the steps of knowledge acquisition.

Modular structure: The modular structure enables students to study only those sections which have not been learned yet, or have special importance

Theoretical explanations, descriptions, illustrations: These features help the accurate learning of concepts.

*Description of procedures.*This feature enables students to learn the concept-based operations. The series of steps required for the performance of the given operation must be described in addition to providing relevant animation and simulations.

*Practice.*The gradual step by step approach helps the acquisition of new knowledge while utilizing existing information. Practical examples lead participants to recognize correlations via the comparison of their own everyday experiences and to draw conclusions. The learned knowledge and skills facilitate confident use of the respective equipment on a regular basis.

Diagnostic measurements (preliminary knowledge survey).At the beginning of each modul the student's pre-existing knowledge level is assessed. The results of the preliminary test indicate whether the given module should be completed or not.

Examinations. During examinations the depth of the student's knowledge can be assessed. The examination questions can be grouped into two categories: test-type theoretical questions check concept-related knowledge, while questions pertaining to practical implementation focus on problem solving skills. The combination of exam questions will help teachers and students themselves which areas areas or educational modules are in need of review.

The use of appropriate level and quantity multimedia devices can evoke student interest, promote attention maintenance while broadcasting content to students with varying perceptive features (visual or verbal type) in an optimal manner.

4.2.3 The functions of an e-Learning framework system

- *Specific identification of students*, recording progress related data, monitoring student activity.
- The *handling of access entitlements* to various course materials and components, the provision of access to students.
- The system should be *adjustable* to the textual needs of the given student or student group
- Setting the *authority* of educational material developers and educational administrators concerning content modification and data access
- The framework system has to store complex student data including registration, starting of the program, previously covered topics, and the results of the examinations.
- *Course administration*. Recording course enrolments and examination sign-ups.
- *Simple modification* and updating of texts and educational materials, structural transformations, reusability of certain parts
- Providing *communication surface* and the respective forms (synchronous, asynchronous).
- Availability of automatic functions promoting student activity
- *Teacher evaluation support (*diagnostic, formative, and summative evaluation)
- Self evaluation and self test features.
- Informing users on *news related to the educational process*
- Providing support for *web lectures* and *webinars*
- Supportive group work in a virtual environment, providing a collaborative surface.
- *Preparation of reports* Easy retrievability of monitoring information for administrators.
- Registering and tracing the activities of users: instructors and students.
- *Connection to existing systems*. The e-Learning framework system should not be a separate component in the educational

system of the given enterprise or organisation as an integral connection can facilitate linkage with employee records, financial systems, and knowledge management devices.

4.2.4 Quality assurance of courses

Professional research literature: Forgó S.: *Szintézisen alapuló* e-learning értékelő *rendszer* (Synthesis-based e-Learning evaluation systems) URL

The foundations of synthesis-based quality assurance systems

- Curriculum development criteria system defined by the Regional Distance Education Centre of Central Hungary .
- The design and launching parameters of the distance learning system introduced at Eszterházy Károly College.
- The e-Europe action plan aiming at the realization of e-Learning goals ratified at a conference held on 2000 June 19-20 in Feira, Portugal.
- CBT educational material development recommendations of AICC established in 1988
- Interdependent SCORM technological specifications. (The model is closely connected to the specifications of other organisations including AICC, IMS, and IEEE.
- Criteria developed by the Swiss Edutech company.
- A scientific treatise published by the University of Manitoba on the qualification of Internet-based distance education systems. The article compares the five highest developed web-based distance education systems.
- The criteria system of CEN ISS Mallorca.
- The e-Methodology system of the Distance Learning Centre of Budapest University of Technology.
- The e-Learning aspiration related pages of the MATISZ.

On course evaluation

During the establishment of expectations related to e-Learning framework systems and instruction software one should take user expectations concerning the provided services into consideration. Swiss researchers at EDUTECH elaborated a criteria system applicable both for electronic knowledge management systems (LMS) and course

management systems (CMS). The criteria system helps the given educational insitution to analyze certain services.

We provide a brief summary of the given criteria.

I. **Student environment** entailing continuous and identification- based access to the educational materials. It is imperative that students could personalize the surface via personal remarks or the use of bookmarks.

II. What should be the main features of the **authorial environment?** At this state such issues have to be considered as the sufficiency of user level design skills (copy, paste, HTML competence), does the program include an editor, can several authors cooperate?

III. The **teaching or instruction environment** should provide opportunities for the performance of educational and performance tasks, the promotion of group work, tutoring, course evaluation, and the creation of an electronic journal from the results.

IV. During **administration** options should be provided for registation, monitoring, the granting and withdrawal of access rights.

V. **Technical requirement** criteria should include the technological features of the server client (non-platform dependent web-browser).

VI. **General featuresand characteristics** should entail the following elements: multilinguality, meeting standard requirements, metadata support, ICT suport, system documentation, stability, and reliability.

Detailed evaluation criteria provided by the EDUTECH Switzerland:

I. Student environment
   A.) Access
   B.) Extent of personalization
   C.) Asynchronous communication
   D.) Synchronous communication
   E.) Pedagogical devices
II. Authorial environment
   F.) Curriculum development
   G.) Course management
   H.) Knowledge monitoring
III. Teaching environment and methods
   I.) General (tutorial, instruction role)
   J.) Group work
   K.) Tutoring
   L.) Course evaluation
IV. Administration
   M.) General features
V. Technological requirements

N.) Technological features of server client platform
VI. General features (expenses)
O.) General features
P.) Support
Q.) Expenditures

4.2.4 Synthesis-based e-Learning evaluation system

Quality assurance criteria

The above quality assurance criteria system was designed according to the recommendations and standards of professional organisations. The synthesis-based quality assurance system considers planning, development, and service-related preferences.

According to users e-Learning texts and services should meet the following criteria:

- providing information on the course;
- provision of a variety (on-line, off-line) forms of comunication;
- proportional appearance;
- recording student progress;
- maintenance of personal data;
- provision of sophisticated content with appropriate methodology;
- promoting user orientation;
- should be fitted to customer needs;
- describe technological requirements;
- opinions should be expressed on its use.

Quality assurance efforts explore control, evaluation and quality assurance options during the design stage of traditional and electronic or distance learning programs. Consequently the following issues are addressed: Which of the traditional approaches are assigned lower priority, which ones can be adapted into the new system without any changes, and does the significance or importance of any criteria increase during use? In light of the above we recommend the application of a comparative and complex quality assurance system for designers, developers, and users.

In the coming section we will introduce a hybrid system, or a quality assurance system connected with design and development processes. We highlight the importance of an important criteria system for the users of the given service. In this case the process and product oriented approaches are incorporated into one system.

Evaluation of e-Learning educational materials and electronic services

Continuous training objectives can hardly be fulfilled in case of traditional instruction as the production, printing, and dissemination of a book is a time consuming process. When information in a written and printed format, i.e as CD utilizing off-line technology, reaches students or interested parties it is already obsolete. However, distance learning utilizing the Internet and electronic network-based approaches tends to meet all technological and methodological requirements of e-Learning programs. Information carriers utilizing off-line technology, i. e. a CD-ROM, are closed units, cannot be refreshed on the same surface, and the production and dissemination of prototypes is expensive and takes a long time. There are several instructional framework systems on the market with varying price and capacity. At this point we can analyze the control, evaluation and quality assurance options and ascertain which traditional procedures receive less emphasis, and which ones can be adapted into the system in an unchanged form, or enjoy increased significance.

Consequently we compiled a criteria system taking into consideration international and domestic experiences which as a result of our own development efforts can promote the realization of standardization objectives.

The evaluation criteria system

Electronic learning programs require the use of software and server facilitating the broadcasting and logging of the given text.

The e-Learning framework system is such a computer software, which facilitates personalized learning via local and global computerised networks. Framework systems perform the following tasks: the dissemination of instruction content, the management of students and the training process, and the performance of educational support tasks. Below we provide a list of tasks:[45:]

- *Provision of course information* (informing, orienting students, text examination functions)
- *Provision of surface (*asynchronous, synchronous forms)

[45] *A tanári mesterség információ- és kommunikációtechnikai alapelemei* című elektronikus tananyag. (Information and communication technology components of the teaching profession)
http://www.ektf.hu/infokomm/?k_tartalom=leckek
http://www.szamitastechnika.hu/archiv.php?id=19695

- *Design* (structure, form) content, form, and methodological structure, transparent well-structured content
- *Administration* (general features), maintaining a record of course and examination sign-ups, adjustable regarding the authority or entitlement of developers and administrators
- *Publication, dissemination of content* (enforcement of content, pedagogical principles, didactic methods, psychological, ergonomic principles, genre expectations) automatic functions promoting student activity
- *Central data base* (specific identification of students, data collections maintaning study results, monitoring student activity)
- *Navigation* (general expectations, supplementary aspects), use can be learned easily
- *Student support* (availability, access, extent of personalization), monitoring student performance, support provided for students with poorer records)
- *Technological requirements* (browser, operation system)
- *Evaluations, feedback*, quality assurance (self-evaluation, practice test components, content, usability).

Connection to existing systems. The e-Learning framework system should be connected to the educational system, employee records, financial system and existing knowledge management devices of the company.

Evaluation of e-Learning courses, educational materials, and services

Table Three: The evaluation of e-Learning courses and services

Criteria	Detailed	Very poor	Poor	Average	Good	Excellent
I. Course information	Information and orientation					
	Introduction					
II. Communication	Asynchronous cooperation					
	Synchronous cooperation					
	Feedback system					
III. Design	Structure					
	Form					
IV. Administration	General features					
V. Content dissemination	Presentation of content					
	Pedagogical principles, didactic methods					
	Psychological-ergonomic principles					
	Meeting medial (genre-related) dissemination requirements					
VI. Central data base	Collection of student-related data					
	Collecting documentation, registration of documents					
VII. Navigation	General expectations					
	Supplements					
VIII. Student support	Availability, access					
	Extent of personalization					
IX. Technological requirements	Client platform – standard					
X. Evaluation, feedback, quality assurance	Content, structure, usability					
Total:	Extent: 20-100					

The chart below summarizes the main criteria.

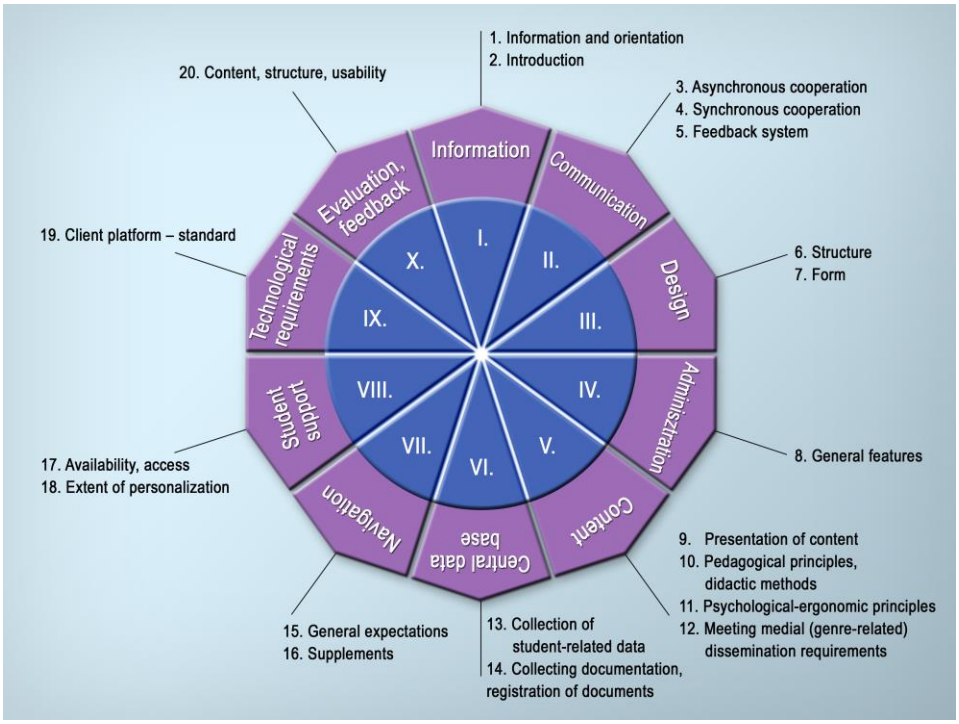

Figure 11: A synthesis-based quality assurance system (Forgó [et al.] 2004a)[46]

4.3 SUMMARY, QUESTIONS

4.3.1 Summary

The chapter introduced evaluation and qualification principles required for electronic educational material design along with the varying evaluation forms of electronic productions. Information was provided on the functions of e-Learning framework systems and the expectations concerning instructional software and electronic educational materials. Students based upon the acquired knowledge are capable of a multifaceted evaluation of multimedia products.

[46] Forgó Sándor – Hauser Zoltán – Kis-Tóth Lajos: Tanulás tér- és időkorlátok nélkül. (Learning without spatial and temporal limits) In: *Iskolakultúra*, 14. évf. 12. sz. (2004), p. 125-141URL: http://www.iskolakultura.hu/documents/2004/12/tan2004-12.pdf

4.3.2 Self-test questions

- What are the main criteria for the evaluation of multimedia-based instructional materials?
- Describe the functions of e-Learning framework systems!
- What are the most important expectations concerning instructional software?
- Describe the synthesis based quality assurance system!
- What are the main features of the evaluation of e-learning systems?

Module II. Electronic learning

5. DEMONSTRATIONS, ILLUSTRATION CAPABILITY, ELECTRONIC PUBLISHING

5.1 OBJECTIVES AND COMPETENCES

The chapter will familiarise students with the historical development of demonstration and illustration efforts, modern learning formats of the 21st century, and the main features of demonstrations with multimedia.

Students will learn about E. Dale's cognition/experience pyramid and its application to electronic learning, the conditions of processing electronic media provided information, and the main features of auditive and audio-visual media. The text will also help the acquisition of program structuring methods.

5.2 COURSE MATERIAL

Demonstration, illustration capability, electronic publishing
21st century learning formats
Demonstration as a profession
Dale's experiential pyramid
Multimedia as an extension of demonstration capability
Processing information provided by electronic media
- Visual media
- Sound (speech and music)
- Motion picture and multimedia

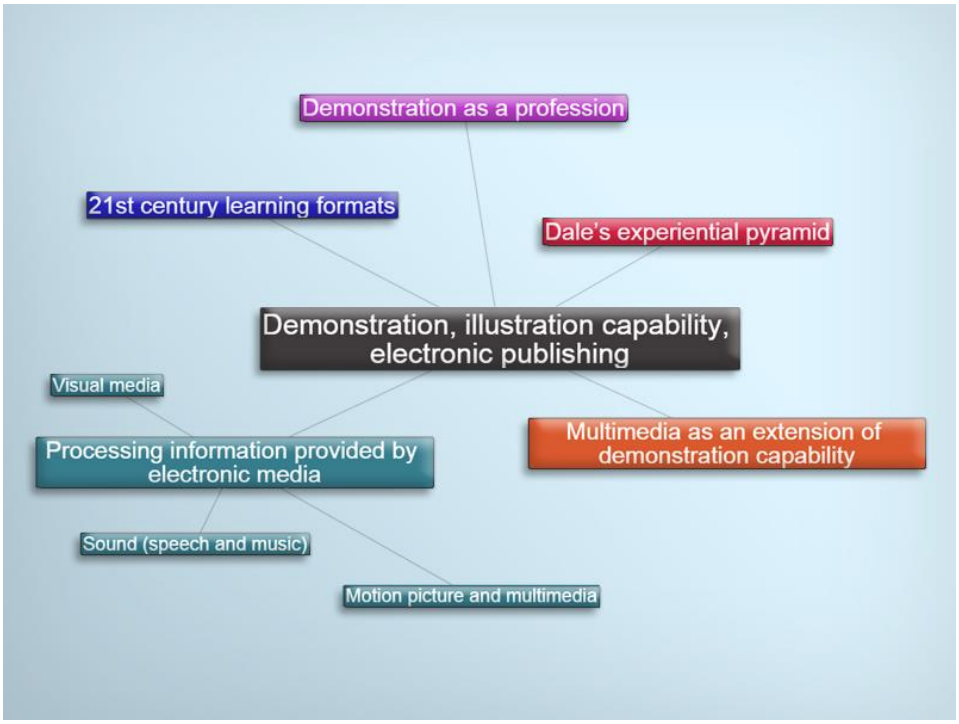

Figure 12: Conceptual map for Lesson 5

5.2.1 21st century learning formats

The Internet-driven generation of the digital age is characterised by a need for fast information acquisition and the prevalence of the Internet as a site for obtaining that knowledge. Today multimedia applications and the *multitasking approach* (simultaneous running of several tasks within a given system) are equally popular. The demand for immediate information is coupled with expectations of instant reinforcement and gratification. The digitally literate can easily retrieve and share information via network-based connections. Tari (2010) asserts that the dimensions of human relationships have changed and the children of the information age, today's 30 year olds, emphasize community orientedness and the sharing of experiences via community portals, blogs, and network-based games.

The increasing availability of information on the Internet raises several questions, namely which source of information can be considered credible or authentic, whether such content can be screened and which information is needed, and which one should be discarded. Human

learning generally entails cognition, performed by a section of the human biological structure, the brain. The brain is capable of modelling the external environment, or immediate surroundings. Learning is a modification of contemporary mental representations most visibly manifested in action. Learning can impact the perception, interpretation, and evaluation of the surrounding world including ourselves as well. Mental representations can be shaped and formed and can promote further modifications as well.

Until the 20th century three characteristic pedagogical paradigms and respective didactic systems had been formed. These approaches differ in the respective priority assigned to *knowledge transmission, demonstration, and the promotion of learner action* and the perceived role of the teacher and the student within the framework of the education process.[47] Consequently, the following stages can be distinguished:

1. *The pedagogy of didactics, the promotion of cognition.* – This approach characteristic of antiquity and the Medieval Age viewed learning as the transmission or acquisition of information, knowledge, and wisdom. Thus the improvement of memory and the storage and retrieval of memory traces received special priority. The learner received information in an indirect fashion, via a conveyance feature (lectures, or text readings)

2. *The second era* assigned crucial importance to didactics, or the *pedagogy of demonstration*. According to the inductive logic of empirism developed in the 17th century correlations derived from the facts of reality provided the foundation of learning. Comenius pioneered the *sensualist pedagogical approach* considering perception as an exclusive source of information. The given paradigm focused on demonstration, while other schools of thought contributed to the theoretical foundation of pedagogy as well. The empiricist school appearing in the 17th century (*Bacon, Hobbes, Locke*) viewed cognition as a sole source of learning, while rationalists (*Descartes, Spinoza, Leibniz, Kant*) declared experience as a sole source of knowledge. *Sentimentalism* based upon perception of impressions *considered humans as thinking and feeling organisms* and its main goal was the promotion of experience acquisition instead of the transmission of knowledge.

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3. *The third didactic approach*, *reform pedagogy*, or the pedagogy of promoting hands-on, direct action, appeared at the turn of the 19th and

[47] Nádasi András: Oktatáselmélet és technológia [(Instruction theory and technology) elektronikus dokumentum] http://okt.ektf.hu/data/nadasia/file/tananyag/oktataselmelet/1_tananyag2.html (Letöltés: 2014. 05. 07.)

20th centuries. Its leading practitioners (Dewey, Montessori, and Ellen Key) considered action, student discovery, and self-generated activity the foundations of successful learning. This school gave rise to Pavlov's classic conditioning theories and Thorndike and B.F. Skinner's operative conditioning model eventually leading to the learning principles of behaviourism and the practice of programmed education.

The interdependence and interaction of such theoretical models facilitated a holistic interpretation of learning, viewing knowledge acquisition as a complex process recognizing the physical, psychological, intellectual, and social dimensions of the learner. The integrative system gaining prevalence at the end of the 20th century utilized the achievements of behaviourism, constructivism, and constructive learning theories.

The theory of **trialogic learning** entailing learning via mutually prepared or modified learning objects and contents is a welcome addition to 21st century pedagogical theory. According to acclaimed Finnish researchers Paavola and Hakkarainen (2005) the learning process not only includes *acquisition and participation,* but *knowledge creation* emphasizing the individual, the community, and the process during which the participants compose a common knowledge object. Browsing, content uploading, and the overall experience of network-orientation played a significant role behind the emergence of network-based learning, or the revolutionary new connectivism paradigm. (Siemens & Downes).

These new 21st century educational paradigms provide a foundation for a fourth didactics, as described by Komenczi. Accordingly, as a response to the challenges posed by the informaiton society hyper learning or e-Learning presents the promise of an unprecedentedly effective format and methodology of learning.[48]

- Discuss the changing role of the teacher on a forum. Varga Miklósné: A pedagógusszerepek átalakulása napjainkban (The transformation of teaching roles today) http://www.ofi.hu/tudastar/pedagogusszerepek

- Bedő Ferenc: A tanuláselméletek és az informatika. A pedagógiatörténet tanuláselméletei. (Learning theories and

[48] Komenczi Bertalan: Az e-learning módszertani kérdései. (The methodological questions of e-learning) http://www.oktopusz.hu/mss/alpha?pg=222&m288_doc=368&st=42

informatics. Learning theories in pedagogical history) http://w3.enternet.hu/infokt/publikacio/k1/k1.htm

The great learning theories of the 20th century[49]

- Conditioned reflex - Pavlov (1904 Nobel prize)
- Learning based on quantitative reactions-instrumental conditioning Thorndike and Skinner
- Mimetic learning - Albert Bandura
- Restructuring - Wolfgang Köhler
- Insight-based action - Karl Bühler
- Operational psychology - Jean Piaget
- Connections between brain functions and areas – Cognitive trends
- Understanding the world and acting upon internal constructions and structures - Constructivism

Even the concept of e-Learning is in transition as with the emergence of the Web 2.0 the heretofore unidirectional information acquisition process was transformed as well.

e-Learning is a training scheme facilitated by a computer network arranging the teaching and learning process into a uniform framework system accessible for the learner. The framework built on effective and optimal knowledge transition and learning methodology integrates educational materials, learning resources, teacher-student communication, and computerised interactive instruction software. (Forgó 2005).

e-Learning 2.0 is a learner centred, irregularly arranged learning format based on the autonomy of the student and the spontaneous exchange of knowledge. The system is not hierarchically structured, as it is multidirectional, decentralized, and multichanneled promoting collaborative learning and student activity. (Forgó S. 2009)

A didactic consequence is the emergence of network-based learning or **connectivism.** According to George Siemens and Stephen Downes connectivism is the learning theory of the information society. The model is based on the pedagogical utilization of network theory, and has informatics foundations as well. Accordingly, the electronically supported

[49] Jenei Zsolt: Ha kíváncsi vagy hogyan oktatják gyermeked... (All you wanted to know about your child's education….) http://oktatas.blog.fn.hu/index.php?view=bejegyzes_oldal&bejid=42065&bejcim=Ha_kivancsi_vagy__hogyan_oktatjak_gyermeked&todo=/

information exchange is integrated into an informal framework facilitating network-based learning.

5.2.2 Demonstration as profession

Demonstration has always been a central concern for the discipline of pedagogical science and the profession of pedagogy. Based upon principles developed by BACON, COMENIUS asserted that "*cognition should always be based on sensory perception (nothing is in the mind, which had not previously been included in the senses). Thus teaching should not start with verbal description of things, but with observation. After showing the subject of our teaching, explanations can be provided.*"[50]

Comenius basically put forth the principle of the necessity of the first signal system, namely cognition should take into consideration the direct perception of the external world. Comenius warned against the overly verbose teaching methods of his day. In his seminal *Orbis Sensualium Pictus* he not only used words to describe the visible world, but included pictures as a way of illustration. [51]

The knowledge transmission and acquisition process has always included demonstrational options and features promoting understanding and intelligibility. While some of these became obsolete, technological development facilitates a constant renewal as well.

The educational process has been fundamentally impacted by the cataclysmic social changes, the explosive growth of scientific research results and the appearance of audiovisual and electronic media, especially the computer.

"In the introductory section of a film catalogue published in 1909 Edison bravely predicted the demise of books in schools. He envisioned that students will gain knowledge via the eyes. All aspects of human knowledge can be taught with motion pictures and the American school system will undergo a radical change in the next 10 years." While the

[50] COMENIUS, J. A.: *Didactica magna* (Nagy oktatástan). Pécs, Seneca Kiadó, 1992. p. 287.
Comenius' didactic and methodological principles provide a foundation for the demonstration and illustration efforts at schools even today. He argues for the inclusion of the highest number of sensory organs into the learning process, while generalization and concept formation should be based on concrete experience. However, this is an inductive means promoting cognition. Further details: URL: http://magyar-irodalom.elte.hu/nevelestortenet/06.01.html

[51] V.ö. A JATE Egyetemi Könyvtára régi magyar könyvművészetről szóló oldala. URL: http://www.bibl.u-szeged.hu/oldbook/comen1.html (website on Hungarian book printing art maintained by the University of Szeged)

hundred year old profecy did not come true, the process had irreversibly been launched."52

5.2.3 Dale's experiential pyramid

We have covered media-based teaching and learning methods and demonstration options complementing verbal instruction. The respective approaches and devices include visual elements (film), audiovisual components, television-based[53] and programmed education along with such recent developments as computer assisted learning, interactive multimedia programs, interactive boards, and e-Learning.[54]

Dale's experience pyramid is useful for discussing the problem of demonstration in education. I consider the model as a guideline and educational material at the same time. The model can be reconsidered and complemented with new information and communication technologies and functional aspects.

The widespread use of technological devices is based on the principle of simplicity, as the former is not as abstract and more tangible at the same time as the spoken or printed word. Edgar Dale, professor of Ohio University constructed a pyramid of pedagogical experiences[55] ranging from the most abstract to the most tangible and realistic ones. A student throughout his career covers all of these steps in both directions thereby connecting symbolic presence with experiential facts, oral statements with instructional devices.

The figure listed below has not lost its currency at the age of multimedia as it demonstrates the mutual relations of the given cognition forms. Dale made the following recommendation: "*Descend as low on the*

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52 In: ROHONYI, A.: *Oktatás és technológia - A pedagógiai technológia kialakulása*. (Instruction and Technology. The evolution of pedagogical technology) Veszprém, OOK, 1982. Idézi: NÁDASI: Az új oktatástechnológia és az oktatásfejlesztés digitális eszközrendszere. (kézirat) EKF, Médiainformatika Intézet 44 p.

53 SCHRAMM aki a 20 század egyik legnagyobb médiakutatója volt, több tanulmányában is felrótta televízió passzív voltát, azaz az interakció hiányát. (Schramm, one of the greatest and most acclaimed media researchers of the 20th century published several essays criticizing the lack of interaction during television viewing, or the inherently passive nature of the activity.)

54 At the onset of the motion picture age opinions surfaced concerning the substitution of teachers with *instructional films* and *radio programs*. While digital and interactive school television, interactive computer programs, online learning, and interactive boards generate both positive and negative comments, the respective methodology is steadily growing.

55 DALE E.: *Audio-Visual Methods in Teaching*. New York: The Dryden Press, 1954. Idézi NAGY Sándor 1967, pp. 200–201. Módosítások GYARAKI F. In: Pedagógiai kézikönyv. Szerk.: BÁTHORI Zoltán. Budapest, Tankönyvkiadó, 1980.

scale as you can for promoting learning, but ascend as high as you can to facilitate effective learning."[56]

Dale's *experiential pyramid* developed in 1946 was further improved by Bruce Hyland in 1969.[57] Accordingly, the principle of simultaneity or the diverse appearance of various forms of cognition was adopted as well.

Accordingly an average student can retain only 5-10% of information provided in oral or writtten form while the retention capacity of media (i.e. film) is 25%. Role play can increase the knowledge retention rate to 40-60%, and the most effective method is the hands-on experience with an 80-90% retention rate.

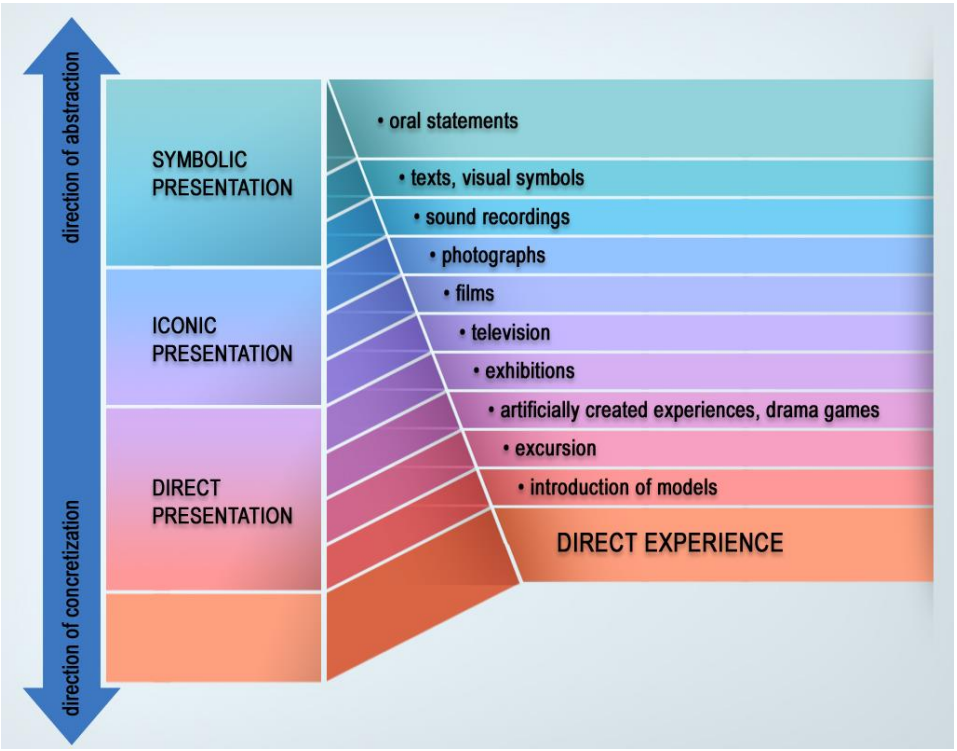

Figure 13: Dale's pyramid of cognition forms

[56] NÁDASI András: *Az információhordozók és információhordozó rendszerek tervezésének és alkalmazásának alapjai*. (Foundations for the design and application of information carriers and information carrying systems) In: Oktatástechnológia II. (szerk.: OROSZ Sándor). Veszprém, OOK, 1985. p. 32.

[57] URL:http://www.public-health.uiowa.edu/icphp/ed_training/ttt/archive/2002/2002_course_materials/Cone_of_Learning.pdf

Following the emergence of the interactive multimedia computers the figure can be complemented with simulation based activities, the tools of virtual reality. Consequently retaining the tripartite division of the pyramid along the concretization-abstraction axis and the action-demonstration continuum the following taxonomy can be established:

1. *Symbolic, monomedial presentation* focusing on the conceptual aspects of the given facts via reading or listening to a text.
2. *Audiovisual presentation*: the three dimensional world is perceived through drawings or photographs,the voice in space is processed in mono, stereo, or quadro format.
3. *The interactive multichannel perception* or experience entails the participation of all sensory organs in the cognition process (vision, hearing, smelling, tasting, touching, and the perceiving of heat).

Having considered our previous experiences we can easily substantiate Dale's theses. (The pyramid model is available in animated form as well).[58]

It must be noted that information literacy is not only equated with the knowledge of computers, buth with the ability to perform manipulations with the applied media components.[59]

5.2.4 Multimedia, as an extension of perception

Multimedia technologies promoting the realization of new potentials in all fields of instruction and knowledge acquisition are crucial parts of e-Learning programs as well. While in-service teachers are familiar with audiovisual presentations and media systems, multichannel presentation options and interactive or dialogue-based forms facilitating high speed processing of a large amount of information contribute to increasing the efficiency of the learning process as well.

During the design of multimedia e-learning texts the effort required to learn or process the given modular material is a crucial requirement. Since the student is learning on his own, in a face to face relationship with the text, the given material should be capable of adequately motivating the student.

The discipline of multimedia utilizes the achievements of a variety of scholarly fields including computer science, informatics, pedagogy, instruction technology, communication, information theory, psychology, ergonomy, visual and motion picture culture.

[58] URL: http://elearning.ektf.hu, és http://www.ektf.hu/~forgos/hivatkoz/DALE_piramis.swf

[59] The expression can have the following meanings: performing sensory corrections, eliminating unnecessary movements, the ability to improve the speed of movement, carrying out modifications.

The term multimedia evolved along and reflects the diversity of human perception. Simultaneous impact on several sensory channels is an ancient tool of school demonstration whose interactive potential was maximised by the development of computer science. In order to promote effective learning we recommend the use of multimedia products supporting the learning process.

Multimedia design facilitating the simultaneous impact of media components and the processing of information via the joint presence of written, verbal, still, and motion pictures poses a significant challenge.

Due to digitalization the production, processing, and recording of information is performed by the computer. Information production and dissemination becomes faster through the use of word processors, graphic drawing and editing programs, data base processing programs, and statistics processing and presentation programs.

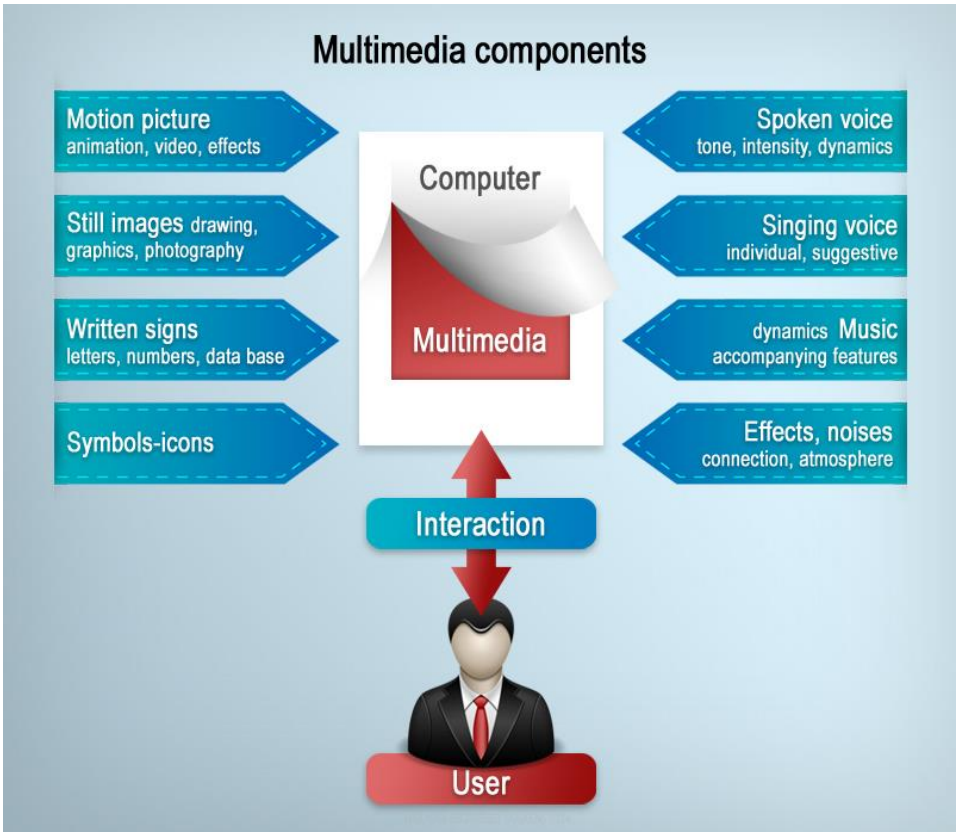

Figure 14: The components of multimedia

Multimedia does not include transmission of information via a variety of channels, but the presentation of *various contents* via visual and auditive means. In order to avoid monomedial transmission textual content has to be coupled with a wide variety of illustrations.

Interactivity is defined as the option and experience of interference in comparison to its opposite, *structuredness* or the edited aspect. In an interactive format the user selects the direction of progress or the next step in the multimedia application according to pre-established connections. Accordingly the reader or user can freely roam or retrieve information within the given context.

Orientation devices facilitate the selection between the interactive and other program offerings.[60]

5.2.5 Processing information provided by electronic media

Textual components of electronic education materials are supplemented not only with still images but with animation, sound, and motion picture as well.

Visual media

Text

Text can promote the *understanding of the picture*, especially when the given picture is not adequate or commentary is limited. At the same time it can hardly be disputed that all text (especially explanations, descriptions of concepts, or addresses) cannot be substituted with pictures. The emergence of electronic text requires a new interpretation of the text concept. In multimedia text can appear in the following format: *information, navigation providing orientation, and an aesthetic element.* The reading of the alphabetic code leads to the formation of meaning.

Typography deals with the creation of the form of textual statement, and the joint arrangement of picture and printed text. Its basic forms are the letters, lines, and spots. *Typography* means writing with types, (typhos in Greek means engraved image, grapho means writing) This expression has been used since the 16th century. Gutenberg called printing as writing without a pen.

[60] Forgó Sándor: *A multimédiás oktatóprogramok minőségének szerepe a médiakompetenciák kialakításában*. (The role of the quality of multimedia instruction programs in the development of media competence) URL: http://www.ofi.hu/tudastar/multimedias (Letöltés: 2012. 05. 07.)

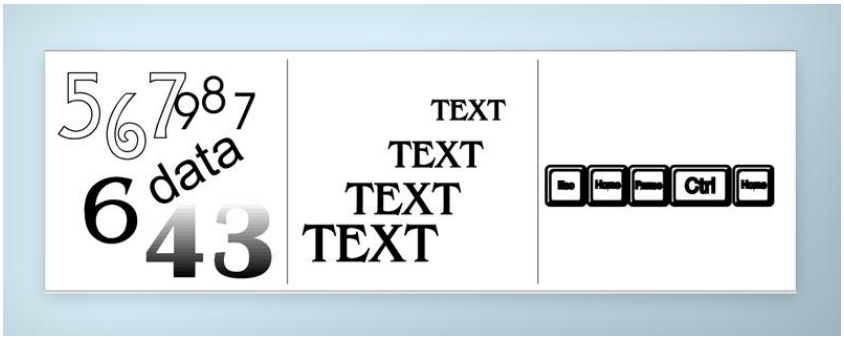

Figure 15: The text as aesthetic, information and navigation component

Printed works reflect the joint impact of covered and blank spaces. The basic form of typography is the sign or the pictogram, which can even be one letter. Even one letter can be judged from a variety of aspects. The given letter can be *informative, serve as an ornament,* can be *neutral, attractive, professional, official,* and even *personal.* Words are composed of letters, and the words form verbal structures or sentences making up lines. Sentences compose textual blocks or paragraphs as the building blocks of a page. Texts are often accompanied with figures. Traditionally figures and text are placed separately, but the respective *connection has to be indicated* as well. Overlapping of text and figure, a means of atmospheric modification, makes reading difficult. Anyone preparing text with a computer should pay attention to the requirements of *readibility* as both the letters and the given document can be continuously altered.

The electronic text

In the next section we provide an overview of the main aspects of processing printed or electronic texts. *These features are similar in many aspects* as the given text can be re-read, or *notes can be prepared* in order to facilitate in depth processing. The image of the typed text can help retention for some students. In case of experienced readers *learning by reading* facilitate selective and flexible information processing. Additional similarities include the size, positioning, highlighting of letters, saturation level background, foreground, colour, and form elements.

When selecting *the type and size of letter* the nature and mood of the given topic, the connection of illustrations and the chosen letter, and readibility play a role.

Printed letters are usually static, impersonal, objective, square shaped, solid, and unequivocal. Written letters are dynamic, personal,

individual, idiosyncratic, soft, and natural. Written letters are rarely used on screens.

Processing (electronic) texts

Research into text perception identifies two levels of the reading process: the *recognition* of letters, words, sentence parts, and sentences on the one hand and sense perception on the other.

Intelligibility and retention are dependent upon textual structure. The dimensions of intelligibility or understanding entail:

- *simplicity* of sentence structure and word selection (short sentences, widely used words, expressions, providing explanation for professional terminology, demonstrations and illustrations),
- *structuring,* logical structuring, (transparency, consistent typograhical solutions),
- conciseness, short informative texts as compared to verbosity or redundancy.

Numbers, data

Most modern multimedia applications *provide a large amount of information* for the user. In addition to textual components *numbers* and data can be included among the multimedia components as well.

Text is primarily a narrative component, numbers as indispensable units of data bases are qualitative, functioning as means of *measurement, comparisons* or *reference.* The respective cognitive content facilitates *fast interpretation*, along with spatial and temporal orientation.

Still image

The expanding horizons and new dimensions of the visible world require new forms of spatial orientation and communication. *Thus pictures are important and effective auxiliary materials* reinforcing the impact of the message even in a black and white form.

The emotion triggering impact of visual impressions was known by the *ancient Greeks*. Nakedness, atrocity, attractive settings or disgusting images influence the feelings of the viewer. The *generation of emotions n*ot only applies to the overall work, but to the given components (dot, line, plane, space, colour) as well.

On a blank sheet any marking can be placed as the components of our visual plane marking system include the dot, line, and the spot. During visual presentation the makers of the explanatory drawings

attempt to provide intelligible descriptions based upon a correlation of dots, lines and spots. During visual presentation the makers of explanatory drawings attempt to provide descriptions reflecting the correlation of dots, lines and spots. The respective correlations provide various effects, tension-release, harmony-disharmony, softness-hardness, in the viewer.

Composition provides the structure of the picture. The elements of the composition: objects, lines, tone, colour, position and the relation of certain details to the surroundings shape the attention directed at the given picture. The composition of a picture can be symmetric, *asymmetric, diagonal, triangular, multiangled, contrastive, regular, tense, settled, disjointed, proportional etc.*

The dot is the basic unit of a composition. Dots comprise the composition. A dot written on a blank sheet not only exists by itself, but in the multidirectional referential framework made up by the picture components.

Lines can represent both sense and emotion *in a given composition.* Lines created by the movement of the dot can help in explaining or presenting the structure and reveal information about the maker's personality and current psychological state.

Spots are forms indicated with a unique outline contrasting effect. Spots evolve from a mass of dots or the accumulation of lines along the plane. If the spots are accumulated in space, three dimensional geometric objects are created.

Mass refers to the external form and internal content of material objects.The concept expresses symmetry and rhythm. The structuring of mass can help in reducing the monotonous appearance of large surfaces along with increasing the given aesthetic value. The interplay of light and shadow intensify the plasticity effect.

Light and colour: Researchers of etiology, the examination of the biological foundation of behaviour have confirmed the crucial role of colours, especially in the animal world in such fields as hiding, camouflaging, or drawing attention to oneself. Since colour is a crucial biological stimulus, it has a definitive role in case of still images as well.

Colours can convey messages as in addition to physiological impact the types of colours and attendant associational and *symbolic meanings* present a tremendous emotional stimulus with a capacity of seriously impacting one's emotional state. Colours can have three kinds of effects:

- characteristic,
- associative,
- symbolic.

Characteristic effects generally refer to the *connection* of a given colour with a *personality trait* reflecting the dynamics of a relation.

As a result of the *associative* effect the emotional charge of a *pleasant or unpleasant experience* is carried by a colour. This can be connected either with a natural phenomenon, object, or person. Accordingly the memory focuses on the colour, and the experience remains in the background.

Symbolic effects are coupled with various emotions related the *society, history, and nation*. The symbol system varies along the respective cultures and civilizations.

The impact of colours. The various colours can impact the human nervous system in a different manner. Colours have been allocated into various categories according the respective effects. The knowledge of the impact of colours is crucial for making visual statements in an appropriate manner.

Black, green, and blue are considered cold colours, while the red and yellow fall in the category of warm colours. Exposure to cold colours reduces the pulse rate, while warm colours intensify the physiological functions. Coloured screens have a major advantage, the presentation of information in greater depth and definition.

Symbols, emblems, icons, pictograms, logos

The capability of *non-verbal communication* to broadcast human thoughts and emotions effectively is continuously being recognized today. Consequently, we are witnessing the rise of a national *sign system* similar to that of body language, an *international sign system* or the visual Esperanto. *Pictorial signs* conveying wider meaning have always been in use. The oldest forms of picture-based writing are *pictograms, ideograms, hyeroglyphics, and our national heritage, runic writing.*

Psychology and reading psychology related research have confirmed that pictorial elements can exert greater impact than words. Texts are interpreted word by word, sentence by sentence, and line by line, but pictures (worth a thousand words according to the Chinese) impact the reader faster or almost immediately.

- *Symbols* are graphic signs developed by a field of scholarly discipline and the *abstraction evolved into a picture*. Its interpretration is based on consensus (symbols of men and women)
- *Emblems* are codes of visual communication promoting the *transmission of meaning* or can take the form of *symbolic*

drawings accompanied with a motto, or can appear as a special sign.

- *Pictograms* are simplified, logic-based, easily intelligible drawings forwarding thoughts or *sentence-level communication*.
- *Icons* are signs referring to the respective *sign object (signified)* according to an external pictorial correlation forming pictorial communication systems. The iconic signs *refer* to the *original meaning*, emphasizing the essential features of the described phenomenon.
- *Logos* are *trade mark protected* or *registered brand marks*, *signs substituting speech.* The term logo or logotypy refers to a word or a few letters identifying an organisation or institution. Trademarks are registered signs propagated via advertisements in order to distinguish various products.

While Arnheim[61] believes that readily available pictures weaken the formation of abstraction ability, visual components are crucial aspects of the efficiency of multimedia productions. Designers of multimedia should always remember that sight or visual impression is provided by composition determined by content. This message can serve as a guideline for grouping the appropriate components.

Descriptions in 3D

Three dimensional descriptions of various illustrative charts, diagrams and models facilitate the understanding of the text. The role of graphs and models is especially important in disciplines connected with technological sciences. Such constructs have a higlight effect and facilitate plastic presentation.Three dimensional modeling can take place in three forms:

- *Wire structure modelling* (describing the outlines of the 3D model): This type of description does not provide surfaces, only lines, arches or circles provide the body of the outline of the object.
- During *surface modelling* an expendable thin layer is allocated to the surface of the object.
- *Solid object modelling* is the highest form of 3D modelling efforts. It is basically a computerised presentation of a fully closed three

[61] ARNHEIM R.: Vizuális médiumok értékei és hiányosságai. (The values and deficiencies of visual media) In: Tanulmányok az oktatástechnológia köréből. Szerk.: Falus I. Bp., Tk. 1982.

dimensional figure describing the occupied space and the bordering surface of the real object.

Animation

The original meaning of the term is *bringing pictures to life*. According to functions in a multimedia production animation is related to film and still image. While by the help of animation we can present much more information than with simple graphic pages, the capacity of the computer should not be increased to that of the level processing video components.

Evoking viewer attention is a crucial component of multimedia productions. Animations are considered the *second most intensive attention provoking components after sound effects*. The revolving, moving objects and frames reflecting vividness provide additional colour to the applications.

During the use of celluloid films the real film scenes were drawn, painted and combined with pictures. Today this function is performed by computerised animation. Animations usually require 2 to 8 frames. While two frame animations are based on a simple exchange of pictures and applied to describe two states of events, multiframe animation reflects continuity. Animations can appear in the following transitory forms:

- *Motion blur:* fading in time, forming the transition
- *Morphing:* used for creating intervals in the picture transition process. A transition is created between pictures created by camera or electronic means spanning from the starting position until the final destination. It differs from the fading effect to the extent that not only the colour of the pixels is run through, but the *distorted version of the picture* as well. The computer inserts transitory frames within the two basic images as one of the best-known examples, Michael Jackson's "Black or White" clip shows.
- The *metamorphosis* entails a temporal aspect as well. Accordingly it takes a few frames during which a cube is transformed into a sphere. A beautifully produced metamorphosis can fascinate the viewer as it is new, shocking, and surrealistic at the same time.

Command sequences

Command sequences are *designed for running a program* and *enabling the user to reflect* on the program. This option is presented by a

sensitive part of the screen promoting interaction. Since there are no relevant standards, the proper arrangement of user surfaces is crucial. *An arrow pointing right indicates the next page*, o*r an arrow pointing upward* refers to the starting position or the main menu. The pictograms usually symbolize the command features of electronic devices(i.e the stop, play, pause, forward, rewind buttons). The sensitivity of the surfaces can be indicated in a variety of ways ranging from the click here messages to the modification of the mouse cursor.

Active surfaces enable the user to run the multimedia production. Active surfaces can take the shape of any geometric form as they help the user to gain *a sense of adventure*.

The crucial action buttons include the movement forward, and backward, or the jumping to the first and last point. Let us summarize the most important aspects of media components! Designers have to observe the following criteria system pertaining to screen message design:[62]

- During the design of graphic elements the size and proportion of the screen have to be taken into consideration!

  The screen must contain adequate amount of space, the picture should have a spacey feeling.
- Take advantage of the reusability of the screen!
- Be consistent regarding the placement and function of screen components!
- Important information has to be highlighted and ranked!
- We should use clear, good size, and readable letter types.
- Textual arrangement should promote readability and the identification of information!
- Select impressive colours!
- Design should take into consideration the strengths of the medium, downplay the potential weak sides!

5.2.6 Sound (speech and music)

Sound materials enliven and increase the effectiveness of multimedia productions. Sound is the most plastic device of multimedia productions. *It has a simultaneous impact on the sense and emotion* of the user. It broadcasts *content and metacommunicational elements*, provides

[62] G. I. RIMAR: Vezérelvek a képernyőn megjelenő oktatóprogramok tervezéséhez. (Guiding principles for screen-based instruction programs) OIT. Hundidac. 1997. 20–25.

information on the language and its user. *Intonation* refers to emphasizing one aspect of the message, while *the speed of speech, the tune* or *musicality of the sentence,* and *the tone* together allude to the characteristic features of the actor. Sound can take the form of *whispering, yelling, animal sound*, but can also appear as *pleasant music,* a surprising special effect, or a dramatic underscore.

Speech helps interpretation and supports the visual elements. Human voice is more powerful than written information as the spoken word can convey emotion or authenticity via adding a stress or adequate intonation to the message.

Audio materials serving *instruction* purposes should have appropriate, *assessable quality and integration capability* into the system. The effectiveness of the sound component is increased by the inclusion of charismatic, convincing, and authentic persons into the program. Furthermore, the *new and heretofore unknown information should not dominate the production* as the discouraged user can give up on listening or on intellectual processing. Audio elements should have *appropriate length* as after a certain time the program can become boring for the user.

We often use *background music* complemented with special sound effects and simple explanatory text. Good background music *can create a mood* or *atmosphere, stress certain elements, anticipate, remind the viewer* and *reinforce the message* without separating the auditive and visual impact during processing. Background music should be compatible with the topic, mood, and rhythm of the given production.

5.2.7 Motion picture in multimedia

The smallest independent unit of film and video is the picture. The temporal composition is the setting paralleling the word in spoken language, while the montage-based *picture sequence* is the equal of the *sentence.* The picture frame is a window to the world, the detail formed by the frame in space is called the plan, or close up. The measure of close ups is the described human itself. *Half or full close ups* penetrate into the topic, while distant pictures remove us from the actual theme. *The structure of the framed picture is the composition*. Visual communication (motion picture) also includes *basic units of composition complemented by motion and time components*.(narrowing, expansion of time).

The presentation of movement is the essential component of motion picture production. The actors or objects are moving within a frame, the given images became darker or lighter, or one picture fades into another, All this means movement. Movement can take place in the depth or

plane of the picture. Camera can be moved around the axis (panorama), in plane (carting), or in spatial movement (craning). Changing focal distance (zoom) can modify close ups or picture depth.

In multimedia movement provides dynamics to the picture. If the camera recording is not smooth or steady, the picture will be shaky. Zooming distance reflects the given approach to a respective theme. In panoramic pictures the shaky presentation can be avoided. In a tele photo lens position the camera can shake in the hands of he cameraman or cinematographer.

Montage or editing can express associations, contrasts, similarity, and rhythm, The recorded scenes are of varying length.

In order to achieve visual transition we use motion, animation, and effects. These not only serve information transmission purposes, but help the user to experience the feeling of action and interactivity within a given episode. While these effects are useful, they should not distort content.

Light is not only a vital life source of the film, but through its play with *shadows* the space and mood are conveyed as well.

The colours of the video can have important effects. *Colours* can express happiness, sadness, or even indifference. The presence of colour on the screen carries messages or adds mood to the topic.

Visual skill surveys and media research both confirm that a shorter presentation is more effective than long productions.

5.2.8 The program structure

Preparation of hypermedia productions yielded substantial preliminary experience for early designers of multimedia. Hypermedia refers to"dividing the text into small interconnected units or nodes facilitating user selection."[63]

The structure of the educational material is always composed by units, made up by modules designed for a single occasion containing nodes[64] The episodes[65]are the building blocks of nodes. Nodes form modules. In multimedia such modules have to facilitate easy learning via presenting

[63] CRAIG LOCATIS–JAMES CHARUHAS–RICHARD BANVARD: *Hipervideo*. Educational Technology Research and Development. 1990, Vol. 38. No. 2. 41–49.

[64] Nodes can contain one or more pictures, moving episodes (computer or video animation), sound accompaniment, or no sound) The presentation of the audiovisual information in the node depends on the presentation of the information in the given context.

[65] Episodes are such textual units which can be interpreted separately, have a message value, but their size makes them suitable as screen messages. The size of the episodes is connected with the node size both in hyper and multimedia. Their aim is to provide information in intelligible units, but they cannot be longer than necessary.

nodes or units containing well described and easily accessible texts. Since individual learning implies a face to face connection with the text, education materials have to provide adequate motivation. The multimedia structure includes the following elements:

- introduction(Title)
- Opening picture (Welcome)
- Main menu (Start)
- menu points
- subchapters
- modules/nodes/episodes
- other options: prompter demo function, tutor, namecard

The figure below shows the textual modules as the composite units of the educational material.

This was ideally connected later to international standards, the SDK.[66] (The episode can also be considered atomic units, nodes are sheets, and modules are sessions.). Note: This structuring can be connected with the *micro-learning* concept used during mobile learning efforts. If we want to match it with the SCORM[67] terminology, the two lower levels are compatible. (In this case the episode, or the atomic unit, or asset are adequate concepts).

[66] KÖNCZÖL Tamás: The Sulinet Learning Methodology and Competence Centre, in short, eSulinet Centre, performs ICT competence development in a new organisational framework by extending the current tasks and target groups in the Hungarian education system..

[67] A SCORM (**S**harable **C**ontent **O**bject **R**eference **M**odel, was created by the ADL (Advanced Distributed Learning) organisation belonging to the Department of Defense. The purpose of the model is the reuse and standardization of learning content.

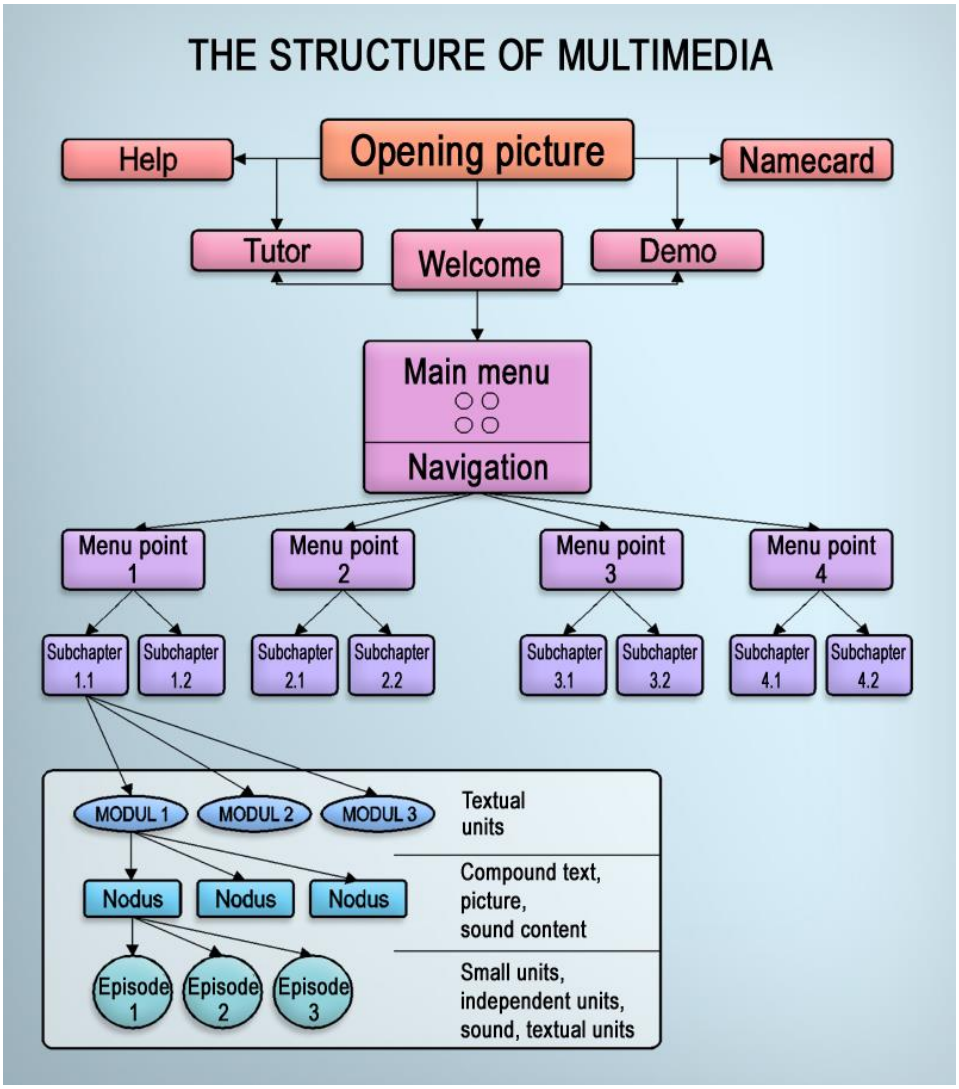

Figure 16: The general aspects of a multimedia text

5.3 SUMMARY, QUESTIONS

5.3.1 Summary

The chapter familiarised students with the historical development and evolution of demonstration and illustration along with modern 21st century learning contexts and the main features of illustration with multimedia.

Additional information included the Dale pyramid of cognition and experience and its adaptation to the electronic learning contexts of the present. Students also learned about the main features of processing information provided by electronic media along with the principal aspects of visual, auditive, and audiovisual media.Furthermore, students could gain knowledge about the means of elaborating multimedia program structures.

5.3.2 Self-test questions

- What are the main features of 21st century learning contexts?
- What is the role of demonstration in cognitive processes?
- Describe the Dale pyramid and apply it to multimedia!
- Describe how multimedia can function as the extension of demonstration and illustration efforts.
- What are the main aspects of processing information via the visual, auditive, and audiovisual media elements?

6. THE CONCEPTUAL SYSTEM AND METHODOLOGY OF E-LEARNING, THE SOCIAL MEDIA.[68]

6.1 OBJECTIVES AND COMPETENCES

The lesson aims to familiarise students with the conceptual system and methodology of e-Learning. Students should be aware of the modern learning contexts of the 21st century and learn about the components of e-learning, and the main aspects of e-learning solutions. Furthermore the chapter will focus on the differences between traditional and social media while imparting skills pertaining to network-based learning and the use of new media systems.

Chapter content:

- Introduction
- Forms of electronic learning
- The components of the e-Learning process
- The interpretation of the E-Learning concept
- Blended learning
- The main aspects of e-Learning solutions
- Text editing and learning management systems
- Network-based learning

[68] Forgó Sándor: Az elektronikus tanítás eszközei és módszerei (The devices and methods of electronic learning). In: Elektronikus tananyagfejlesztés (szerk.: Czeglédi L.): Líceum Kiadó, Eger, 2011. pp. 41-64

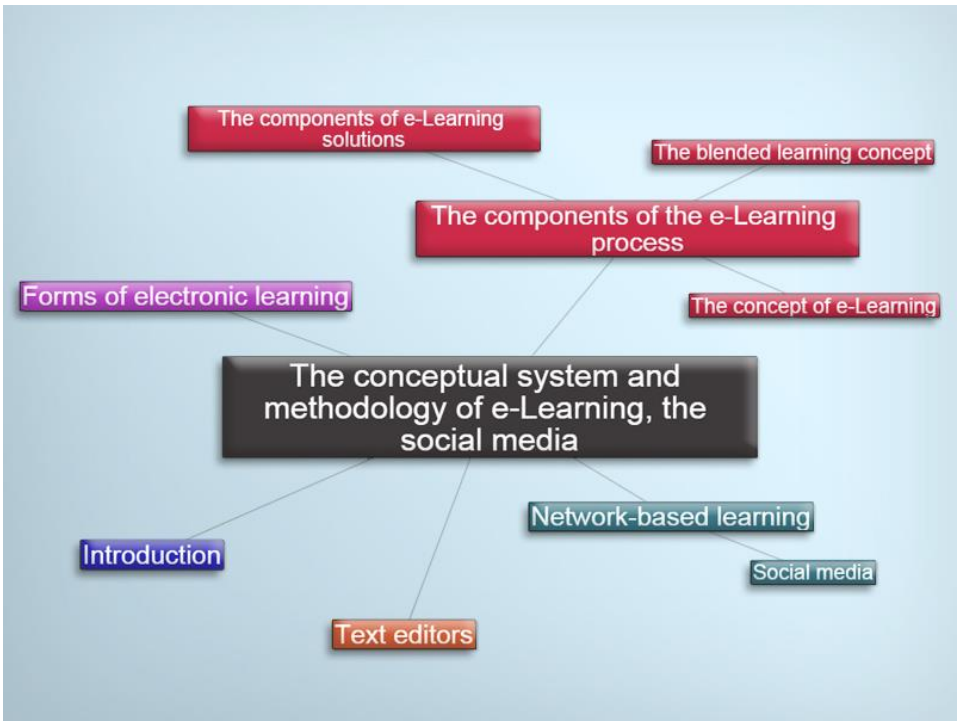

Figure 17: Conceptual map to Lesson 6

6.2 COURSE MATERIAL

6.2.1 Introduction

Social arrangements of the internet-based community have impacted the education process, especially electronic learning forms. Students have developed media products including blogs, forums, community web-pages, and content sharing programs, which can be characterised as uncontrolled resources of the non-governmental sphere. Such multimedia based interactive packages promoting individual and community action were elaborated via new media devices forwarding content via a variety of channels including webpages, interactive television, and mobil phones.

Digitalization, which at first revolutionized content processing and communication via local media has developed new forms of network based communication, among them the web 2.0 based social arrangement and learning formats and learner centred web-environments (e-learning 2.0). The wealth of media and interactivity provided by new

television technologies enable the viewer to take part in an experience supported simultaneously by the computer and the television. This lesson explores the theoretical and practical aspects of New Media brought about by the convergence and diversification of media technologies. New Media promotes individual and community action in a network-based, interactive multimedia context.[69]

6.2.2 Electronic learning formats

While distance learning primarily utilizes printed materials (textbooks and lecture notes), Computer Based Training (CBT) schemes have penetrated public and adult education.

TBT, or Technology Based Teaching emerged in the Anglo-Saxon world due to the integration of traditional instruction technology, modern information technology and learning theories, and personality development programs. However, TBT utilized other areas as well including programmed instruction, instructional technology, pedagogical technology, and communication theory.

Open learning forms containing flexible and more accessible components than their traditional counterparts also played a significant role in the development of TBT. The main features of TBT and CBT systems prove that technology supported learning should be an externally directed process. Interactive technology increases student control and promotes repeated or periodic repetition and reviewing of the given material.

TBT is an educational method or technology combining traditional information carriers with the latest versions utilizing high technology (interactive CD, video, computer).

It serves both traditional teaching and person-centered education by accelerating the instruction process while providing consistently high quality instruction in general and professionally specialized subjects.

While previously the focus was on teachers and teaching, today the learner and the learning process have become the subject of scholarly inquiry. Consequently, the respective terminology changed as well, as instruction was substituted with learning, thereby implying student centredness. The subsequent greater freedom of the learner implies greater levels of responsibility as well This philosophy and educational approach led to the development of CBL or CAL, (computer based or assisted learning) materials and programs.

[69] Forgó Sándor: Az új média és az elektronikus tanulás. (New media and electronic learning) In: *Új pedagógiai szemle*, 59. évf. 8/9. sz. (2009), p. 91-97.

- CBT refers to computer assisted knowledge acquisition (medial learning). The learning process utilizes a variety of presentation forms (graphics, animation, motion picture, data base) in an interactive, dialogic form. The program has an intelligent theme structure, high interactivity, and user-friendly appearance.

The interpretation of concepts

CAL (**C**omputer **A**ided **L**earning): learning assisted by the computer.

CBL (**C**omputer **B**ased **L**earning): an umbrella term for all computer supported instruction/training formats, educational materials or instruction technology devices.

CMI (**C**omputer **M**anaged **I**nstruction): the learning process is arranged by the computer, the student is not in direct connection with the computer, the machine does not store educational materials, it registers student related data and provides external support for the management of the learning process.

CBI (**C**omputer **B**ased **I**nstruction): instruction which fully utilizes the computer.

CAI (**C**omputer **A**ided **I**nstruction): in case of computerized or computer assisted instruction the computer itself fulfils instruction functions storing content and learning management related information while helping teachers in solving a variety of didactic tasks.

WBT (**W**eb **B**ased **T**raining): Currently web-based training schemes include asynchronous teaching and instruction and the asynchronous student collaboration options.

The application of appropriately designed instructional software can make computer-based educational materials the most effective devices for supporting individual learning, including open and distance learning schemes.

Learning this way provides a sense of immediate achievement for the learner thereby reinforcing learning motivation encouraging individual knowledge acquisition as well. The method is ideal for individual or group learning or for presentation purposes. Along with being cost effective its versatility makes it suitable for the preparation and evaluation of class assignments as well.

A learner can maintain connections with a CBT program on various levels ranging from the communication level via use and application to the developer-programmer level.CBT is not only suitable for the transmission of knowledge, but promotes the mastery of more complex

skills. Students mostly prefer a combination of CBT and personal face to face instruction. One of the proven best methods is the establishment of a didactic connection between teacher presentation and group discussion options.

6.2.3 The components of the e-Learning process

The interpretation of the e-Learning concept

In e-Learning-supported mixed instructional schemes the spatial and temporal boundaries are implemented by digital (off-line, on-line) technology utilizing the CD-ROM, DVD, and Internet which as an alternative to traditional educational materials play a continuously increasing role in the education process.

According to András Benedek: "The technological background is a crucial aspect of the e-Learning problem. While Hungary keeps pace with international developments, the theoretical and practical aspects of e-Learning are not integrated into a coherent strategy."[70]

The primary aspect of electronic learning is independent or individual learning. This new system calls on the teacher to design the educational materials in a way suitable for autonomous processing outside the classroom.

e-Learning-related curricular development efforts in Hungary at first were primarily supported by informatics experts and projects utilizing international experience, trends and standards. In time as the history of e-Learning forums[71]illustrates (distance) learning experts appeared. In the beginning e-Learning gained a foothold in the enterprise sphere branching into public, adult, and higher education programs later.

e-Learning programs were primarily designed to take the place of correspondence instruction schemes. At first the programs were organized from the top, in a regular form providing a framework for the uploaded educational materials and to the uploading process itself along with course management and shared communication. Soon e-Learning penetrated full time programs in a complementary or blended manner.

The emergence of the Internet and the subsequent widespread popularity of its web-based services (Web 1.0!) – not only impacted the economy and the forms of communication, but promoted the

[70] Benedek András: E-learning stratégiák (e-Learning strategies) In: *Az eLearning szerepe a felnőttoktatásban és a képzésben.* (The role of e-Learning in adult education and training) Szerk. Harangi L., Kelner G.. Budapest, Magyar Pedagógiai Társaság Felnőttnevelési Szakosztály, 2003. p. 6–7.

[71] *eLearning forums*. URL: http://elearning.sztaki.hu/archivum (Letöltés: 2014. 05. 18.)

enhancement of the arsenal of both teachers and learners. At first educational materials or learning content were made available only in the form of non-interactive textual, illustrated or multimedia products. Students participated in the process as passive receivers of downloaded information. In addition to transmitting knowledge and fulfilling adminstrative tasks learning management systems promoted increasing student activity within pre-set frameworks.

- **e-Learning is a computer network-facilitated training format independent from spatial and temporal limits. The program utilizing effective and optimal knowledge acquisition and learning methods integrates educational materials, learning resources, tutor-student communication, and computerised interactive software into a unified framework system accessible for learners.**[72]

Blended learning as a demonstration option and method

Mixed learning forms (*blended learning*) exceed classroom boundaries as the use of ICT facilitate both formal and informal learning in a learner centred manner while promoting both individual and community based, directed and discovery oriented, synchronous and asynchronous and independing learning efforts.

As Allison Rosett asserts blended learning is assisted by work shop efforts, consultations, learner support features, online classrooms, and decision making support options.

[72] Forgó Sándor: wikipédia

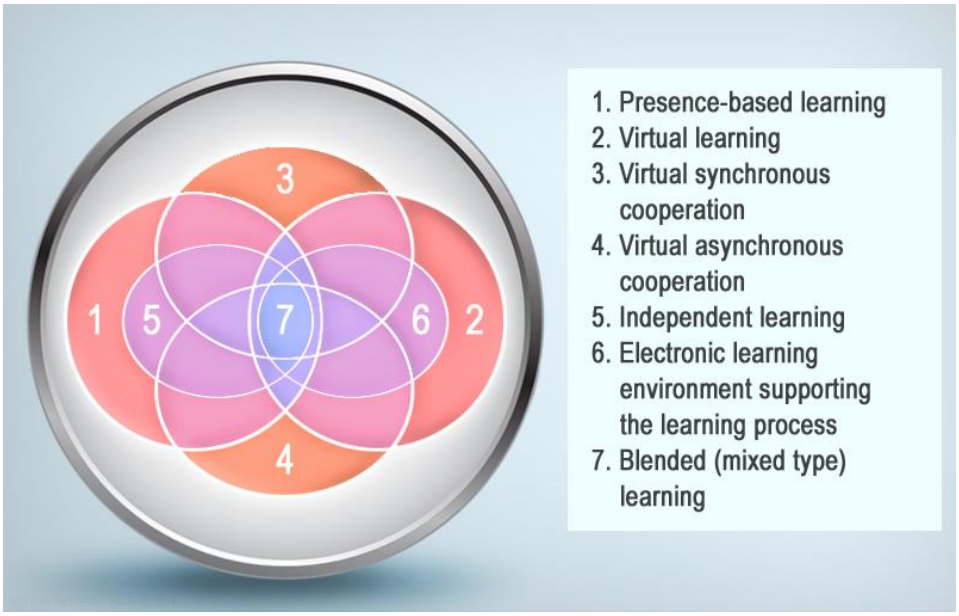

Figure 18: The components of blended learning

Blended learning is a learning and instruction theory and methodology-based info-pedagogy strategy facilitating optimal knowledge acquisition in a spatially and temporally independent manner via the integration of a variety of cognitive and communicative functions and capabilities.

Blended learning programs have developed from traditional face to face instruction and consultation schemes along with the electronic learning environments and instructional materials of distance education.

The components of the e-Learning process [73]

e-Learning texts

Traditional paper based educational materials are not ideal for continuous further training since the printing and selling of the given text is time consuming and the respective knowledge can become obsolete by the time it reaches the students. Off-line technology based information carriers have similar limitations as an educational material stored on a CD-ROM cannot be modified after completion. New information can only

[73] Forgó Sándor: Az elektronikus tanítás eszközei és módszerei (The devices and methods of e-Learning). In: Elektronikus tananyagfejlesztés (szerk.: Czeglédi L.): Líceum Kiadó, Eger, 2011. pp. 41-64

be conveyed by making a new CD, which is faster than book printing, but its dissemination is expensive and requires considerable time.

The emergence of the Internet and the increasing prevalence of electronic network applications contribute to the fulfilment of the technological and methodological needs of distance education.

Framework systems and instruction software

Electronic learning environments require the application of software and server making the transmission and registration of the given text possible. Let's explain the respective concepts!

The e-Learning framework system is a computerised software facilitating the performance and organisation of personalized learning efforts via local and global services integrated into a computerised network. Framework systems provide help in the dissemination of the educational materials, the management of the students and the learning process and the fulfilment of support and complementary tasks.

Actors in the e-Learning process

Apart from the most essential component, the learner, comprehensive e-Learning schemes include[74]:

- System managers – responsible for the operation and maintenance of the e-Learning infrastructure
- Instructional administrators – responsible for the continuous monitoring of the instruction process, the enrolment of students, the compilation of training programs, and the identification of new training needs
- Instructors – responsible for the handling of problems, questions pertaining to students, the compilation and updating of the content of educational materials.
- Text developers – responsible for the conversion of traditional texts into electronic educational materials and the respective maintenance tasks.

The components of e-Learning

One of the most important functions of standardisation is the facilitation of harmonius cooperation of the components of Internet-based instruction schemes. The components are not necessarily provided by

[74] Hídvégi Péter: *E-learning megoldások*. (e-Learning solutions)URL: http://www.ofi.hu/tudastar/tanulas-kora/learning-megoldasok (Letöltés: 2011. 05. 18.)

one firm, and it is possible that an e-Learning program integrates the products of various firms. In this case the smooth communication and data exchange between the elements are assured by standards. Standards are regulations entailing rationalization, quality assurance, safety, environmental protection, and communication development requirements in the field of industry, technology, science, and public administration.

The most important components or e-Learning schemes are:

1. *Learning Management System*. This system provides the instruction surface indispensable for Internet-based education.
2. *Text*. CBT instruction unit whose structure and components are regulated by standards.
3. *Meta data*. Data facilitating data base search.
4. *Author software*. It is responsible for the production of educational materials, the sequencing of components according to standardized patterns, and the grouping of components optimalising the learning process. Author software can inlude integrated test preparation components.
5. *General components*
   a) *Browser*. It allows anytime, anywhere access to the learning material.
   b) *Connection point*. Learning management systems have connection points facilitating data exchange and the data processing with other systems, the web page of a different service provider, and with another data base or ERP system.

6.2.4 Learning content management and learning management systems

Learning content management systems (LCMS) are suitable for the production of standardized educational materials along with facilitaing course design, lesson delivery, and testing. The system facilitates knowledge acquisition via the production of the main and complementary tier version of the given text. Such effort does not even require a SCORM display equipment as a browser can provide access even in off-line situations.

The eXe Editor is one of the most frequently used learning content management systems. In comparison to other web editing programs it does not require a long training process and provides a variety of options in a much simpler way. The program contains several built-in features including the test preparation or rss reader functions.

Learning management frameworks are web-based systems facilitating the systemization and storage of educational materials, support texts, or any objects pertaining to learning.(Wikipedia).

The system has to meet the following requirements or perform these tasks:

- facilitating enrolment, notification of admission
- overlooking the types and the framework system functions related to scheduled courses both from a tutorial and learner point of view
- harmonising learning support functions and demands
- means of testing, or administration of examinations with automatic or instruction supervision, the storage of the results
- criteria system for statistics and reports
- the configuration of the framework system
- personalized profile
- data entry
- instruction function

Open source free software facilitating flexible and dynamic text development, the application of cooperative methods, the guaranteeing of communication forms, evaluation and administration, (ILIAS, MOODLE) have enjoyed greater use since the millenium..[75] Recently MOODLE has become prevalent in the Hungarian higher education sphere.

6.2.5Web-based learning

5. Main text: Sándor Forgó: Az új média és az elektronikus tanulás New Media and electronic learning.Új Pedagógiai Szemle. 8-9. sz. 2009 94. URL

The social media

The emerging Web 2.0 solutions have converted the previous users or the consumers of Web 1.0 into content providers. Consequently, the heretofore unidirectional web-based communication became multi-directional facilitating the sharing of digital content, texts, pictures, videos, sound recordings, and links.

[75] A magyar MoodleMoot konferenciák, valamint a magyar Moodle közösség oldala: http://moodlemoot.kfrtkf.hu (Letöltés: 2011. 05. 18.)The social webpage of Hungarian MoodleMoot conferences and the Hungarian Moodle community
The availability of the Moodle starting page: http://moodle.lap.hu (Letöltés: 2011. 05. 18.)

The increasing prevalence of social applications changed the Internet from a mere provider of information to a new socialization space for the students of the 21st century.

The web 2.0 and the attendant interactivity integrate previously isolated users into a social space where information can be mutually prepared or shared.

According to Tim Berners-Lee[76] the term web 2.0 is only an example of professional jargon and the previous web 1.0 served the purpose of connecting people. Consequently, no one has a clear definition of the concept and the main difference between the two versions is the speed and the extent of data transmission capacity.

While no clear distinction can be made between the web generations, the primary feature of the web 2.0 is community orientedness. Accordingly users are making or sharing content together. A tagging process helps us to establish additional categories.

> The tag is a free key word fulfilling marking function. Compared to classic hierarchic taxonomies (i.e. decimal library systems) tags are unorganized and have equal value. Tags can be integrated into tag clouds where their appearance is proportional to their presence in a given text.

The following figure shows the tags associated with the concepts pertaining to electronic learning.The cloud view or the size of letters represent the proportional presence of the given words.

6. Reading: Web 2.0 in instruction available here itt

[76] Developer Works Interviews: Tim Berners-Lee: http://www.ibm.com/developerworks/podcast/dwi/cm-int082206txt.html [elektronikus dokumentum] (Hozzáférés ideje: 2014. 07.09.)

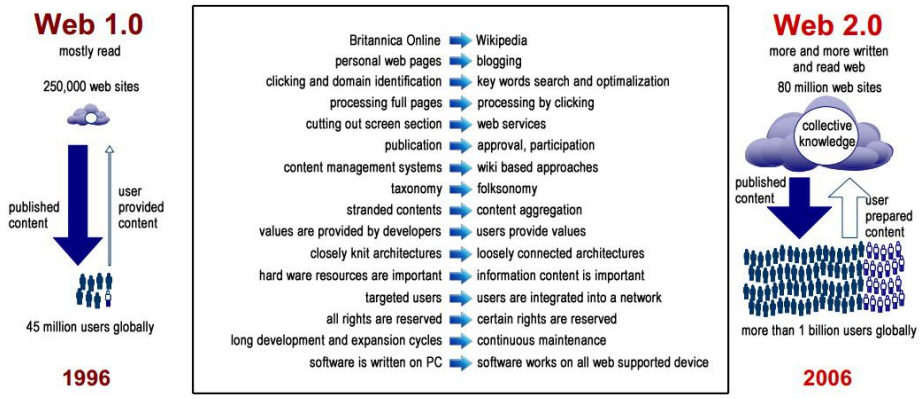

Figure 19 The main features of transition from web 1.0 to web 2.0[77]

Social media is a ”group of internet applications built on the ideological and technological foundations of web 2.0 facilitating the formation and transformation of user prepared content”.[78]

Social media and new type e-Learning

The web 2.0 based social or community arrangement format facilitating and encouraging participation is not only suitable for unidirectional reception and processing, but it can advance the user into the status of writer, or editor. Thus it can also impact the learning process.

The web 2.0-based learner centred context converts the users into a knowledge development community via connecting network contents on a simple web surface, The theoretical background of the e-Learning 2.0 is provided by connectivism, the learning theory of the digital age.

By now the web 2.0 services enabling the user communities to prepare, share, or criticize content have made their impact felt on the field of e-Learning. Digitalization, at first revolutionizing local media-based content processing and communication has by now contributed to the emergence of learner centred e-Learning 2.0 environments inspired

[77] Krauth Péter, Kömlődi Ferenc: A Web 2.0 jelenség (és ami mögötte van) (The web 2.0 phenomenon and its background) http://www.nhit-it3.hu/images/tagandpublish/Files/it3-2-2-2.pdf [elektronikus dokumentum] (Hozzáférés ideje: 2014. 07.09.)

[78] Forrás: Kaplan Andreas Kaplan és Michael Haenlein Wikipédia http://en.wikipedia.org/wiki/Andreas_ (Hozzáférés ideje: 2014. 07.09.)

by the contemporary social and community arrangements provided by the web 2.0. The increasing availability of the Internet, (in the first half of 2008 46% of the Hungarian population used the Internet) gave rise to a new generation of screenagers or downloaders who use digital devices on an everyday basis, are at home at the world wide web, and possess basic ICT competences. They prefer instant, optimally timed information acquisition (learning, acquiring multimedia content), have developed wide social networks encouraging sharing of prepared or downloaded content.

Thus the previously defined e.Learning concept needs to be reconsidered after the emergence of the e-Learning 2.0 version.[79]

The reconsidered definition of e-Learning will touch upon cardinal aspects of traditional pedagogical approaches.

- The question of arranging the ”teaching-learning process” has to be reconsidered.
- The integration of the educational material into a unified framework.
- Providing exclusive access to educational materials.

Thus in light of the e-Learning 2.0, and the emergence of *new media* the previous definitions should be reconsidered. However, Zsolt Kulcsár asserts:”*Despite all these technological innovations we have to accept that the web 2.0 primarily provides not technological changes, but the renewal of user attitudes*.”[80]

- **e-Learning 2.0 is a learner-centred, irregularly organised knowledge acquisition context facilitating learner autonomy and knowledge exchange. The collaborative system is not hierarchic, but multidirectional, decentralized, and multi-channeled and its main goal is the promotion of the creativity of the learner.**

6.3 SUMMARY, QUESTIONS

6.3.1 Summary

The lesson familiarised students with the conceptual system and methodology of electronic learning along with the modern learning contexts of the 21st century. Students obtained knowledge concerning

[79] Forgó Sándor: Az eLearning fogalma. In: (The concept of e-Learning)*E-learning 2005*. Szerk. Hutter Otttó, Magyar Gábor, Mlinarics József. Budapest, Műszaki Könyvk., 2005. p. 14.

[80] Kulcsár Zsolt: *Az integratív e-learning felé*. (Towards integrative e-Learning) URL: http://mek.oszk.hu/06600/06695/06695.pdf (Letöltés: 2011. 05. 18.)

the components of e-Learning, the conceptual system of blended learning, and components of e-Learning solutions. Furthermore, the chapter focused on the difference between traditional and social media while acquiring skills related to network-based learning and the use of new media systems.

6.3.2 Self-test questions

- Define the concept of e-Learning!
- Describe the didactic categorization of educational materials!
- What do we call multimedia?
- What are the main features of multimedia?
- How would you define the e-Learning 2.0 concept?

7. THE PROCESS OF ELECTRONIC EDUCATIONAL MATERIAL DESIGN, E-LEARNING STANDARDS, STANDARDIZED E-LEARNING TEXTS.

7.1.1 Objectives and competences

The aim of the lesson is to familiarize students with the theoretical questions of electronic text design, the structure of electronic texts, the preparation of scripts, and the technological, genre, and didactics requirements of e-texts. Moreover, students will have a clear knowledge on the conceptual system of e-learning standards, and the main features of the most important standards

Contents:

- The process of electronic educational material design and media genre issues
- Scripts of media components
- Technological requirements of e-Learning texts
- Didactic and methodological questions and technological criteria
- e-Learning standards
- Issues of instruction theory
- What is e-Learning?
- The conceptual system of e-Learning
- The advantages of the standardization process
- The structure of electronic instruction programs

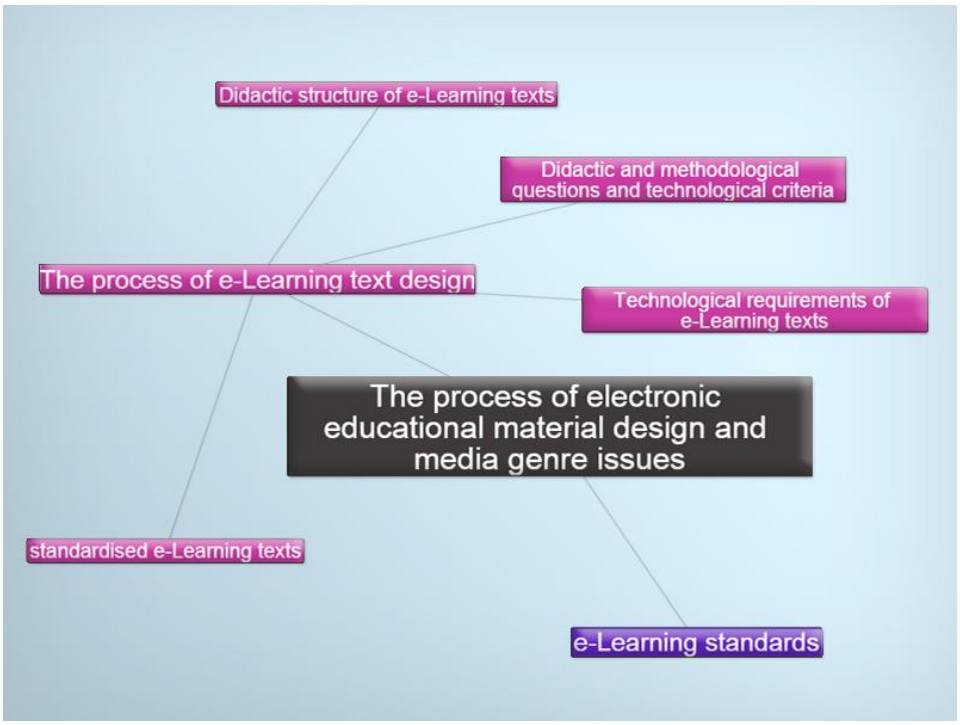

Figure 20: Conceptual map to Lesson 7

7.2 THE PROCESS OF ELECTRONICTEXT DESIGN AND MEDIA GENRE ISSUES

The didactic and methodological aspects and technological conditions of electronic text design

During project design the following aspects have to be kept in mind:

1. The clarification of the general principles of the system for management.
2. The clarification of the general principles of the system for the staff
3. The elaboration of the methodological structure
4. The elaboration of the didactic structure.
5. The exploration of the features of text editing programs (methodologically complete blocks, simple structure, variety of export methods).
6. Selection of text editing program (i.e. eXe Editor).

7. The introduction of the expectations concerning the learning management (framework system) system.
8. Didactic structures and media.
9. Scripts of media components.

Didactic structure of texts

I. Parts of the introduction: course objective, the concise description of the course, competences and requirements, learning advice, information.

II. **Lesson (parts of the main section (1-8)**: objective, (a brief description of lesson objective, brief introduction of content based upon lesson titles, detailed course material, summary, self-test questions, practice tests, textual summary.

III. **Summarising course content**: summary of objectives, detailed summary of course content, closing thoughts, other supplements (optional).

IV. **Supplements to the whole text)**: works consulted, references media components (list of figures, tables, audio and video files, external URL, glossary, interpretation of key concepts (optional), tests (practice tests, mock exams, final exams).

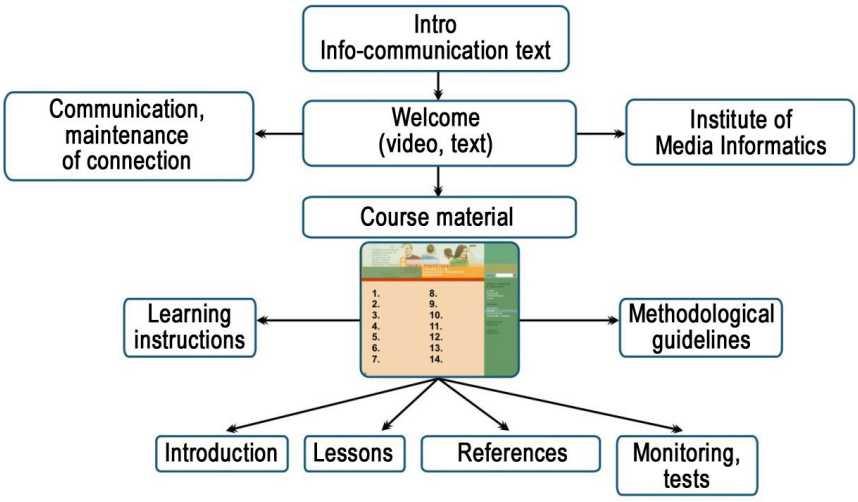

Figure 21 The structure of an info communication text

7. Infor-communication text URL: http://www.ektf.hu/infokomm/

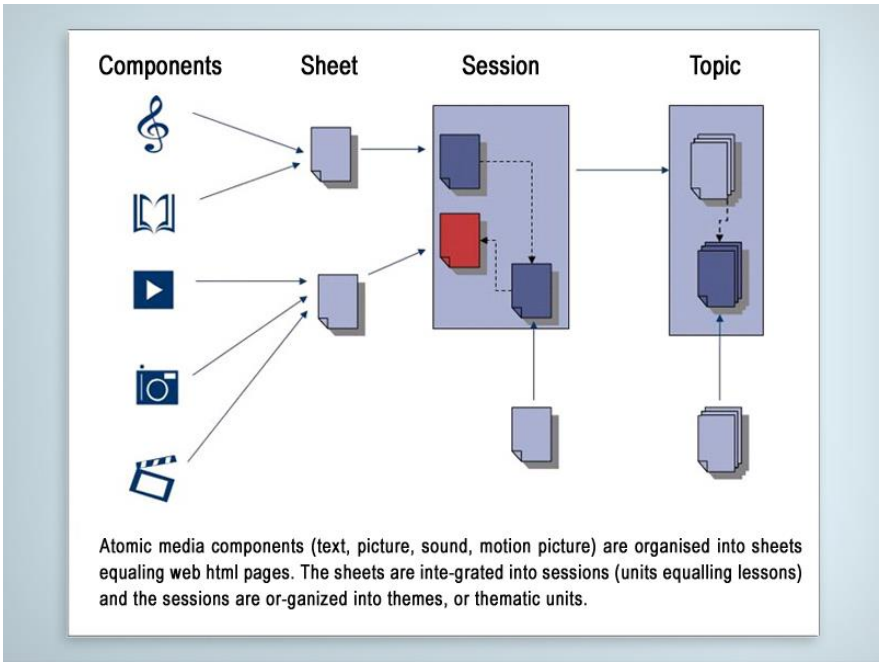

Figure 22: The structure of SDK (Sulinet Digital Knowledge Base)

Figure 23: The starting page of the Sulinet Digital Knowledge Base http://tudasbazis.sulinet.hu/hu

7.2.1 Scripts of media units

The selection method of textual unit components has to facilitate optimal level subject content transmission and knowledge acquisition for the given student.

The most frequently used media units are the text, still image, sound, moving picture, animation, and the references (SDK Sulinet Digital Knowledge Base).

Photographs, illustrations, charts, graphs and other pictorial components serving either as basic components or illustrations must be clear, unequivocal and relevant to the given text. Irrelevant content and segments should be ommitted. Several content-related metadata are available for promoting easier and more effective use,[81]

The description of **stills** (photographs, illustrations, charts, graphs, and other pictorial content) includes textual (colour, forms, mood, actors, location), technical (size, definition, colour depth) information and the placement of visual objects (persons, textual blocks) along with the structure of the given image. Graphic descriptions appear in form of a sketch or source image, along with the identifiers of the given picture.

Animations are micro-learning contents promoting interactivity or introducing or simulating a given process or event. Animations following modern media principles demand interactivity from and promote action of the user. Such scripts should be developed, which prioritise the thinking, creativity of the user along with communication and collaborative efforts. All animations have to be equipped with concise, yet appropriately informative guidelines. The components of animation scripts include the title (subscription under the picture) identifier, the description of the general aspects of the scene, and of the content of the animation, the name or title of the event or phenomenon, and the respective user activity parameters. Only those textual or educational materials can be regarded interactive which fulfilll the given instruction objective via the active participation of the user. (cf. SDK).

Motion picture: excerpts from films, cartoons and animation-type materials belong to this category.It is important that such components transmit professionally sound information and meet the technological requirements of sharpness, composition, camera movement, and close ups. Motion picture components should not contain irrelevant or distractive features, such as noises, incompatible pictures, objects or sound elements.

[81] Sulinet Digitális Tudásbázis felhasználói kézikönyv. (Users' Handbook for the Sulinet Digital Knowledge Base) URL: http://ikt.sulinet.hu/segedletek/SDT_kk_1j25.pdf (Letöltés: 2011. 05. 18.)

The components of motion picture scripts: title (subscription under the given picture), identifier, the description of the location and duration of the scene, general information (description of text, pictures, sound materials, accompanying music, sound effects and scene atmosphere).

Acoustic information (musical detailis, speeches, noises) is an important component of multimedia productions. Narration and accompanying musical effects should mutually reinforce and complement each other while promoting the effective presentation of the given message. Sound components should be free of noises or sounds distracting the viewer's attention.

The length or duration of the motion picture or sound elements should be appropriate and such media players have to be used, which can stop or accelerate the recording on demand.

The components of the script of sound or audio units: title (the subscription indicated under the media player), identifier, location, length, general descriptions (audio content, narration, description of text, accompanying music, sound effects, and atmosphere).

The inclusion of external, Internet-based sources (web pages) into the texts should be indicated with links facilitating the connection with other information or educational materials. References should be indicated in a professional and accurate manner, and only freely accessible materials published in a language identical to that of the text should be referenced.

The components of reference scripts: title and author of the text found under the given link, the description of the given link.

Scipt component	Detailed description
Author's name	
Script identification code	
Title of film, or video:	
Topic described:	
Music, effects:	
Length:	
Location:	
Detailed description of scenes	

No.	Picture	Sound	
Scene number	**Description of motion picture scenes and subtitles for still image**	**Narration, dialogue** (Narr. in normal letters, dialogue in bold letters)	**Music (title, function)** (presented under narration, or as an accompanying element)
1			
2			
3			

7.3 COMPONENTS OF PICTURE RELATED SCRIPTS

Identifier	Description of the content of the picture	Source	
	Textual description of photographs, illustrations, figures, graphs, and other picture-based content (size,colour, form, mood, actors)	***Sketch, source image.*** Visual elements, person, textual blocks.	***Idea, URL:*** *http://www* ***or ppt***
Title:		**Identifier:**	

7.4 ANIMATION SCRIPTS

Components of scripts	Detailed description
Author	
Scipt identification code	
Title of animation	
Topic or theme described	
Prompt texts (optional)	
Parameters	

Description	
Screen plan	
Connected component units (link, ppt, other file)	

7.4.1 Technological requirements of e-learning texts

The eXe Editor (e-learning XHTML editor) is a user-friendly authorial system with easy to apply professional features. The operation of the system does not require a programming background and it is ideal for instructors and curriculum developers. The eXe program allows the user to integrate the following media components in the text by the help of an iDevice (Instruction Device):

- Video: video components have to be integrated in the form of flash video (flv).
- Sound: sound components are integrated in mp3 form.
- Animation: animations are integrated in SWF format
- The table below lists the requirement criteria pertaining to the integration of media components.

Table 1: Media formats and their requirements

Type	Requirement	Definition	Format
Still image	Screen image	800×600, 72 DPI	JPG, PNG
	Drawing	800×600, 72 DPI, Arial, 10-12pt line width min. 0,5 mm	
Type	Requirement	Definition	Format
Sound	Minimum	22.050 Hz, 16 bit, mono-stereo	MP3
	Recommended	44.100 Hz, 16 bit, mono-stereo	
Type	Requirements	Definition	Format
Motion picture	Recommended	Frame: 720×576, 25 FPS, Sound: 44.100 Hz, 16 bit, mono-sztereo	FLV
Type	Definition	Picture rate	Format
Animation	640x480	24	SWF

7.4.2 Didactic, methodological questions and technological criteria[82]

The general structural pattern of digital learning content

The general structural pattern of digital learning content includes the following elements:

- training program or curriculum integrating compatible courses.
- the term “course” could refer to a sequence of lessons, a subject, or even to a textbook.
- Lesson, a logically consistent textbook unit or chapter including learning objects.
- Sharable textual unit including many units
- Textual component (asset), including non-dividable media files containing unique elements (text, still image (picture), sound, motion picture).

The sharable learning objects are organised into pages (including either one or more objects) forming the smallest content component independently handled by content and learning management systems. Standards and recommendations provide much needed help in the elaboration and application of electronic instruction frameworks and electronic texts or educational materials. e-Learning standards allow the arrangement of the educational material into data structures, the unification of communication forms while facilitating full compatibility of tranining objectives and systems. The SCORM (Sharable Content Object Reference Model) established by the Advance Distributed Learning company(ADL) is a pattern scheme faciltiating the re-use and standardisation of learning content.

[82] Forgó Sándor: ELEKTRONIKUS TANANYAGOK DIDAKTIKAI SZERKEZETE. (The didactic structure of electronic texts) http://tarsadalominformatika.elte.hu/wp-content/uploads/2013/10/modszertaniutmutato_tarsinf_eger_fuzet_1.pdf

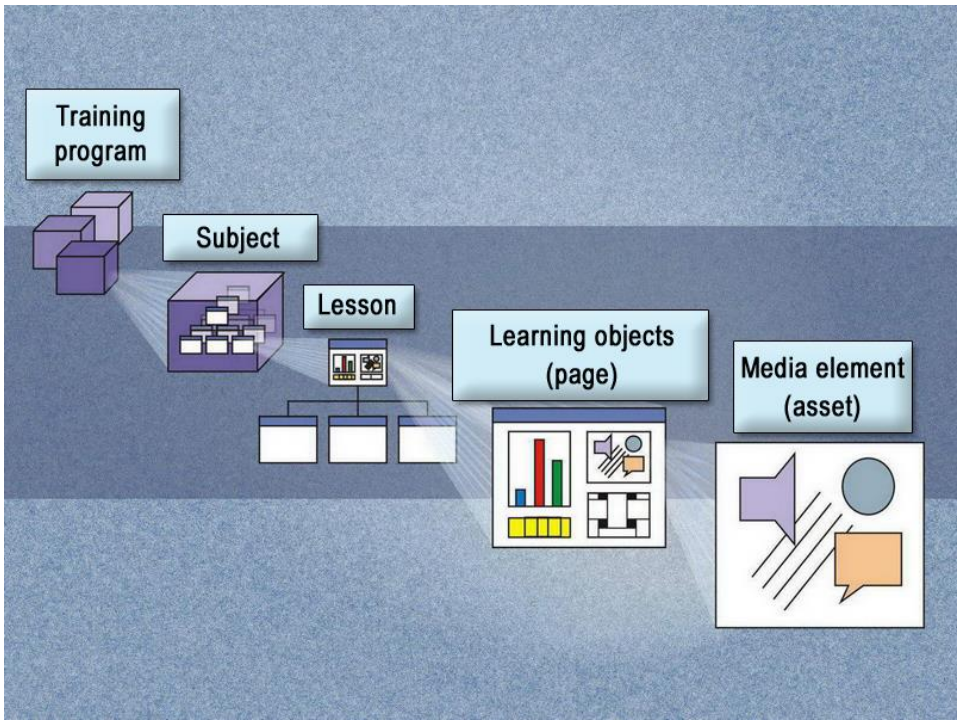

Figure 24 The digital learning content (learning content)

7.4.3 Didactic, methodological questions, and technological criteria

The didactic structure of educational materials

There are many ways for integrating e-learning educational materials into courses. In our professional practice we always adjust didactic structure to the given course needs.. We have consistently used this professionally sound structure:

- **Introduction** (objectives, competences, learning support)
- **Lessions, sessions** (main course material divided into 10-12 weeks)
- **Tests** (practice, mock, final exams)
- **Supplements** (*works consulted),* references, media units, glossary)
- **Summary** (textual or course summary)

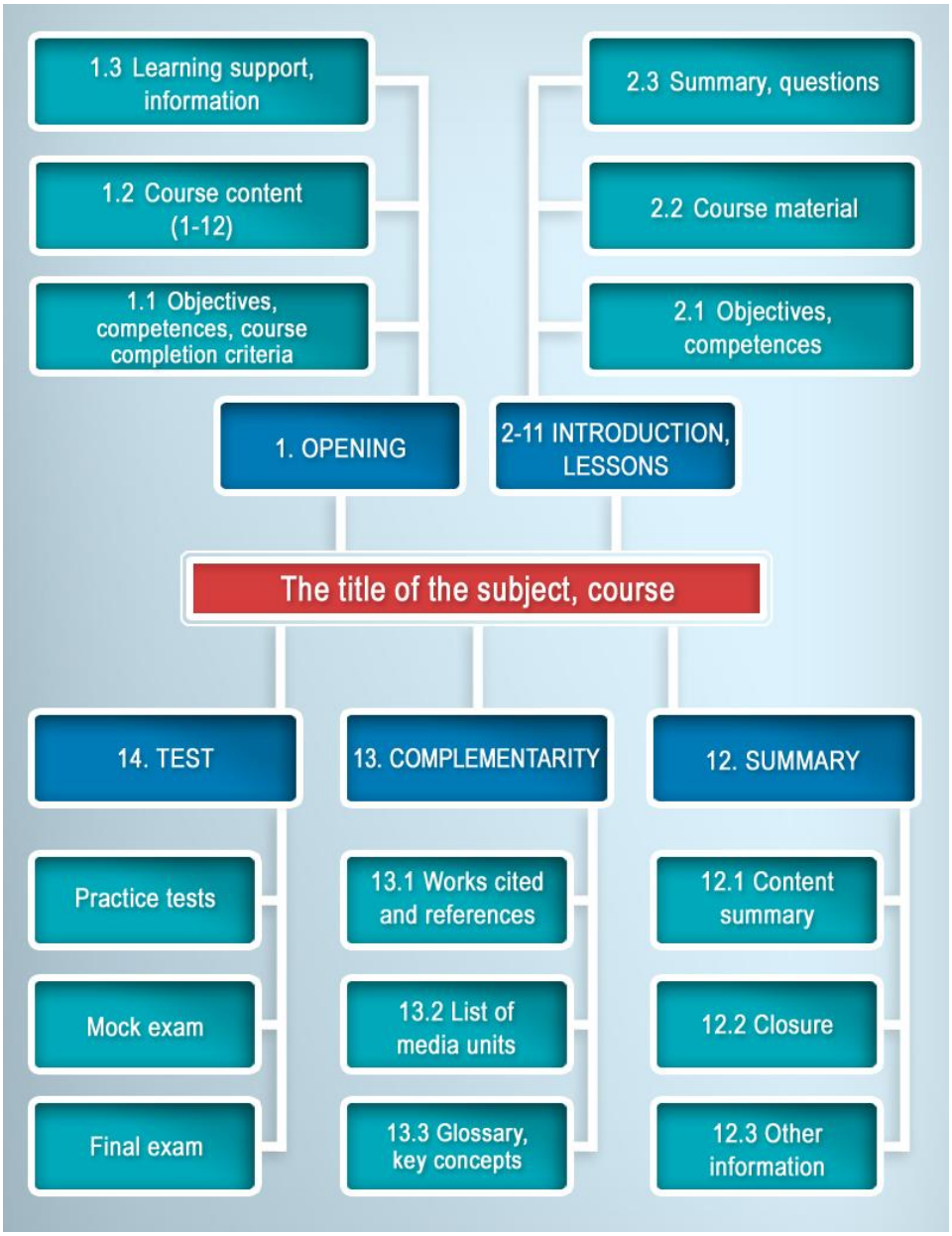

Figure 25: The didactic structure of e-learning texts.

The Introduction

The *Introduction* and *Learning instructions and support* section should promote motivation and student interest. The *Contents* should include the

module and lesson titles and the segment titled *The use and structure of the surface* should provide information on the use of the learning management system and supply learning advice.

Objectives: This section expresses the added value or excess information possessed by those completing the course. The determination of objectives should rest on sound pedagogical principles. The respective training objectives should be expressed in clear, accurate, and professional manner. (Instruction objectives in a general sense tend to mislead the students) Objectives are integrated into a system of expectations related to the completion of the course. The objectives are realised via the fulfilment of learning arrangement tasks deployed during the learning process. The objectives and competences should reflect the course plan. Such terms should be used as “the student will become familiar with, obtains knowledge of, processes, enables creative application etc.”)

Course completion requirements should clearly describe the expected results including the the extent and level of the student’s knowledge and skills along with the criteria to be fulfilled during the course.

Content requirements should clearly and unequivocally determine the results, knowledge, skills, attitudes, and competences attained by the end of the program. The course requirements can be considered realistic if the allocated training period, the course material, the training activities (options, instances of knowledge acquisition, methods) and the prescribed evaluation procedures are harmonised.

Requirements should include those specified expectations whose fulfilment facilitates the successful completion of the program.Consequently, such criteria reflect output requirements based on the current instruction methods, support materials, and mandatory readings.

Course content is determined by the textual structure. The elaboration level of the program depends on its intelligibility and accuracy. The logical, structural, and methodological composition of the text must facilitate individual learning.

Course content can be presented in a personalized textual or multimedia format (Podcast/Video)**.**

The structure of the lessons and sessions

The lesson is a web-based instructional unit exposed according to six points. It contains specified objectives and competences, the brief content, information to be acquired in multimedia supported interactive format, teaching and learning activities, along with examples evoking user interest

The expectations of the lesson (information, knowledge, attitude, perspective, skills) reflect the crucial competences to be acquired by students. Such competences facilitate the implementation of objectives ("become familiar with, obtain knowledge, be capable of naming or applying the learned material in an analytical, synthetic manner, evaluate, and compare").

Following the course summary, self-test options (in the form or open or closed questions) should be provided.The components of the lesson:

1. ***Objective***
2. ***Content***
3. ***Exposition of content***
   a. *descriptions*
   b. *definitions*
   c. *questions*
   d. *task*
   e. *reference*
   f. *example*
   g. *highlighting*
   h. *solution*
4. ***Summary***
5. ***Self-test sections***
6. ***Test questions***

Testing the acquired knowledge

The course material is followed by a summary section including such crucial elements as feedback and the clarification of self-test methods (questions, tests).

Self-test and practice questions check certain elements and the respective correlations of the presented information.

Control efforts must ascertain whether the participant fulfilled the content-based requirements of the course.The means of control and monitoring is determined by the task situations, performance levels and manifestations of information accessibility relating to the fulfilment of the respective requirements. This section should provide a summary of the preparation of documentation pertaining to the participant's performance. The means of monitoring and control should be described in a length and detail corresponding to the respective requirements.

The form of control must be compatible with the set objective or requirements, thus in case of practical training sessions written or oral

examination elements should not be included. Tests appear insufficient for performance oriented courses, while in case of training exclusively aimed at providing theoretical information practical application of the acquired knowledge should not be expected.

Supplements pertaining to the whole text contain the following elements:

- *works consulted,* references, inventory of media units (list of figures and tables) list of sound and video files, (Recommended readings and the referenced sources represent the foundation of the comprehended and systemized knowledge)
- *glossary*, interpretation of key terms (optional)
- *tests* (practice tests, mock exams, final exams)

7.5 E-LEARNING STANDARDS

7.5.1 Instruction theory questions

In antiquity and in the Middle Ages the channels of knowledge acquisition were words and books. Teachers had a central role in the process. The respect of authority was coupled with the reproduction of the teacher-delivered information and independent, creative thinking was pushed into the background.

The didactics of Comenius emphasizing demonstration and the greater efficiency of sensory organ-based cognition, as compared to speech-based learning, revoutionized pedagogy in the 17th century.

These principles have become even more dominant today as adequate knowledge is highly valued in today's information society. At the same time the quality and content of the acquired information has become a definitive feature as well. Accordingly the knowledge of one profession is not satisfactory in itself as individuals are expected to possess complex synthetising knowledge integrating several competences.

Consequently, one of the greatest challenges of the education system is the formation of competences and skills expandable and modifiable on demand. In addition to a disciplinary perspective inter and multidisciplinary perspectives have developed and instead of subjects the focus is on the overlapping of several subjects.Reproductive knowledge is superseded by competence based knowledge. Thoroughly considered competences with long term validity facilitate the efficiency of learning,

and promote differentiated, personalized training schemes.[83] The labour market has a similar expectation, that is, the immediate and effective transmission of currently needed knowledge, while instruction facilities must elaborate flexible systems for this purpose.

The implementation of such objectives depends on a developed technological background facilitating new ways of knowledge acquisition while generating unprecedented methodological and pedagogical challenges. The application of e-Learning schemes is one possible alternative for this challenge.

7.5.2 What is e-Learning?

Simply put e-Learning entails the effective use of information technology during the instruction process.

However, we have developed a more complex definition as well:

- **e-Learning is a computer network facilitated training format independent from spatial and temporal limits. The program utilizing effective and optimal knowledge acquisition and learning methods integrates educational materials, learning resources, tutor-student communication, and computerised interactive software into a unified framework system accessible for learners.**[84]

- Survey the Internet on e-learning definitions and analyze the respective differences of interpretation. Develop your own e-learning concept in a short summary form and share it with your teacher and fellow students.

The definition reveals that e-Learning is a complex system requiring substantial organisational effort and the convergent cooperation of several disciplines. The efficiency of the system also requires a technological protocol operating the whole process, and a pedagogical innovation converting the traditional role of the instructor into a supporter of the learning effort. In case of e-Learning texts the traditional textbook undergoes a metamorphosis, the teacher's personal content transmission role is eliminated, and the the distance learning textbook including the learning program is transformed into a software application

[83] Forrás: Vass István: A tantárgyköziség különböző megjelenési formái - Ember és társadalom programok; (Various manifestations of interdisciplinarity, human and society programs) Megjelent: Iskolakultúra, 1998, 11. szám.

[84] FORGÓ Sándor: Az e-learning fogalma.(the concept of e-Learning) In: HUTTER Ottó – MAGYAR Gábor - MLINARICS József: E-LEARNING 2005 (e-learning kézikönyv), Műszaki Könyvkiadó, 2005. 14.

supporting the learning process and providing information. Our lesson determines the protocols facilitating the operation of an e-Learning system.

The conceptual system of el-learning

Learning Object (LO)

The learning object is the smallest unit of the course. We arrive at the learning object via the analysis of the text. The result of the analysis is the smallest intelligible independent or separate unit of the program.

Learning Objects can include any media unit, picture, text, motion picture, sound, or animation. One of the most difficult challenges is to find the limit below which the given media unit cannot be divided without losing intelligibility or above which the textual components form a structure.

While in order to promote reusability the textual units can include references to other components, any reference to the respective textual background could reduce the reusability capability.

Metadata

Despite the lack of mutual references to textual units, logical connections have to be established between them. One such method is the identification of metadata. Metadata describes and at the same time identifies the textual components. Such logical connections can be established in three levels. The simplest one is identification according to a pre-selected classification system allocating textual units into identical meaning domains. This definition can be further specified by key voting and we can make specific references to one or more connected textual units. The content-based connection and the respective sequence among textual units is described by the manifest.[85].

- Select at least three pages from any textbook. Divide the text into logical units and place those units one by one on the left side of a two column table. Write key terms in the right side column.
  Perform the same task with picture elements and share the results with your fellow students and your tutor.

[85] The **manifest file** is a special file used for storing data related to packages and extensions. The manifest file contains meta data in the form of name-value dyads.

e -Learning system

e-Learning systems are also considered framework systems. These systems integrate such applications, which facilitate access for various users including administrators, authors, instructors, tutors, and learners. These applications have a modular structure and their names vary according to emphasis and functionality.

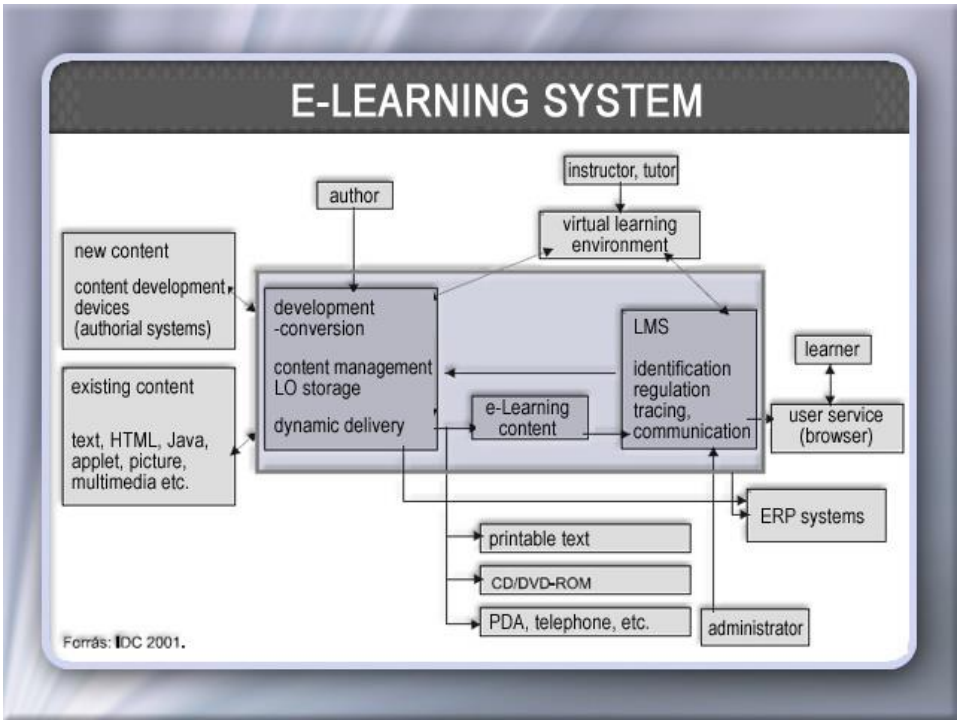

Figure 26: The structure of the e-Learning management system

LMS – Learning Management System

It can also be called learning direction system. Its main tasks are the identification of users, providing access according to the respective authorization levels, and maintaining a log on the activity of users. The recording of student activities and performance related data is especially

important. Standardised LMS servers store the text or the educational material in a structured, course form[86].

CMS – Content/Course Management System

Content or course management systems are more like document handling systems than interactive educational materials. Content management systems are not suitable for the logging of e-Learning related activities. While the system records the appropriate authority levels, the given logs do not provide pedagogically relevant data.

LCMS – Learning Content Management System

Learning content management systems primarily store textual units, while providing identification. One of the special aspects of the system is that it contains an authorial module facilitating the construction of textual structures or courses.

While LCMS systems have a logging capability, their primary goal is the tracing of manipulations performed on textual units or the components of the educational materials. The system provides options for monitoring student activity and the collection of performance-related data. However, the systems can publish data not only form e-Learning frameworks, but can provide output in the form of CD/DVD, or printed materials Applied with an LMS server it can form ideal e-Learning systems.

VLE - Virtual Learning Environment

Virtual learning environments provide communication options and cooperation opportunities for users within the e-Learning framework system. VLE provide devices and features (chat, forum, e-mail, messages, message board etc.) facilitating or substituting teaching, learning, and social activities (asking questions, reinforcement, meeting with teacher etc.) related to traditional classroom-based instruction.

There are two basic forms of implementation for the use of virtual classrooms, synchronous and asynchronous. In case of asynchronous training the learner studies at his own pace in the learner network, at the same time it can use online devices.

[86] The course is the e-Learning format version of the educational material, Courses usually contain modules and the modules can be divided into lessons. The length and structure of the course can vary according to the type of the educational program.

Synchronous training format entails the simultaneous presence of participants. In this case live video or sound connections are established among the participants of the virtual classroom.

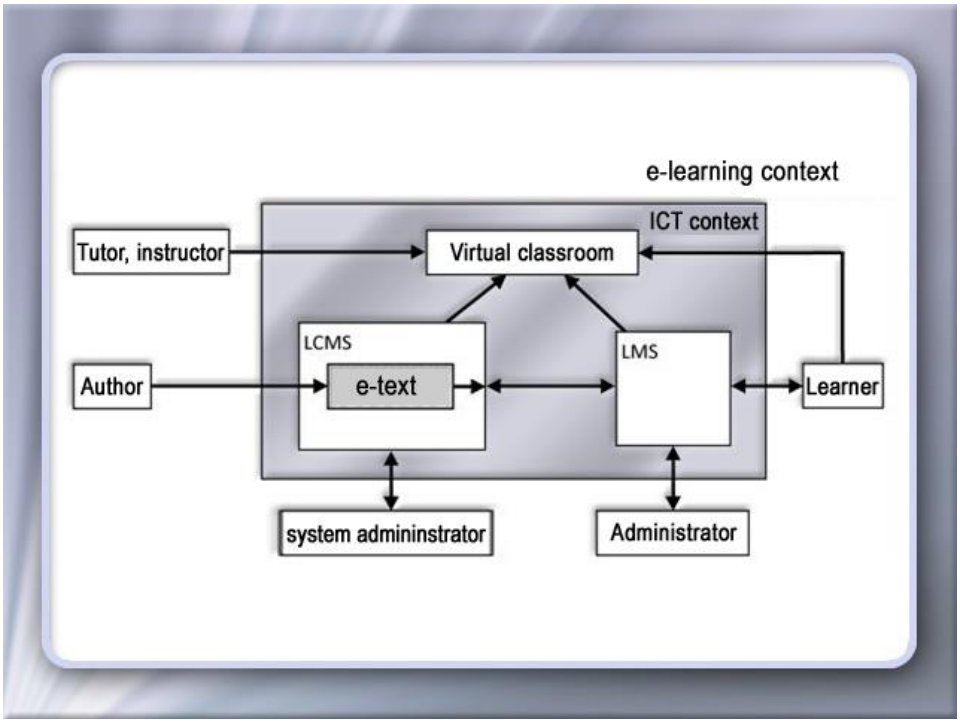

Figure 27: The scheme of virtual learning environments

Why is standardisation important?

Varying logic of design makes traditional computer-based instruction programs unique. Consequently, as physically closed units including references to the original textual context the complete text or its parts cannot be used in any other context, or integrated into different educational materials.

The production of digital educational materials is a long and expensive process. There is no reason for repeated manufacturing of separate textual units, thus reusability or portability gain significance.

The need for standardisation indicates increased demand for a given product whose cost-effective satisfaction requires rationalization and unification of the applied technology. Furthermore, the globalization of e-learning technologies reinforces this tendency as well.

7.3.3 The advantages of standardization

Cooperation ability

Texts meeting the given standards can be delivered within the respective supportive framework system.

Personalization, individualization

Today's technology allows the tailoring of educational materials to individual needs, skills and tastes. The personalization of mass produced texts is only a question of appropriate application technology.

Cost-effectiveness

Standards facilitate the reduction of production time and after reaching a critical mass level of educational material quantity, production costs can decrease radically as well.

While traditional classroom-based expenditures grow proportionately with the increasing of student numbers, high standard e-Learning programs display inverse proportionality between expenditure and student number.

Availability, retrievability

Educational materials can be modified in a flexible manner if the appropriate textual units are available. Consequently, textual components have to be clearly identified, indexed, categorized, or classified.

Therefore both the textual components and the resultant structures are provided with metadata. The functionality of metadata differs according to the given structural level. Such information enables the student to select the personally most appropriate educational texts, and by accelerating the design process it provides much needed help to curriculum development experts as well.

Durability

Durability refers to the compatibility time of the given text with the subsequent version of framework systems. Consequently, independence from platforms is essential.

Reusability:

Reusability is assured if the educational material is built up from learning objects. If the learning objects meet the respective restrictions

and specifications they can be used either in the same text or in other texts in a variety of contexts.

7.5.4 The structure of electronic instruction programs

Structuring has two forms: **Didactic structuring** is based on the logical correlation system and its aim is the optimalization of the learning process. **Technological structuring** is based on data types and it assures effective programming and a varying combination of the abundant media selection.

Didactic structuring

Course

The course as a version of the electronic educational material suitable for independent learning includes modules, which can be divided into lessons. The length and structure of the course depends on textual structure.

Modules

Modules are parts of a course. Modules are made up by lessons, and their main function is the structuring of the text according to the logic of its content. One of the most often used solutions is the linear structure following the architecture of traditional materials. A module focuses on a clearly defined or delineated topic or field.

Lesson

Lessons are the basic didactic units of the multimedial text structure. Lessons are integrated into models and appear as texts with varying length, one or more pages. Lessons include the description and introduction of the topic, didactic texts supporting the learning process, motivational quizzes, or games, and examples designed to evoke and sustain learner interest. Summarising questions and tests are found at the end of lessons. In case of multi-level texts the principal text and the auxiliary or support materials should be clearly distinguished.The respective structural and visual presentation can include background pages connected with links, or such material can be presented in different windows.

Learning Object

In e-Learning programs modularity is primarily manifested at the software technology level of text editing. The flawless handling of the given educational material components by e-Learning instructional framework systems (CMS, LMS) and the technological compatibility of the given components are assured by standardization. Learning content should be divided into small blocks or learning units similar to the knowledge units of programmed learning schemes. Such elementary units or **learning objects** are equipped with **metadata f**acilitating identification, systemization, and reuse. (Reusable Learning Object). Thus texts composed of long chapters are divided into 2-15 minute long small units intelligible and functional on their own. The learning objects can be organised into larger content units in a variety of ways. The optimal arrangement of learning objects and the promotion of the effectiveness of the learning process requires substantial skills in didactic design.

Technological structuring

Technological structuring entails the distinguishing of the educational material components and the respective data types. These components have to be distinguished within the text of the educational material along with providing additional information faciltiating the presentations, systemization, retrievability, and unequivocal identification of such elements.

Textual components

The main text can include: table of contents, definitions, examples, problems, summary, regulation, commentary, quote, note (foot note, side note, annotation, teacher's instruction) case studies, exercises, control questions, solutions, etc.

Data table components

Chronological items; references to resources (bibliography, filmography, discography) web catalogue, picture catalogue, data table;

Visual components

Picture: segmented picture, animation, simulation, video, presentation.

Acoustic components (sound-based materials)

Acoustic materials can be categorized by form (speech, song, noise, music, tune, accompaniment) and by function (independent audio information, explanation, musical piece, documentation, archived recordings, illustration, noises, supplementary elements, sounds).

- Exercise: Analyze an electronic educational material of your choice, i.e. Sulinet Digital Knowledge Base). Find examples of each technological component and discuss the results with your instructors and fellow students.

7.5.5 E-learning standards

The two best known examples of e-Learning standards are the models developed by the IMS Global Learning Consortium and the SCORM model of the ADL.

IMS standards

IMS specifications apply to all essential parts of e-learning systems. Due to a wide connection network its recommendations are implemented by several firms. The practical implementation is guided by the XML[87] system.

In addition to documentation the IMS provides schemes, validation data and specified examples for developers while assuring immediate testing options.

Content Packaging (CP)

Content Packaging is one of the most significant innovations of IMS for the description of the structure and portability of the educational material. Content Package provides a key for the LMS to deliver the educational material. Furthermore, Content Packaging presents the description of the structure of the text as contracted data including the physical components representing the elements of the educational material, and metadata describing the arrangement of the text.

[87] Az XML . *Kiterjeszthető Jelölő Nyelv*) a W3C által ajánlott általános célú leíró nyelv, speciális célú leíró nyelvek létrehozására. (The Extensible Markup Language is a general purpose descriptive language recommended by W3C for the creation of special purpose descriptive languages)

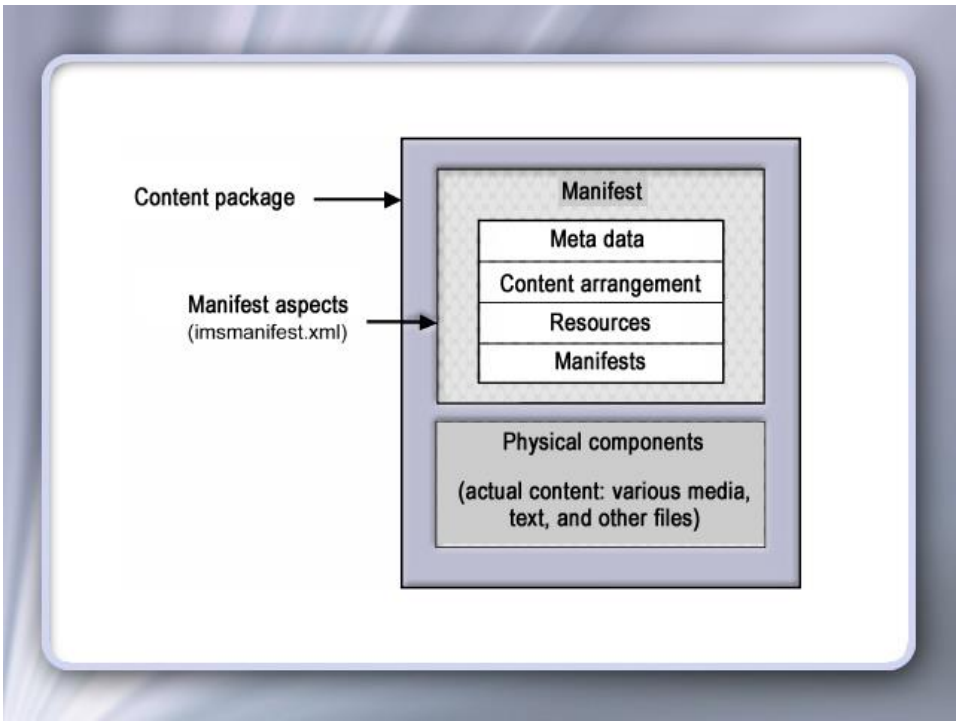

Figure 28: The structure of content packaging

LOM – Learning Object Metadata

The objective of the LOM (Learning Object Metadata) standard is guaranteeing the independence of the respective learning components from the operation system. It is widely accepted and both the IMS and the SCORM base their metadata processing options on LOM.

Metadata become significant when the educational materials are stored at an element or atomic level. In this case they provide numerous advantages for the producers of digital educational materials. Metadata can help in the elaboration of easily browsable and retrievable catalogues providing the foundations of digital text repositories.

Metadata facilitate the description of educational material components as the features of a given textual unit are stored in metadata. LOM categorizes these features into groups representing varying roles as instructors, administrators, authors, and merchandisers are interested in different aspects of the given text. The standard established nine groups:

1. General– its primary purpose is the primary identification and brief description of the textual component. In addition to ID and adress,

a brief summary and information on the language of text are included as well.

2. Life cycle – provides the status, previous developments and current version of the text along with the names and functions of persons and organisations involved in the production process.
3. Meta-metadata – This section provides information on the metadata themselves, it also identifies the used metadata scheme.
4. Technological data – form and size, along with the accessibilty route of the text and the respective compatibility data.
5. Instruction data– definition of the target group (age, school type), the level of processing requirements, the expected time of processing and the extent of interactivity.
6. Property rights – the conditions of use are determined at this section.
7. Connections – the connection of the given textual unit with other textual components can be noted here via the provision of the respective data
8. Commentary – this section has a role in the qualification of the educational material via its evaluation by independent and acclaimed experts or organisations.
9. Ranking, categorization – What is the position of a given textual component in a categorization system selected by the respective organisation, which system will be most suitable for the categorization process?

SCORM - Sharable Content Object Reference Model

The SCORM has become one of the most widely accepted e-Learning standards. It is not only used by producers of framework systems, authoring applications, but by the non-profit sphere and the higher education sphere as well. Its popularity is primarily due to its integration capability and the networking activities of its developer ADL aimed at both the professional community and society at large.

While the SCORM standard is not applicable to the full spectrum of the e-Learning system, (learner information,or standardised test processing is not included) its capability of presenting the best recommendations and a practical orientation makes it the most popular standard among users.

The guiding principles of the SCORM standard:

Full scale operation and cooperation: Compatible with any system, without loss of functions (can be run in ILLIAS and Moodle).)

Accessibility Content (the text or a respective unit) should be accessible from any point: accordingly a content developer can easily retrieve a textual component in the LMS.

Durability: Keeping pace with the technological changes, new versions should be used without greater expense or modifications.

Reusability: The given contents should be approached according to different contexts. A text on internal data protection prepared for a company should be presented in other versions, depending on the given department. Furthermore, obsolete content should be brought uptodate without any difficulty.

The content of the standard

SCORM standardizes four aspects of the e-Learning program:

1. content packaging
2. communication
3. content sequence, navigation
4. meta data

7.6 SUMMARY, QUESTIONS

7.6.1 Summary

The lesson familarised students with the theoretical aspects of electronic educational material design, the structure of electronic educational materials, the preparation of scripts, along with technological, genre-based, and didactic requirements. Furthermore students gained knowledge on the conceptual system of e-Learning standards, and the main features of the most important standards. Students became aware that the essence of standardisation is the promotion of the compatibility and accessibility of products developed in different systems.

7.4.2 Self-test questions

1. Why is the standardisation of e-Learning texts important?
2. What is the meaning of the Learning Object concept and what is its role in the development of electronic educational materials?

3. Why metadata are important in the standardisation of electronic materials?

Module III. Digital content in online and offline contexts

8. THE PROCESSING OF DIGITAL CONTENT, CREATIVE MEDIA TECHNOLOGIES

8.1 OBJECTIVES AND COMPETENCES

The aim of the lesson is to promote knowledge acquisition pertaining to the theoretical background of designing picture-based sound, text, and video materials required by multimedia productions. Students should become familiar with the main features of digital picture formats, the respective quality parametres, the steps of digitalizing audio materials and the quality features of audio materials. The chapter will also provide information on the role, presentation forms, and dramaturgical function of picture, sound, text, and motion picture elements of educational materials.

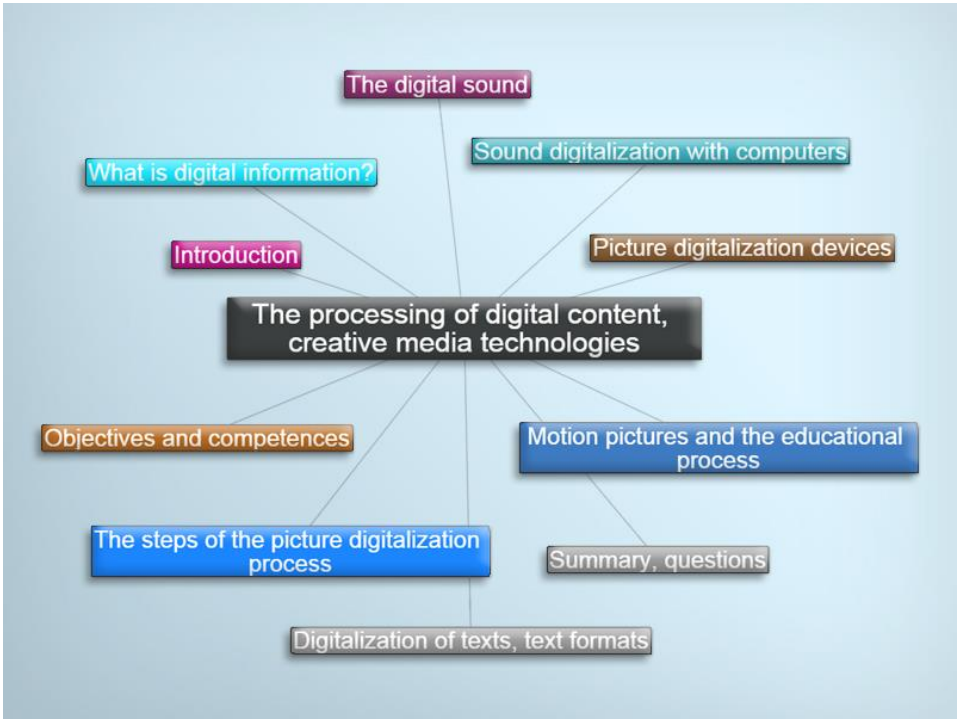

Figure 29: Conceptual map to Lesson 8

8.2 INTRODUCTION

One of the increasing challenges the pedagogical profession faces is the use and preparation of interactive educational materials. While the application of such materials presents tremendous potentials, the elaboration of digital texts requires advanced informatics and methodological competence. In addition to design and implementation problems teachers have to cope with such issues as inadequate media components or formats.

Demonstration or illustration is one of the most important components of pedagogical design since the more sensory organs are impacted during teaching, the more effective is the knowledge acquisition.Yet, demonstration or illustration efforts have to be optimalized, teachers should choose a methodology compatible with and relevant to the given subject. Besides the educational material analysis one has to consider technological issues requiring the assistance of professional experts. Consequently, the following questions have to be answered: how to design an interactive text, what kind of media elements should be used, how should the given components be digitalized, and what kind of programs or data formats should be deployed during the design process? Our lesson aims to provide answers emerging during the design, editing, and implementation stages.

8.3 WHAT IS DIGITAL INFORMATION?

The original meaning of the word “digit” is number. Digitalized information refers to information converted to numerical form suitable for processing by computer. Any type of information (sound, picture, motion picture) can be digitalised. One of the main features of the digitalization process is sample taking from the original analog information. The samples can yield a version of the original, but it is perceived to be of higher quality. This deception of the human sensory organs requires the adjustment of the parameters of the digitalization process to the physiological characteristics of human sensory organs. The most important features are the quality, size, and number of the given samples.

8.4 THE DIGITALIZATION OF PICTURES

During the digitalization of pictures the original is broken down into pixels (picture points). The computer processes picture related information as digital data, thus it allocates a number to all characteristics of the given picture.

During the digitalization of a photograph or graph we take a sample of the given point of the picture and establish a numerical value proportional to the colour and shade of the point according to the chosen colour system.

Having placed these points into a two dimensional chart reflecting the position of the original point, we arrive at the digitalised picture.

All pixels can be defined according to their coordinates.

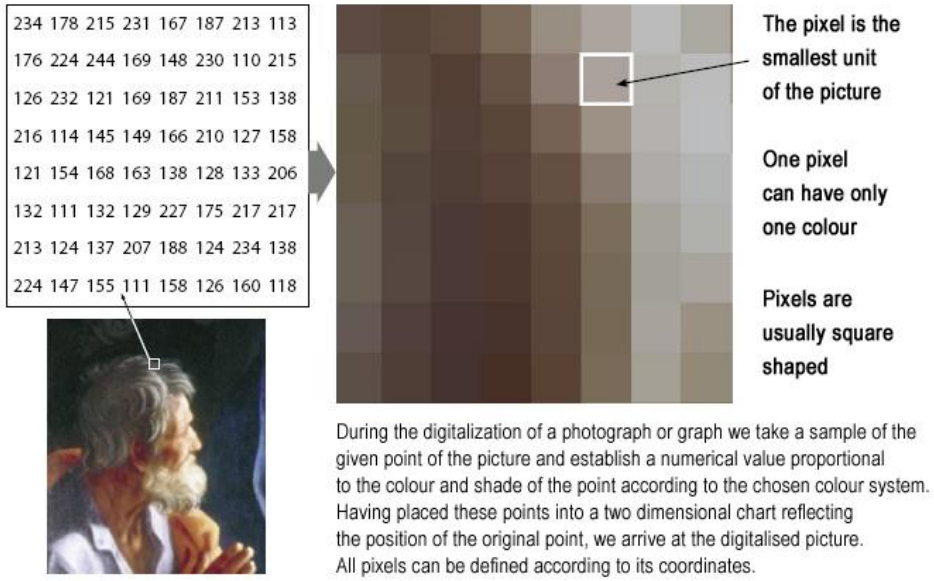

Figure 30 The outline of the picture digitalization process

8.4.1 The steps of the picture digitalization process

Sample taking (definition)

The aim of the sample taking process is the establishment of digital picture points or pixels, or the allocation of certain components of the analog picture to the digital pixels. The definition, or the accuracy of the sample taking process can be adjusted by the control of the definition capacity of the reading equipment. The sample taking process results in the establishment of a grid describing the given pixels.The measurement of the definition of digitalized pictures is **dpi** (dot per inch).

This value indicates the dots found in one pixel line of 1 inch (2,54 cm) length. If 300 dots are located at an inch, the definition is 300 dpi.

The definition of pictures can be performed in two ways:

Optical definition: the number of points distinguishable by the scanner.

Interpolated definition: indicates the definition capability of the machine.

Higher definition leads to increased picture size, which can be disadvantageous in case of dissemination on the Internet.

Quantization (colour depth)

During quantization the digital reader determines the colour and brightness parameters of certain analog picture components. Quantization provides a synthesis of the colour and brightness of picture components allocated to grid points determined during the sample taking process. During scanning the colour intensity should be 16-48 bits.

Quantization practically determines the colour intensity of the picture, and colour intensity defines picture quality.

Colour intensity is measured by bits.The best known levels of colour intensity are 1, 8, 16, 24, 32, 48 bits. The bits indicate the number of colours on a given picture. Black and white drawings can be described by 1 bit, 8 bits represent the shades of grey (256 greys), 24 bits represent the RGB pictures[88] (3 channels x 256 shades), while 32 bits stand for CMYK pictures.[89] (4 channels x 256 shades).

But how can the number of colours be established? A bit can occur in two states 0 or 1, thus due to this dual structure on a 1 bit picture only the black and white can be seen.

In case of 8 bits the number of colours is equal to the variations of the eight bits, thus we want to find out how many ways can the eight 0 or 1 digit be described. The number of possible version is 256, thus on an 8 bit picture 256 colours can be distinguished.

Consequently, the number of the bits is the exponentials of the digit two, thus in case of 16 bit colour intensity the number of colours is 2^{16} = 65536.

However, the 24 bit colour intensity is used most frequently during digitalization. This means much more colours than can be perceived with the human eye. Yet, due to the colour and tone correction operations

[88] RGB (Red Green Blue) This operation utilizes these basic colours. Said colours can be combined up to 16.7 million versions. Each of these colour channels store the intensitiy of the pixel compared to the basic colour. One channel can describe 256 shades, thus this description method is based on storing all pixels on 24 bit. As a result of appropriate monitor setting the colour transitions are not visible.

[89] CMYK (Cyan Magenta Yellow blacK)A colour scheme providing real pictures based upon the principle of subtractivity. The four basic colours are allocated to 4 channels, each pixel has 32 bits with the number of possible combinations of almost 4.3 billion. This method is primarily used in the printing industry. Frequently RGB schemes are converted into a CMYK colour model.

after scanning it is good to have more information and even greater variation. Thus professional digitalizing scanners have a capability of 32 or 48 bits. (12-14 bit/colour channel). It is well known that it is better to process higher colour intensity pictures during scanning as we can produce a smaller picture from the additional information.

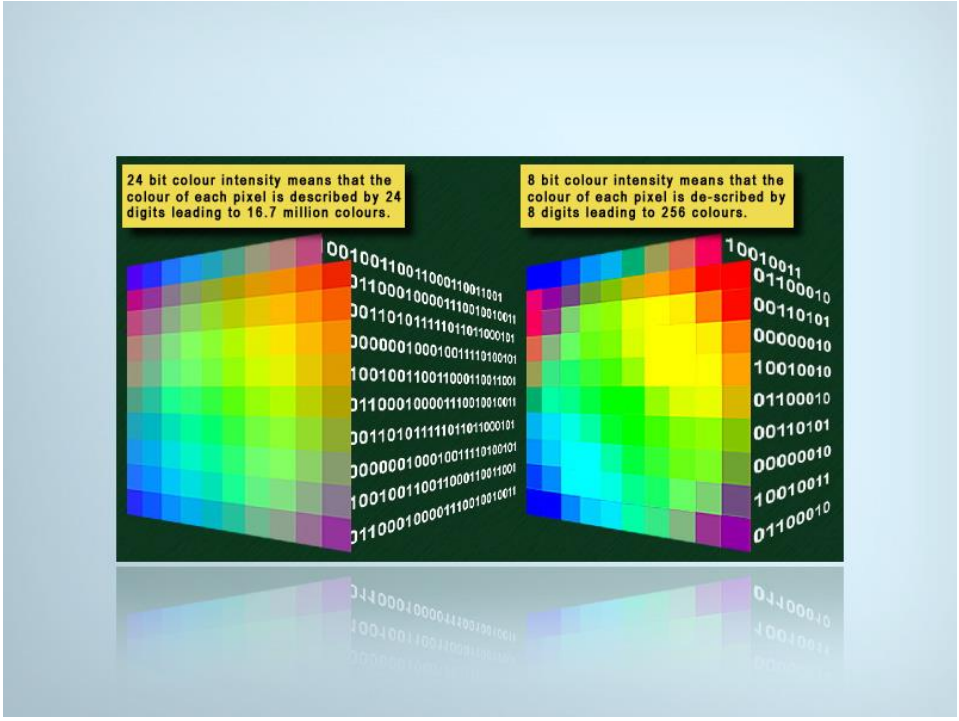

Figure 31: The interpretation of colour intensity

8.5 PICTURE DIGITALIZATION DEVICES

8.5.1 Scanners

Scanners facilitate the entry of data found in one plane. According to the material undergoing digitalization two types of scanners can be distinguished.

1. film scanners
2. positive scanners.

Each scanner type has different structures. One of the most importatn scanner parameters is the dpi. The definition describes the scanner's capability of recognizing the smallest possible details on the original

picture. Scanners recognizing more dots can provide better pictures. A scanner with a 1200 dpi capacity can recognize 1200 x 1200 dots on the surface of a one inch square. The capacity of presently used scanner is between 300-2400 dpi.

A significant difference can be discerned between the optical (real) and interpolated (software-based) definition. While the first value reflects the actual sensitivity of the scanner, the latter is a mathematically derived software produced version.The 600-1200 dpi real optical definition is usually sufficient for the digitalization of texts appearing original at first glance.

The other significant parameter is colour sensitivity, the scanner's capability of reflecting different shades of colour. Colured scanners have a minimum 24 bit capacit, that is 8-8 bits per RGB channels. While this variation figure appears sufficient at first glance, it is recommended to use even higher bit capacity due to the need for more information during post-scanning colour and tone corrections. Professional scanners have 36 up to 48 byte capability (12/14 bit/colour channel) and while it is generally true that during scanning greater shade variations and more information can result in the problem free production of small pictures, the process is not viable in reverse.

8.5.2 Digital cameras

Digital cameras have basically eliminated their traditional counterpart. Their main advantage is immediate feedback, the instantly produced picture can be seen on an LCD display, and bad pictures can be deleted rightaway.

The most important feature of digital cameras is the picture processing capability.The light sensitive diodes of CCD[90] or CMOS panel perform the digitalization process via converting light into electronic signs yielding digital signs. The extent of definition is measured by megapixel. One megapixel entails one million pixels, thus 6 megapixels equal 6 million pixels.

While today's digital cameras have a 6-50 megapixel capability, high technology devices can surpass this capacity. The basic feature of a digital camera is the optical zoom, or the capability of filming distant objects without leaving our place. While most cameras have a triple 3 x optical zoom, some machines have a 12 x, 30 x, or even higher zooming capacity.

[90] CCD and CMOS: picture receiving elements perceiving analog light information and converting it into *electronic* signs.

The macro option is another important feature facilitating the taking of close ups. Today's digital cameras can make sharp pictures from 1-2cm distance. However, a tripod is needed for the preparation of such pictures.

The format of the stored picture is an important aspect as well. Currently most machines prefer the JPEG format, but this is not suitable for professional archiving purposes. If possible we should select a camera suitable for the TIFF or RAW format,[91] as these are capable of saving the pictures without loss or previous corrections according to the original setting of the given equipment.

8.5.3 Digital picture formats and their most important features

There are many standards in digital picture processing serving various purposes or faciltiating various tasks. Lets overview the most important picture formats used during the preparation of electronic materials.

JPEG (Joint Photographic Expert Group)

The JPEGis the most frequent and best known picture format and it is ideal for the presentation of monitor images. The JPEG format utilizes a loss based condensation procedure. Its main guideline is the fact that the human brain cannot recognize small changes in the shade of colour. Thus the fewer colours are seen on a picture, the lower the respective quality.

Starting from the Photoshop 6.0 version 12 quality categories are available in the JPEG format. Most picture related information is preserved at the 12 quality category, and the smallest extent of file decrease can be achieved at this level as well. This format is useful for the condensation of high definition, constant tone pictures (photographs) without the least possible loss of data.

The JPEG is one of the most widely used formats on the World Wide Web. This is due to the fact that the browsing program has to process small size data packages and the unpacking and re-interpretation of the pictures is rather fast. The format, however, is only suitable for the storing of home made digital or digitalized photographs. They can be rarely corrected and are only suitable for web-based or electronic publication while being used in the RGB colour domain.

[91] For archiving purposes the digital mirror reflex so-called DSLR machines are most suitable.

TIFF (Tagged Image File Format)

The TIFF is ideal for archiving and storing of original or master copies.

It is not dependent on operation system or hardware,and can be used in any picture description mode for saving pictures in bit map (2 colours, black and white) 256 shades of grey, 8 bits, colour palette (256 colours of 8 bits,real colour 24-48 bytes.

The system is suitable for saving and archiving pictures in any colour domain, (RGB, CMYK, Lab, HSB).

It facilitates data condensation without loss (ZHW compression) and allows the saving of non-picture related data including printing adjustment, colour correction, and exposition. Various compression software can condense or compress digital data to a level that facilitates their re-conversion to TIFF format.

PNG (Portable Network Graphics) format

PNG is a popular picture coding algorhythm developed as the alternative to the GIF by the World Wide Web consortium in 1995.The main goal is the unification of features and options provided by the GIF and the JPEG formats.

The PNG uses a loss free compression procedure for the condensation of pictures and has a10-30% higher efficiency as compared to the GIF. The PNG format supports 2-256 colours and the 8, 16, 24, and 48 bit colour intensity. It is suitable for the preparation of transparent pictures and it is widely spread on the Internet.

PNG-8 Format: It is developed for the substitution of the GIF and practically can be applied int he same way.

PNG-24 Format: competes with the JPEG format

It is loss free as compared to the JPEG, its condensation is 24 or 48 bits and can have an 8 bit alpha channel for the transparent information, where partial transparence is feasible.

The PNG is less sensitive to mistakes than the GIF or JPEG.

The PNG format is suitable for good quality archiving and electronic publishing[92] of library collections and old periodicals along with saving the pictures of electronic educational materials.

RAW format (digital negative)

Pictures made in RAW mode give a sense of a traditional image as raw data can be gathered without any correction.

[92] http://egerujsag.ektf.hu/index.php

Raw data format means that the data are forwarded for processing directly from the picture sensor in original condition. Thus data processing takes place int he raw, original state, not in the digital camera.

RAW files are usually smaller than the files saved in TIFF format, because the colour data has not yet been processed at this point. The viewing and editing of the files and saving them in a more familiar format require a special program or plug-in.

When opening the RAW format the picture data have to be provided by the user so that the program can correctly interpret the respective information.

8.6 DIGITALSOUND

8.6.1 The role of sound in electronic texts or educational materials.

Sound as a media component has an important function during the preparation of electronic texts. In addition to a serious dramaturgical role and the capability for conveying emotions and moods, sound is a significant component of multimedia.

- Sound can appear as
- effect
- narration
- accompanying music

The use of sound effects has to be carefully planned as arbitrary application at inappropriate places and in an improper manner distracts student attention and interferes with concentration. In some cases, however, sound effects can be useful. Such features can help with navigation for the disabled, or in cases when the target audience (kindergarten students) cannot read it is ideal for monitoring the acquisition of knowledge or checking the solutions of various exercises. Thus a good answer can be indicated by an applause, while an incorrect solution is marked with sound effects evoking negative emotions.

Narration is frequently applied during the production of electronic educational materials. It can be used for books on tape, providing sound for films or in case of multimedia containing excessive amount of texts. (In the latter instance the program has a built in narration feature). For narration purposes a professional performer with a well toned, pleasant voice should be selected.

Sounds can take the form of accompanying music in electronic educational materials. Sound elements can strengthen motivation by creating the appropriate mood and evoking positive attitudes. Our choice

of music should be compatible with or relevant to the given theme. During the design process the demands of the user have to be taken into consideration and a switch off option should be included. In case of texts whose processing requires high concentration the accompanying music should be omitted.

Good quality is an important requirement for audio materials. In order to provide good quality parametres we have to be familiar with the physical features of sound, the parameters and devices of digitalization.

8.6.2 The concept and main features of sound

Sound is a vibration wave spreading in a flexible context while evoking a "sense of hearing" in living beings.

The sensation of sound is produced by a vibration or oscillation moving the ear drum via the activity of air molecules. Sound waves, whose direction of vibration is parallel with their dispersion are longitudinal.

The speed of sound at +15^{o}C in average humidity is 340 m/s.

The speed of sound depends on the density and flexibility of the trasmission context, its sign is c, and it is measured by m/s.

Frequency

Sound waves can be described by several established variables including frequency, wave length, amplitude, or period time. Amplitude indicates the extent of the maximum digresson of a wave within a wave cycle. Amplitude can be constant, or can vary according to location and time. The shape of the amplitude modification is the covering curve of the wave.

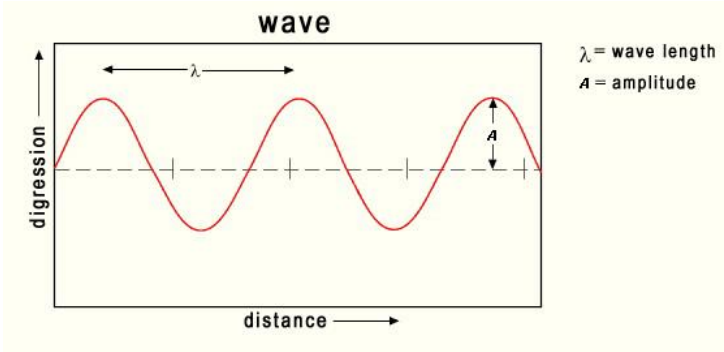

Figure 32: The main features and characteristics of sound waves

wave, wave length, amplitude distance, digression

Wave length (λ) is the distance between the maximum (or minimum) length of two consecutive sound waves.**Period time** (T) is the length of time required for full sound oscillation, from one maximum to another maximum. **Frequency** (f) measured in hertz, (Hz, kHz) refers to the number of periods of a certain wave within a given time,i.e., a 10 Hz frequency means that 10 wave periods take place in 1 second.

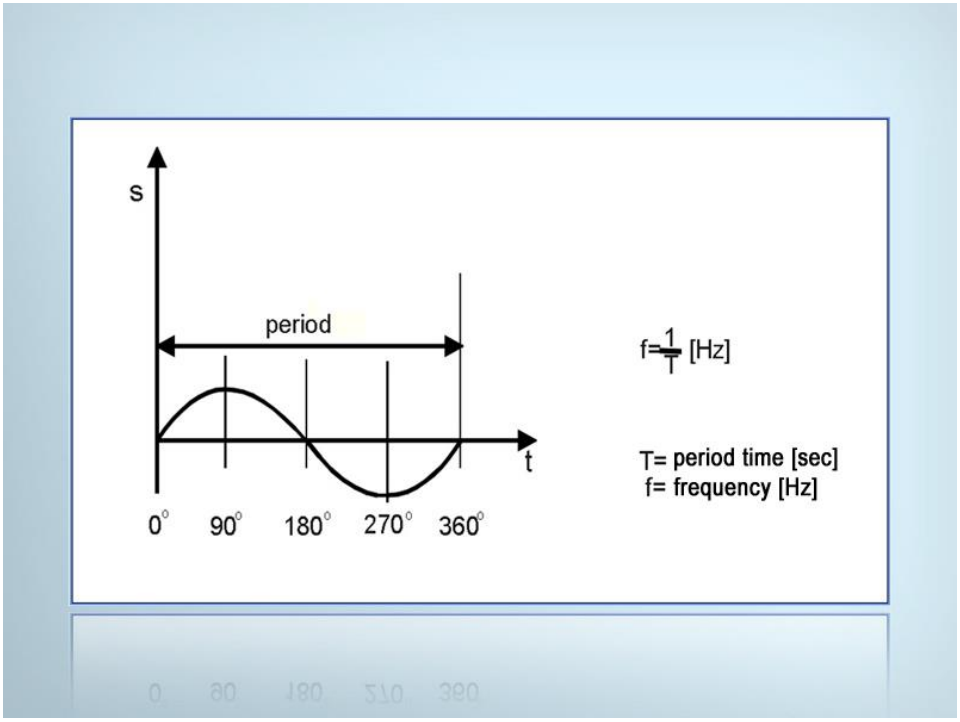

Figure 33: The correlation between frequency and period time

Period, period time, frequency

The correlation between sound and noise

During the operation of the speaker the voltage generates noise, or noise voltage in the electronic parts. Noise voltage attached to the useful sign will ruin the quality of sound. Such a phenomenon can take place after turning off a loud tape recorder when the speakers give a dinning sound. The correlation between sound and noise is an important parameter of good quality sound recordings.

Technically it refers to the division or fraction of two performance data related to the sign (information) and background noise respectively.

Dynamics

Dynamics of a given transmission channel is defined as the relation between the maximum value of a flawlessly reproduced output sign and another output sign still perceived as noise free. Dynamics is regulated by the maximum control from above and by system noise from below. Thus a given sound system can produce better dynamics value, and simultaneously better sound quality if during amplification the difference is greater between maximum performance and system noise values, that is, the system noise does not exponentially increase with amplification.

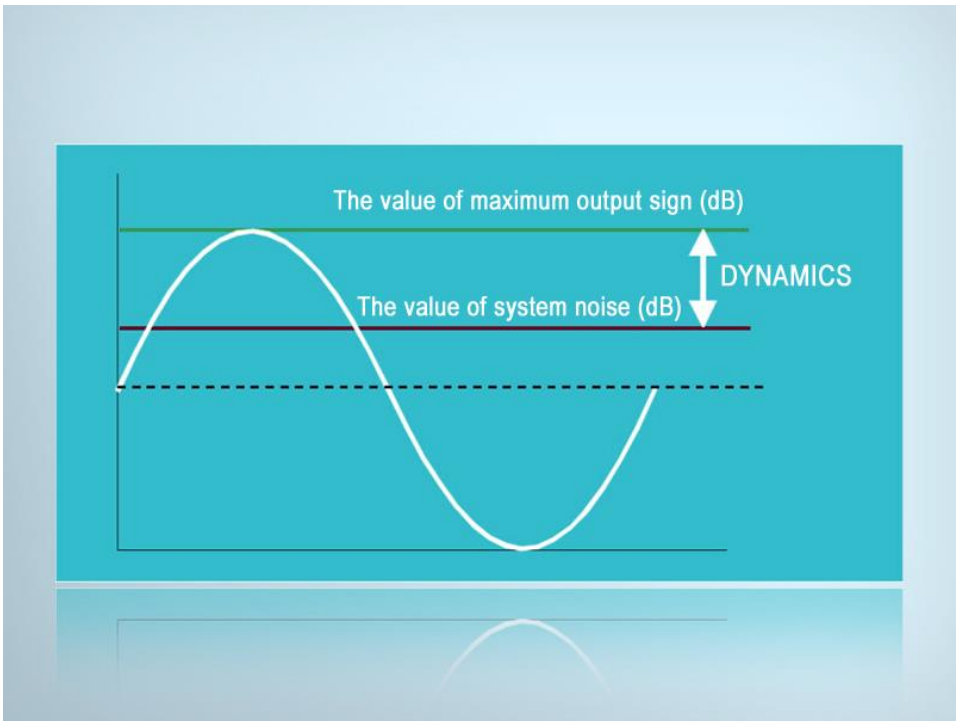

Figure 34: The interpretation of dynamics

8.6.3 The main features of digital sound

Analog signs continuously change according to sign, time, and amplitude.

Digital signs are composed of a series of impulses as compared to the temporally continuous feature of the analog signs. Accordingly, the digital sign does not contain all aspects of the analog sound, only the respective sound samples. Since sound can be divided into unlimited units in a

temporal sense, there is no capacity available for storing such an amount of sound.

Despite not containing all components of the original sound, the digital sound appears to be of better quality (fuller, more complex) than the original analog version. This misconception is is caused by the correlation between sound and noise along with the greater dynamics domain.

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The main features of digital sound:

- Insensitivity to temperature and voltage fluctuation;
- Lower sensitivity towards transmission channel noise;
- High speed of sign transmission;
- Unlimited copying capability without loss of sound quality;
- Greater sign-noise correlation and dynamics domain;
- Signs are not distorted
- Sensitivity to data loss– the use of corrective circuits
- Complexity of sign processing and transmission circuits

8.6.4 The sound digitalization process

During the digitalization of sound the analog sign is converted temporally into a series of separate impulses. The information content of amplitude values is carried by binary coded code word sequences.

The quality of digitalization is defined by two factors:

- **sample taking frequency:** the density of sample taking from a continuously changing original sound sign (number of samples per second).
- **sample size:** the quality of definition, or the bit content of a chosen sample
- The Pulse Code Modulation Process includes four steps.

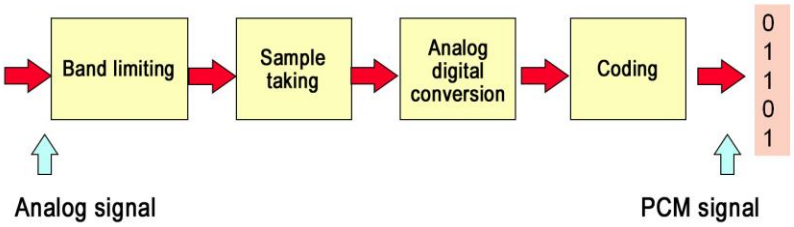


Figure 35: The steps of the sound digitalization process

Band limiting

The first step of digitalization is **band limiting** or **quanting.** During band limiting the definition of the sample is determined and such data will form the steps of the quanting process. The more parts the voltage of the analog sign is divided into, the more accurate can be the reconstruction during the analog to digital conversion. Current sound cards have a capacity of 16-24 bits (in extreme cases 64 bits) but according to the HiFi standard a 16 bit definition is sufficient for the restoration of the original voice. If we imagine the process in a a system of coordinates, the band limit is represented by a vertical axis indicating the zero and maximum voltage level.

During quanting the interval of voltage values is divided into a definite number of steps and instead of the real voltage values we rely on these fix values.

Sample taking

The second step of digitalization is sample taking during which at certain intervals we measure the analog sign and read the voltage value. These values cannot be used for digital processing as we receive continuous information. During sample taking we have to take Shannon's law into consideration. According to Shannon's law

- **A sign can be fully restored if the sample taking frequency is at least twice the amount of the highest frequency components found in the given sign.**

While the law appears to be complicated, it can be easily understood.

As we mentioned earlier the frequency domain of human hearing is between 16-20 000 Hz. Thus according to Shannon's law the highest possible frequency found in an analog sign is 20 000 Hz. Since we have to use at least twice the amount of the frequency as a sample the sample taking frequency will be 40 000 Hz. According to the HiFi standard a 44.100 Hz. is a standard value, but during professional digitalization the applied values can be 48 KHz, 96 KHz, or 192 KHz.

Naturally, the greater is the sample taking frequency, the higher is the given sound quality.

Analog to digital conversion

During the third step of digitalization the sample values expressed in the decimal system are stored by a digitalizing algorhythm.

Coding

During coding the decimal values of sound samples are converted into binary codewords.

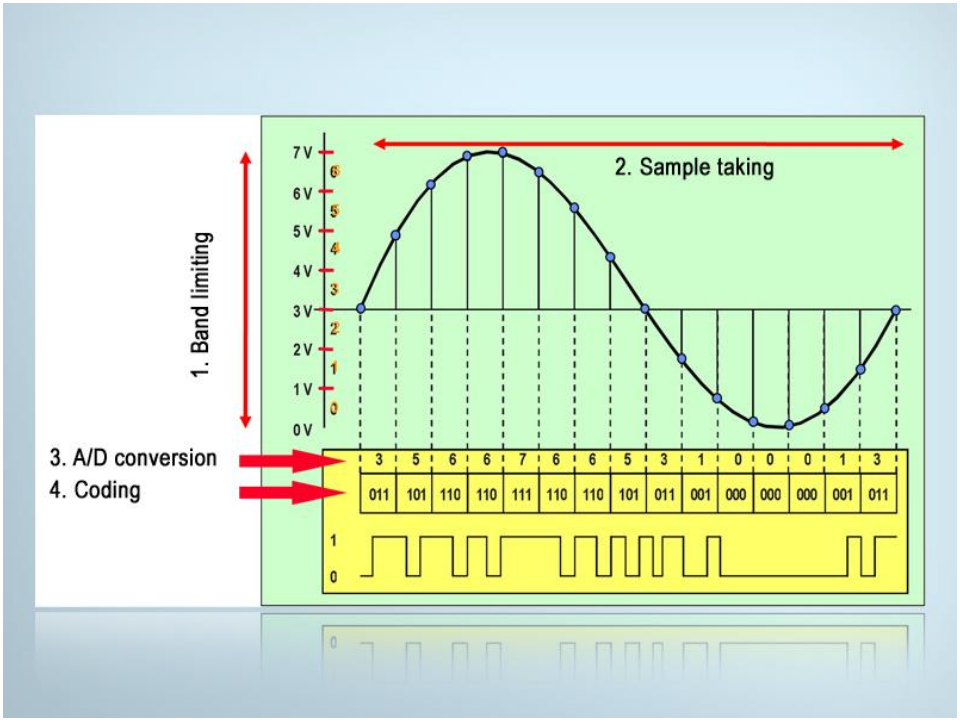


Figure 36: The stages of sound digitalization

8.6.5 Digital sound formats

The WAV format

The WAV format is one of the data formats of digital audio data. Compared to the MP3 and other data formats, the WAV format does not compress audio data, but compressed data can be stored in WAV format.

The WAV format was defined by Microsoft for the Windows operation system under the name Resource Interchange Format" (RIFF)

In a WAV data sequence three blocks or chunks can be found with the following information:

- The RIFF segment identifies the sequence as a WAV data sequence.

- The format stores a few characteristics including the sample taking frequency.
- The data segment includes real actual data.

The WAV (WAVe form audio) files are considered the standardised format of digitalized sound in multimedia productions. The digital sound waves can have differing sample taking levels (11,025 kHz, 22,05 kHz, 44,1 kHz; mono or stereo). In addition to standardised sample taking proportions the WAV files can contain other sample taking proportions. In this case, however such recording programs or sound cards are required, which support these proportions and are able to disseminate the sound appropriately. All programs support such proportions without exception.

MP3, MPEG Audio Layer-3

The MP3 is a file format developed in 1991 in the Fraunhofer Institute. The format facilitates standardised sound compression with a high rate of data loss.

As a result of compression sounds inaudible or hardly audible for the human ear are eliminated from the MP3 file.

The quality of the MP3 file depends on the compression program and the complexity of the coded sign. *Psycho-acoustic coding* is based on a variety of algorhythms which via modeling the characteristics of the human ear determine which sounds are omitted. A compression density of 128 kbps can reproduce CD quality sound. This technically equals to an 11:1 compression rate with compromises on the field of sound quality.

Experienced listeners can recognize quality differences between a 192 kbps and a 256 kbps file. If we want to archive files without quality loss we should use data loss free codecs including the FLAC[93], SHN or LPAC – these programs can compress a sound file to 50-75% of its original size without data loss.

The MP3 format is ideal for the establishment of sound data bases of libraries or the publication of sound repository materials on various quality factor levels.

8.7 SOUND DIGITALISATION WITH COMPUTERS

8.7.1 The sound of the computer, the sound card

Sound cards are the general sound processing devices of computers.

[93] http://www.tutorial.hu/flac-vesztesegmentes-audio-tomorites/

Sound cards provide a wealth of opportunities but their basic two functions are the displaying of the digital audio sequence and the digitalization of speech or other audio material.

In order to prepare good and reliable quality recordings professional users have to buy special and unique sound cards with a capability of fulfilling digitalization tasks in library contexts.

The most important components of sound cards is the sound processor performing diverse operations on the sound, relieving the CPU, the analog sound circuits (FM chips), the wave tables, the A/D, or D/A converters, the ROM, and the RAM storing data required for wave table synthesis, and the various connections (inputs, outputs).

The input of sound cards

The sound cards have three inputs :

1. (Line in),
2. (Mic in) and
3. CD-input

With *Line in* the digitalised sound is entered or played from the speaker via direct amplification. *Mic-in* facilitates the connection of a microfone. In order to listen to audio music the CD input can be connected to the connection point found at the back of the CD-ROM. These solutions became obsolete after the introduction of the Windows XP and subsequent other systems as audio is provided by software.

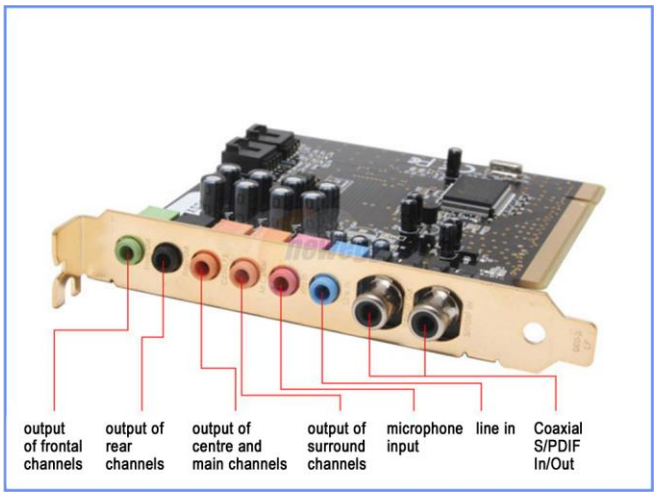


Figure 37: Connection points to modern sound cards

The output of sound cards

The output of multichannel sound signs can be provided via analog or digital channels. The numbers indicate how many surround speakers compose the sign and the digit 1 indicates whether there is a separate sign available for the deep impression format. In case of analog connection 3 connectors are present and the 5.1 and 7.1 numbers indicate special multibranch connections. The analog output 1 is the most frequently found sign on sound cards, providing sound in decoded, analog form. In case of digital connectors only one connection is used for the forwarding of all channels. The digital sign has to be connected with an amplifier and in special cases optical output can be used as well. Optical output refers to the transmission of digital codes in the best possible quality by a thin fiberoptic cable.Its use requires an amplifier as it can include multichannels. The best means of digital connection is the coax cable forwarding the sound signs in digital form regardless of stereo or multichannel formats.

8.7.2 Types of digital connectors

S/PDIF

The S/PDIF (Sony/Philips Digital Interface Format) is a connection facilitating high quality digitalized sound output for home electronics.

Sign transmission can take place via standardised, copper based RCA designed specifically for this purpose (KOAX) or via fiber optics with the help of TOSLINK[94] connectors. The S/PDIF is suitable for sign system transmission with Dolby Digital or DTS surround without any loss of information.

The use of S/PDIF does not require multicable data transmission as the digitalized signs can be broken down via a standardised connection surface.

[94] The TOSLINK forwards the same S/PDIF sign as the one transmitted by the coaxial version, but it provides a somewhat lower sound quality. This is due to the fact that the internal sign processing of both the DVD player and the amplifier is electronic. Thus the optical sign transmission requires an electronic optic conversion and its opposite on the receiving end. The laser diode and the photosensor performing the respective operations is not homogeneous, causing jitter in the sign eventually leading to decreased sound quality. The optic sign transmission can only be advantageous if the sign is forwarded to great distances (more than 4-5 m). In this case the coaxial cables can pick up electronic disturbances, also leading to poorer sound quality. The quality of the cable can determine the sound, but the optical cables only differ in mechanical structure and do not substantially impact sound quality.

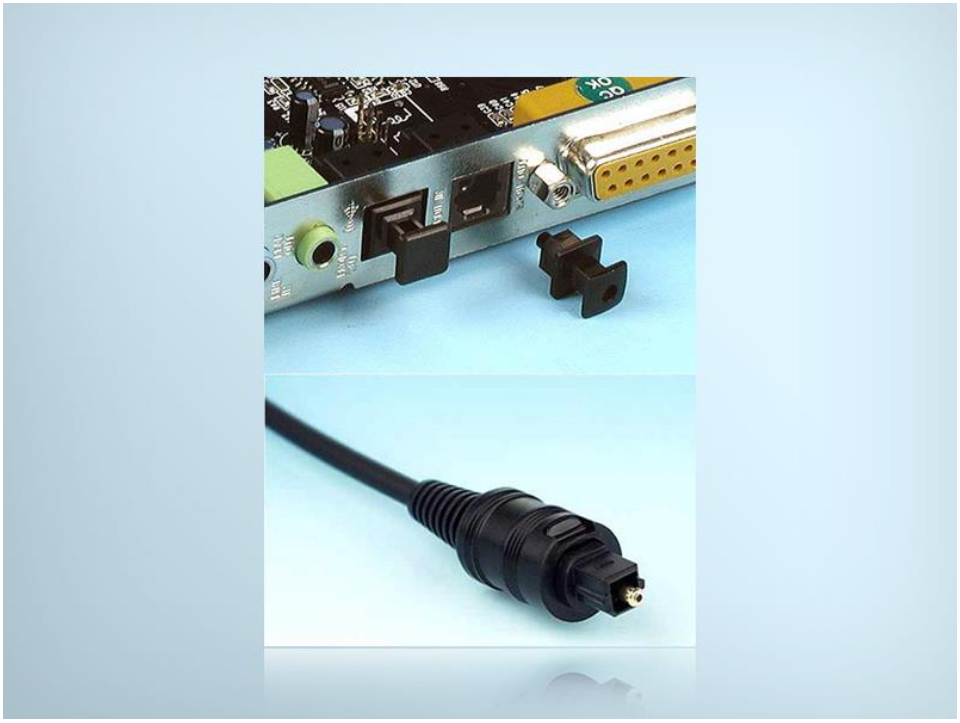


Figure 38: S/PDIF (TOSLINK) connector and jack

HDMI

The HDMI connector (*High Definition Multimedia Interface*) is a multimedia sign transmission standard facilitating the forwarding of any digital picture, sound, or control sign in an uncompressed format.

Its main advantage is its capability to connect two sets with one cable, thus the user does not have to watch out for the input and the output of the respective sound or picture transmission function. The HDMI connector is suitable for simultaneous forwarding of HDTV pictures and high definition upto 7.1 channel DVD-A or SACD digital sound sign. The data transmission speed of the HDMI is 5 gigabits per second.

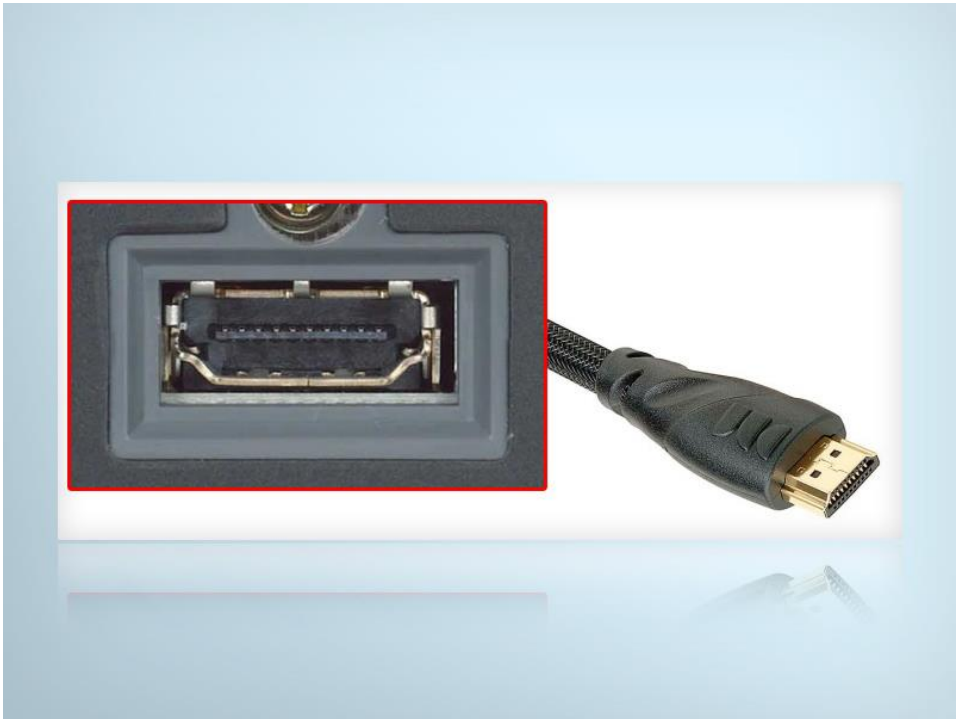


Figure 39: HDMI jack and connector

8.7.3 Matching analog and digital sources with computers

The sound card of the computer can process both analog and digial signs as input sign.

Analog sources (disc player, tape recorder) can be connected with a LINE IN connector, or with a 3,5 jack, or with RCA connectors.

Digital signs can be received from MiniDisc or other digital sources via S/PDIF connectors (TOSLINK or coaxial)

Figure 40: S/PDIF connectors

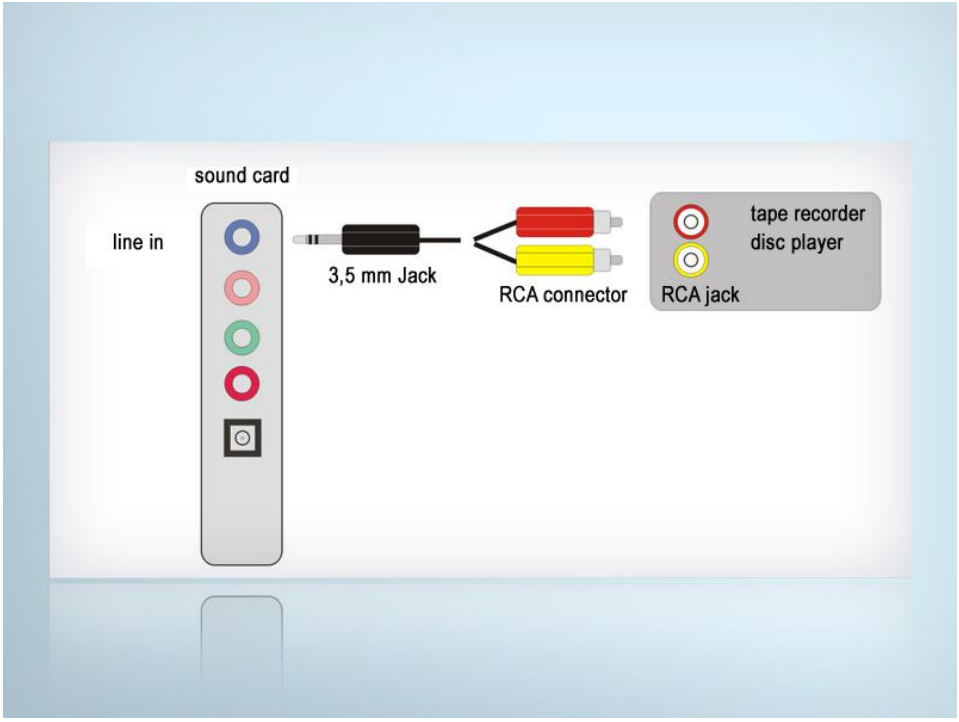


Figure 41: Matching analogue device with sound card

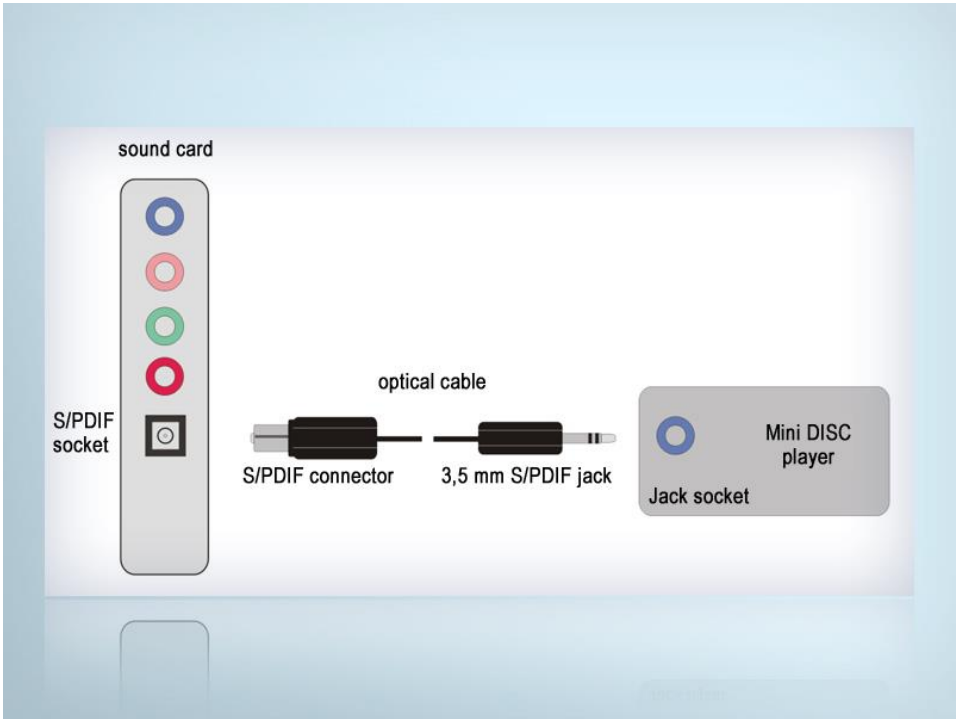


Figure 42: Connecting digital device to sound card

8.7.4 Sound digitalization software

Sound Forge

Sound Forge developed by Sony is ideal for professional digital sound editing and digitalizing purposes.

The program allows digitalization in multiple quality and the recordings can be edited after digitalization. Sound Forge is capable of mixing, repairing, and effecting several music patterns, and even removing noise from older, poorer quality recordings The program can prepare multichannel recordings, take 64 bit samples even at 192 000 Hz sample taking frequency.

Files can be saved in different formats with a multitude of parameters.

Adobe Audition

The Adobe Audition is a professional sound editing program developed for audio and video experts. The program allows the combination of up to 128 channels, along with preparation and editing of unique sound files. It can provide more than 45 DSP (digital sound

processing) effects, along with filtering and audio retouching options. The Adobe Audition is ideal for the production of music, radio programs, mix, or any other sound material. The 32 bits can provide excellent sound quality during recording, editing, or mixing. While sample taking is possible above 100 MHz, most frequent sample taking frequencies (44.1 kHz, 88.2 kHz, 96 kHz, 192 kHz) are available as well. We can easily prepare audio materials for the 24 bit/96 kHz DVD-ready format as well

8.8 THE APPEARANCE OF MOTION PICTURE IN THE EDUCATION PROCESS

The application of pictures in education was first described by Comenius in his *Orbis Sensualium Pictus*, (the visible world in pictures) (1650-54). *He asserted that students should be influenced via their sensory organs*.[95] The film-like application of pictures was developed long before the birth of the motion picture. Interconnected picture sequences were suitable for describing long processes.

The application of films for educational purposes coincides with the birth of the motion picture. As most researchers agree the film was first used for educational purposes in France in 1896 a year after the public screening of the work of the Lumiere brothers (Nagy, 1928). The Eclipse firm issued a catalogue of films recommended for educational use in 1907 and Pathé established an instructional film division. However, other firms were involved in the production of educational films as well. (Körmendy Ékes, 1915).

8.8.1 Motion picture and illustration

Motion pictures can become effective demonstration or illustration options only if the respective demonstration effort is organically integrated into the educational process, that is the demonstrated information has precedents and antecedents, in other words it is placed in a context. In all other cases demonstration becomes arbitrary. The appropriate demonstration context requires relevant observation, task performance, and activity criteria.

While motion picture, as compared to still image can be processed in a linear manner, electronic devices, especially the computer faciltate the combination of linear and non-linear processing as the given work can be viewed again and even certain details can be selected. Due to electronic

[95] Source: http://www.magyarpedagogia.hu/document/Szabo_MP1091.pdf

devices (computers, content stored on servers) the frontal work format characteristically required by motion picture processing was complemented with individual, independent activities.

Motion picture elements are the most spectacular components of electronic texts. They should be concise, short, and clip-like.

8.8.2 Motion picture formats

The digitalization of motion pictures requires the greatest information storage capacity. The size of 1 minute uncompressed video can be even 100 MB. Consequently video storing standards were introduced with the aim of promoting the production of good quality and small size files.

MPEG standards

One of the most frequently used standards is the MPEG (Motion Picture Experts Group) enabling the production of good quality video with relative low storing capacity demand. Based upon this compromise the MPEG condenses or comprises material at 1:100, or 1:200 magnitude with a loss. The program following a set algorhythm does not store all frames, only preserves the differences between the given frames. Compressing results in 3 kinds of frames

1. Intra pictures are fully stored frames
2. Predicted pictures store the movement and the differences between two frames.
3. Bidirectional pictures connect intra (I) and predicted (P) pictures.

Various MPEG standards guarantee different picture quality.MPEG1 produces the lowest merely VHS quality practically equal to the quality of the Video CD, with 25 half picture/sec quality (TV produces 50 halfpicture/sec quality).

The MPEG 2 provides DVD quality with 50 half picture/sec at a 720 x 576 picture size.

The quality requirements of the MPEG 3 standard have only been used for a few years. It is primarily used with HDTV applications until 1920x1080 definition with 20-40 Mbit/sec data transmission speed.

The MPEG4 standard was developed for the fast and good quality motion picture and sound transmission, primarily for video conferences but it provides the foundation of the 3G telephone technology and the DivX, XviD video format as well. The MPEG 4 is the most popular MPEG standard. While it was specifically designed for other areas, due to its

highly developed algorhythm it was successfully applied for HDTV definitions as well.

Quick Time

This multimedia technology developed by Apple. Quick Time can be used for the processing of differing format media content (digital video, sound, animation, text, music) on Windows and Mac OsX systems as well. The file extension is MOV.

AVI (Audio Video Interleaved) standard

Designed by Microsoft, AVI is a widely used multipurpose format condensed via a different coding algorhythm (codec).

It is an originally uncompressed format capable of the synchronised presentation of sound and motion picture.

It is based on the RIFF format in which it forms a block divided into two mandatory and one optional sub-blocks.

The first sub-block the headline of the file contains meta data on the video (size, number of frames), the second is the video data sub-block. The codecs code the second, sub-block, thus the AVI format can play any data compressed by any algorhythm as the codec translates the respective data and forwards it into the second sub-block without touching any other part of the file.

8.9 TEXT DIGITALIZATION, TEXTUAL FORMATS

In order to digitalize text we have to use OCR programs in addition to the scanner. The OCR program refers to optical character recognition. During the process the computer identifies the characters of the scanned text with its own stored characters and creates a digital text file. While character recognition programs are usually not complex, they have to meet a number of requirements. The optical recognition process includes the following elements:

1. reading the picture of the text,
2. examining the textual blocks and lines displayed on the picture,
3. recognizing the letters or letter pairs in the blocks or lines,
4. spelling or grammar control of the recognized text.

One of the disadvantages of text recognition programs is that they can process only good quality typed or printed texts, and they do not recognize handwriting and even the recognition of special characters or formula can cause problems as well. It must be noted that one of the best

text recognition programs, the much acclaimed Recognita Plus was developed by Hungarians.

Several development programs use their own built-in text processing program modules, but formats borrowed from external word processors can be used as well. The most frequent formats are the Word DOC, RTF and the simplest TXT (text).

8.10 SUMMARY, QUESTIONS

8.10.1 Summary

The lesson familarised students with the theoretical background of the digitalization of pictures, audio materials, text, and video required for the production of electronic educational materials. The chapter provided information on the following topics: the main features and quality parameters of digital picture formats, the digitalization and quality criteria of audio texts, the role of sound, text, and motion picture in elctronic educational materials.

An important aspect of the production of electronic educational materials is the digitalization of appropriately selected texts. During development special care has to be taken regarding quality and the use of formats compatible with the developmental software.

8.10.2 Self-test questions

1. What kind of media units are used during the development of electronic educational materials?
2. What does the term *digitalization* mean?
3. What are the theoretical differences between the digitalization of picture or sound?
4. Which are the most frequently used video sound and picture formats?

9. ONLINE PEDAGOGICAL KNOWLEDGE BASES

9.1 OBJECTIVES AND COMPETENCES

The lesson's main objective is the familiarisation of students with the structure and use of the most important electronic knowledge bases developed in Hungary.

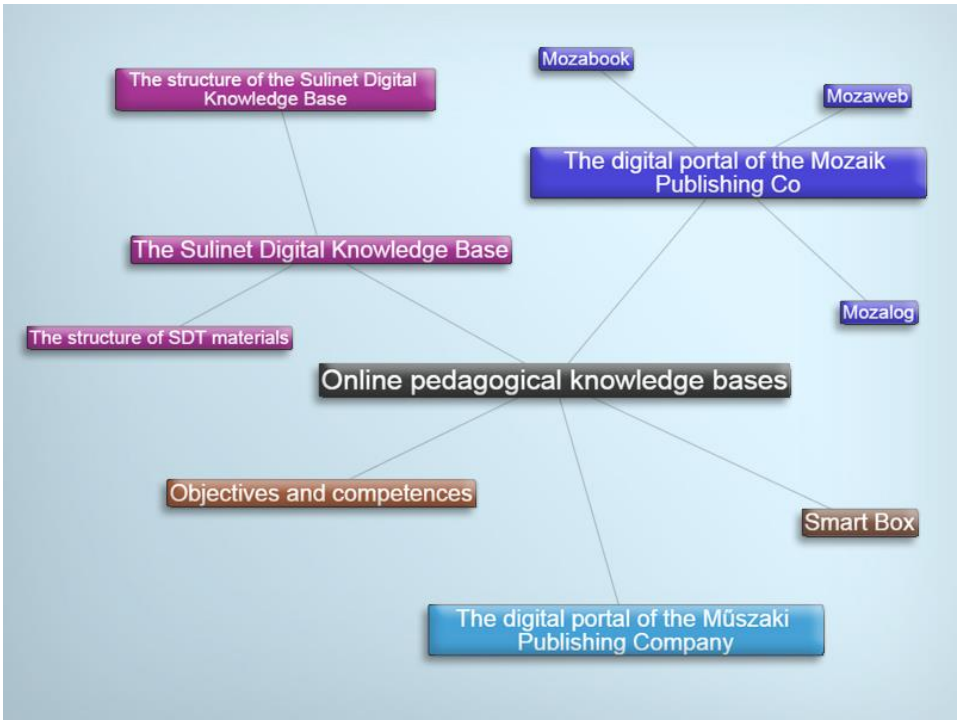


Figure 43: Conceptual map to Lesson 9

9.2 THE SULINET DIGITAL DATA BASE

The Sulinet Digital Database (SDK) is an e-Learning framework system and digital educational material data base. The main function of the SDK is promoting the development of ICT competences via the elaboration of a standardised digital text system. SDK however, is not only a collection of digital texts, but a practical implementation of application oriented methodological and technical support services as well.

The e-Learning framework system contains educational materials in more than 11 000 class hours length along with more than one million textual units, texts, pictures, animations, simulations, videos, sound materials, links, and test. Said educational materials cover the secondary school graduation requirements along with the 17 fields of professional education.

The web surfaceof SDK has been freely available since September 2004. (http://**tudasbazis**.**sulinet**.hu/).

9.2.1 The structure of the SDK system

The SDK system is based on the following architecture
Components and modules:
The Learning Content Management System and its components

- The SDK object repository
- Publication module
- Work-process module
- User-operator module
- Search module
- SDK user surfaces
- SDK Web surface
- SDK Content producer
- Other SDK surfaces

The most important aspect of the system is that the given objects are accessible not online, via a continuous server connection, but through bundled publication processes (complex import/export procedures).

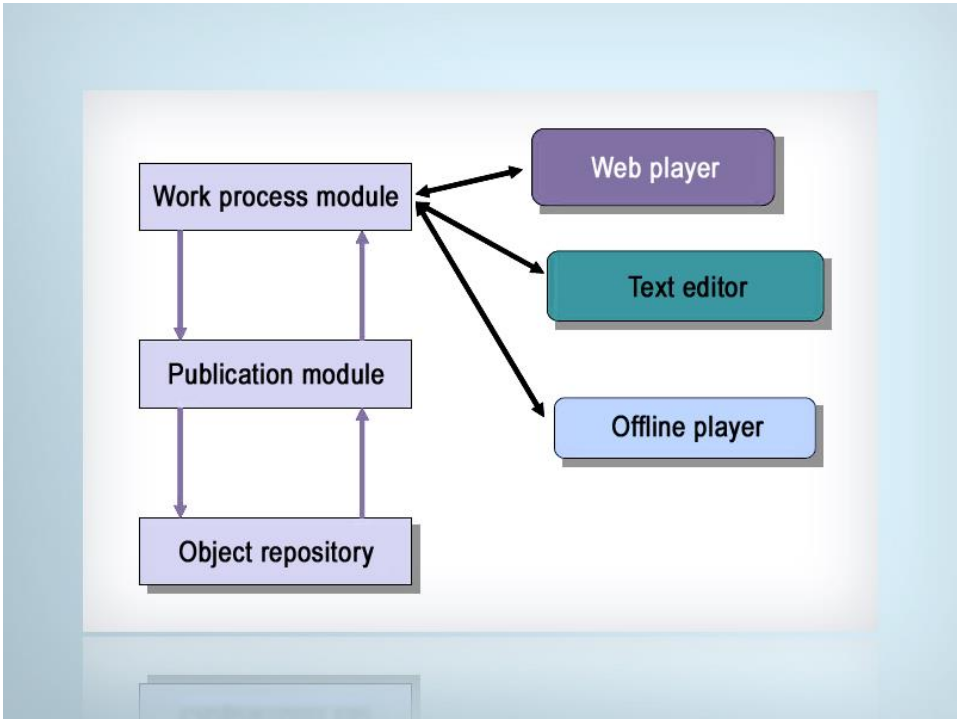


Figure 44: The structure of the SDK system

9.2.2 The structure of SDK materials

The SDK is based on a modern object content management system. This system is capable of storing specific content units or objects regardless of the respective physical format. Such objects include the text, picture,motion picture, but also the SDK sheet containing several simpler objects,texts or pictures equaling a lesson with the same duration as a traditional classroom session.

The individual objects do not correspond directly with a given file. A given SDK object can contain several files along with metadata or information not related to the main features of the file. Such metadata can include identifiers (the name of the object), key features promoting search (key terms, categories) or pedagogical information (the target group of a session, or the respective competence development criteria).

The pedagogical and methodological features (characteristics) of a session include the respective length, the developed competences, and the given target group. These features are provided by the SDK type and the SDK types compose the SDK scheme.

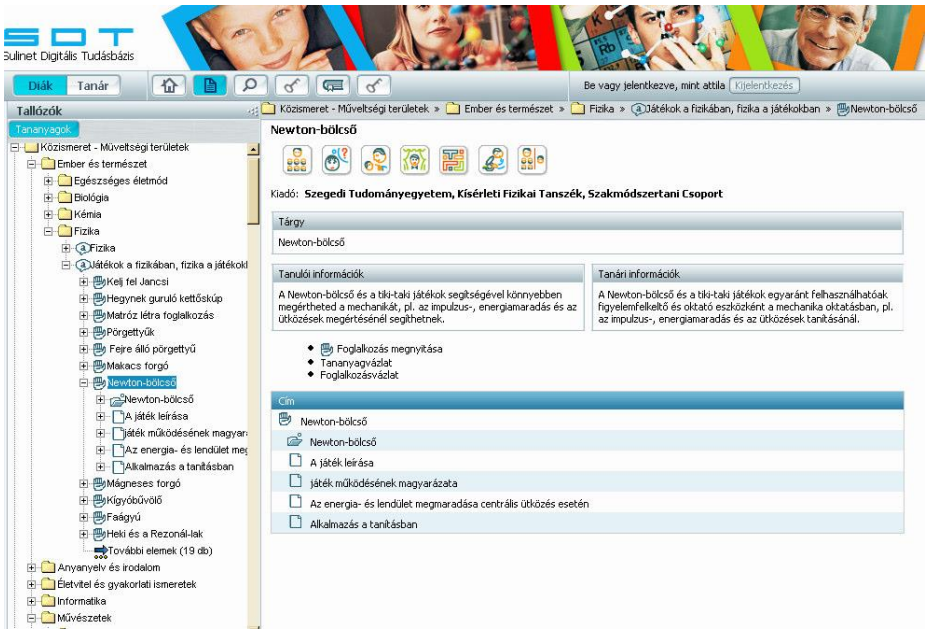


Figure 45: The structure of educational materials in the SDK.

Student,teacher,browsers,field of discipline, humans and nature, health,biology, chemistry, physics, games in physics, Newton cradle,the description of the game, the operation of the game, energy and momentum, educational application, published by the Special Methodology Group of the Department of Experimental Physics of Szeged University

Learner information: These games will help you to understand such concepts as mechanics, the concepts of impulse, energy retention, and physical clash.

Teacher information: The games can be used as an attention evoking device for the teaching of such concepts as mechanics, the concepts of impulse, energy retention, and physical collision

Newton cradle, the description of the game, the operation of the game, retention of energy and momentum in case of collision, educational application

9.2.3 The structure of SDK[96]

The knowledge base has two important components the framework system and the educational material data base. The key functions of the framework system are navigation among the materials and the presentation and displaying of the given texts. The framework system (Learning Content Management System, LCMS) and the respective educational materials promote the development of ICT competence and the application of modern digital pedagogical methodology. The educational materials facilitate a simultaneous display of textual, multimedia, and other sound elements.

The well-known e-Learning standards also apply to the SDK materials. The curriculum is divided into separately processable textual units, and the clear and unequivocal use of said units is promoted by a demonstrative and subject specific symbol system. The materials are available for education, research, and dissemination purposes.

Learning objects

The curriculum contains separate units called learning objects. The most frequently applied learning objects include the topic, session, and sheet, but collections, glossaries, text outlines and session outlines should be treated in the same way.

Theme

The texts are organised into themes covering the whole curriculum. The given themes process a larger textual segment including sub-themes. The building unit of themes is the session.

Session

Sessions are textual units containing information processable within 5-40 minute periods. The session is composed of structural nodes, mostly in form of pages, but collections, tasks, activities, and sometimes even animations can function as nodes.

The titles of sessions are listed in the left side browsing window. After marking a session title, the icons pertaining to the session appear in the right window along with the relevant topics, teacher and student

[96] Dancsó T.: A Sulinet Digitális Tudásbázis tananyagainak felhasználása az oktatásban (The use of the materials of the Sulinet Digital Knowledge Base in education) http://epa.oszk.hu/00000/00035/00116/2007-09-in-Dancso-Sulinet.html

programs, class outlines, text outlines, and the downloadable reference package options.

Session graph

The structure of sessions is represented by the session graph indicating the sequence of the processeable nodes for teacher and learner at the same time. The structure of the session graph reflects learning routes whose completion is required by the given session. There are many ways of conducting sessions and the branching off of the graph indicates the available differentiated learning support options.

Pages

Pages are the building units of sessions functioning as textual components presentable on a screen or accessible via minimal scrolling. Pages present textual components in organised form. Each page has separate teaching and learning programs becoming visible in the window titled Service after the activation of the given page.

Teacher and learner information provided by pages

Learning and teaching support guidelines become available after clicking on the Teacher/Student button of the Service window. Students can access only learner information, while teachers are provided access to information related to the instruction process. The respective teacher and learner information provides ideas or makes methodological recommendations for the arrangement of the learning process.

Repository, collection

Repositories or collections are learning objects containing textual units, pictures, audio material, animation, motion picture, links or activities. There are two types of collections: homogeneous repositories and heterogeneous repositories storing identical and varying components respectively.

Learner programs

Learner programs allocated to the given textual units provide ideas and make recommendations for the effective processing of the materials and successful learning on an individual basis. Such information could include prerequisites for fulfilling the requirements of a given page, advice for managing the learning process along with illustrations of learning exercises and methodologies.

Teaching program

Teaching programs provide information for instructors conducting the given session.The teaching program highlights, confirms, and specifies the instruction objectives of the given session, presents various alternative application options, indicates potential means of combining ICT-based methods with traditional teaching approaches while making recommendations for studying the available professional texts in online or traditional printed format.

Concept repository

Concept repositories include the descriptions and definitions of relevant concepts. Authors tend to interpret concepts in a broad manner as a given text could include up to several thousands of concepts in session specific groups. The relevant concept repositories contain all concepts and terms pertaining to the given textual segment while students are provided concept descriptions and definitions in textual units as well.

Conceptual map

Conceptual maps arranging information in a determined structure promote the understanding of the given material via the promotion of systemization, arrangement, and effective text processing.

Conceptual maps represent the connections of textual concepts and the sequence of processability in a tree-like structure.

Conceptual maps facilitate the structuring of a session along the respective conceptual correlations.

Text outline

Text outlines summarise the content of a given session practically fulfilling the same function as a class outline written down in an exercise book. Text outlines include the conceptual map, the learner information, the level of output requirements, the titles, topics and learner information provided by the given pages.

Session outline

Session outlines summarise the basic information of a given session for teachers. Session outlines include the respective teacher information, the title, topic, and other teacher-specific information provided by the given pages.

Textual and session outlines are directly accessible under the learner and teacher information segment.

9.2.4 The digital portal of the Mozaik Publishing Company

The Mozaik Publishing Company is one of the most dynamically developing publishers of textbooks. The company offers an integrated digital instruction system designed for interactive boards. The mozaLearn program provides online options and school administration features promoting individual learning at home. The three components of mozaLearn are mozaBook, mozaWeb and mozaNapló (mozaLog).

The portal is available at the http://www.mozaik.info.hu/Homepage/Mozaportal/index.php link.

9.2.5 mozaBook

The **mozaBook** is a framework system facilitating access to the electronic textbooks of the publisher. The Mozaik Publishing Company has prepared the interactive version of all of its elementary and secondary school textbooks. The use of the surface requires registration provided by the publisher along with the purchased textbooks for the school. The registration enables teachers to download the necessary textbooks.

The electronic versions are faithful copies of the original printed version of courses in an interactive form. Any component of the electronic textbook can be highlighted and shown on the interactive board, while paragraphs can be shown according to the beginning section as an ideal means of the presentation of definitions. The pictures can be enlarged upon demand,the electronic texts contain 2D or 3D interactive animations not available in printed forms. The viewing of 3D animations naturally requires special glasses.

The system provides another important service, the teacher can create exercises according to his own needs. The media units can be composed into an exercise book. Any component of the textbook can be placed in a photographed form into an exercise or notebook promoting independent learning or effectively supporting in class monitoring efforts.The notebooks can be saved and the respective elements can be combined into an animation improving the didactic capability of the teacher’s explanation or the task at hand.

The various changes can be saved and retrieved at any time, making studying at home or preparing for classes problem free.

In addition to the auxiliary materials insertable by the help of the framework system functions, the publisher provides additional content,

which can be started from icons located at the edge of the electronic textbook pages. Thus pictures, illustrations, audio materials and 3D animations fully representing reality (experiments, science propagation short films) not included in the printed version become available. Playful exercises and several devices (periodic system, mini-map, numerical line) help the experience-based processing of the given materials.

The electronic version of the environmental, geographic, and history atlases published by the Mozaik Publishing Company can be accessed via the mozaMap map program. Similarly to the **mozaBook** the full content of the atlases (almost 300 maps) can be accessed. Fast navigation, enlarging capability without data loss and drawing and animation preparation functions make this digital atlas simple, yet spectacular.

One of the biggest advantages of the program is the capability of hiding and revealing the respective map units on demand. Thus we can produce our own maps without unnecessary pictograms and map units. The settings can be saved, and uploaded with one click.

The program similarly to the mozaBook framework system is optimalized for interactive table use.

The **mozaSlide** interactive transparencies are the digital versions of the traditional Biology and History transparency series. The transparencies can be placed upon each other, enlarged without quality loss while the subscriptions can be displayed separately. The transparency groups include test sheets, control questions, demonstration guide, and the determination of objectives.

Euclides is a geometry editing program facilitating the digital implementation of manually performed constructions. The program allows the plotting of base points along with sections, lines and circles. The plotted geometric objects form intersection points and provide the foundations of additional geometric objects. The computerised version of geometric constructions is very accurate as compared to the printed version, namely when two lines have to intersect in a point, they do.

The elements of the completed construction can be moved and the origination relations remain the same.

We can use various colours and line styles in order to provide better and more transparent figures, while the non-essential objects can be hidden.

The **Euler3D** is a spatial geometry editing program facilitating the editing, demonstrating, and mathematical control (screening self-intersections, fractured plane, the division of concave polygons) into triangles of various polieders and surfaces. The program can help in the creation of geometric shapes defined by the vertex, base, and altitude.

The program allows the performance of various spatial geometry manoeuvres even as a multiplication of the respective transformations including, mirror projection, shifting projection, revolving projection, and stretching.

The constructed shapes can be moved or enlarged by the help of the mouse. The geometric objects can be described in two ways: perspective and axonometric (orthogonal) projection.

9.2.6 mozaWeb

The Mozaweb interactive publications available at the **www.mozaweb.hu** site were primarily prepared for Internet and home use. They can be accessed with any browser as no special program is required for their use. The desired textbook can be selected from the list of themes. The web-textbooks similarly to the mozaBook digital textbook are the full versions of the textual and picture content of traditional texts. However, the text is not available in a page turning sheet format, but in chapters, on individual pages.

The constantly visible table of contents facilitates fast navigation.The chapters and the respective lessons can be accessed with a single click. The search function enables the user to find any texts in any textbooks.

The digital encyclopedia or lexicon contains interactive additional content and the explanation of terms in the actual textbook under use. At the same time theme-specific glossaries pertaining to the whole textbook collection and a browsing option for the whole lexicon data base are offered as well.

9.2.7 MozaLog

The electronic report function or the **mozaLog** facilitates effective communication between the school and the parent. The system is easy to operate, transparent, and provides administrative security. The digital class records allow parents to follow the academic progress, absences, and behavioural evaluation of their children.

The program helps the teachers as well since it makes administration and the related monitoring tasks easier. Furthermore, the statistic reports prepared by the program can be applied for a variety of purposes.

The school webpage provided by the publisher, **mozaPorta**l was especially designed for an educational environment and has a currently functional structure. Schools can shape the menu system and the content according to demand, the maintenance and updating of the webpage takes place on a transparent user surface, which can be operated by any person with basic level of computer literacy.

9.2.8 The digital portal of the Műszaki Publishing Company

Similary to the Mozaik Publishing Company the Műszaki (Technical) Publishing Company offers interactive solutions to its textbooks.

The portal is available at the following link: http://muszakikiado.hu/ok_online_konyvek_

As a result of the development process 58 textbooks are offered for elementary and secondary **education purposes** in OK! format.

The educational materials can be used on learner computers and on interactive board.

The main features of the program:

- it contains built in professionally lectured excess content, or so-called hot spots helping understanding, practice, self-monitoring, and control.
- allows teachers to upload and share their notes and generated contents, to create new materials for computerised or interactive instruction.
- Differentiation, remedial education, and talent nurturing objectives are implemented in one text.
- The preparation of students is helped by their own notes, references and the self-test questions.
- easy accessibility at school, on the road,or at home.
- The **OK! Teaching Assistance Online Books** program helps the class preparation of pedagogues by providing freely accessible animations and applications and tested links in addition to the hotspots of the publisher. The program provides a wide selection option, reduces class preparation time, and increases the availability of student friendly content.

The teaching assistant version accompanies the upper division Hajdu authored mathematics textbooks, but the collections related to the given topics can be used by any teacher at the upper level elementary school.

In order to promote individual learning the Műszaki Publisher prepared the **OK! Online version for individual learning a**ccessible both for students and parents from an internet connected computer, laptop, tablet, or smart phone. The additional content helps at home preparation, practice, and self-monitoring. Students learning from other textbooks can use the program as well.

The individualized version helps parents to keep pace with teacher expectations concerning the material and the homework and they

become more effective in helping their children while monitoring their knowledge level with test questions.

Smart box

The Smart box was developed by the editorial board of the egyszervolt.hu as a game based skill and aptitude development educational material for the 5-11 age group.

In addition to being acclaimed both by parents and children the program was awarded a special Knowledge supporting application prize at the eFestival competition in 2013.

The exercises become accessible at the http//:okosdoboz.hu webpage. The exercises are divided according to grade and subject, each grade has its own colour as indicated with the exercises. In the boxes of the matrix we find playful exercises and riddles pertaining to the given text. A cell contains at least 3-4 exciting tasks, but in some cells we find more games.

After clicking on the name of the subject all relevant and connected tasks are displayed. The program provides a task search option as well. If we find a task or exercise different from the grade assigned colour we can use it as a review option. The Smart box program provides support to the education process in the four lower elementary school class grades in four competence areas: mathematics, text production and reading comprehension (native language communication), life plan construction (arts) and social, life style and environmental issues along with six subjects: mathematics, reading comprehension, grammar, visual culture, music, and environmental education.

The program offers developmental games to all 170 educational topics with 251 exercise sequences incuding 1506 playful exercises for students and teachers alike.

9.3 SUMMARY, QUESTIONS

9.3.1 Summary

The most important manifestations of ICT applications are data bases which are available for anyone on demand, can be continuously improved and make the teacher’s work more attractive while meeting the technological demands of our times. Many applications provide a didactic background for independent processing by students.

9.3.2 Self-test questions

1. Describe the structure of the SDK.

2. Describe the components of the SDK framework system.

3. Describe the mozaWeb.

4. What are the main aspects of the application of the Smart box?

Module IV. Electronic learning spaces /AP/

10. THE PRACTICAL ASPECTS OF THE PREPARATION OF AUXILIARY ICT MATERIALS

10.1 OBJECTIVES AND COMPETENCES

The aim of the lesson is to introduce the use of the Lynx and WordWall interactive board software and the respective polling system. Students can become familiar with the options provided by the program, the methodological background of the preparatation of interactive task sequences. Furthermore, methodological options will be provided for the use of CMPC by the introduction of the Netsupport classroom management program.

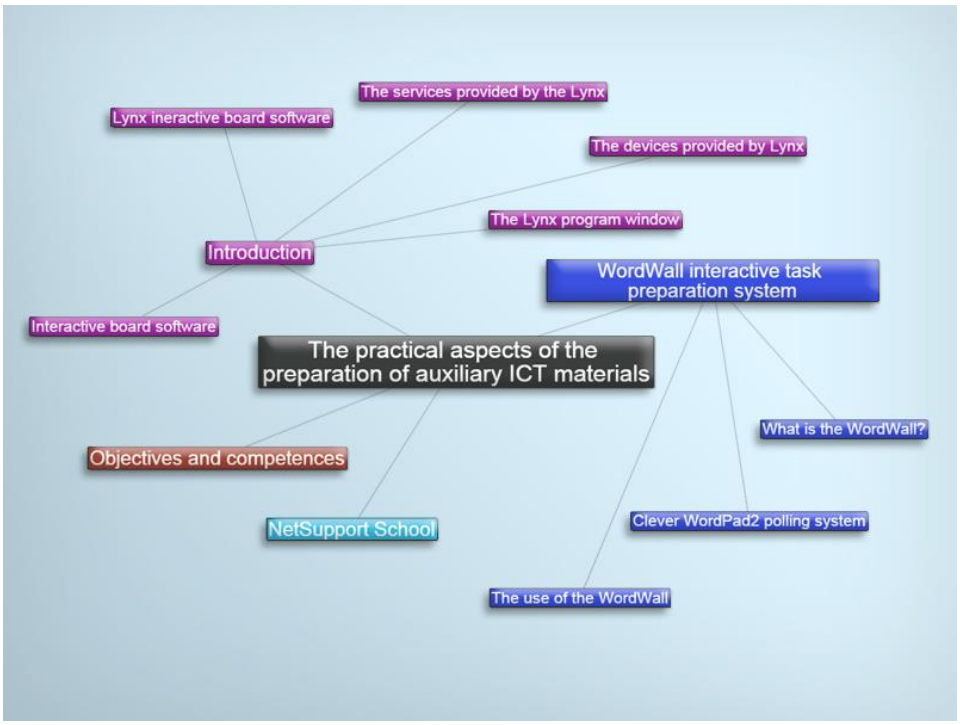


Figure 46: Conceptual map to Lesson 10

10.2 INTRODUCTION

The quality and the efficiency of the learning process is determined by teacher competences, the applied instruction technology devices, the effectiveness of the respective methods and the quality of the learning environment.

Recently curriculum development strategies taking the increasing economic and labour market requirements into consideration have prioritised strongly medialised text structures suitable for independent processing.

The technical and methodological arsenal of ICT is especially suitable for the elaboration of the criteria system of situative learning.

According to Andrea Kárpáti ICT devices have as much potential as the pedagogical arsenal of their user.

In other words an ICT system can be efficiently operated if all of the above listed conditions met. However the teacher's competence is the most important as it determines the quality of the pedagogical process. Consequently, teachers have to become familiar with the respective device system and acquire the relevant methodology. The lesson will introduce programs that can be used universally in any learning environment.

10.2.1 The software of interactive boards

All interactive boards have different software. This could either be a positive or negative statement, but upon careful examination we can realize that the boards themselves have no or limited pedagogical use, it is up to the teachers to fill it with content. While not all manufacturers keep this in mind, recently only boards with appropriate interactive support have been merchandised. Why is this important?

The right software support provides the methodological options enabling the instructor to take advantage of the respective technology. Manufacturers of the *SMART, Cleverboard* or *Promethean* have assigned top priority to software development from the beginning. These firms provide substantial help to teachers by providing access to webpages, forums, and sample exercises.

10.2.2 Lynx interactive board sofware

The Lynx program is the official presentation software of the Cleverboard interactive boards. The related advantages include the use of the Hungarian language, the continuous development according to user demands, and the compability with any type of interactive board.

The use of the program is very easy as it very closely resembles the well-known Power Point system.

The program helps in the construction of lessons either on our own, or according to samples provided. The software makes a wide combination of ClipArt pictures, maps, patterns, and backgrounds enlivening the class or a lecture.

The Lynx program window
The basic tools are indicated below:

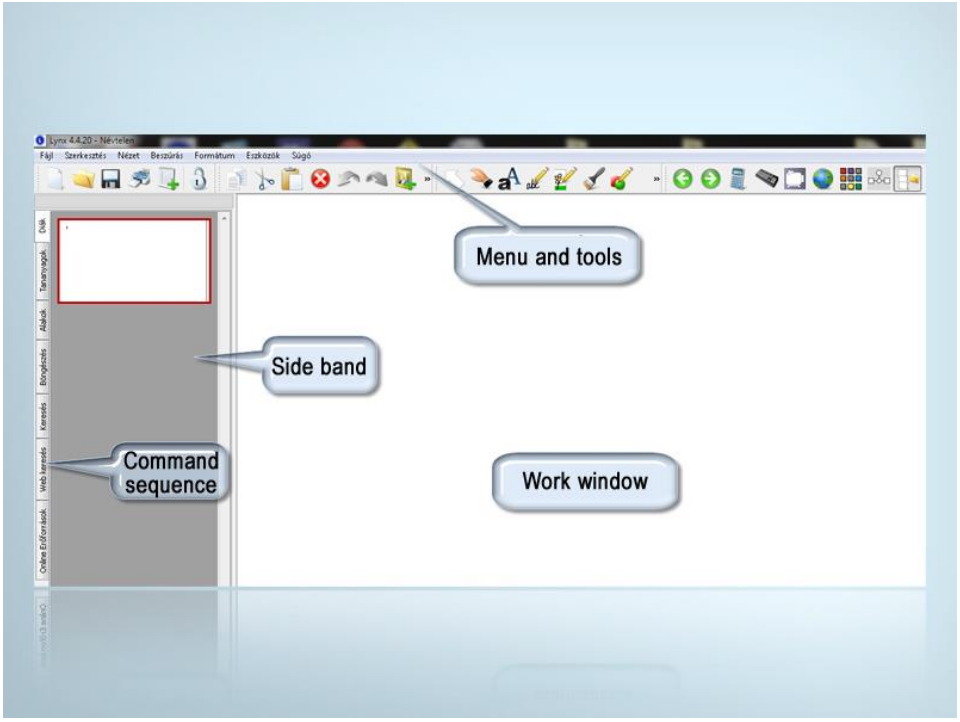


Figure 47: The Lynx work surface

The structure of the program window is similar to the arrangement of the Power Point. The menu is located above the tools and the adjustment options of the textual characteristics. The side band is located on the right and options other than the prepared slides are revealed in the vertical command sequence. The aim of the commands is to make the search and the opening of local and web-based data bases possible. Such options help the teacher to improvise during class.

Under the *Texts* tab we find the prepared educational materials. To promote efficiency of the learning process various forms and shapes can be included in the interactive texts. These are available under the Shapes and Forms tab. The *Browser* helps us to find our existing files or ClipArt files, the *Search* options can help us to find anything on the machine and the Web search tab opens up the Google searcher window facilitating quick processing as well. Finally the *Online resources tab*

reveals a freely formable link collection providing substantial further help for instructors.

In the middle of the program window we find the work window in which various media units and interactive exercises can be posted.

10.2.3 The devices of the Lynx program

Text input, text creation

There are several methods available for text production. If we want to enter pre-written or printed text we should use the text box icon. The entered text can be corrected or edited with double clicks, and textual characteristics can be changed with the text options found at the bottom of the work window.

We can also choose the Writing pencil method allowing us to write on the surface of the board with hand. The colour and type of the pencil can be selected at the tool section found at the bottom of the window. However, texts entered this way can only be corrected after erasing and re-entering.

Construction of pictures or shapes

The highlighted elements can easily be edited during the inserting of pictures and shapes. During highlighting the following frame appears:

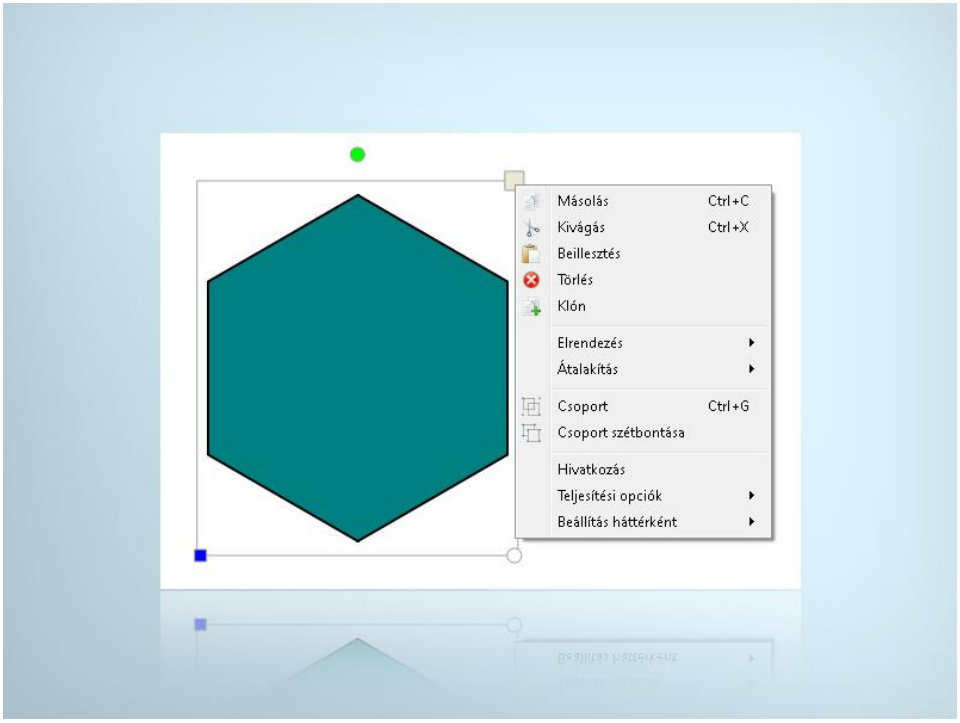


Figure 48: Object with the editing or construction points and menu

The Lynx handles each picture, shape, form or line as a separate object. The object can be replaced by being grabbed by the mouse. The highlighting mode includes several functions: the top right corner includes an option window facilitating further construction or editing possibilities including the grouping of objects, cloning, arrangement etc. In case of handwritten texts a text recognition option is available. The program can convert the handwritten text into a printed form. The green circle on the picture indicates the rotation options by the left side of the mouse. During rotation the angle of rotation becomes visible as well.

10.2.4 10.2.5 The services provided by the Lynx

In the next section we introduce the most important service options promoting interactivity and didactic diversity.

The adjustment of backgrounds

One of the frequent options provided by interactive boards is the changeable background. The changing background does not necessarily

mean the modification of colours, but of the surfaces used for the relevant tasks.

Thus in the *Format* menu point we can set various backgrounds including lines, grids, and music sheet forms by the help of the *Background pattern* type command.

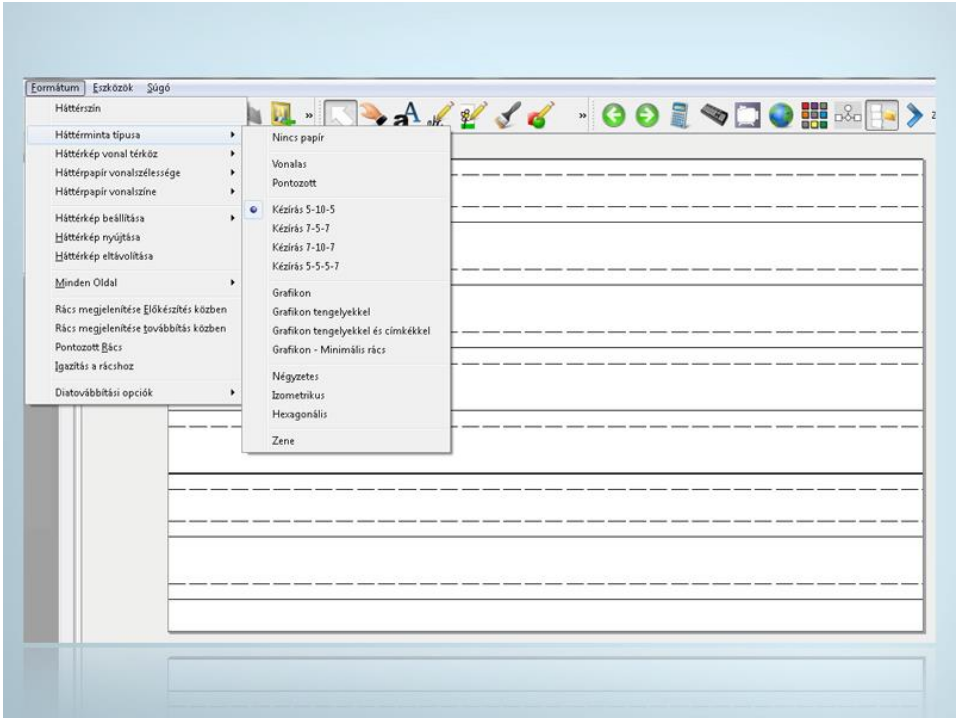


Figure 49: The setting of a line background

Remote control

The remote control function can be turned on in the Tools menu point providing access to the drawing and editing functions of the Lynx during the use of freely chosen Windows applications and other programs.

Figure 50: The components of the remote control

1. *Starting the notebook function/Return to the notebook function:* facilitates return to the already known notebook option
2. *Taking notes on the desk*: this application starts a tool uniting the *Drawing* and *Devices* function facilitating writing notes on the screen directly. One disadvantage,is the unavailability of the applications in the background during use.
3. *Fix screen*: this command leads to a freeze frame of the screen similarly to the Print Screen command. One difference is the option of selection between the four functions: Full screen, Square area, Free hand area, and Simple window. The freeze frame is saved into a file and the full screen recording is pasted into a new page during return to the notebook function.
4. *Internet browser:* starts the basic browser program after loading the http://www.cleverlynx.com/ web page.
5. *Lynx calculator:* starts the built in calculator.
6. *Screen keyboard:* reveals the Lynx screen keyboard enabling the user to write without a real keyboard. However, its use is a little difficult, we only recommend its use for typing short texts or web addresses.
7. *Clicking with the right mouse:* allows access to local menus by clicking on the right mouse by the board pen.
8. The horizontal section has two functions which we can select with an arrow located in the bottom left corner. After starting the manual

device option we can reach the side menu including the following options: *Quick media, Online sources, ClipArt, Maps, Own folder, Side pictures, Effects*

Picture freeze

This option helps with making short embedded videos on the events pictured on the screen.

Reflector

The reflector (high beam) is a spectacular and rather useful option from a methodological aspect enabling the user to highlight certain details from the given content and the attached magnifying options can make the given message more spectacular and demonstrative. By the help of the right side of the mouse or the interactive pen we can adjust the size, shape, colour along with the extent of magnifying.

Blind

The Blind is a well adjustable device offering a variety of didactic options. It can help in covering the content of the board during the checking of the solutions given to the respective problems or enables the teacher to demonstrate the text in a directed manner. Similarly to the Reflector option its direction, colour, and other parameters can be easily set.

- Download the Lynx software from the following link.[97] Install the program and prepare at least a sequence of 10 slides for a fictitious lesson. Enclose a brief description to the presentation and share it with your fellow students and your instructor.

10.3 TASK PREPARATION WITH LYNX

In the next section we describe the preparation of a simple, yet spectacular task, named Magic Box. The assignment calls on students to select a certain picture belonging to a given category. After completion students receive immediate feedback concerning the correctness of the solution.

The green background reveals the picture of 10 animals and the task is the selection of mammals and their placement into a square titled Mammals.

[97] http://cleverproducts.hu/tamogatas/driverek-szoftverek.html

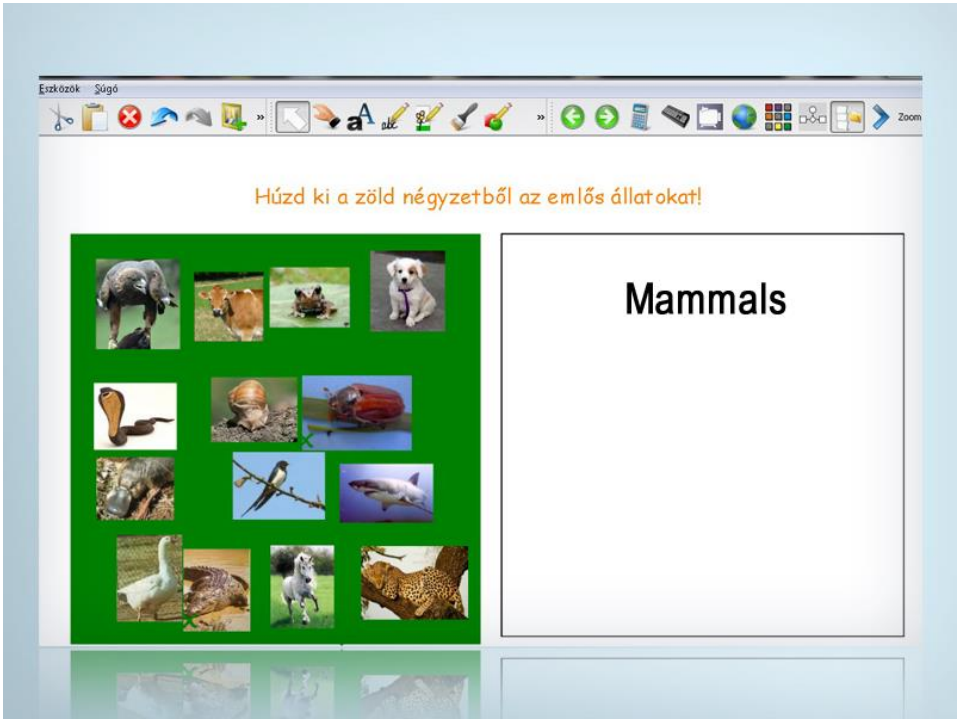


Figure 51:The screen image of the task

But how does the control pocess take place simultaneously with the movement of the pictures?

The key is using a *check* or *x* mark with the same colour as the respective background.

Figure 52: The prepared task pattern

We draw a green *check* or *x* mark with the drawing option.

These marks should be cloned (after highlighting, right click, and Clone command) thus the check and x marks should be drawn only once. We select a picture describing a mammal and drag the already prepared check sign, we highlight the pictures and integrate them into a group with the CTRL+G keyboard combination.

We should do the same with the other pictures marking those describing mammals with a check, and those not describing mammals with an x.

The pictures integrated into a group should be dragged into the green square. Due to the identical colours the x and check marks will not be visible.

From here the task becomes easy. After the student removes the picture from the green surface the revealed marks will indicate whether the choice was correct or incorrect.

10.4 WORDWALL INTERACTIVE TASK PREPARATION PROGRAM

One of the biggest obstacles to the use of interactive boards is the lack of good interactive exercises. The main problem is the incompatibility of tasks to the individual expectations of teachers and due to a lack of time and appropriate knowledge of software the teacher cannot undertake the lengthy process of task preparation. Thus instructors return to the old and established methods.

The WordWall is designed to answer this challenge by offering 19 types of tasks ranging from the crossword puzzle to complex tests. The solution of tasks takes only a few minutes and the main advantage of the software is that the CleverClick polling option facilitates use outside the interactive board.

10.4.1 What is the WordWall?

The WordWall is a program for the preparation of Interactive Board tasks. The program can be used separately, but it is originally part of the Lynx board program.

One of its most important features is the capability of saving the prepared tasks into a web database facilitating the sharing of the results of our efforts. In case of running out of ideas, the Activity repository tab provides several thousands of tasks. Unlike the manually collected texts of the competitors the installment of the Lynx or WordWall software provides access to a live data base.

In Hungary thousands of educational materials have been developed to be re-edited or complemented according to the needs and demands of the next user.

It is best that a task is written only once and becomes available for all users.

Furthermore the CleverClick polling system helps in personalizing the knowledge monitoring process. The program evaluates the results and performs a variety of statistical screenings on the data which can be saved or processed later. Additional extra features include the video recording option perpetuating the task solution process.

10.4.2 The use of the WordWall program

After installing the program language should be set. While in basic mode it is running in English, the Languages menu point of the top left corner can help us in adjusting the program to Hungarian.

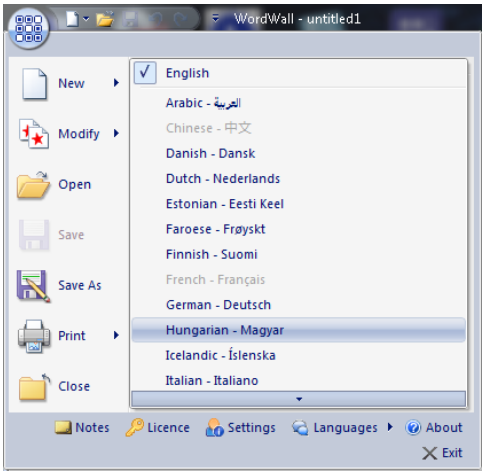


Figure 53: The setting of the language of the Word Wall program.

The Magic Browser

It is best to start with becoming familiar with the information options provided on the right side. The Magic Browser option provides a thematic overview of the exercise options helping the easy preparation of one's exercises or tasks. **If we want to modifiy or edit an existing task we should use the Back to Magic Browser option revealed after clicking on the Modification menu point found in the top left corner of the screen.**

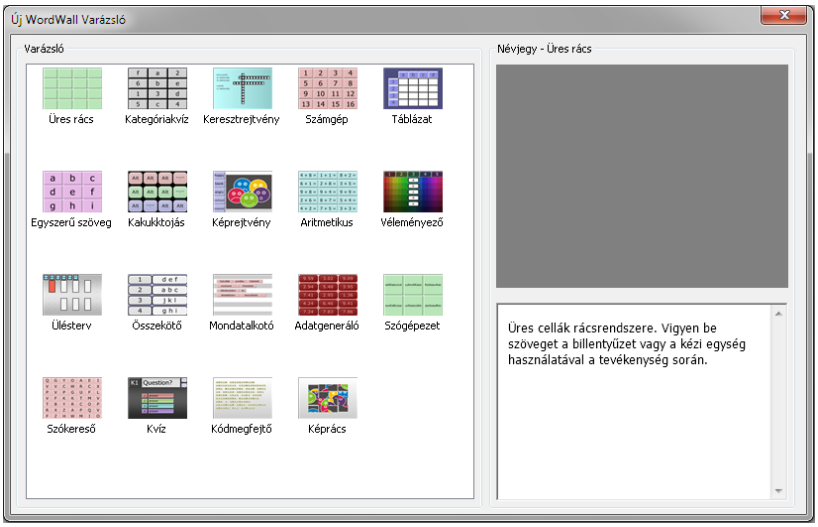


Figure 54: Magic Browser

Picture grid

A grid system of blank cells. Pictures can be inserted or texts can be written into the cells which can be ideal during matching or category preparation tasks. Following highlighting the cells can be moved in any direction within the grid.

Category quiz

This kind of exercise can be used with any subject-related assignment in which true or false or category identification tasks have to be solved.

In the example below students have to determine whether the results of the mathematical maneuver are true or false. After clicking on the given problem the answer is revealed. We can provide key terms such as *gymnospermous* or *angiospermous* and the students will determine the right category. First the label of the category has to be given and after that the components meeting the requirements of the key term or category have to be entered into the category field.

Numerical machine

The numerical machine option promotes fast mathematical thinking and the development of logic. The exercises can reveal the elements of mathematical sequences, help students recognising the rules and exploring complex operations.

Table

We establish various categories with this type of exercise. In addition to texts pictures can be placed in the cells. During solving the tasks the location of the cells can be modified facilitating the logical restructuring of content. After highlighting the cell and clicking on the right button we can choose from a variety of commands including closing, deleting or marking the cells according to the didactic requirements of the given task.

Simple text

This is a simple grid system of key words. Options include the display of the main text and the pertaining alternative concepts. The order of the cells can be mixed or shown in an alternative sequence.

Odd one out

This is a sequence of words including one not belonging to the sequence. After providing the key words we can find the right answer with the cursor. Unfortunately, category criteria cannot be displayed, thus teacher explanation is necessary.

Picture puzzle

A larger picture flanked by smaller cells. In the cell a certain feature, or the name of an animal or person can be given. A picture appearing after clicking should be allocated to the respective criteria, the task is ideal for the improvement of memory, and for practice or reviewing of the given material.

Aritmethic

This option helps in the display and practice of simple mathematical maneuvres. The machine automatically generates the exercises, there is no modification option, only the number of the questions can be changed.

Seating plan

A seating plan can be generated which can be changed upon demand.

Connector

This option provides a list of key words and their definitions. It is ideal for practicing and learning concepts and definitions along with the

development of language skills. A key word or definition can be hidden or revealed with one click.

Sentence constructor

A system of word cells organised in lines. It is ideal for making sentences or practicing the word order in case of foreign languages.

Word machine

It is an excellent program for the development of the improvement of memory and thinking. The program enables the user to prepare a variety of language games including anagrams, mosaic words etc. Furthermore, the number of letters can be substituted with question marks, or the wovels could be removed from the key terms and expressions.

Word search

Students have to find words with independent meaning in a random letter matrix. It is ideal for monitoring student knowledge, motivation reinforcement at the beginning of class, and the practicing of concepts. Before assigning the task the relevant category should be given. I.e. we have included the names of domestic animals in this task, find them.

Quiz

One of the most ideally applicable task types of the WordWall program. It can help in the preparation of tests for monitoring or checking student knowledge. Questions can be enhanced with relevant pictures.

The quiz can be prepared in a simple manner. During the preparation phase both the question and the answer alternatives have to be provided. In front of correct answers the marking square should be checked. New questions become available after clicking on the Plus button. The completed questions can be modified and their orders changed. The report system helps in the quick evaluation of student work.

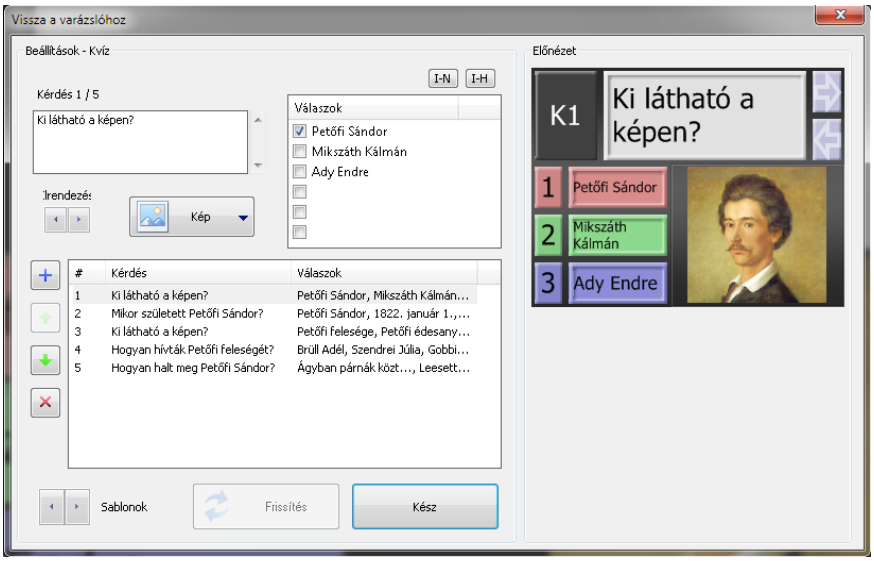


Figure 55: The editing window of the quiz option

Code breaker

The option includes classified or secret series of letters. This exercise helps in identifiying excerpts from poems or quotes. The entered text can appear in separate words, or in a fully coded version. Students can be helped by providing a few letters.

Picture grid

A popular yet simple game, the picture can be divided into smaller mosaics mixed up by the machines. Students have to reconstruct the picture. The task can be made harder by breaking down the picture into several small mosaic pieces.

Program views

The WordWall program enables the user to set the view. After clicking on the View button we can choose from three options.

Full screen

The editing or construction components disappear from the screen.

Close up, stamp view

The task we actually work on is revealed in a stamp picture facilitating arrangement and selection.

Overlap

This view allows the user to see the tasks or buttons while using other programs. The view also provides the *Screen recording* option capable of recording a picture in an editable form

- Download the WordWall software from this link.[98] Install the program then choose 5 tasks and prepare matching exercises. Enclose a brief description of the task and share it and the exercise with your group mates and teacher.

10.4.3 The Clever Wordpad2 polling system

The Clever Wordpad2 polling system enables the teacher to quickly check the results of the tasks in a manner exciting and engaging to the students.

The system contains polling or voting units, and a radio receiver connected to a computer with USB connection.

Figure 56: The Clever Wordpad2 polling system

Before starting the polling the teacher has to exit from the WordWall program and connect the USB receiver. After restart, the system is ready for use. The polling tools are revealed among the commands. The blue

[98] http://cleverproducts.hu/tamogatas/driverek-szoftverek.html

Submit button starts the polling unit and the receiver recognizes the voting units. After this in some versions the blank table for listing the participants is revealed. Students enter their name for identification purposes.

Pushing the Play button starts the voting. The means of the use and categorisation of the manual unit can be selected. In case of quizzes, the private type is the basic model.

Figure 57: The picture of the quiz window

Who is on the picture?

Before clicking on the Play button we should choose the Settings menu point and check the automatic page turner option. This will guarantee the automatic change of tasks and questions.

In case of proper operation the questions are uploaded on the WordPad2 sets where pushing the Submit button starts the questions for the students. Students can answer the questions with the selection and push of the appropriate numbers.

The test results appear on the teacher's screen. The respective data can be evaluated and saved as well

10.5 NETSUPPORT SCHOOL

The NetSupport School is a leading education support software in its category. In addition to providing effective instruction and monitoring tools it makes communication possible with one student, a group, or all students at the same time.

The program combines a supervisory function with real time display and explanation devices with a personalized examination system, the supervision of Internet and application use, automated lesson plans the regulating of printing capacity, the control of message programs, content monitoring, and safe access to computers.

The NetSupport School continuously engages students via the monitoring of class computers, the sharing of digital educational materials, and by providing cooperative work options.

Student attention is sustained by the monitoring of application and web use, the availability of instant help and the communication between the machines. Fast and effective checking of student knowledge is assured by the quick questions and the immediate evaluation option. The system enables teachers and instructors to save the images of the students' screen along with controlling keyboard and mouse use as well. The respective images can be replayed later.

Task preparation module

Its main objective is to prepare tests and examinations with multimedia support. The examination questions can be enhanced with sound, picture, and video materials which students can view or listento during the testing process.

The first task of test preparation is the creation of the questions and the test will be composed by an arrangement of questions reflecting subject, age, or difificulty level.

Question types

The program provides a simple Magic browser type device for the creation of all types of questions.

- **Choosing from the options provided:** Students have to choose the right answer from the four possibilities. Help can be provided by sound materials or media clips.
- **Inserting text by dragging:** The sentence has to be filled in by a chosen word or expression. The solution can be dragged with the mouse to the proper location.
- **Choosing a picture by dragging:** Students have to choose the right picture and drag it with the mouse into its appropriate location.
- **Scroll down menu:** Students are given four questions, each question is paired with a scroll down menu with six potential answers. Students have to select the right answer.
- **Labelling:** Students see a picture or diagram. The task is matching the highlighted parts and texts by choosing the right combination from a list of answers.
- **Yes/no:** Students have to determine whether a statement is true or false.

- **Multiple yes/no:** Students have to determine which statement out of the four is true or false.
- **Arrangement of answers:** Students see one question and four answers. The task is not choosing the right answer, but arranging the answers in an appropriate order.

The compilation of a mock test

The NetSupport School enables the teacher to construct a fully structured and functional test in minutes. The test questions can be installed on all student machines and the testing process can be started at the same time for all participants. During testing the teacher can monitor the solutions with each student or with the whole class.

The export/import function facilitates the exchange of questions among the teachers, thus a full institutional test library can be established as well.The tests can be compiled from the selected questions along with the task descriptions and the respective time limits for each answer.

Observation mode

In case of each question the answer can be set in Observation mode or Manual mode.

In Observation mode the student has to become familiar with the previously uploaded multimedia material (picture, video, or sound file) and has to answer the question from memory.

Upon marking Manual mode, the answer options are not revealed, the student has to provide the answer according to his knowledge.

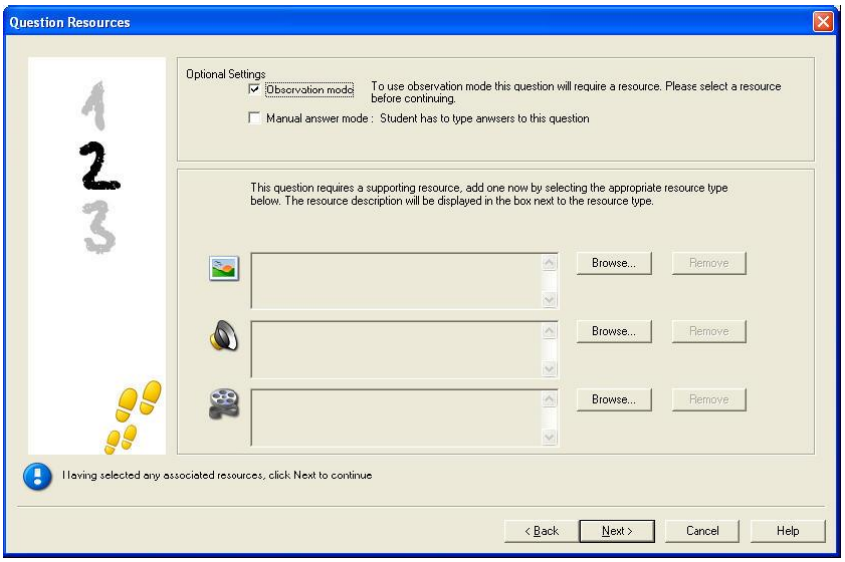


Figure 58: Turning on the Observation mode

Examination marks

The teacher can establish grading criteria according to which the system automatically evaluates the test sheets.

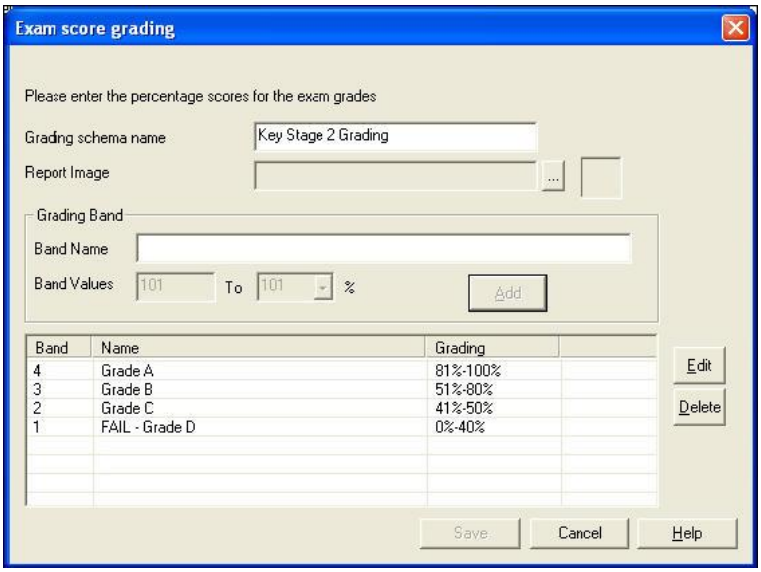


Figure 59: The setting of the evaluation function

Point system

An amount of points can be allocated to each question in the examination construction module when the teacher chooses the question for the relevant examination according to the model described below:

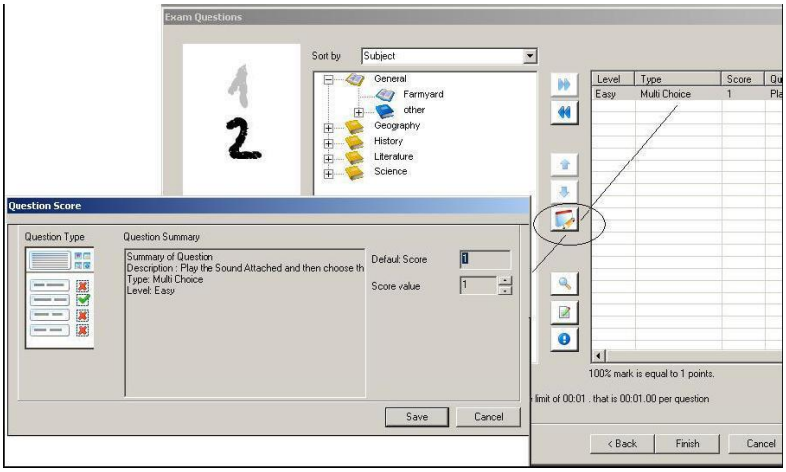


Figure 60: Setting the points

Examination

During the examination the students see a simple and clearly structured screen enabling them to solve the tasks at an order they choose while easily checking the available multimedia-based information. During testing the remaining time is continuously indicated.

Students can check the results in two ways. Either they check the incorrect answers while looking through the whole test, or can learn their overall points broken down to each question by the machine.

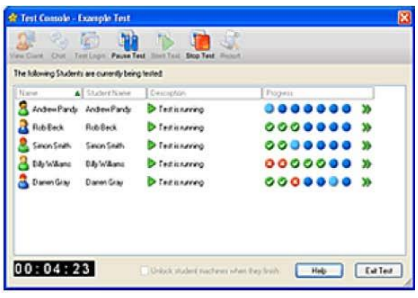


Figure 61: The results of the examination as shown on the teacher's screen

10.6 SUMMARY, QUESTIONS

10.6.1 Summary

The application of digital boards requires good quality teacher and learner software. The lesson introduced two examples the Lynx and WordWall program developed for CleverBoard systems. Apart from board software student monitoring software can be applied during class work. The NetSupport system offers full monitoring options and a complete class management system facilitating effective direction of the teaching and learning process.

10.6.2 Self-test questions

1. What kind of tasks and exercises are offered by the WordWall program?
2. How can we use the Clever Wordpad2 polling system?
3. What kind of solutions does the NetSupport program offer?
4. What kind of questions can be used in the NetSupport program?
5. What are the system requirements of the installment of the Lynx program?
6. What kind of files are used by the Lynx program?
7. What kind of help does the program provide for the fast preparation of presentations?
8. What kind of methodological options are presented by the ”blind” function?

11. DEVICES AND METHODS OF COMPUTER USE IN THE CLASS ROOM

11.1 OBJECTIVES AND COMPETENCES

The lesson will introduce the concept and use of class room ICT devices, the didactic options, tasks, along with the devices of effective directed class room-based computer use (CMPC iPAD).

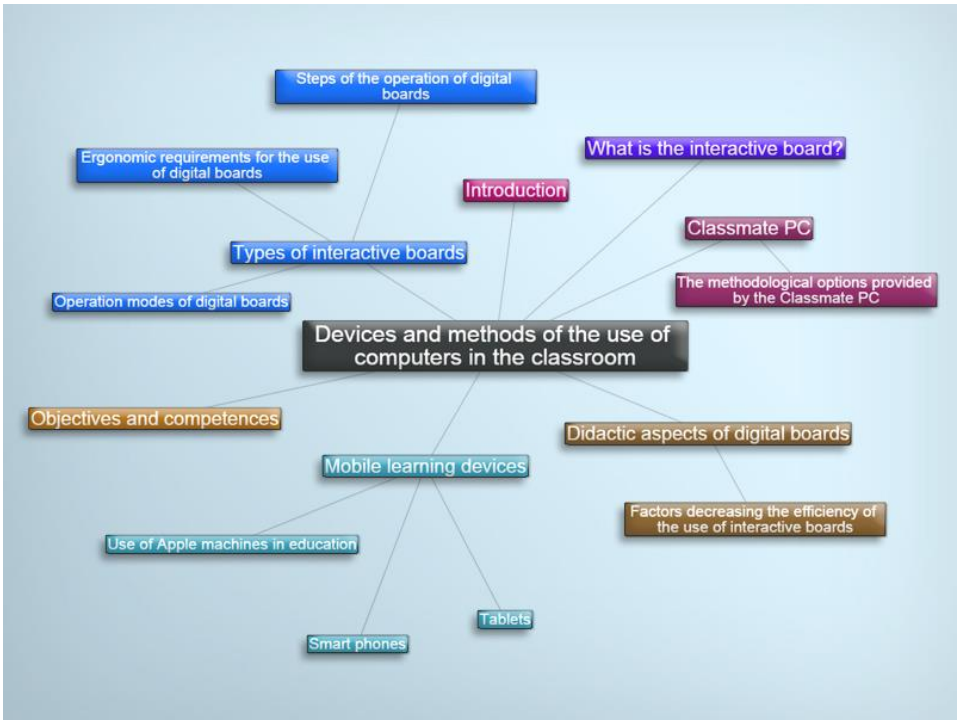


Figure 62: Conceptual map to Lesson 11 https://www.text2mindmap.com/

11.1.1 Introduction

Uploading the pictures of the class party to the school webpage, searching for illustration materials on the Internet for tomorrow's lesson, downloading an interesting film clip, checking an on-line test, opening a student's project work, and answering to a parent's e-mail…

Yes, these are the activities of the teacher in the 21st century. The computer and the related devices are gaining an increasing role in the educational process and learning in general

The problem now is not the availability of a given device but the way of integrating it into the pedagogical and didactic efforts.

One such device is the digital board which is becoming increasingly popular in schools. The board itself was subject to several technological and ergonomical changes until skeptics were convinced of its use while the first thorough methodological analyses and efforts proved the benefits of the device.

11.1.2 WHAT IS THE INTERACTIVE BOARD?

We provide an explanation of the concept below.

- **The interactive board is an information and communication technology device used in education. The board is connected by software to a computer and a projector. The system can be controlled by the board and the respective information displayed can be saved into a background storage facility.**

The use of interactive boards is primarily encouraged by constructivist pedagogy. The board along with the multimedia options (multimedia CDs) and the Internet connection can facilitate the establishment of a learning environment promoting the creativity of the teacher and student, thereby arriving at real problem solving methods. Students can learn by play and discovery in an entertaining manner while participating in the shared experience of learning.

The digital board along with the computer and the projector would not be special by themselves, as such options are widely available today. The unique feature is provided by the interactive surface based upon a control software capable of fulfilling tasks previously restricted to computers.

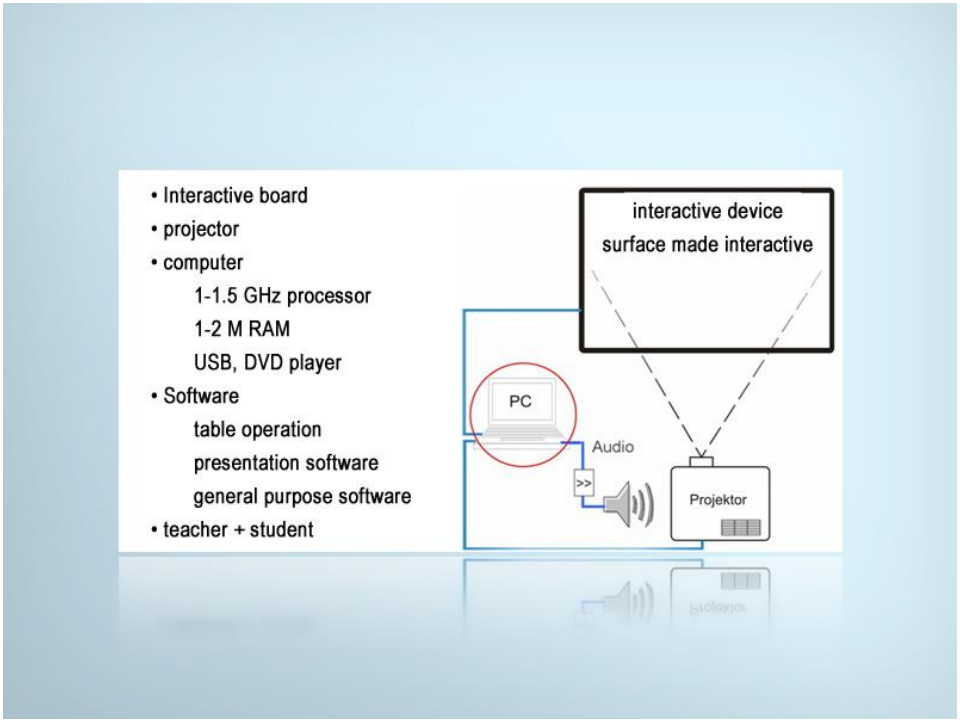


Figure 63: System requirements of digital boards

11.1.3 Types of interactive boards

Interactive boards can be categorised according to many aspects including the location of projection and the operation principle.

Types of interactive boards according to the location of the projector

– In case of frontal projection, the projector is located in front of the board.

Main features: simple, cost effective technological solutio, the presenter can block the view of the board, the projector light can distract the presenter.

– The other type is the back projection, with the projector located behind the board.

Main features: expensive, the projector light does not bother presenter, it is not widely used in schools.

Types of interactive boards according to operation principle

Ultra sound /infra red sensors

In other words E-beamer. Its main advantage is that the sensors can be used with any whiteboard. The board does not fulfill sensory functions, it is done by a separate unit attached to the side of the board. The operation requires a special pen (battery) sending signals to the sensor. Today it is not used as widely, but can fulfil several digital board functions including the recording and saving of the respective content.

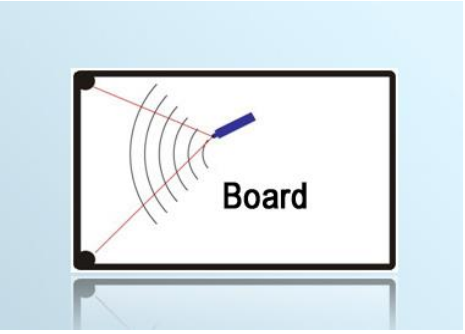
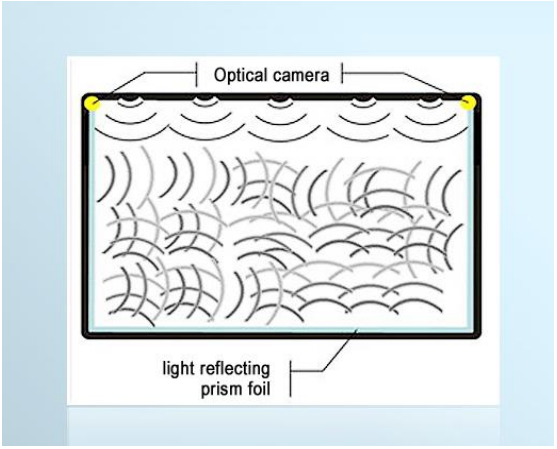


Figure 64: Ultrasound sensor

Optical sensors

These types of boards solve one of the most frequent problems, namely enabling many people to work at the board simultaneously. The complex system includes two optical cameras and infrared sensors with a special surface. The board can be run manually and by a pen as well.



Figute 65: Optical sensor board

Resistance-modification principle

- Flexible plastic front – covered with conduction resistance layer
- Hard rear disc – conduction resistance layer
- air layer in between with distance maintenance pearls (hairline thin)

The operation of these tables does not require a special plan as they can be controlled by a finger as well.

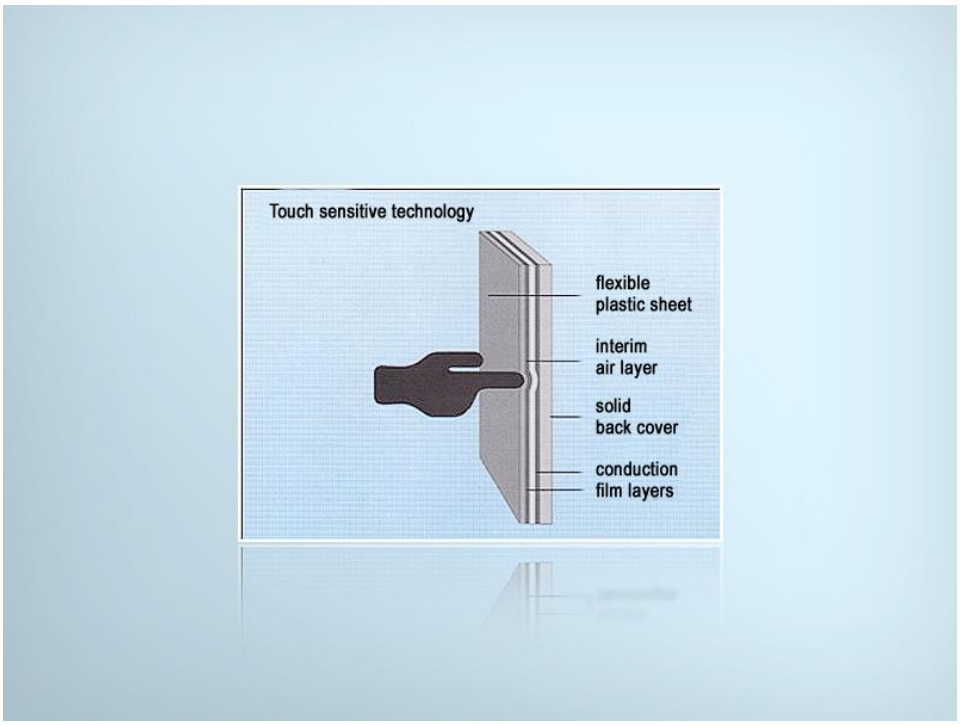


Figure 66: The operation scheme of touch sensitive boards

Upon touch the surface impression can give an unpleasant feeling and the calibration requires practice. Another disadvantage is that the boards cannot be used as white boards, due to the porous surface and the inability to fully clean the marks made by felt pen. The main advantage, however, is the cost effective and simple operation. One of the device's largest Hungarian producers is the SMART Company.

Electromagnetic boards

Electromagnetic boards make up the fourth type of interactive boards. A sensory net is placed within two hard plastic layers and the writing surface is made from indestructible glass like enamel steel. The hard and durable surface of the white board issued with a lifetime guarantee can be magnetized, and written on. It is used with an electronic or magnetic pen. The largest Hungarian manufacturer is the CLEVERBOARD Company.

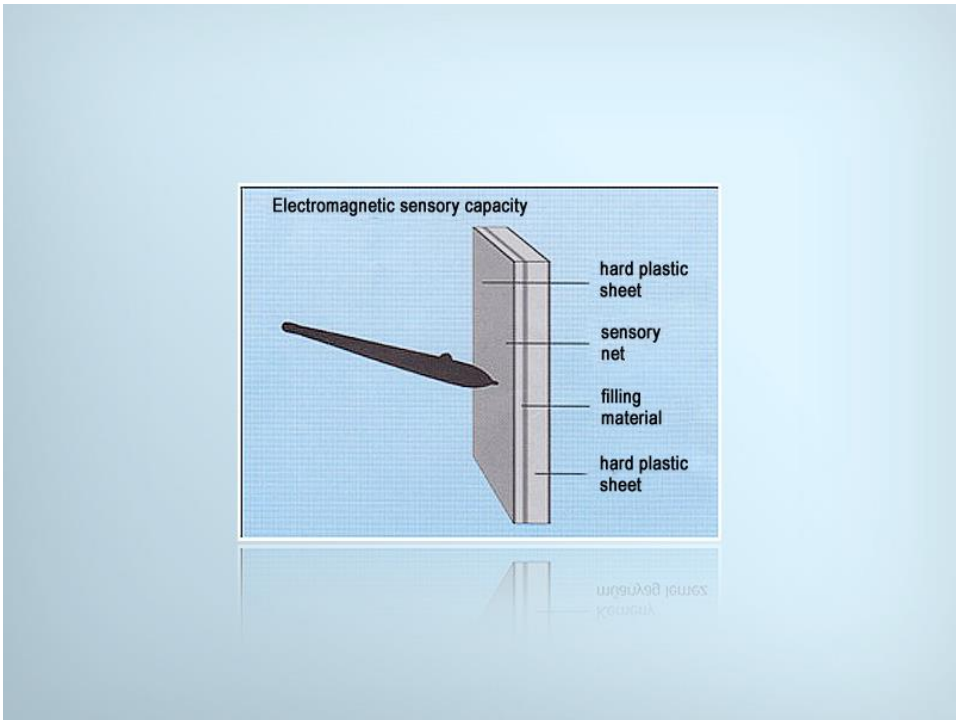


Figure 67: The scheme of an electromagnetic board

Table One: Comparison of soft and hard boards

Resistance change principle: (soft)	Electromagnetic principle (hard)
can be controlled manually	can only be controlled with a special pen
can be controlled by any device, lack of right button function, simple to use with less functions	more difficult to operate due to software and right button option, more complex use, more functions
not all of them can be used as white board	ideal for use as white board
lower resistance to physical impact	higher resistance to physical impact

11.1.4 The definition capability of interactive boards

Definition is perhaps one of the most frequently misunderstood parameters. At first we have to clarify whether we are dealing with touch or projection definition. The touch definition of interactive boards refers to the number of connection points distinguished upon touch. An average board has a 4096 x 4096 definition, including approximately 16 million potential connection points. On the other hand projectors with XGA definition are capable of providing 1024x768 definitions entailing 786.432 pixels. Thus we can conclude that the projector definition does not hinder the touch definition of the interactive boards.

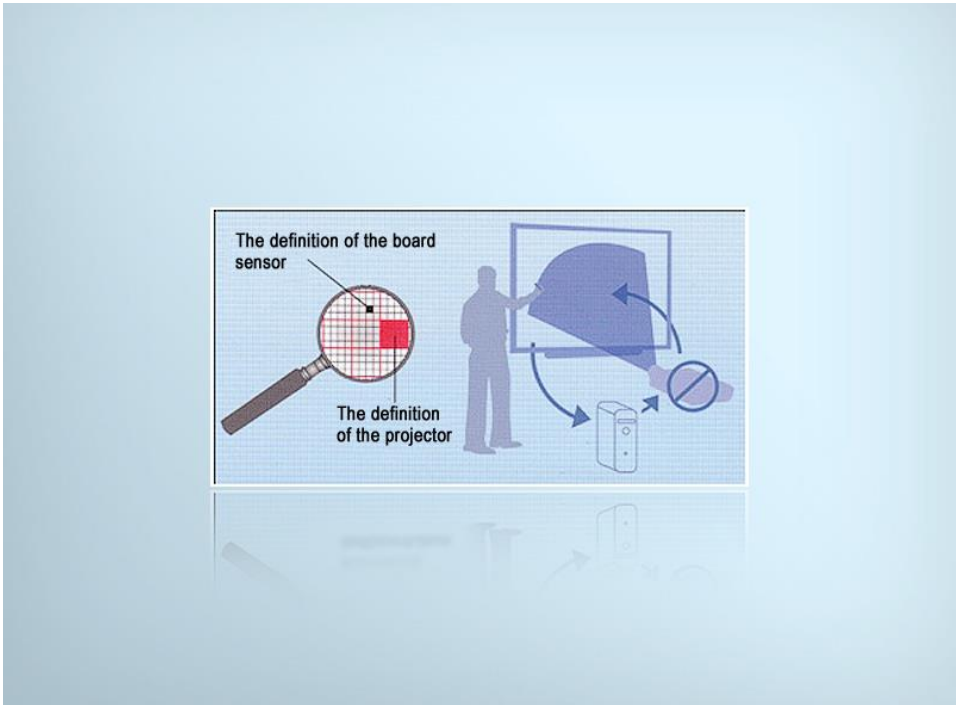


Figure 68: Comparison of the projector and display definition

During the use of boards several ergonomic guidelines and recommendations have to be observed. The first issue is the placement of the boards and the projector. Accordingly there are four variations.

1. The best solution is a board affixed to the wall and the projector placed in a standard fixed location. The board has to be calibrated and the projector has to be adjusted so that the picture would be fully on the board. This arrangement assures that the components of the system are permanently placed.
2. Movable board with permanently placed projector. The board and the projector are installed on a shared consol, the main advantage is the physical mobility of the system.
3. Affixed board with movable projector. Several problems can occur incuding the loss of board accuracy upon moving the projector, the blinding of the teacher by the projector light, while blocking the view of the board.

4. Movable board with moveable projector. This solution is not recommended at all.

The other problems are due to the location or placement of the board:

1. The board is too low, thus the bottom is not visible…
2. The board is too high, neither the teacher or the student can reach it …
3. If the computer is not permanently built in, cables can hinder the teacher.
4. Computer and projector definition
5. If traditional chalkboards are used next to digital boards, chalk dust can ruin electronic parts.
6. The ability to darken the room is important.

11.1.4 Steps in the operation of interactive boards

1. Installment of control. At first we have to install the control program facilitating the operation of the board.
2. Installment and patching (freshening) of the table software. Manufacturers provide a variety of software for the given board to be further developed according to user demand. The software enables the teacher to compile various tasks and exercises for the student. It is important that a language of the software is Hungarian.
3. Connecting the computer and the projector with a cable.
4. Connecting the USB cable joining the board and the computer. The USB cable also functions as the energy source of the board.
5. Setting the monitor operation mode. It is important, especially on laptops, to share the picture between the projector and the display.
6. Adjustment of the computer definition to that of the projector. It is a frequent problem that projector and computer definition are not identical leading to dull, distorted images. This problem can be corrected by lowering the definition level of the computer monitor.
7. Calibration. Calibration is the last step before operating the board. Calibration guarantees that the board cursor is harmonised with that of the computer. The computer presents a point on its screen, the projector displays it on the board, if the teacher

touches the point, the board sends information concerning the location of the point back to the computer. If this happens in case of many points, the computer will be able to identify all points of the board. During the calibration process nine points have to be identified.

11.1.5 The operation mode of digital boards

1. Whiteboard mode (Cleverboard), In this case the board can be used as a traditional school white board.
2. Projection mode. The glimmer free surface makes the board an ideal projection surface.
3. Table copying mode. The board software allows the saving of the board content as a picture, thus it can save the class notes of the teacher.
4. In an interactive board mode we can project the image of the computer screen on the board and we can work the same way on the board as on the computer screen.

11.2 THE DIDACTIC ASPECTS OF DIGITAL BOARDS

The digital board functions as the control surface of the computer, the computer can be run from the board and the operations displayed on the board can be recorded and saved on the computer. This is the basic function of interactive boards during which the board becomes the enlarged touch screen of the computer. Such feature by itself can promote the effectiveness of the teaching and learning process. The teacher can use digital texts, and interactive learner support surfaces enabling the whole class to see and work with such materials simultaneously. There is no need for individual computers for each student to process interactive educational materials. The didactic advantages of the interactive board include sharing the thinking process, working in a cooperative manner, and enabling the teacher to step out from behind the computer screen and communicate with the class while working with the computer. The other basic function is the so-called digital green board, or a surface the teacher can write on in a way that it is visible to the whole class. Such option requires a software making writing on the board and the use of other auxiliary features (background pictures, gallery) possible. Despite the varying structure of interactive board software, they basically fulfil similar functions.

Compared to traditional classroom boards the greatest advantages of the digital board include the capability of preparing the class materials in

advance and the saving of all operation and recorded information in a file. Consequently, the work of the teacher becomes significantly simpler as he can work on one surface, and there is no need to print out or copy lesson plans or class materials on the board prepared earlier. Furthermore, instead of summarising the class after the lesson, he can rely on the saved notes. The digital board can help in creating spectacular and aesthetically attractive pictures and images as well.

While the interactive board provides numerous advantages, some teachers primarily due to a lack of technological skills and aptitudes appear reluctant to use them.

11.2.1 The uses of the digital board

The two most frequent uses of the board are demonstration or illustration and (playful) practice.

1. Demonstration: One of the most frequent didactic goals of using the digital board is to promote experience-based learning. Digital boards make the reception and processing of the materials possible while enhancing student knowledge by playful exercises. The digital board can provide high quality visual and auditive experiences, and the table software helps in the preparation of analyzing and synthesizing exercises promoting constructive thinking. Furthermore, the interactive board is ideal for analyzing processes and logical correlations while facilitating the frontal and individual processing of a given material as well.
2. Practice exercises: The completion of tests even in a competitive manner, and solving various tasks and playful puzzles can promote the acquisition of practical knowledge. Moreover, if this is done in an interactive manner, the instant feedback enhances the learning experience. The boards also allow the repeated performance of tasks and the accelaration of the engraving or ingraining process.

Criteria behind the effective didactic use of interactive boards

While the interactive board provides a wealth of opportunities for the renewal and diversification of our pedagogical culture, we must remember that the main goal is not the use of the available devices, but the functional integration of the board into the teaching-learning process, the promotion of a variety of pedagogical approaches, the development of different skills and aptitudes, and providing application level knowledge by the use of information and communication technology. The criteria for effective interactive board use include:

1. providing opportunities for teachers to become familiar with the theoretical and practical aspects of the new technology, the testing of new educational materials, shared use by teachers and learners, thorough preparation and careful task design before use;
2. the availability of reliable and regularly maintained technological background, the placement of such devices do not impede free movement in the classroom, the continuous development of educational materials;
3. The availability and at the same time encouraged use of auxiliary devices (digital camera, scanner, document camera, software devices etc.) in order to demonstrate information (abstract thoughts and concepts) and solution alternatives promoting the understanding and experience acquisition process;
4. More symmetric design of teacher and learner activities and communication should ensure student interaction and the interactive use of multimedia materials;
5. Making good quality, motivating, dynamic presentations based upon familiarity with consistent application of the presentation preparation rules promoting student interest, the formation of concepts and conceptual systems, and the overall development of the thinking process
6. The careful use of the board and the saving of lessons and questions can lead to an effectively applicable question and test bank;
7. The board can promote task awareness and concentration along wiht appropriate processing and teaching speed. The fast and effective operation of the board and class management requires the direct availability and readiness of all materials before class;
8. The texts prepared for the board can be used later allowing the teacher to save a large amount of time;
9. Teachers should have enough time to acquire technological confidence and to collect, adapt, and elaborate the respective digital materials;
10. Teachers share their ideas and resources with each other and with project and other professional partners;

11. A well organised and highly reliable technological support helps in responding to all problems in the fastest time possible;
12. The sharing of the prepared materials at least within the school, or in optimal case between many schools is crucial, making the modification of materials possible;
13. The design of interactive table use is primarily a decision making or selection process. This means that during our decisions we have to take alternatives into consideration and have to make the best choice from real alternative solutions. During the design process we have more time available to make the best decision via the careful consideration of the anticipated events and the appraisal of the expected efficiency of the given solutions. The more thorough is the preparation process and the weighing of the respective options, the less likely are the occurrence of unexpected events in the interactive stage of the instruction process and the uncertainty of the respective immediate decisions.
14. We recommend the following criteria for the pre-lesson design process:
15. Determining the specific objectives of the learning process by selecting from the curricular goals and by the exploration of the specific options provided by the educational material while taking into consideration the main features of the target group.
16. Concept and logical analysis: The examination of the new concepts and correlations of the new segments and their connection to previously acquired materials or those scheduled to be learned later. From a gnoseological point of view the instruction strategy guaranteeing optimal processing must be identified as well.
17. Psychological analysis: The teacher designs the modes of motivation corresponding to the capacity of the material to engage the learner. The comparison of the difficulty level of the material with the development level of the students results in various forms of differentiation and individualization. Psychological analysis identifies the potential types of problem situations, the creation of such situations, and the respective solutions.

18. Pedagogical analysis: The teacher identifies personality development and behaviour shaping options to be utilized during the processing of the given content and task system.
19. Didactic/methodological analysis: The teacher determines the strategy of instruction (the scope of didactic tasks, the specific structure of the education process, the arrangement methods, methodology, and devices of the instruction process, the determined questions and tasks of the knowledge monitoring process after completing a given topic)
20. Instruction technology analysis: The reconsideration of the functional education material and media use is indispensable for the design of the effective and successful instruction process. The media selection taxonomies help with the selection of the optimal demonstration methods or techniques.

11.2.2 Factors decreasing the efficiency of the use of interactive boards in education

1. The virtually unlimited options provided by the interactive board entail the loss of the teacher's mandatory awareness and planned use of technology. While a large amount of information suitable for the education process can be found on the Internet, well-planned and spectacular educational materials can be produced with a few well applicable programs. Accordingly we prepare a variety of resources and prepare our own materials for our students.
2. Usually teachers want to show everything in a variety of ways thus the outlined pedagogical objective has to be kept in mind continuously. Although we strive for a presentation fully engaging the learner, we should not be lost in details. Thus the presentations should be concise and contain only relevant ideas.
3. After we complete our text, we should rehearse our presentation and time it. One of the advantages of pre-planning is the recognition of the importance of time management. As a result of time management we will not run out of time and the resulting time saved can be used for compensation purposes processing auxiliary materials and those that students tend to be interested in.
4. One of the most frequent mistakes is the use of presentation components not correlating with the original instruction objectives.

Thus striving for spectacular solutions should not weaken the usability of the given material.

5. Frequently applied devices without any function could lose their effectiveness or attractiveness. The real potential and knowledge of the teacher is in the wealth of his methodological arsenal and the variation of the given methods. Teaching materials should appeal to the heart, not only to the mind.
6. In order to promote understanding we should avoid extremely complex tasks, thus the exercises should be carefully selected. The exercises and tasks should be concise, emphasize essential aspects of the text, along with building on the previous knowledge of the learner. We should keep in mind that too complex and difficult examples or materials require additional explanations.
7. Control of the students' knowledge and the respective evaluation (frequent diagnostic evaluation via the use of the response system) are important means of gaining timely information on the performance of the individual learners or learner groups and the potential problems. Checking or monitoring knowledge should always correspond to the processed subject matter and its difficulty level.

11.3 CLASSMATE PC

Classmate PCs (CMPC) appeared as result of a program preferred by Intel[99]. The aim of the program is the introduction of low cost computers into the education process. While such computers were originally designed for the schools of the developing world, they have become popular all over the world.

The Classmate PC was prepared for meeting the demands of competence-based instruction. The computer provides support for project-based instruction, group work, and mobile educational options. The designers of the laptop machine took the children's needs into consideration, thus small, light weight, and durable computers were manufactured. The programs installed on CMPC enable teachers to prepare instant tests, make films and presentations, while controlling the students' computer and Internet use.

[99] http://en.wikipedia.org/wiki/One_Laptop_Per_Child

Figure 69: Classmate PC

11.3.1 The didactic options provided by the Classmate PC

The methodological variety is not provided by the machine itself, but the client software installed. The three options include teacher's monitoring software facilitating full control of the students' computers, a software for students, and a parental monitoring software. .

Below we list the main features of the three software variety.

The main characteristics of the teacher's monitoring software:

1. The teacher can broadcast the screen of his computer to the students
2. The content of any student monitor either homework or class work can be projected thus shared with the class immediately.
3. Films or videos can be shown
4. Files can be shared with students
5. Monitoring and directing class activity
6. Commands can be given from remote locations, all machines can be stopped or teachers can ban an application or stop the functioning of a student's machine.
7. Groups can chat with each other and with the teacher

8. Each group can be given different tasks
9. Monitoring takes place with digital methods in the form of multiple choice questions, essay type tasks, or the combination of the two.
10. The teacher can compile questionnaires, categorize the answers given to the questions, and share observations with students.

Options provided by the student client software:

1. Students can chat with the instructor or attempt to solve tasks
2. If permitted students can send files to the teacher's computer
3. Basic settings concerning own monitor if the definition is different from the teacher's monitor.

11.4 MOBILE LEARNING DEVICES

Ignoring the variety of options provided by mobile devices in education would be a major strategic error. The capacity of today's tablets and smart phones match that of any computer and relevant software is widely available.

By now these devices have become widely available and can be found in any home.

Education is one of the main areas where such technology can lead to dramatic changes, although this sector is rather price conscious. At any rate in India a simplified model was developed with government support and it is available to students for 35 USD.

The experiment of the "One Laptop Per Child" [100] organisation led to interesting results on the educational benefits of tablets. Tablets were distributed among illiterate children of two remote Ethiopean villages. Before distribution educational programs, e-books, and films were installed on the machines.

Once a week a researcher visited the villages to monitor the development of the children. In a few months significant results were achieved. Some children learned the ABC song by heart, or could even spell certain words. The most shocking finding was that after five months the children who previously had no exposure to information and communication technology were able to break into prohibited sections and functions of the machines.

[100] Jeffrey J.: New Technology in Developing Countries: A Critique of the One-Laptop-Per-Child Program Social Science Computer Review February 1, 2013 31: 136-138

11.4.1 Tablets

While it is considered the latest segment on the computer market, such equipment appeared in sci-fi films decades ago. Devices similar to tablets appeared first in Stanley Kubrick's 2001 Space Odyssey (1968).

Tablets or tablet PC are portable computers developed primarily for content use. The large display comparable to the size of the set increases the enjoyment of the user, but the lacking input peripheral devices make it hard to operate. According to its features and size tablets can be placed between the handheld sets (PDA, smart phones) and netbooks equipped with keyboards. Its main objective is retaining portability while providing the largest size display possible in order to promote comfortable and convenient use.

Figure 70: Modern Tablet PC

The primary control surface of Tablet PCs is the touch screen fulfilling a display function. The touch screen requires a use, development and control philosophy differing from that of the keyboard and mouse operated computers

Today's Tablet PCs come with such integrated accessories as wi-fi and blue tooth facilitating wireless connection, or the SIM base needed for the use of mobile net, along with the microphone, speaker, GPS, camera, gyroscope, and magnetometer.

11.4.2 Smart phones

Smart phones are mobile phones with PC capacity including such developed functions as e-mail, Internet, e-book reader, key board and VGA connection. In other words smart phones are miniature computers capable of functioning as a telephone.

Figure 71: Apple 5S smart phone

Only few smart phone manufacturers reached the level of Apple whose hardware and software support makes it suitable for the fulfilment of traditional educational functions.

11.4.3 Apple in education

Although the Apple Company is one of the leading manufacturers of ICT devices only few people know that in addition to its equipment the firm supports the formation and development of electronic learning environments with educational programs, services, and trend making concepts.

The prescription for success: make a light weight, portable, trendy and high quality device with excellent technological parameters.Offer outstanding programs (Apple Store), motivate the innovative capability of developers, and the company will provide the framework and the high quality production background.

One of the greatest achievements however is not the actual ICT device, but the development and promotion of a philosophy determining

new trends and adapting to the demands of the future. Consequently, in the field of education the options provided by Apple fully respond to student demands and reflect the thinking process of today's learners. Furthermore, the impressive methodological background plays an exemplary role in the promotion of mobile learning.

The digital backpack: iPad

While digital boards primarily promote group-based learning the iPad is a tool for independent learning, note taking, or reading. Apple's merchandising campaign was built on a philosophy of the digital backpack. This means that the iPad can make all printed educational materials, textbooks and exercise books obsolete. The iPad essentially an ICT device equipped with software support capable of substituting most traditional school paraphernalia.

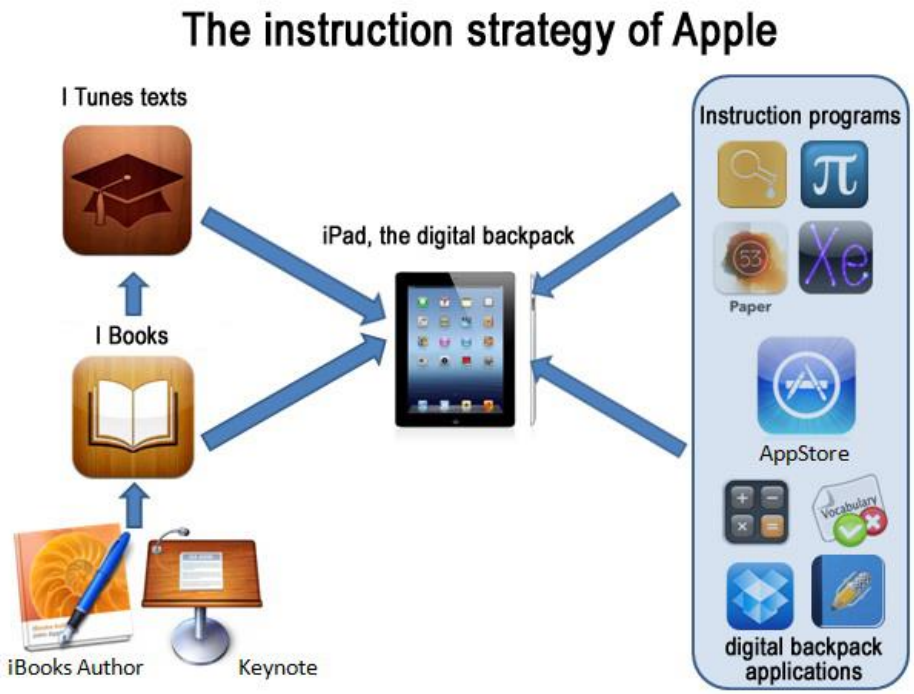


Figure 72: The digital backpack of Apple

Let's examine the structure of the system!

Teachers can prepare texts or presentations in a simple way. One possible means is the Keynote program available as part of the iWork

package. The Keynote program can help in the making of presentations similar to that of the Power Point. The other text development option is the freely downloadable iBooks Author enabling the instructor to prepare high standard digital interactive textbooks without the need for a background in programming.

The programs are available to students via the iBooks application. Such content can form the components of an iTunes U course. The other pillar of the digital backpack is formed by the approximately 450 000 digital applications including programs designed for general use, such as calculators, and dictionaries along with special applications for educational use downloadable from the Apple Store.[101]

Apple in higher education, the iTunes U

At the beginning of 2012 Apple unveiled its new iTunes U application enabling both instructors and learners to teach and acquire full curricula by the help of the iPad, iPhone, and IPod Touch sets.[102] The iTunes U application enables instructors to compile and manage courses including lectures, homework, textbooks, test, and course syllabi.

The application has a uniform surface, or a scheme or pattern into which the texts can be uploaded and easily comprehended by the user. Users of iOS sets can gain access via the iTunes U application to the largest textbook catalogue of the world including texts used by more than 1000 famous institutions, among them Cambridge, Berkeley, Harvard, Oxford, MIT, and Stanford.

[101] Compare this appliication collection with http://edujen.com/files/2013/02/AISWA-iPad-Image-1-2013-mu8kro.pdf

[102] Az_Apple_felsooktatasi_strategiaja_es_az_Apple_hasznalata_a_mindennapokban (The higher education strategy of Apple and its every day use) http://videotorium.hu/hu/recordings/details/2454

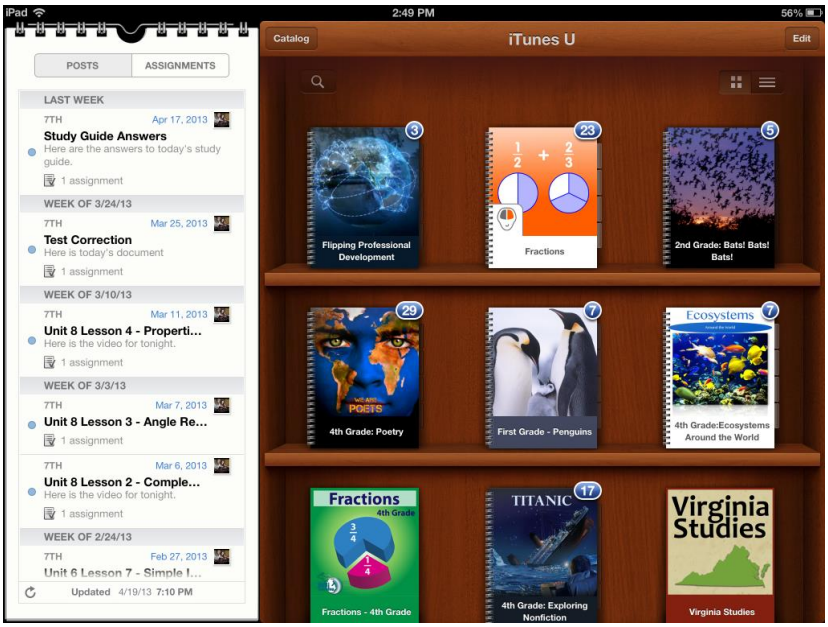


Figure 73: The user surface of iTunes U

The courses can be created by a web-based device the iTunes U Course Manager permitting the processing of the course schedule, the available instruction materials, tests, learner support materials and other contents. Any material or reference related to the iTunes U application, or downloaded from the Internet, the iBookStore or the Apple store can be integrated into the course plan.

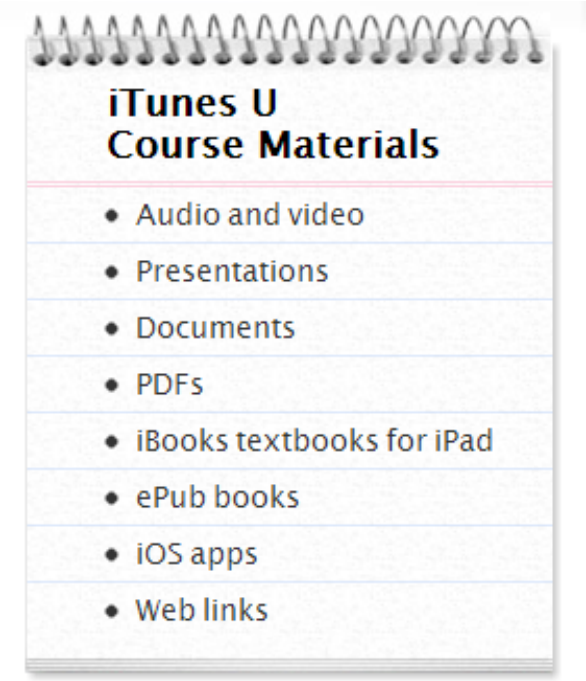


Figure 74 Potential educational applications provided by iTunes U

The texts are available for all students enrolled and registered for the class. While as a basic setting everyone can see the surface, access can be restricted allowing only the students of the respective educational institution to reach the given material. Thus the iTune U can provide a tremendous variety of educational materials for e-Learning and the program can be introduced as an educational platform as well.

Prior to the appearance of iTunes U the educational materials of the best universities were restricted to the actual students in the lecture hall. The iTunes U enables anyone to fulfill the requirements of a course with free access to all aspects of the text. The program provides direct access to new books and summarises the notes prepared in iBooks in a clear and intelligible manner. In addition to the book reading, presentation, and course list features students can ask for a Push-based notification (instant notice on new materials uploaded) enabling them to receive the latest course-related information in time.

11.5 SUMMARY, QUESTIONS

11.5.1 Summary

ICT devices in schools provide support for the realization of the perspective and goals of competence-based, constructivist pedagogy. During the application of any device the solution of the methodological challenges depends of the personal attitude and appropriate competence level of the teacher. The lesson introduced the use and methodological options of said devices.

11.5.2 Self-test questions

- What types of digital boards are you familiar with?
- What are the operation modes of the digital board?
- What are the most important ergonomic criteria of the installment of an intelligent board?
- What kind of methodological principles do we observe during the use of digital boards?
- What are the factors reducing the efficiency of digital boards?
- What are the main features of the educational use of mobile devices?

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12. ICT INNOVATIONS: E-PORTFOLIO, E-PRESENTATIONS, E-BOOK, IPAD INNOVATIVE PROJECTS

12.1 OBJECTIVES AND COMPETENCES

The aim of the lesson is to introduce the background and results of the latest ICT research, applications, and projects. Students will become familiar with the technological, operational, and methodological aspects of the running and management of the given projects. Furthermore, students will learn about the most modern device systems used in schools.

12.2 INTRODUCTION

There are several adjectives to describe 21st century society. On the one hand we can call it the information society as most activities are about or related to information. Consequently in the information society, the production, distribution, dissemination, use, and processing of information are major activities with economic, political, and cultural significance. In such societies information technology plays a central role in production, economy, and in general social relations.

On the other hand our society can be described as the network society defined as a social formation of societal and media networks on the individual, group/organisational or macrosocial level.

In information societies networks fulfill an information transmission role, thus networks form the nervous systerm of modern societies. Therefore one of the foundations of the information society is the Internet and the related services and technologies.

The basic tools of communication are the increasingly intelligent computers, mobile phones, digital cameras, MP3 sets, CD players and the computer connected web cameras. In the past few years these technologies have radically altered our life style, communication, entertainment and consumption practices, and social relations.

Contrary to public opinion most research results indicate that information and communication technology devices do not have an isolation effect as these technologies can only be fully maximised if they ”break out” of the four walls of someone’s apartment. These new devices make anywhere and anytime communication possible while emphasizing the portability of a variety of media we can share, view, or listen to. Furthermore, by sharing content we can become producers as well.

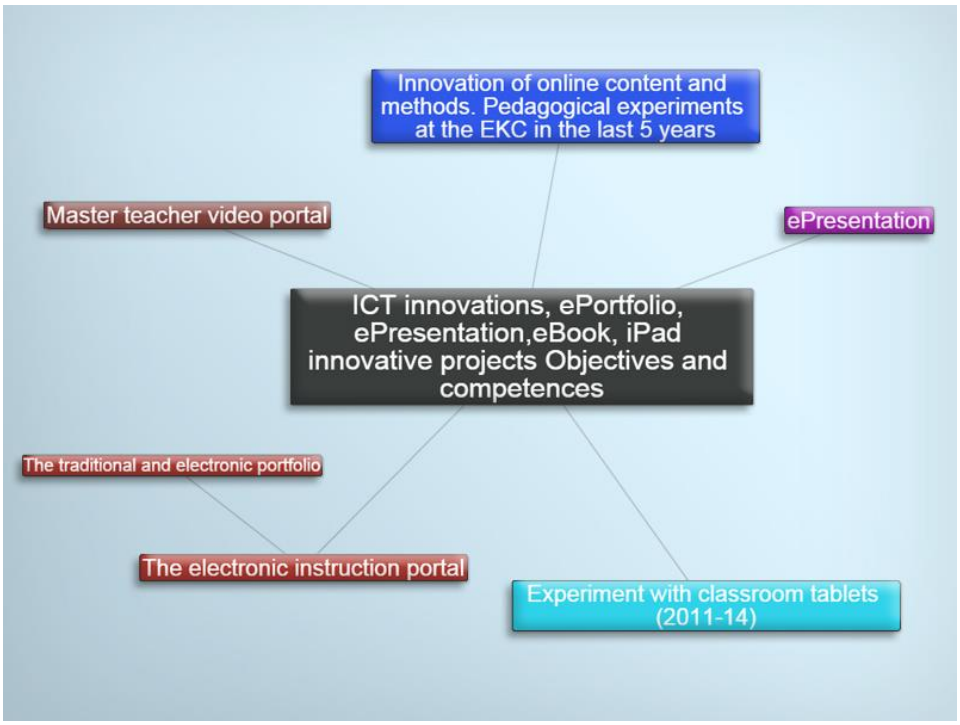

Figure 75: Conceptual map to Lesson 12

12.3 THE ELECTRONIC INSTRUCTION PORTFOLIO[103]

Currently, the electronic portfolio is enjoying an increasing significance in higher education.The main objective of the portfolio is to provide a comprehensive picture on the professional and personal development of a given individual. While this method cannot be expected to provide exact and objective data, it can produce more comprehensive and realistic information than its previous counterparts. In the following section we provide a brief overview of the theoretical aspects of the device.

While the electronic portfolio can be defined in a variety of ways, the storage of the respective information in electronic form and web-based availability are shared features highlighted by the researcher community. Portfolios can be categorized according to function as evaluationary and

[103] Kis-Tóth Lajos, Komló Csaba: Az elektronikus oktatási portfólió a gyakorlatban, (The practical use of electronic instruction portfolios) PEDAGÓGUSKÉPZÉS 6: (3) pp. 63-77.

collection portfolios, while according to ownership we can identify student, instructor, or institutional versions.

The respective advantages include the ability to measure features previously unassessable via traditional methods. The successful application of such device, however, depends on the extent of its integration into the given training system.

12.3.1 The traditional and electronic portfolio

The forerunner of the electronic portfolio is the traditional portfolio whose educational application originates from the 1960s. While it started to lose its popularity at the beginning of the 1990s, it returned in a renewed form by the middle of the decade. Consequently, at the beginning, the digital portfolio appeared as the portable and searchable digital version of its traditional counterpart.[104]

According to function the electronic portfolio can be defined in a variety of ways. Lorenzo és Ittelson[105] view it as a collection of either CD or on the web-stored digital products (resource materials, assignments, presentations) pertaining to a person, group, organisation, or institution. Another definition of said researchers considers the electronic portfolio a personalized, web-based collection of asssignments, solutions and reflections with a key function of context and time based demonstration. Researchers identify three major portfolio functions:

The presentation of selected works by students (visual arts students present their best works)

The introduction of the teaching process (video recordings of demonstration lessons)

The portfolio can function as an evaluation device, as in the 1980s it was named evaluation portfolio.

Herman és Winters[106] argues that the portfolio provides a fairer and more sensitive means for presenting the student's knowledge and abilities as compared to traditional means of knowledge monitoring and control. They also emphasize that the main function of this device is the evaluation of student work (evaluationary portfolio).

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[104] Helen C. Barrett: Researching electronic portfolios and learner engagement (2005). Megtalálható: http://www.taskstream.com/reflect/whitepaper.pdf, Letöltve: 2008. május 5-én.

[105] George Lorenzo, John Ittelson: An overview of E-portfolios. Megtalálható: http://www.educause.edu/ir/library/pdf/ELI3002.pdf, Letöltve: 2008. május 5-én.

[106] Herman, J.L., & Winters, L.: Portfolio research: A slim collection. Educational Leadership (1994), 52 (2), 48-55. o.

Instead of the evaluatory function Paulson és Meyers[107] emphasize that the main function of the portfolio is to provide a complex and comprehensive picture of student performance in a given context: ”the main requirement for a portfolio is to function as a forum encouraging the student to develop his skills and abilities in order to achieve the status of the independent and consciously directed learner.”

12.4 FACTORS PROMOTING THE APPEARANCE OF THE E-PORTFOLIO

As we mentioned earlier the traditional portfolio returned to education in a digital form in the middle of the 1990s. Batson[108] identifies three factors behind its emergence:

- While student assignments are finally submitted in traditional printed form, they are prepared electronically.
- The global presence of the Internet. Higher education institutions provide general access to the World Wide Web.
- The availability of data bases via the web allows students to fulfill most of their tasks by the help of the Internet.

12.4.1 Producing the electronic portfolio

Gibson és Barret[109] distinguish two methods. The first one includes the preparation of portfolios with generally used software (word processors, web page editors, multimedia author systems etc.) requiring a wide knowledge of processing media components and web based publishing. In this case the portfolio compilation process starts from scratch.

The second method refers to making portfolios by the help of personalized data bases and user surfaces providing appropriately structured storage facilities and the storing of the respective data in a systemized manner. While in this case such skills as web page editing is not needed, the production of the respective hardware and software components requires significant resources and competences on the part of higher education institutions and their technical staff.Thus colleges and

[107] Paulson, F. L., Paulson, P. R., & Meyer, C. A.: What makes a portfolio a portfolio?, Educational Leadership(1991), 48 (5), 60 - 63. o.

[108] Trent Batson: „The Electronic Portfolio Boom: What's It All About?” Syllabus,, 16. évfolyam, 5. szám (November 26, 2002)

[109] Helen Barrett és David Gibson: Directions in Electronic Portfolio Development, Contemporary Issues in Technology and Teacher Education, 2. évfolyam, 4. szám, 559-576. o.

universities frequently order this service from external providers (iWebfolio, E-Portfolio, FolioLive etc.) while passing a part of the respective expenses on the students.

12.4.2 The advantages of electronic portfolios

The advantages associated with the use of the electronic portfolio include the media integration option. Accordingly traditional text and pictures can be enhanced with motion picture, sound, and animation elements. Portfolios equipped with appropriate metadata become searchable thereby significantly simplifying the retrievability of information. Furthermore, while the traditional portfolio could have been seen only by a few people, the electronic version can be published on the web. Moreover, the files of the portfolio could be duplicated and the fully identical versions facilitate the preparation of numerous other presentations as well.

According to Siemens[110]ePortfolio production provides the following benefits and advantages:

1. Personalized knowledge and information management
2. Improved knowledge acquisition and skill development
3. Improved skills of objective planning and design
4. Understanding the correlation between learning experiences
5. The provision of metacognitive elements of future learning design efforts based upon previous success and failure
6. Control of personal learning history

e-Portfolios can be beneficial to departments of higher education institutions in the following manner:

1. Sharing content with departments and other institutional units,
2. More credible evaluation as compared to traditional evaluation methods,
3. Preparation of students for lifelong learning,
4. Centralised collection of evaluations which students are also familiar with.

[110] George Siemens: ePortfolios http://www.elearnspace.org/Articles/eportfolios.htm Letöltve: 2008. április 2-án.

Benefits for the given institution:

1. Value creation by students via personal control of the given portfolio,

2. The relationship between the institution and the student is not restricted to the actual enrollment period as the respective lifelong learning opportunities facilitate lifelong professional collaboration options as well.

12.4.3 The criticism of e-Portfolios

While the popularity of portfolios is steadily on the increase, certain criteria have to be observed during their poduction. One frequent criticism is that the application does not gurantee all the positive results promised. Obviously, the mere existence of a device does not guarantee all the positive results expected, and at the beginning stage only few of the positive effects can be anticipated.

Another complaint is that the making of a portfolio takes valuable time away from the already limited time allocated for teaching.[111] Certainly at the beginning portfolio making requires considerable time and effort from students and teachers as well. One way to reduce the excess burden is the provision of appropriate methodological support and technological background. We believe that presently the hiring of external portfolio providers and the partial passing of the respective costs to students is not feasible in Hungary.

The third critical observation questions the evaluatory function. Matthews[112] quoting English evaluation expert Dylan Williams, asserts: “The most fair and just means of checking students’ knowledge at the end of mandatory schooling is the examination.” Matthews cites Lisa Graham Keegan, the Chair of the Council of Educational Leaders of Washington as well: ”Although the collection of student works can be tremendously valuable, it cannot substitute systematic and objective evaluation efforts. We hope that the time comes when the two methods can be combined.” It is obvious that the last view objects to the lack of the evaluatory function, and certainly the electronic portfolio is not suitable for the assessment of lexical or content knowledge. Its main

[111] Daniel Koretz, Stephen P. Klein, Daniel F. McCaffrey, Brian M. Stecher: Interim report, the reliability of Vermont portfolio scores in the 1992-93 school year, Kiadja: National Center for Research on Evaluation, Standards, and Student Testing (CRESST), Graduate School of Education, University of California, Los Angeles, 1994.

[112] Jay Mathews: Teachers struggle for depth despite tests. The Washington Post, 2004, július 6.

function is to identify the presence or lack of certain competences not always detectable with traditional methods.

The fourth observation is crucial as it is based on research performed in the field of electronic student portfolios. Moreover, this is the type of portfolio introduced in Hungary where the circumstances are similar to the original context of the respective research. Zou[113]explored the portfolios of students enrolled in teacher training programs. The range of the prepared texts spanned from the second year until the final examination. The portfolios contained two types of materials, texts proving that the given student met the respective course requirements, and the justification of the given choices.

The subsequent questionnaires, direct observations, and student interviews revealed that student attitudes to portfolios is primarily passive, it is seen as an additional academic burden along with the numerous other tasks. (In the questionnaire portfolios were rated with the second most negative mark of the scale as *not too useful*). The problem however, was not only the passive and negative atttitude, but the selection of student works. They frequently chose products which where irrelevant to the given curriular requirements and the justification of the choice was unsatisfactory as well. Zou identified three factors behind the problems:

A lack of clear correlations between the portfolio and the other tasks connected with the subjects makes the objective of the portfolio rather ambiguous for the students.

Students had insufficient information concerning the significance of the portfolio and the respective evaluation methods, thus they had no internal compulsion for the control and monitoring of their own work.

We believe that the conclusions of Zou's study hold the key to the successful implementation of the electronic portfolio of students' work. Success, however, cannot be achieved merely by the trendy application of the portfolio. The efficiency of implementation primarily depends on the integration of the portfolio in the current training system so that students become aware of the objective of the portfolio, namely proving the existence of competences expressed in the curricular requirements. We believe that the portfolio is ideal for this purpose since traditional measurement and assesment methods are not suitable for the examination of such competences.

[113] Min Zou: Organizing Instructional Practice around the Assessment Portfolio: The Gains and the Losses. http://eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED469469&ERICExtSearch_SearchType_0=no&accno=ED469469, Letöltve: 2008. április 15-én.

12.5 THE E-PRESENTATION

Lectures, or instructor presentations have been one of the oldest and most established methods of knowledge transmission in the higher education sphere. The need for recording or perpetuation of such presentations had emerged from the beginning and usually technical devices reflecting the current technological standards were used for this purpose.

Until the emergence of the electronic media paper was the primary medium despite the fact that the option of recording the lectures on film had existed since the beginning of the end of the nineteenth century. Due to the respective high costs higher education institutions could not take advantage of this option.

The wide spread availability of video technology in the third quarter of the 20th century brought significant changes in this area. Consequently full courses could have been recorded at a relatively low cost, and the modernised versions of such recordings can still be found in the iTunes U applications.

In addition to the increasing dominance of computers the emergence of presentation programs meant the other change. These programs allowed instructors to provide concise lecture materials complemented with still images, sound, or video clips.

Building on the earlier filming and close circuit educational television heritage we have been experimenting with the electronic recording of instructor presentations since the 1990s. Contemporary technology (VHS, SVHS) only permitting the recording of the presenter and the given system was not suitable for sophisticated demonstrations.

As presentation programs became generally used after the Millenium the need for providing students access to the given presentations became even stronger. The mere online publication of slides, or the rapid e-Learning method would not have been effective as the understanding of instructor outlines required explanations and illustrations as well. Consequently, we elaborated a system facilitating the availability of the slides and the recordings of the given instructor on-line.

In order to promote better comprehension and efficiency students can select the given slides without viewing the whole presentation in a linear manner.

While the method had several advantages, we encountered problems and difficulties. The presence of the recording crew distracted the presenter and the time and energy required for the conversion of the slides and the recorded video into a form publishable on the web along with the synchronisation of the slides and the video (the appropriate video is displayed after clicking on a given slide) made live broadcast

impossible. Another problem was that this method was only suitable for the presentation of still images or static content complementing the lecture presentations while the demand for a system capable of boadcasting web-based activities (use of web pages, and web services) and other dynamic content (use of software) was on the increase as well.

Driven by such demands we changed the system in the following way: At first, in order to preserve the intimate atmosphere of the lectures we installed remote control cameras and zoom microphones for filming and sound recording purposes. As a second step we developed a software facilitating the recording of the presenter's screen thereby the storing of dynamic contents.

During both stages our goal was to ensure real time dissemination of the given content on the Internet. Thus the applied technology enabled viewers to follow the class on the web in a synchronous manner.

We provided users an opportunity to select the manner of viewing the presentation. The choices included the presenter and the given text, the presenter him or herself, or only the presentation with the voice of the presenter. The real time presentations can be archived and uploaded into the text repository for later viewing.

12.6 INNOVATIONS CONCERNING EDUCATIONAL CONTENT AND METHODS IN THE PAST FIVE YEARS: AN OVERVIEW OF ICT EXPERIMENTS PERFORMED AT THE ESZTERHÁZY KÁROLY COLLEGE

The researchers of the Institute of Media Informatics at the Eszterházy Károly College have played a pioneering role in the formation and promotion of electronic learning environments in the teacher training and public education sphere. The school-based pedagogical experiments have resulted in numerous innovations used as methodological and innovation related best practice by other institutions. Inspired by earlier research results and international experiences we performed methodological experiments pertaining to the implementation of tablet PC-s in public education.

The school bag of an elementary school student could weigh up to 8-10 kgs and the amount of notebooks, exercise books, and texts only increases during the years. Consequently, we raised these questions: Is it really necessary to carry such a weight every day to school? Couldn't the printed texts and materials be made acessible and used electronically? Would it be possible to highlight the important information on the screen or display the static pictures of the textbook in a three

dimensional image? Why could we not use maps edited by ourselves during the lessons?

In order to provide a real alternative to traditional textbooks digital educational materials have to meet the following requirements:

- Fully identical content with the printed version,
- Option of enlarging or zooming on the selected parts,
- Navigation or page turning on demand,
- The use of bookmarks, the capability of making notes, and highlighting certain sections,
- Teacher should be able to attach notes, audio material, web references. Grouping of students during the solution of assignments, differentiated task allocation, the capability of recording the images of the given electronic textbooks of instructors and children as well.
- Everything should be available at the place of planned use, students should not scroll back. Placement of references and notes and the capability of sharing them with the students.

While the technological background for the development of digital textbooks is available in Hungary, the respective financial conditions must be met both on the individual and social level. Among the few attempts the series of experiments performed in the Demonstration School of the Eszterházy Károly College is one of the most significant. Accordingly experimental classes have been identified within the range of the elementary and secondary school grades in which iPads have been introduced. In the 2013 academic year all 8th grade textbooks have been converted into digital texts in iBooks format. The respective content was provided by the a Nemzedékek Tudása Tankönyvkiadó (Knowledge of Generations Publishers).[114] Moreover, in the 2014 academic year digital exercise books and tests are being prepared both for lower and upper level elementary school students. Our objective was the covering of all disciplinary areas[115] in case of the 8th grade students, while we relied on

[114] By the help of the iBooks Author mutimedia textbooks or e-Textbooks can be created. This type of books could not have been developed on tablet PCs. Thus from now students will not only be able to take advantage of educational applications, but they can download books containing special learning and practicing options in the iBook 2. The new e-Books can contain video, slide show, animation, test questions, and interactive images along with HTML content.

[115] 6. c.: Literature, history, mathematics, geography, nature studies, music, visual arts, English, technical studies
9th grade.: Literature, history, mathematics, geography, visual arts, and in one class English

the topic selection of teachers in preparing digital materials for the lower elementary grades. The research effort also includes development of educational materials, the preparation of digital textbooks and exercise collections or crestomathies in iBooks format meeting the curricular requirements of 6th grade students.

In addition to skill tests we outlined long term strategic objectives relevant to all fields of instruction. The most important goal was to find the appropriate innovative devices and elaborate the methodological components with in-service teachers which are necessary for successful application in the education process. An increasingly prevalent trend in digital pedagogy is the personalization or individualization of the respective developments according to the needs of the users (Racsko, 2012). We strove to elaborate a learning environment model observing disciplinary and student needs and which is well adaptable to the Hungarian public education sphere and can be implemented with the available ICT tools.(Racsko, 2012). The chart below provides an overview of the main research trends of the last 5 years according to the respective student groups, subjects, applied methodology, and pedagogical objectives.

Table 2: The main features of pedagogical experiments performed in the Institute of Media Informatics of the Eszterházy Károly College

Aspects/ Projects	**CLASSMATE PC PROJECT** 2009/2010.	**E-paper experiment** 2010/2011.	**Tablet PC in education iPad2** 2011/2012.	**Tablet PC and interactive educational materials Samsung, iPad2 and iBooks** 2013/2014-
School grade	5th	. 7th and 11th grade 2-2 classes + control group	8th grade	1st grade. 3d.grade 6th grade. 9th grade (Samsung)
Educational objectives	the symbiosis of traditional textbook and ICT device	elimination of paper-based textbooks	the symbiosis of traditional textbook and ICT device	elimination of traditional textbooks
Educational content	tasks, auxiliary materials, interactive educational materials	eBooks published by National Textbook Publishing Company in pdf format	static pdf format texts of National Textbook Publishing Company, the use of applications supporting the learning process	the use of locally developed iBook texts based upon materials provided by Mozaik Publishers
Applied methodology	frontal classwork, demonstration	presentation, explanation, homework discussion, demonstration, structuring questions,	presentation, explanation, demonstrations, student presentation	presentation, explanation, homework discussion, demonstration, structuring questions, student presentation
Subjects included in the research	English, music, history, informatics, mathematics geography, German,	all subjects except skill development subjects	English, biology, geography, physics, informatics, chemistry, literature, mathematics, motion picture	English, biology, geography, physics, chemistry, literature, mathematics, history

			and media studies, history	
ICT background of teachers	beginner	beginner/medium intermediate	beginner/intermediate	beginner/intermediate

The e-Paper methodological experiment aiming at the introduction and pedagogical examination of e-Book devices was a significant step in the elaboration of electronic learning environments. The e-Paper experiment was performed by a consortium including the Eszterházy Károly College and its partners in 2010.[116] The exploration of the feasibility of the respective devices and the examination of the pedagogical application options along with the possibilities, advantages, and disadvantages of interactive learning environments took place in selected student groups in the autumn semester of the 2010/2011 academic year.

Consequently, two classes and the respective teachers in 7th and 11th grade were provided with devices of various development levels along with other educational materials used in lessons. The third class functioned as a control group. The methodological experiment took place in a two month period of the 2010/2011 academic year (September 1-October 31) and involved altogether six subjects. Students completed various attitude and knowledge assessment tests facilitating the exploration of the impact of electronic learning environments on the teaching and learning process. In order to guarantee the success of the experiment students were not allowed to use traditional educational devices, textboks or crestomathies pertaining to the chosen six subjects during the two month term.

The devices were selected according to pre-established criteria[117] including the characteristic technological parametres, the number and

[116] The research effort was performed within the framework of the ”Public education in the 21st century– development, coordination” – TÁMOP-3.1.1-08/1-2008-002 research and development project. The consortium implementing the goals of the project included the Eszterházy Károly College commissioned by the EDUCATIO Social Service Provision Non-profit Co, the E-Animation Corp, the Apertus Public Foundation for Open Professional and Distance Learning, and the Apertus Distance Learning Methodological Development Consultation Centre. The pioneering methodological experiment was implemented by the co-financing of the European Union, the European Social Fund, the European Regional Development Fund and the government of Hungary.

[117] Students and teachers used two devices, the basic category DPS E800 with less extra functions and developed for reading electronic books and the more sophisticated Onyx Boox 60 touch sceen set. The latter was capable of more functions and was

types of built in functions and other non-reading related use options. The research focusing on English, mathematics, literature, history, along with physics, and geography at the elementary level attempted to maintain a balanced focus between the science and humanities. The textbooks scheduled for digitalization were supplied by the Nemzedékek Tudása (Knowledge of Generations) Textbook Publishing Company. Participants were required to prepare 10 lesson plans for each subject. In the lesson plans the use of e-Paper or other ICT devices, among them the interactive board had to be given priority. Furthermore at least two video recordings had to be made concerning a part of the given lessons. Assessment devices included attitude tests at the input and output or closing stages both for teachers and students along with knowledge monitoring tests compiled by teachers.

An essential project component was the provision of continuous ICT support in the form of weekly contact times with technological and methodological experts along with a webpage[118] complemented with a forum option.

Although at the beginning of the research project six hypotheses were established, due to the relatively short time (altogether two months) several variables including the development of reading and text production comprehension, and the positive changes in reading habits and student knowledge could not have been substantiated. The demonstration and proving of such changes requires a longer experimental term.

The final output objective of the research was the formation of a handbook for teachers reflecting the pertaining methodological and practical experiences. Furthermore, we aimed at compiling a scholarly essay summarising the present conditions and facilitating the propagation of electronic educational environments in the future.

12.7 THE TABLET PC SCHOOL EXPERIMENT (2011-14)

In the the 2001/2012 academic year the Institute of Media Informatics and the Demonstration Elementary School of the Eszterházy Károly College had launched a novel perspective methodological experiment focusing on the use of Tablet PC in educational environments. The tablets containing several educational support options came with touch screen colour display and wi-fi connections. In order to perform the

equipped with wifi Internet access. The display of both devices is a so-called e-ink model which does not require additional source of energy. Since it is lit by reflecting light it does not harm one's vision either.

[118] www.epapir.ektf.hu

experiment we chose one of the optimal devices, the iPad 2 made by Apple.

Accordingly all students of the 8 c class and the respective subject teachers were provided iPad2 tablet PCs. In the classroom an interactive board with LCD display was installed as well. The textbooks were supplied in a static pdf format by the Mozaik Publishers in the following subjects: literature, history, physics, biology, chemistry, mathematics, informatics, and geography. The modern state of the art educational environment included numerous other interactive applications enhancing the knowledge transmission and acquisition process.

Subsequently, a new tablet PC-based methodological pilot project was launched in the 2012/2013 academic year. One basic difference was that teachers were not only equipped with an ICT device, but with the digital form of all textbooks related to the given class. The subjects included mathematics, physics, chemistry, geography informatics, literature, history, art education, and technology. In addtion to the modernized content and the uniform access the professional support and accredited textbooks were provided by the Knowledge of Generations Textbook Publishers. Moreover, the formal implementation and appearance of the texts was exemplary as well. The project utilizing options provided by a unique platform focuses on iPad2 made by Apple making good use of the iBook Author textbook editing function.

Throughout the 2013 academic year we converted all 8th grade textbooks into interactive textbooks in an iBook format along with several exercise books and tests both for lower and upper elementary students as well. Our objective was the covering of all disciplinary areas[119] in case of the 8th grade students, while we relied on the topic selection of teachers in case of preparing digital materials for the lower elementary grades. The research effort also includes development of educational materials, the preparation of digital textbooks and exercise collections or crestomathies in iBooks format meeting the curricular requirements of 6th grade students.

The 8th grade textbooks of the Knowledge of Generations Textbook Publishers is the first such collection with accredited content. The textbooks complemented with video components, 3D animations, and interactive mutliple choice self-evaluation tests provide support for the teaching and learning process. The subjects include: physics, biology, geography, chemistry, twin texts in literature, history and art analysis,

[119] 6. c.: Literature, history, mathematics, geography, nature studies, music, visual arts, English, technical studies
9th grade.: Literature, history, mathematics, geography, visual arts, and in one class English

while the English language and mathematics textbooks are currently being prepared.

The research and development process surpasses the limits of text conversion efforts. In-service teachers participated as professional readers and functioned as catalysts of the editing and compiling process performed by experts in the field of graphic and visual arts, informatics, and programming. The task for the teachers was not writing new textbooks, but the elaboration of knowledge assessment assignments pertaining to the given subject and promoting the maximisation of the interaction capacities of the given developmental application. The other segment of said creative activity was the promotion of multimedia options provided by the given devices. Accordingly they had to design the basic idea for a few media units which they implemented together with the professional teams. Furthermore, a comprehensive video surveying the whole text was prepared for each subject. The textual components of the videos were prepared by the respective teachers. The narrated texts provide a summary of the materials learned during the given semester. The e-books adapted to Tablet PC are major innovations not only from the aspects of the given platform, but the respective developmental method as well. The educational materials are prepared according to the trialogic learning model reflecting cooperation by partners in equal standing both from the point of view of content and applied technology. An accredited textbook family in such a format has not yet been produced in Hungary.

During the 2013/2014 academic year we extended the iPad experiment to the lower elementary school level. Accordingly in addition to the 6th and 9th grades the 1st and 3d grade was included in the experiment as well. In the 1st grade taking the respective age-related features into consideration the machines were utilized for motivation, skill development, and practice purposes, while in the 3rd grade an interactive exercise book promoting the development of reading skills was tested.

12.8 THE MASTER TEACHER VIDEO PORTAL

The idea of the Master Teacher Video Portal was realised within the TÁMOP 4.1.2 B 6. sub project in 2011. The making of the portal was partially inspired by the Teacher's TV of England along with the given deficiencies in the teacher and mentor training process.

The goals behind the establishment of the portal included the need to help instructors, students, and mentors by providing access to a wealth of video materials covering the pedagogical, methodological, psychological, and ICT aspects of teacher training. Additional objectives included the synthesis, selection, and dissemination of the tremendous

amount of videos along with the production of methodological presentations.

Videos can be uploaded by external users prior to an approval process by a professional evaluation panel.

The Master Teacher Video Portal is more than a simple video collection as 90% of the films are complemented by auxiliary materials, descriptions, link collections and methodological guidelines promoting effective information processing. The films also come with forum and comment options faciliating professional information exchange. Currently the portal includes more than 130 films and at least 30 films focus on the methodology pertaining to information and communication technology.

The portal is available at the http://mestertanarvp.ektf.hu

12.9 SUMMARY, QUESTIONS

12.9.1 Summary

One of the most important requirements of the application of ICT is the motivating introduction of best practices and innovations. The lesson aimed at exploring the latest applications and developments in Hungary earning domestic and international acclaim.

12.9.2 Self-test questions

1. Which are the most important domestic and international innovations in public education?
2. What are the main features of digital textbooks?
3. What are the uses of the e-Presentation?
4. What are the main features of the e-Portfolio?

13. COURSE SUMMARY

13.1 CONTENT SUMMARY

The course dedicated to the promotion of information literacy explored the methodological foundation of the application of instruction and info-communication device systems, with special emphasis on the services available at the World Wide Web.

Students became familiar with the main aspects of the design and implementation of electronic educational materials.

Regarding their own special subject content background students completing the course will be capable of effective information search and retrieval along with developing multifaceted network communication skills, the electronic processing of data and information, and the creation, modification, and dissemination of digital content.

13.2 CLOSURE

The lessons of the course focused on the following topics:

After providing a detailed description of the thematic structure of the course in the introductory section we described the course completion criteria and the respective work methods.

Lesson Two provided an overview of the main features of the traditional and new media systems, along with options for grouping the respective educational materials. Students gained an understanding of the conceptual system and criteria of multimedia, became familiar with the various levels of media competence and became capable of distinguishing the functions of traditional and new media supported educational materials.

Session Three focused on the historical evolution of ICT devices, with special emphasis on McLuhan’s technological determinism model and the subsequent media perspectives along with the interpretation of the concept of electronic learning.

Students became aware of the basic instruction technology principles and models enabling them to utilize the defining components of the instruction system model in a creative way.

Lession Four focused on the evaluation and qualification principles and the differing assessment methods of electronic productions. Students became familiar with the main functions of the e-Learning framework system along with the expectations related to instructional software and electronic texts. Having completed the lesson students are

capable of the evaluation of multimedia educational materials according to a complex criteria system.

In addition to the historical development of educational demonstration efforts Lesson Five focused on the learning formats of the 21st century while discussing the main features of multimedia-based demonstration. Students became familiar with E.Dale's cognitive/experimental pyramid and its application to contemporary electronic learning efforts. The lesson introduced the main aspects of processing information received from electronic media along with the characteristics of visual, auditive, and audio-visual media. Having completed the course students became familiar with the foundation of program structures as well.

The focus of Lesson Six was directed at the concept system and methodology of electronic learning efforts along with modern 21st century learning formats. Accordingly students became familiar with the components of e-Learning, the conceptual system of blended learning, the difference between the traditional and social media while gaining practical exposure to network-based learning and new media systems.

Lesson Seven provided knowledge on the theoretical background of the design of electronic educational materials, the structure of electronic educational materials, the means of preparing scrips, along with the technological, genre, and didactic requirements of e-Texts. Information was provided on e-Learning standards aiming to promote compatibility of and uniform accessibility to products developed in different systems.

Lesson Eight focused on the theoretical background of the digitalization of pictures, audio materials, texts and videos required for designing electronic educational materials. Students could learn about the main features and quality parameters of digital picture formats, the details of the digitalization of audio materials, and the principal aspects of the respective texts. Furthermore students became familiar with the forms and dramaturgical role of picture, sound, text, and motion picture in electronic educational materials.

Lesson Nine provided information on the structure and use of the most important electronic knowledge data bases. On line data bases provide crucial foundations for ICT applications. Such data bases are freely accessible, anyone can enhance them at any time while improving the attractiveness and quality of the work of the teacher. Moreover, many applications provide the didactic background for independent processing by learners.

Lesson Ten proved that the application of digital boards requires modern state of the art teacher and learner software. We introduced two software developed for the CleverBoard, the Lynx and the WordWall programs. We showed that teachers can use non interactive board

dependent supervision software as the NetSupport program provides comprehensive supervision options and class management functions.

Lesson Eleven demonstrated that ICT devices in schools support the competence-based constructivist pedagogical perspective. The application of any device requires an appropriate attitude and competence level from the teacher in order to meet the emerging methodological challenges. The lesson provided practical information on the use and methodological aspects of the given devices and tools.

Lesson Twelve focused on innovations in the field of ICT including e-Portfolio, e-Presentation, e-Book, and iPad. Students became familiar with the technological, content-based, and methodological criteria system of the ICT-related projects via the introduction of the latest research results and applications. One of the most important requirements of the application of the achievements of information and communication technology is the inspirational introduction of best practices, and innovations. The lesson aimed to explore the latest applications and ideas developed in Hungary and receiving increasing professional recognition in the international arena.

14. SUPPLEMENTS

14.1 WORKS CONSULTED

14.1.1 References

14.2 THE SUMMARY OF MEDIA UNITS

14.2.1 List of tables

14.2.2 List of figures

15. TESTS

15.1.1 There is no test

15.1.2 Lesson

1. Which statement does not apply to media competence?
   a) It refers to the possession of information promoting effective and creative media use.
   b) It refers to the possession of media related knowledge +
   c) It refers to media related knowledge and their practical application
2. Which of the following features pertain to multimedia criteria?
   a) Independence, computer control, combination of media, interactivity and navigation, linearity
   b) Independence, computer control, combination of media, interactivity and navigation, non-linearity +
   c) Independence, computer control, interactivity and navigation, combination of media, linearity
3. Which of the following statements is false?
   a) The principle of independence means the accessibility of various media fully independent from each other.
   b) The main aspect of interactivity is that in a mutltimedia product the direction of further action is not chosen by the user +
   c) The concept of nodes refer to information units or their collection
4. Which of the following statements is false?
   a) In non-time dependent media information exclusively contains a series of unique elements or a non-time dependent continuum (picture, text).
   b) Time dependent (continuously functioning) media include the signs provided by various sensors (pressure, temperature, moisture, video, motion picture) and the digitalized signs of audio sound waves.
   c) In non-time dependent media information exclusively contains a sequence of unique components or non-time dependent continuum (picture). +
5. Which multimedia definition is false?
   a) Multimedia is a type of media mix including electronic and printed media +
   b) Multimedia implements computer assisted communication-interaction with a complex, interactive media system.

c) The multimedia system is determined by independent computer-control, integrated productio, target oriented processing, presentation, storing, and forwarding manifested in time-dependent (continuous) and non time-dependent (discreet) media.

6. Which statement pertains to media creativity?
   a) The problem free application of media and its respective devices
   b) The ability to select the most effective medium based upon genre and form-language related information
   c) An ability of self expression and suitability for the directing of electronic products.
7. Which media can be considered non-time dependent?
   a) Figures*
   b) Motion picture
   c) Animations
   d) Still images*
   e) Text
   f) Sound
8. Select the correct statement!
   a. Since traditional analog television is unidirectional, it cannot provide feedback ☺
   b. Since traditional analog television is unidirectional, it can provide feedback.
   c. Since tradtional analog television is not unidirectional, it cannot provide feedback.
9. Select the correct statement!
   A news unit, report, or a mere presentation of a real event is called:
   a. Infotainment ☺
   b. Entertainment
   c. Edutainment
10. Which of the following concepts reflect entertainment, information provision, and orientation purposes?
   a. Infotainment
   b. Entertainment *
   c. Edutainment
11. Which of the following concepts reflect an intention of acquiring instructional content via network-based communication devices?
   a. Infotainment
   b. infoeducation*
   c. Edutainment
12. Which of the following statements does not apply to new media?

a. An e-Learning 2.0 based regularly organised learning form based on the automatisms of the learner. ☺
b. New Media includes interactive television options facilitated by mobile phone and digital broadcast applications in addition to interactive, network-based multimedia presentations.
c. The knowledge acquisition principles of e-Learning 2.0 are described by connectivism, or the learning theory of the digital age.
d. Media diversification means the maximisation of the potential of mass communication options.

13. Establish the chronological order of the periods of the media evolution according to Bailey, BOWMAN and WILLIS!
    a) printed press and electronic broadcast (**Mass media**)
    b) multiplicity of (digital) media (**Masses of media**)
    c) Personal media (blogs) (**Me media**)
    d) Social media (**We media)**
14. Media diversification implies that anybody in possession of network-related competences can provide content
    a) T ☺
    b) F
15. e-Learning 2.0 is a teacher centred regularly organised learning scheme
    a) T
    b) F ☺
16. e-Learning 2.0 encourages collaborative learning
    a) T ☺
    b) F
17. e-Learning 2.0 is multidirectional, multichanneled, and decentralized
    a) T ☺
    b) F
18. In case of e-Learning 2.0 communication between tutor and student is pushed in the background
    a) T
    b) F ☺
19. Media convergence refers to a new discipline formed via the informatization of mass and telecommunication technologies.
    a) T ☺
    b) F
20. e-Learning 2.0 based upon spontaneous knowledge exchange ignores learner autonomy.
    a) T

b) F ☺

21. Electronic learning promotes community based learning.
    a) T
    b) F ☺
22. Media convergence was the result of the digital intertwining of mass and telecommunication technologies

    a) T ☺
    b) F
23. Media diversification implies the expansion and maximisation of the potential of mass communication media
    a) T *
    b) F
24. In e-Learning 2.0 the user is converted from being a reader to an author and editor.
    a) T ☺
    b) F
25. The meaning of the acronym UGC is
    a) user (consumer) generated content

15.1.3 Lesson

1) Who developed the"hardware and software-based" instruction technology approach?
   a. Bruner
   b) Lumsdaine*
   c) Gagne

2) Who elaborated the conceptual system of"instructional design"?
   a. Bruner
   b. Lumsdaine
   c. Gagne*

3) Match the names and concepts listed below!

Lumsdaine	The hardware and software approach to instructional technology
Gagne	In this context the following aspects are emphasized: evoking attention - motivation – informing students on the exact expectations – reviewing prerequisite knowledge – presenting new material – substituting learner activity - feedback – promoting recording and transfer processes – performance evaluation

McLuhan	*Emphasis on the declining galaxy of printed culture via the rise of digital culture.*
Davies	The emergence of a new instruction technology complemented with modern organisational theory implying the application of optimal strategies including teaching and learning resources in order to fulfill pedagogical objectives.

4) **Is the following statement true or false?** In case of instruction technology models and regarding the practice of instruction design and development the *adherence to the system perspective is the most important criterion. (F)*
5) **Who made this statement?**
"*Books in schools will soon become obsolete. Student will be instructed via their eyes. All aspects of human knowledge can be taught via motion pictures. Our schools system will completely change within 10 years."*
   a. Edison*
   b. McLuhan
   c. Schramm
6) **Match the following researchers and trends!**

E. L. Thorndike (1912)	the elaboration of the branching program
S. L. Pressey (1926)	designed a testing machine,
N. A. Crowder (1959)	elaborated the main features of programmed education
Wilbur Schramm	categorised educational materials into generations
B.F. Skinner (1954),	elaborated the concept of reinforcement

7) **Who was the founder of the instruction technology perspective in Hungary?**
   Árpád Kiss *
   László Nagy
   Zoltán Báthory

15.1.4 Lesson

1. **Which aspect of multimedia evaluation is described by the following expressions: transparent, clear, consistent?**

a) structure
b) message
c) navigation*

2. **Which of the following statements pertain to the basic features of structuredness?**

a) focus on content and placement
b) focus on transparency and placement
c) can be described by the following expressions: *content, logical structure, placement structure* *

3. **What is not part of structuredness?**

a) welcoming picture, sound, greeting
b) main menu, subpoints, text modules, nodes
c) forward, backward function*,

4. **Which of these statements is the odd one out?**

a) The purpose of the message is to address the user
b) The unification of the principles of conciseness, brevity, and pregnancy is in contrast with verbosity or excess redundance
c) During the formation of the *message* we don't have to clarify what kind of content we want to transmit *

5. **Which of the following is not part of the criteria for the evaluation of multimedia programs?**

a) professional accuracy and credibility, simplicity of communication, meeting medial broadcasting expectations,
b) adhering to pedagogical and didactic guidelines, observation of psychological and ergonomic aspects, aesthetic aspect of presentation
c) design conditions, preparation process, user behaviour*

6. **Which of the following applies to the appropriate proportion of media?**

a) primary emphasis on picture and sound
b) prevalence of text
c) balance of text and pictures while reinforcing each other's impact *

7. **Which of the following statement applies to the personalization of educational materials?**

a) The *personalization* of the production is based upon adaptation to group skills.
b) The *personalization* of the production is based upon adaptation to individual skills.

.

8. **What is the layout?**

a) sub point
b) opening image
c) placement structure*

9. **What is the main focus of ergonomics?**
a) the correlation of concepts and informational units
b) checking content knowledge
c) the quality components of work situation, efficiency, and safety *

10. **Menus, icon tables, windows, and indicators are components of:**
a) interaction
b) structuredness
c) graphic user surfaces*

11. **Which principle the following belong to: motivation, sustaining attention, promoting independent work?**
a) psychological basic principles
b) communicational basic principles
c) didactic basic principles*

12. **Mark the true statement!**
a) The SWOT analysis is a psychological process
b) The SWOT analysis is one of the tools of monitoring didactic guidelines during CSD analysis
c) The SWOT analysis is a tool for elaborating subjective opinions during CD analysis *

13. **Which of the following are considered external factors in a SWOT analysis?**
a) weakness, opportunity
b) strength, threat
c) opportunity, threat*

14. **Which of the following statement is false?**
a) In case of interactive multimedia systems mutual acts take place between man and machine on the communication surface in real time.
b) Action related to communication with medium can be reactive, communicative, and interactive.
c) Real time interaction and communication forms are realised in off line mode.*

15. **Which concept are the following expressions are connected with:** work situation, efficiency and safety, quality aspects of human work**?**

a) didactics
b) psychology
c) ergonomics*

16. ***Match the multimedia evaluation concepts with the respective content!***

Aspects	Description
Accuracy and intelligibility of the message	Professional accuracy, credibility, simplicity, intelligibility, conciseness, unification of the principles of conciseness or brevity with pregnancy.
Systemised thinking, organisation	Does processing meet learning objectives, is there sufficient motivation, does it sustain interest, or promote self activity?
Structuredness	To what extent is the program adjusted to the needs of the user, does it provide a sense of accomplishment, is a cognitive map formed about the text? Are the applied color and form compatible with content?
Forward navigation	Does it contain minimum navigation elements, do the navigation elements promote orientation, is an object and name index included?
Simplicity of communication and interaction	Action-reaction (waiting time), interruptability, sustainability of the chat option
Meeting pedagogical and didactic principles	Compatibility with objectives, suitability with differing learning styles, availability of self-test options
Meeting psychological-ergonomic expectations	The appropriateness and transparency of content, logical and placement structure
Visual and auditive aspects of multimedia components	The right proportion of media, the selection of media components according to content specifications

17. ***Match the multimedia evaluation concepts with the respective content!***

Aspect	Description of content

Textual segments	Simplicity readability, structuring, conciseness, lack of eye strain,
Numbers, data base	Speed of retrieval, transparency, the demonstration of progress
Still images	Extent of composition, conscious use of colour, highlighting devices.
Icons, symbols, logos,	Simplicity, intelligibility, extent of highlighting
3D description	Spatial complexity, presentation, spatial effect and materiality of the modular object
Animation	Continuity, steadiness, realistic nature, and dynamics of motion
Auditive information	Intelligibility of text, adequacy and elimination option of background music
Motion picture	Composition, close-up, sharpness, lighting, steadiness of camera movement.

15.1.5 Lesson

1. **Match the concepts and didactic periods!**

1. First didactics	*the pedagogy of familiarisation*,
2. Second didactics	*the pedagogy of demonstration*
3. Third didactics	*the pedagogy of promoting action*
4. Fourth didactics	social, community content

2. **Which of the following should be matched with the intro?**
   a) demo
   b) tutor
   c) name card*

3. **What does ergonomics focus on?**
   a) Work situation, efficiency, safety
   b) quality aspects of human work
   c) all of the above*

4. **What does the term ergonomics mean, which discipline does it belong to?**
   a) independence, Pedagogy
   b) work psychology, Pedagogy
   c) work psychology, Psychology*

5. **What is the placement structure?**
   a. node

b. teach
c. layout*

6. **What does the question mark mean in case of multimedia or instruction programs?**
   a) questions can be asked
   b) we can contact the maker
   c) help is provided for operation*

7. **What is the purpose of the Intro on multimedia CDs?**
   a. farewell, closure
   b. discussion, analysis
   c. introduction*

8. **What is the meaning of the node?**
   a. text module
   b. subpoint
   c. nodal point*

9. **Match the following concepts with the colour related impact!**

Characteristic impact	connection with a given personality feature
Associative impact	*emotional aspect* of experiences related to natural phnomena, objects, and persons
Symbolic impact	*emotions-related social, historical, and national aspects*

10. **Match the following concepts pertaining to the still image description!**

Symbols	graphic signs developed by a given discipline and which *evolved from an abstract image into a picture*.
Emblems	*visual codes facilitating visual communication and the transmission of meaning*, a *symbolic drawing* accompanied by a motto, distinguishing sign
Pictograms	simplified, logical, easily understandable images can transmit thoughts or *information of sentence value*.
Icons	signs producing the *signified* via an external pictorial relation, Iconic signs refer to the *original meaning* while highlighting the essential feature of the phenomenon described.
Logos	protected *trade marks, signs substituting speech*, Logo

	or logotype: a word or few letters used for the identification of an organisation, The trademark is a registered sign introduced by advertisement. *Trade marks* facilitate the distinction of the products of various manufacturers.

11. **Who made the following statement: ”Descend as low as you can on the scale to guarantee learning, but ascend as high as you can to assure effective learning!”**
    a. E. Dale*
    b. Edison
    c. Einstein

12. **Put the following menu points of a multimedia product in order of appearance!**
    a. Title image
    b. Welcome
    c. Main menu (Start)
    d. Menu points
    e. Sub chapter
    f. modules/nodes/episodes

13. **Match the following concepts!**

Symbolic/monomedial presentation,	we learn the facts via concepts (reading or listening to texts)
Audiovisual presentation	we perceive the 3 dimensional world and voices in space visually via drawings and photograps and in mono, stereo, or quadro format respectively.
Multichannel, interactive perception	we use all our sensory organs in becoming familiar with the surrounding world via vision, hearing, smelling, tasting, touching, and heat sensing.

14. **What does a question mark mean in multimedia programs?**
    a. questions can be raised
    b. connection with maker can be established
    c. providing help for the use of the program *

15. **What purpose does the INTRO serve in case of multimedia CDs?**
    a. farewell, closure
    b. structure
    c. introduction*

16. **What is the meaning of a node?**
    a) text module
    b) subpoint
    c) hub*

15.1.6 Lesson

1. **What new network-based communication forms have been promoted by digitalization?**

    a. Web 1.0 based social organisation and learning formats and student centred web environments (e-Learning 1.0).

    b. Web 2.0 based social learning organisation and learning formats and learner centred web environments (e-learning 2.0). ☺

    c. Web 2.0 based individual (social) organisation and learning formats and instructor centred web environments. (e-learning 2.0).

2. **Which of the following statements is correct?**

    a. In blended instruction programs supported by e-Learning spatial and temporary boundaries are established by digital technology. ☺

    b. In blended instruction programs supported by e-Learning spatial and temporary boundaries are established by analog technology.

    c. In blended instruction programs supported by e-Learning spatial and temporary boundaries are established by the simultaneous application of digital and analog technology.

3. **Select the correct statement!**

    a. At first e-Learning methods were designed to complement and improve part time instruction in a regular form, starting from the top.

b. At first e-Learning methods were designed to complement part time instruction in a regular form, starting from the bottom.

c. At first e-Learning methods were designed to substitute part time instruction in a regular form, starting from the top. ☺

4. **Select the correct statement!**

The acronym LMS stands for:

a. Learn Manipulation System

b. Learning Management System ☺

c. Learning Mandatory System

5. **Match the following concepts!**

CBT (Computer Based Training) i	**computer-based instruction**
TBT (**T**echnology **B**ased **T**eaching)	a discipline formed by the integration of traditional instruction technology, modern information technology, learning theories and personality development efforts
CBL (**C**omputer Based **L**earning),	a learning activity based upon the computer
CAL (**C**omputer **A**ided **L**earning),	a learning activity helped by the computer.
WBT (**W**eb **B**ased **T**raining)	web-based learning .

6. **Which of the following statements is false?**

a. e-Learning 2.0 is a student centred regularly organised learning scheme based upon the automatisms of the learner.

b. e-Learning 2.0 is a student centred irregularly organised learning scheme based upon the autonomy of the learner ☺

c. e-Learning 2.0 is a student centred regularly organised learning scheme based upon the autocracy of the learner.

15.1.7 Lesson

1. **Is the following statement true or false?**

   SCORM is a standard describing the break down of the text or educational material into units and the subsequent compilation to pormote effective use by learners with varying skills.

   True

   False*

2. **Is the following statement true or false?**

The asset contains indivisible media files (T)

3. **Is the following statement true or false?**

The SCORM (Sharable Content Object Reference Model) elaborated by ADL (Advanced Distributed Learning) is such a reference model (T)

4. **Match the following concepts!**

digital learning content	learning content
Textual unit	asset
SCORM	Sharable Content Object Reference Model
ADL (Advanced Distributed Learning)	An organisation founded by the Department of Defense (USA) developing the given reference model