Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

Proposal for classifying e-learning models

Antónia Berecz
Dennis Gabor College / Institute of Basic and Technical Sciences, Budapest, Hungary
berecz@gdf.hu

***Abstract* — This paper gives a kind of overview about the typing options of the models in the far-reaching e-learning area. Such a classification system for e-learning models is not yet available in the literature. The reason for this is that the pursuit of completeness and accuracy is very difficult in this complex, interdisciplinary field.**

Along which dimensions can we perform or should we consider the classifying? There are trendy, generic models with a few features or dimensions, but an organization (or tutors, teachers, curriculum-authors) must choose not fashionable e-learning model, but appropriate one(s), which should fit to its/their own learning strategy, goal or situation. Then they should tailor their own e-learning model with the selected sample(s), model type(s).

This overview about classification of the e-learning solutions provides support for the orientation of the models. The overview is put into a historical framework with the emergence of the e-solutions and the outline of future trends.

Keywords: e-learning models, classification of e-learning models, educational design, education strategy, higher education.

***Összefoglaló* — Dolgozatomban a szerteágazó e-learning területen fellelhető modellek tipizálási lehetőségeiről adok egyfajta áttekintést. Ilyen osztályozási rendszer az e-learning modellekről az irodalomban még nem található meg. Ennek oka, hogy a teljességre és egzaktságra törekvés igen nehéz ezen a komplex, interdiszciplináris területen.**

Mely dimenziók szerint végezhető vagy érdemes végezni az osztályozást? Vannak divatos, pár jellemzővel, illetve dimenzióval alkotott általános modellek, de a szervezeteknek (és tutoroknak, tanároknak, tananyag-szerzőknek stb.) nem divatosat, hanem a számukra megfelelő(ke)t kell választaniuk, amely illik saját stratégiájukhoz és az adott tanulási célhoz, helyzethez stb., majd azokhoz illeszkedően kell kialakítaniuk a választott mintá(k), modelltípus(ok) segítségével a saját e-learning modelljüket.

Az e-learning modellek közötti eligazodásban nyújt segítséget a megoldások osztályozásának áttekintése, amelyet történeti keretbe foglalok az e-megoldások kialakulásával és a jövőbe mutató tendenciák felvázolásával.

Kulcsszavak: e-learning modellek, e-learning modellek osztályozása, oktatástervezés, oktatási stratégia, felsőoktatás.

I. INTRODUCTION

In this paper, I deal with the learning and teaching models that are generated by the widespread use of computers and the internet. I'm talking about the models of the earlier "classical" e-learning (using radio, television, etc.) models just for the evolution of e-learning history. – Although the pioneering tools have created the methodological basis of the e-learning and modeling can be interpreted for them as well. –

E-learning can not teach anything other than postal mail – but it allows mass access to education that was previously fewer and less easily accessible. E-learning models are e-development of teaching models, they have added value relying on technology. Teaching is a complex system without any e-tools, which is difficult to model together (with its surroundings). Ever since we use electronic devices widely in education, we need to integrate them also into the work of those involved in teaching and learning.

Without designing or modeling, it is not advisable to solve a task, especially so large. Moreover, it is worth "to look", to study the works of others. Many people have made general models from many perspectives or focuses. More people have adapted them to their own organizations, making smaller or bigger modifications on them, and published case studies about them, that are descriptions of the models' preparation and practice, related findings, experiences and models' evaluation.

Today, when we use the Internet broadly, using it every day, in designing new education systems or transforming old ones, or if we are interested in e-learning models from a professional point of view, it would be useful if "labels" would give guidance among the large and varied models. Until today I've only found one publication that attempts to give an overview of all models, but [1], a learning aid, names only three large groups, noting that there are more.

It is therefore useful to classify the different e-learning models: for the understanding of each e-learning model; to choose one or more suitable for us; to recommend ones to others; to measure their success and effectiveness; to classify a new model to others. Unfortunately, when publishing models, authors usually do not give their models classification (in other words, they "labels", types), although they describe they purposes in variety of ways, the problems they are trying to solve, the practical functioning of their models, and illustrate their experiences with case studies.

E-learning models usually focus on only a few dimensions of teaching and learning using e-tools, and are made of aspects provided by model makers. The grouping solutions so far have been created model-classes only by specific dimensions or aspects. These classifications are useful in studying these aspects and models more thoroughly.

The categorization of e-learning models is almost as problematic as defining the term e-learning itself [2]. By classifying e-learning models, I mean that e-learning models that are created or examined on the same aspects are described and classified under the designation. An e-learning model can belong to several classes. In addition to the large model classes proposed in this paper, it is of

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

course possible to create more ones and to train classes differently. Also new models and classifications are still being created, which should be placed in a larger system.

To sum up: e-learning teaching models generally lack they aspects, focus, and class names, which would help builders and users of models. It is therefore useful to work out a wide-ranging systematization taking into account all aspects.

II. Initial Proposal for Classification of E-learning Models

This paper is a starting proposal for classification of e-learning models. Creation, structured and named of classes requires longer research and professional coordination. It is important to note that there is a smaller or larger overlap between criteria system and model structure of each class; the models can usually be classified in several classes; and the models are not mutually exclusive even for a class.

My classification was made by "heuristic clustering". Which I mean if a new model is more similar to "average" of my class or to one member of my class than more different from it, then I added the model to the class. But if it is not close to the "average" of my classes, I have created a new class name which expresses its focus frankly, and expresses its difference from the others of my classes and became its first member. If more models created by others were included into an own class, I needed to create a more concise name to express they differences. It also happened that some models were "more similars" in one class, which would be desirable to form a subclass.

My classes have been set up so far:

- Models based on e-learning history
  - Models based on technical tools and technologies used in e-learning
  - Models of electronic support degree
  - Models by evolution of web
- Models by type of educational institution
- Models by talent management
- Models by e-learning environments
  - Models of life-long-learning
  - Models focused on e-learning environments
  - Models based on platform type
- Mobile-learning models
- System models, cybernetic models
- Models from the perspective of learning theories
- Drivers-made models
- Models that emphasize the potential of interaction
- Educational design models
- Competence-based models
- Intelligent tutoring systems
- Models for measurement of e-learning systems
  - Models for measurement of success
  - Models for effectiveness of technology
- Multidimensional models
- Experience-based models

These classes are presented briefly in the following chapters.

III. Models Based on E-learning History

Beetham argues that the effectiveness of e-learning models focusing directly on technology's affordability (the technology environment offered by the technology environment) is questionable [3, p. 4], but the production of e-learning models must be considered that those will be successful in practice, which using the most commonly available, comfortably-used technologies in the given era [4, p. 49]. "Early models, such as the demand driven model [5] focused on the role of technology in content, access, and electronic services. The demand-driven model stresses the customer's demands for quality content, delivery and service "[1].

A. Models Based on Technical Tools and Technologies Used in E-learning

The development of e-learning history has been outlined many times in the literature along with the tools and technologies used. These changes have been studied in hardware and possibly software. We get a more complete picture of the weight of the typical human resources of the ages in our model. (This can be referred to as mindware, which is the sum of people's knowledge and procedures to solve problems and decision-making.) These three aspects: hardware, software, and human resources draws the opportunities and the limits of the phases of e-learning [4].

"Hardware is the range of electronic devices applied in teaching and learning. By software we mean, apart from programs, courseware and framework run on hardware, the methodology of e-education and e-learning. By human resources we mean those taking part in the teaching and learning process, i.e. the teachers and the students, as well as tutors, mentors, training organizers, organizational controls and frames, within the e-learning operates (Figure 1)" [4, p. 51].

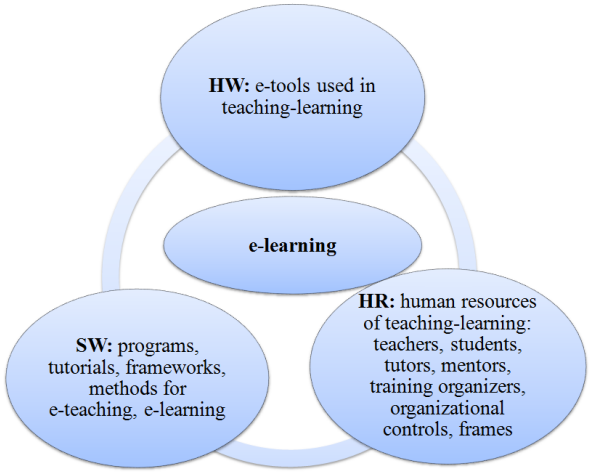

Figure 1. Components of e-learning: hardware, software and human resources [4, p. 51].

It breaks down to four sections the history of e-learning [4] from 1920, from the widespread use of radio and television in education to the use of today's mobile tools and mobile Internet. This review uses the events of Hungary based on Seres et al, who specified No 1–3 phases of e-learning history in 2010 [6]. And [4] uses the work of Ferriman in 2013 on the main e-learning events in the world [7].

The main features of the four sections of the e-learning history are (their explanation is included in [4]):

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

"1st phase: years 1920s – 1950s

- HW: public radio- and TV-broadcast; radio schools, educational television; nationwide coverage, sufficient number of receiving sets.
- SW: significant need for background support (directing, editing, etc.).
- HR: mass interest; topics fit for teaching, channels and air time; few interesting lecturers for a wide audience.

2nd phase: years 1960s – 1980s

- HW: magnetic audio and video recording, PCs in school education, too.
- SW: cassette players mainly in language labs, language teaching programs; editing video recordings with recorders is complicated, PCs' office software is still cumbersome.
- HR: language teaching programs are also made by teachers; video recordings to illustrate traditional lectures, presentations, MS Office programs and their clones for several platforms.

3rd phase: years 1990s – 2000s

- HW: Internet, broadband data transmission; more and more powerful and expensive hardware for users.
- SW: computing services, storage, video broadcast, and virtual classroom in "cloud".
- HR: discovering services in the cloud to be inserted in the teaching-learning process, obtaining competences, qualifications online.

4th phase: years 2010s

- HW: mobile internet, larger storage space; smartphones, tablets, phablets with variable features; smart-devices connected to networks.
- SW: variable platforms, apps markets.
- HR: mobile learning, involving the disadvantaged and the elderly in learning; the generation gap between teachers and students may grow" [4, p. 52].

B. Models of Electronic Support Degree

Those who use such a classification system will include education systems in classes, whether or not they have and how much they have to do with teaching and learning in e-learning. Between just the two extremes (just attendance or online education), many blended learning can be implemented. As we advance in time, the greater the integration of software, hardware, and electronic services into education, as prices have been steadily lower, while compatibility and standardization are growing in this area.

Among the many of the classification solutions here, I mention Wilson's [2]. The Ministry of Education (MoE) of New Zealand in order to inform the qualitative and quantitative level of e-learning in the tertiary sector, they established a classification system in 2003. The categories were slightly modified in 2004 because the two middle classes were not clearly different for fillers and it contained overlaps. (Data request was later discontinued.)

What are the benefits of classifying, how to help leaders at institutional level and the state control? Institutions can use their categories to inform their students about the requirements of their courses and digital expectations. They can also use it as a development foundation for institutional planning and e-learning support for the faculty. The government can orient by the form data request about the level and penetration of the e-learning in the institutions, and they can create a comprehensive picture.

The MoE classification categories were as follows:

1. No web access: No part of the curriculum or course can be accessed online.

2. Web-supported: Students have limited access to online materials and resources. Use of these is not mandatory, as there is probably a small proportion of studies involved in online participation.

3. Enhanced web support: Students are expected to use online materials and resources. Online participation is likely to make a significant contribution to studying the curriculum.

4. Web-based: Students are expected to use online materials and resources. Their use is necessary as the online participation is required [8, p. 93].

Wilson offers a more pragmatic system of institutional analysis and planning, which is called a banded approach (see Figure 2).

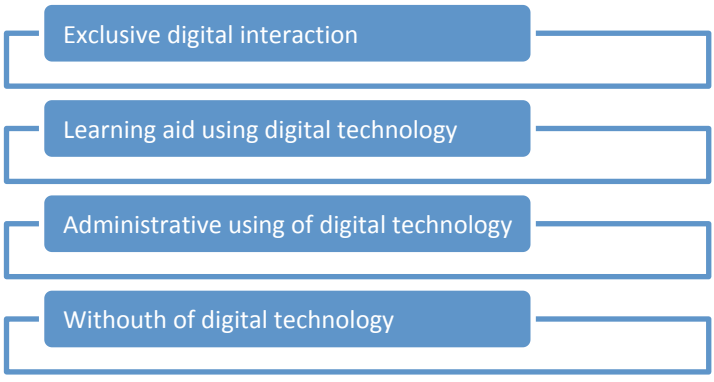

Figure 2. A banded approach instead of the MoE system [2, p. 160]

Compared to the two classifications, the band approach is very similar to the MoE's, but some ambiguous things has been removed from it.

Band 1: Without of digital technology: No digital technology is used in education. At this level, the two systems are similar.

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

Band 2: Administrative using of digital technology: Students and teachers use technology for administrative tasks (such as sharing of course descriptions, chronological tables, task assignment). In the MoE system, the level is called "web-supported" and there is no link to access, only an increasing expectation of student technology use to complete the studies.

Band 3: Learning aid using digital technology: This is more about using e-learning in teaching. Such questions can be asked here: How will digital technology support students in their learning? Which tools can be used? If a course is on this band, we expect that the faculty have the skills to use the technology, or they will be able to acquire them with technical development. In the MoE system, this level is called "enhanced web support".

Band 4: Exclusive digital interaction: Similar to the MoE system, which is called "web-based". It assumes access because the course is either entirely online or largely based on digital technologies.

The problem with the revoked system was to make a distinction between the middle two categories, while Wilson's band approach differentiates the two categories according to whether digital technology is used as a tool or is used in the pedagogical process.

C. Models by Evolution of Web

If we focus on the world-wide web's evolving, strikingly noticeable concepts, functionality, technologies, and potential interactions over time, we often use web x.y versions or xyz web expressions. Web-versions do not have clear definitions, and the sections they indicate do not result in sharply separable sequences. Yet it is useful to give names to web-ages as we can talk about them. (According to the Sapir-Whorf hypothesis, the world view is largely determined by language, and the definition of concepts allows people to talk about them.)

Those interested in this subject will be able to read many of shorter entries on the Internet about web-versions. [9] describes the results of web and literary research with a scientific approach, and provides new definitions for web-versions and classifies today's web services.

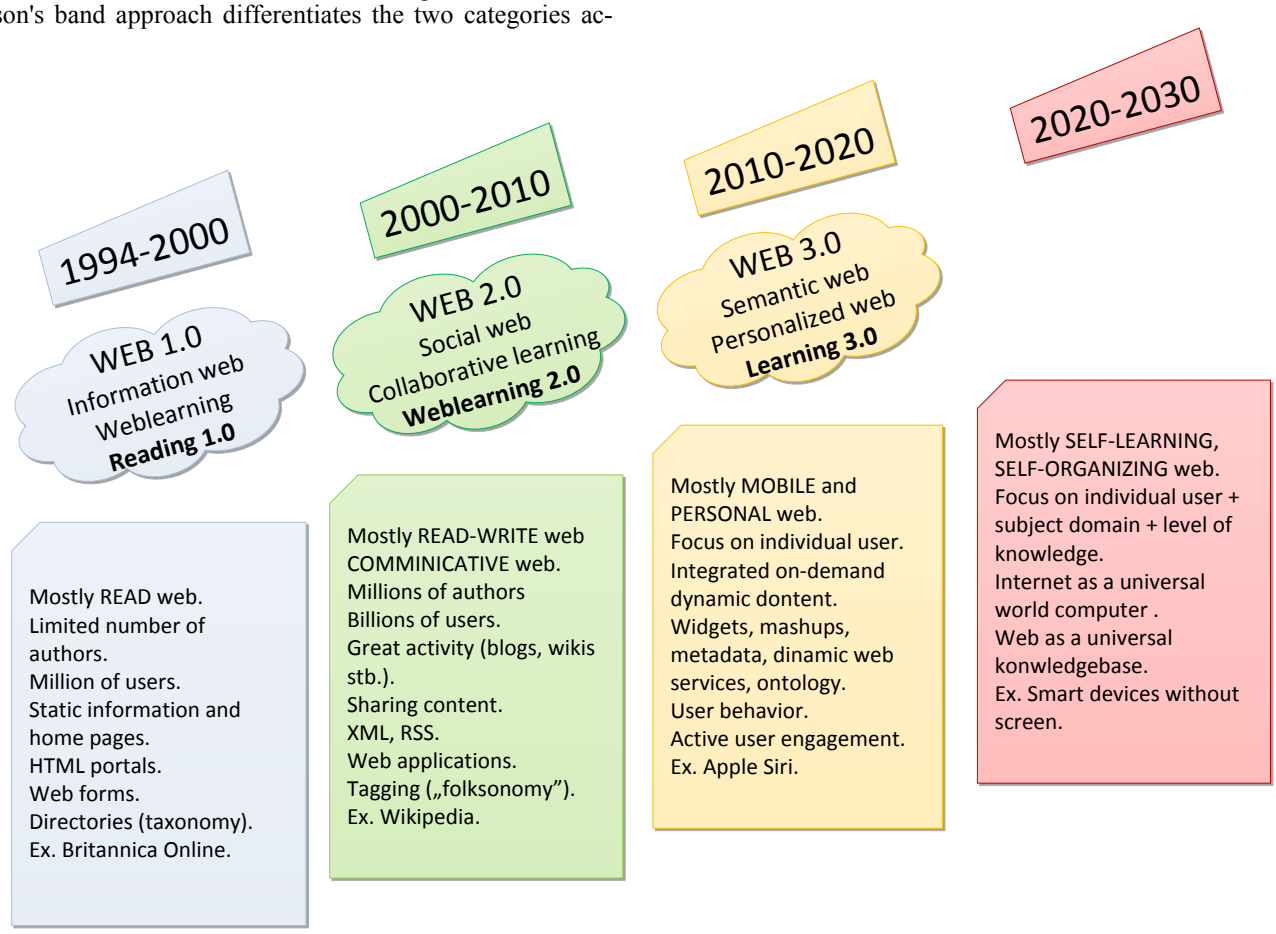

Figure 3. Basic differences between web / e-learning 1.0 / 2.0 / 3.0 / 4.0 [10] [11]

The main features of general e-learning models that utilize the capabilities of web generations / versions can also be specified in parallel. First let's look at web-generations.

The name of the creator is in parentheses, and after the dash is a suitable indicator structure for the version:

- web 1.0 (Tim Berners-Lee) – read web;
- web 2.0 (DiNucci, 1999) – written web;
- web 3.0 (Tim Berners-Lee) – semantic web;
- web 4.0 (Jeff Moriarty, 2006) – mobile web.

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

Now let's look at the names of parallel e-learning generations and their distinctive features:

- e-learning 1.0 – focus on online available and administrable contents;
- e-learning 2.0 – focus on social aspects in learning theories;
- e-learning 3.0 – uses pragmatic and connective learning theories, advanced smart mobile technology, 3D visualization and interaction strongly;
- e-learning 4.0 – focus on personalization and playful learning (e.g. gamification).

Some people do not forget the beginning of the Internet and web 0 (emergence of browsers and web pages) also distinguish web 0.1 (videotex). Also milestones are found in the mid-half of the decades marked by the number of versions: web 0.5 (preflight for content), web 1.5 (transaction web or dotcom balloons), web 2.5 (mobile tool-oriented), web 3.5 (services fully comprehensive, interactive and autonomous agents). These terms can be more or less extended to education, too. We can read about web 5.0, the emotional web, where human-computer interactions based on neurotechnology are becoming part of the daily routine [10].

For an overview of some other significant differences between the web and e-learning 1.0, 2.0, 3.0, 4.0, see Figure 3.

IV. Models by Type of Educational Institutions

Classification of e-learning models can be by educational institutions. These are followings without the necessity of completeness:

- Public and accredited higher education institutions: kindergarten, primary school, secondary school, vocational training, higher education (college, university), postgraduate education (in higher education institutions), doctoral education.
- Education required by law: military officer career training in Disaster Management Education Center; the further training of the electronic information security directorate and the further training of civil servants are at the State and Administrative Faculty Leading and Training Center of the National University of Public Service. In the military, the preparation and the examinations for the qualification exam for career development are carried out by the Faculty of Military and Defense Education's Military Examination Center in the National University of Public Service, etc.
- Businesses: give internal trainings, further trainings for employers (e.g. insurance firms, banks).
- Educational firms: sell e.g. languages, professional, skill-developing courses for people or firms.
- Private teachers: deal with one or several students synchronized simultaneously in video conferencing; give asynchronous material and consultation in a framework or email, etc.

V. Models by Talent Management

Special emphasis should be placed on teaching talented students in education. But how do we know who is gifted? According to Gyarmathy, "Observation helps to identify talents the most. My proposal for really accurate estimation of talent for observation identification: talent is a knowledgeable person with a kindergarten attitudes – constant desire for action, questions, naive openness to the world, vigorous targeting "[12, p. 91].

For example [13] gives a comprehensive presentation of the international and nationwide talent care, then it displays the general models of talent management: enrichment models, acceleration models, separation.

Models of talent management are very varied in our country. Varied: organizational frameworks (institutions, enterprises); supplying with specialist (e.g. psychologists, career assistants besides the teachers of the disciplines); the geographical range (institutional or regional, national, European); covered talent areas (according to Gardner's classification, it is generally accepted that there are seven types of special ability: language, musical, mathematical-logical, visual-space, body-moving, social-interpersonal, intrapersonal); coated age groups (from kindergarten to age 35); supported forms of assistance (e.g. science student circle (TDK) in higher education, special college, scholarship, involvement in university or industrial research, mentoring and tutoring system, etc.).

[14] distinguishes four main groups of talent solutions in Hungarian higher education: “There are some institutions, universities where talent management is organized and directed complex way, where the work plan of a coherent, well-thought-out university strategy works well. But some institutions can develop and support certain areas of skills especially. Institutions that do not participate in the integration of higher education, organize their talent support program in Talent Points in frames of Genius Program” [14, p. 7].

[14] examines the complex talent programs (models) of several universities, which are good practice examples for others, and describes the content, timing, similarities and differences of programs. (It describes one model of second-class talent giving university models, and the third-fourth group is not intended to be presented.)

VI. Models by E-learning Environments

A. Models of the Lifelong Learning

Lifelong learning (LLL) is a voluntary knowledge management from personal or professional reason. It has become intensified and generalized in the developed societies in the last half century. Its reason is the constant, and accelerating scientific and technological innovation, and the fast changing social or economic environment. That’s why people often change jobs, and even profession, trade area during their working lives. Lifelong learning enhances personal development, self-sustainability, competitiveness, as well as employability, social inclusion and active citizenship.

Examination of adult education projects began when Alan Tough read Houle's 1961 results of interviews on student motivation. Tough and his team continued Houle research work and showed that people are doing a lot for their learning, for their expertise and for increasing their skills in almost every segment of society consciously. Tough has publicized in 1971 that almost every adult completes 1-2 learning projects per year, and an "average man" eight. These projects took 700 hours per year on average, some people in turn 2000 hours. 70% of the people has planned learning by Tough’s research [15, pp. 2-3].

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

Our learning in any age can be seen as a continuous event in our daily interactions with others and the world around us. Its form can be varied: formal, informal, independent, etc. learning.

Some professions require taking part in further training, or taking professional exams periodically for rank to higher classification or even in order to stay in the position (e.g. public service, finance, education, and army).

It is well illustrated in Miskolczi's model, which emphasizes life-long learning beside the life wide learning [16]. Figure 4 "illustrates that according to the traditional approach they are separated from one another – or slightly overlapping each other – the formal (schooling) and informal learning sections.

However, used and applied the tools and possibilities of the XXIst century – according to the modern approache these sections are no longer separate from each other, as we also get tasks in the schools that need to be solved "informally" using the Internet, during play games on Internet we can "formally" learn about history, geography or anything else »from all parts of life«, too" [16, p. 24].

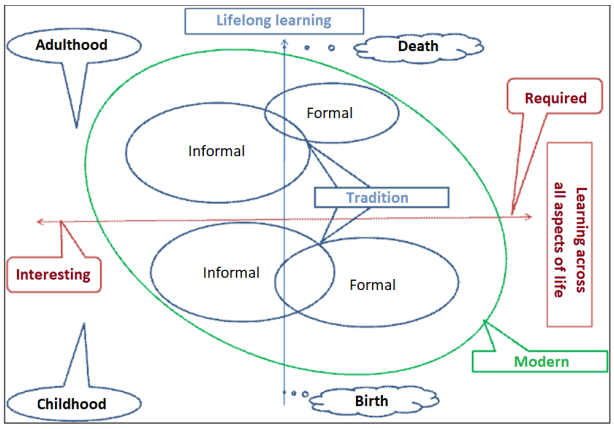

Figure 4. Lifelong and life-wide learning model [16, p. 24]

B. *Models Focused on E-learning Environments*

Models are also often created by focusing on e-education environments. Ollé (2013) gives a typology of educational environments and classifies the methodology of teaching methodology as follows [17]:

1. Instructive model: As using the e-learning framework (e.g. Moodle) by majority of educators.
2. Action-oriented: Individual activity, Personal Learning Environment (PLE), community interaction (web 2.0, social media) etc. feature.
3. Open education: E.g. MOOC (Massive Open Online Courses).
4. Virtual education: E.g. Second Life.

The education methodology strategies are mixed in modern education environments in case of concrete courses. Thus hybrid education use offline, online and virtual environment elements, too.

Ollé characterizes these environments and technologies by ten aspects [17]: culture of education; organize of education; role of students; role of teachers; information and communication flow; content of education; rating; feedback; organize and differentiation of learning; advantage – optimal application; disadvantage – risk of application; good practices.

C. *Models Based on Platform Type*

Model can be built on one platform or service type. The list below can be further expanded:

- blog
- discussion board
- e-mail
- e-portfolio
- screen broadcast
- LMS (Learning Management System)), LCMS (Learning Content Management System)
- social network
- multimedia CD / DVD
- presentation sharing
- text based chat room
- video sharing and broadcast
- wiki.

VII. MOBILE-LEARNING MODELS

Mobile devices (smart phones, tablets) are so widespread nowadays, and the role assigned to them is so great that their separate classification is justifiable. For a couple of years, it was a hit story that the mobile devices will have key roll soon in the e-learing, and from e-teaching / learning will be mobil teaching / learning – shortly from e-learning will be m-learning. It is undisputed that in the last few years, the users want to reach the same content and service on mobile devices and small displays as they want on a PC / laptop display. In addition to these, for mobile devices are constantly emerging new "trends" in teaching-learning, and their integration into our models should be considered.

„Several mobile learning models have been created based on one or two aspects of information, communication or educational technologies, e.g. according to supported mobile devices, the type of wireless communication, supporting synchronous and / or asynchronous communication, the facility of permanent internet connection between the mobile learning system and the user, the geographical position of the user, or the access to learning material and / or administrative services.

Georgieva et al. (2005) [18] generalized the aspects previously mentioned in the literature and added two more: support for e-learning standards and communication between teachers and students. They also provided the 3D model of their categorization, with axes of online-offline contact, service provision within or outside campus and access to material for learning and administration. In the 3D rectangular coordinate system formed by these three axes, mobile learning systems (mLSs) can be placed according to nine different features. Those considered as best, which are present at the origin of the sphere" [4, p. 58]. (See Figure 5.)

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

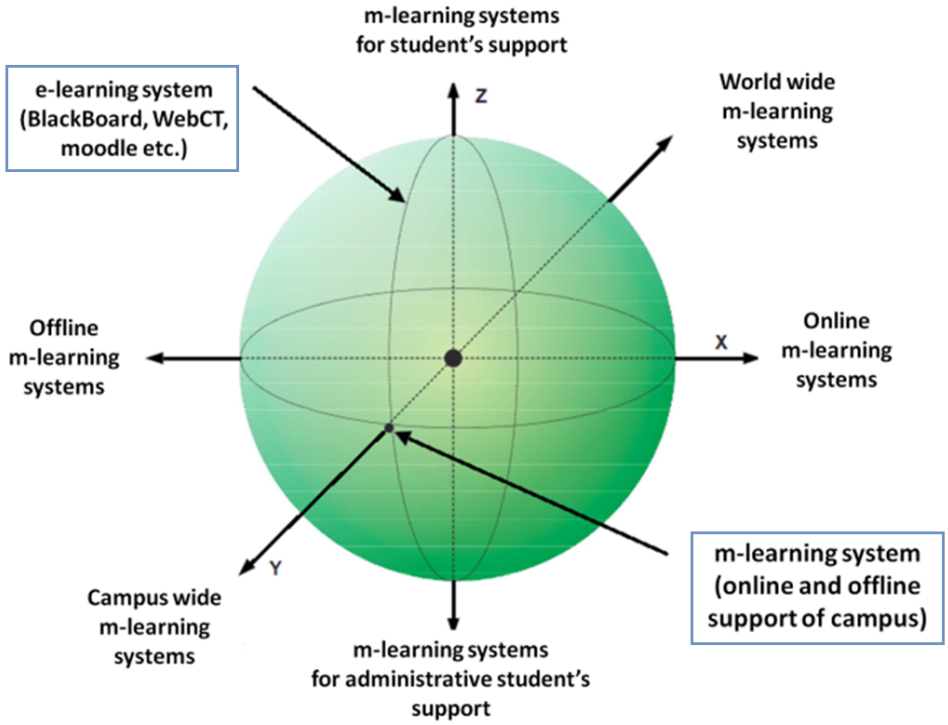

Figure 5. The 3D Diagram of the Classification of Mobile Learning Systems by the Three Indicators [18]

Mobile learning is also a vivid part of the united technology acceptance model.

Technological advances and the widespread use of new tools are constantly delivering new, innovative applications and services. Which new devices or applications an d how integrates into life of e-learning users, or which from them will be forgotten it will be decided by time. Here I show some of the most popular m-learning solutions that have become fashionable in recent years. Of course, models can be built on these as well, and many of the existing models can be easily expanded.

Bite-sized learning: Learning process is broken into small, easily "digestible" pieces. It is used to increase learning performance or provide instant useful information.

Moment of need mobile support: Online learning curriculum is not always enough, there is often a need for additional knowledge to be gained or to explore from a different perspective a field of expertise. You should also be in need of extra material immediately during work. Such solutions are tutorials, manuals, reference materials. With this mobile support, you can increase your employee productivity and performance.

Social mobile learning: Discussions and arguments are taking place on social networking sites, specially created community mobile platforms, forums in professional groups. During the interaction, those who are willing to learn and seek professional help can help each other and share their knowledge.

Augmented reality: In this case, virtual information is displayed in the real space or in the camera of a smart device. In real-world view of your mobile phone's camera, you can also output data from databases (points of interest) – such as e.g. the Pokemon GO application. Either simply pointing markers to the camera, you can display three-dimensional objects in the real space – e.g. to illustrate the molecules or the human body.

Geo-location sensitive learning: It provides the student with authentic, personalized, contextually relevant information. If an e-learning system automatically recognizes the student's location, it can provide the course or course material (e.g. themes of agriculture, fishing, hunting, weather), which is contextually appropriate. To do this, deeper and wider research is required about the students.

VIII. System Models, Cybernetic Models

Use of the cybernetic systems opens another way of modeling. "The system-based interpretation of the teaching-learning process was initiated by pedagogy based on cybernetics in the 1960s. The system approach modeling of processes aims to understand the operation of complex systems and improve the efficiency of their regulation efficiency. Cybernetics education models had a relatively small impact on didactics compared to other models.

System theory helps in the teaching-learning model to identify the most convenient way of examining the education system, to clarify what, how and why the factors related, and to form the factors consciously and predictably. We can consider training as a regulation that determines an information flow process in the system or its subsystems.

For example, in the cybernetic model of [19], the operation of the system starts from the objectives / outputs to be achieved (acquired knowledge, skills, competence, practice; opportunities to grow; student satisfaction). The input (in large lines) is the family, the society, and the initial knowledge. The two subsystems of the system are the teaching (with the organization, teacher, curriculum, technology) and the learning subsystem (with students and technology). The two parts of the teaching-learning process are teaching and learning. Teaching-learning can be algorithmized, e.g. by breakdown a course to subjects,

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

texts, reports, etc. The purpose of the regulatory process is to allow pupils exposed to external and internal disturbances to reach the goal. To do this, we consider the student's actions, responses, and the responses to the teaching and organization that can be given to them "[19, p. 146-147].

"A well-prepared, well-equipped educational institution (school, university, educational portal, private teacher, etc.) forms a conflict-free teaching system. When encountering a student, a teaching-learning process is created as a conflicting system, with two subsystems: teaching and learning process. The system of the teaching-learning process is now general, and can be interpreted at several levels: lessons, curriculum, course, training.

The goal of the system of teaching-learning process – as every conflict-based system – is eliminating itself, as the two objectives of its two subsystems are the same, to achieve the competence defined in the closing requirements. That is why they work together to eliminate the process. The environment of process – as of a system – is the same, and determines the conditions for the operation of both subsystems" [19, p. 149].

The e-learning model illustrated in Figure 6 "is designed to be analogy to the overall cybernetic system model of the air defense and the air transport, or the armed combat, which are conflicting systems. While in the system of armed combat characterized by antagonistic conflicts, the subsystems' aim to eliminate the system itself. The conflicts can be solved with cooperation in the air transport system" [19, p. 159].

The model outlined above covers a general, complex e-learning process, it is theory-oriented. Application of the model by using technology's capabilities will help you optimize the education system in a number of ways to prevent conflicts in the process, not just to deal with conflicts.

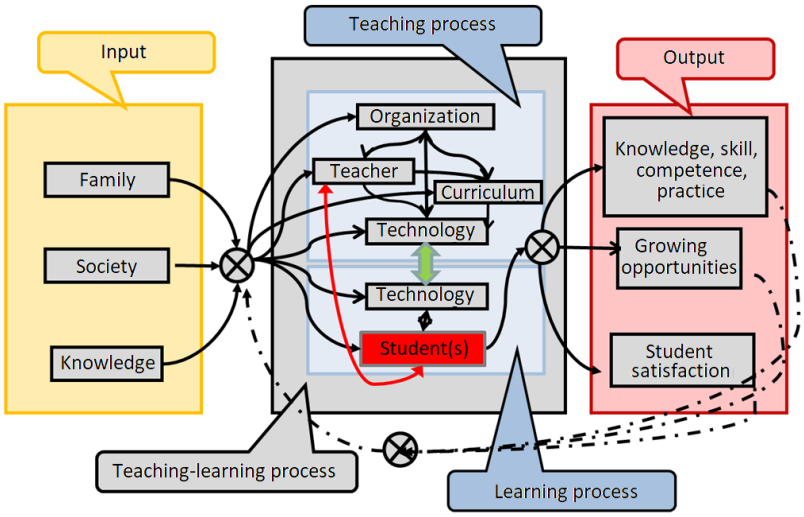

Figure 6. Structural model of teaching- learning process [19, p. 150]

IX. Models from the Perspective of Learning Theories

The e-learning models are widely categorized according to which pedagogical theory and trend is the basics of the models, or which of them is implemented by the models. More writing, such as [20] provide a wealth of collections of learning theories, educational guides, and useful tools with a brief description.

Mayes and de Freitas in their "Review of e-learning theories, frameworks and models" paper [3] follow the approach of Greeno, Collins and Resnick. This approach from 1996 identifies three classes or broad, fundamentally different perspectives to understand the essential elements of learning [3, p. 7]:

- associative / empirical (activity as learning);
- cognitive (learning as achieve of understanding);
- situational (learning as social practice).

The assumptions of these theories are fundamentally different: what they consider to be critical in understandable learning and contribute differently to the definition of learning outcomes, to the design of learning environments, to the teaching models, and to conduct the appropriate evaluations [3, p. 7].

Mayes and de Freitas created four intersecting sets / classes (see Figure 7). The e-learning models were categorized into a part of set, focusing on what their main focus is on:

1. Instructional System Design (ISD): This is characterized by the analysis of the learning outcomes by module units; it is curriculum-focused.
2. Cognitive / constructive: This is characterized by the active participation of students in learning and teaching activities; solving tasks for the feedbacks of tutor and students; it is focused on assigning unique tasks and dialogue.
3. Socially mediated constructivist: This is characterized by active debates and tasks to be performed together.
4. Practical approach community: This is characterized by development of practical knowledge in the real life; the focus is on building the community practice.

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

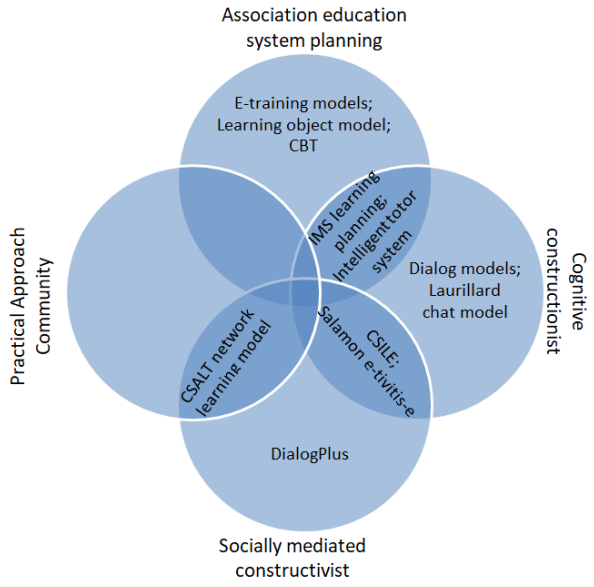

Figure 7. E-learning models in a wider perspective of learning theories [3, 25]

Of course, these are very high-end categories, and many e-learning models cannot be characterized in this way – writes the authors [3, pp. 23-24].

X. DRIVERS-MADE MODELS

When e-learning system is introduced or significantly converted we can classify models by drivers – main driving forces, motivations, culture or demands of participants and organization.

This class includes the models of [21] for the Australian Army: drivers for change, training culture, and students' needs. The model summarizes the impact of the workplace context of the Army from the perspective of participants for design, develop and delivery of e-learning.

In the Australian Army, e-learning has been used since 1987. It has become a strategic support since 1996 as the development of multimedia CD-ROM training packages that were part of traditional training content began.

During the research, from which the case study was conducted in 2005, a theoretical approach was used to understand the concerns of those interested in implementing e-learning. Interviews with army leaders, course developers, educational designers and trainers revealed that it is important to focus on organizational priorities and learning goals if they want to respond to changes. It turned out that for effective implementation, e-learning needs to be continuously adapted and coordinated to respond to changing needs while meets the organizational culture and learner needs.

The e-learning environment of the armies is influenced by the special hierarchical and autocratic organizational culture that is necessarily within them, and also affects learning. Culture determines the nature, motivation and emotional factors of social interactions in organizations. Therefore, adequate e-learning requires being coordinated sensitive to the characteristics of organizational culture.

In particular the people in charge in the training department were able to influence decision-making as they appreciated the pressure they had and they inspired lower-level working groups.

Using the organization's need for efficiency, managers were able to achieve the desired learning performance increase.

During the work, it was possible to get an overview of what the military's e-learning context should look into. In order to further consider issues and strengthen the results, they wanted to involve other stakeholders, trainers, and extend the research to other military sites.

Factors affecting the effective implementation from cumulative research data (Figure 8):

- drivers for changes;
- dynamic integration as answer to changes;
- alignment with organizational culture for compliance;
- contribution to priority of organizational context;
- effective e-learning implementation;
- conform to needs of student's context.

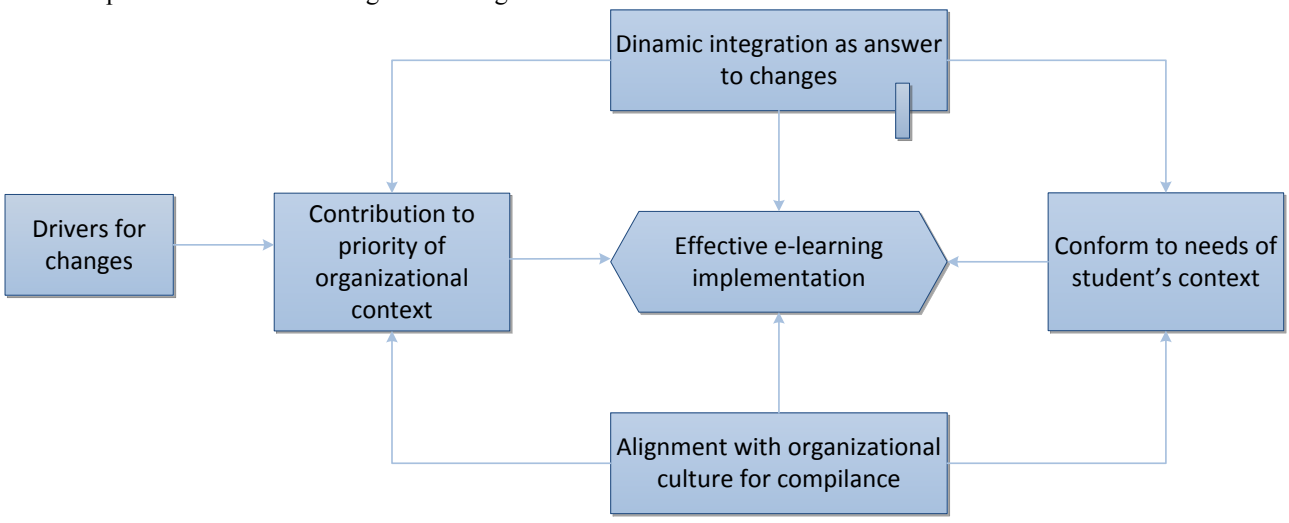

Figure 8. Effective e-learning implementation model based on the Australian Army case study [22] [21]

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

XI. Models that Emphasize the Potential of Interaction

One of the three model classes in [1] emphasizes the potential interactions in e-learning between: student–teacher, student–student, student–content.

[1] mentions the example of the Community of Inquiry Model developed by Garrison and Anderson in 2003 [23]. This focuses on student interaction and interactions that guide learners. It emphasizes that students are interacting with each other in the community and should be encouraged to take responsibility for their own learning.

According to the creator of the model, e-learning designers should consider three key elements in design of the education (see Figure 9):

- The social presence of the student: The ability of students to create themselves social and emotional through learning experiences.
- Cognitive presence of the student: The ability of creating and confirmation of the meaning through the interaction and reflection.
- Teacher presence: Includes a preview of the structure and process required for learning.

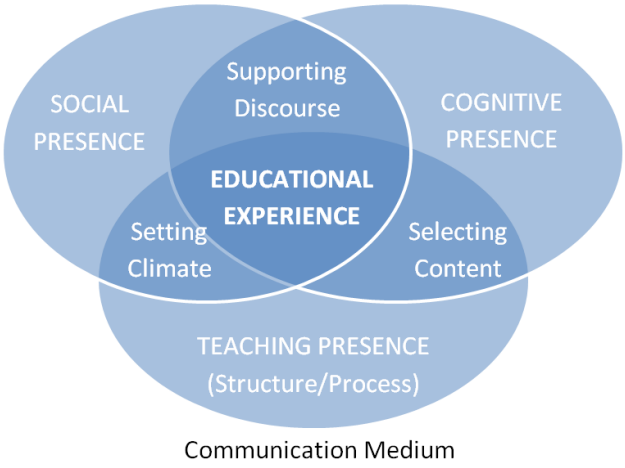

Figure 9. Community of Inquiry Model [23, p. 28] [24, p. 3]

Social presence is controversial. Emphasis should be placed on it, because it has a connection between community presence and student satisfaction, as well as the evolution of student community and the perceived learning – summarized Lowenthall (2009) [25]. To improve social presence, we can do e.g.: opportunities for students and teachers in the course or LMS to create their own profile; limited class size; regular tutorial posts in the forum; prompt feedback; students are called by their name; students are encouraged to share their own stories and experiences; exploiting group strategies [25].

XII. Educational Design Models

In class of the educational (instructional) design models have being created many models continuously. Schneider presented 108 of them briefly in 2014 [26].

According to [1] "Many appropriate the traditional instruction design models for eLearning, including Gagne's Nine Events of Instruction (gain learner's attention, inform learner of objectives, stimulate recall of prior knowledge, present the content, provide guidance, give practice, provide feedback, assess), the traditional ADDIE (Analyze, Design, Develop, Implement, Evaluate) model, the Instructional Systems Design (ISD) model, rapid prototyping, and the ARCS Motivation model, to name a few. New instructional design models are continually being promoted, although most of them emphasize similar steps in the process, including:"

1. Needs analysis: verifies items for teaching, online publication of the specific content; incurred costs.

2. Student profiling: identifying of the learners' expectations, characteristics (e.g. age, culture, work experience, prior subject knowledge, goals and motivation, learning attitudes, learning styles, computer literacy, access to technology).

3. Determination of organizational support for the e-learning and the goals for the program. This includes the vision and mission of the organization, whether it has an emphasizing learning culture, implementation costs and sustainability, experience of the content experts and the instructional designers, technology infrastructure and available resources.

4. Selection of pedagogy: that meets the requirements of the subject matter and the needs of the learning target group, including learning theories, objectives, delivery methods, assessment possibility, interactions, and development strategies [27].

XIII. Competence-Based Models

Competence-based education has also great literature. Its popularity increased in higher education during the Bologna process in the last years, too – we can think e.g. about general characteristics and competences describing qualifications in the trainings [28]. Definition of the competence isn't unified. By Péter Gerő competence is the ability to use knowledge in practice [29, p. 51].

Competence based models concentrate acquisition of concrete proficiencies, rather than abstract learning (e.g. algebra). These methodologies are more frequent in learning of kinetic and/or ability based specializations. Higher education institutions are placing more emphasis on competence based models, because they grant constant success of learning in case various pre-qualified, studying in different places and at individual pace students. Knowledge is measured instead of the time required to deliver the education.

The individual skills, abilities and learning outcomes are regarded as competencies – they are simple units, smaller components of a more extensive learning goal. Students work at one competence at the same time. Students often find some skills more difficult than others. The competence based models allow learning and exercise for students in own tempo. If he/she acquired one competence than he/she may proceed to the next. More complex competences can be learned isolated from each other.

Students can test or prove own skill before entry a new learning module – by preliminary study or work experience. If proving is successful, he/she can skip modules.

The competence based learning is student-centric – educator is in facilitator role. He/she works along with students, guides their learning, answers their questions, leads conversations, supports to synthesize and apply. Technological possibilities can be highly flexible in these models.

In case of competence based learning all unique learning element must be met (unlike summative testing, where

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

70% result means that student 70% skilled in each of learning modules, or skilled absolutely in 70% of the whole modules and in the rest 30% skilled not at all. All of competences must be exactly defined and reliable evaluated. Student meets exam if he/she proves that he/she has mastered each competency.

Two competence based learning model are shown. First is the Life Tailored Learning model of Péter Gerő [29]. It is "series of methodologies and regulations (practical guideline)" – recipe for adult learning. It covers the knowledge acquisition, the design, organization, implementation, evaluation and regulation of knowledge transfer.

The main steps of the learning process according to the methodology are: assessment of learning needs, measurement of the fulfillment of entry conditions, creation of the professional material, modular design of the curriculum, role of the participants (student, teacher, tutor, tutor, mentor) [30].

The coordinated, practically applicable methodology for adult and self-learning curriculum development and learning support are in large lines:

- determining criteria for measuring a safe result;
- criteria of the smallest distinguishable part of professional material;
- prohibition of forward references; and
- order of the steps for curriculum preparation (learning goal → final conditions, final measurement → entry conditions, entry measurement → professional material → curriculum) [30].

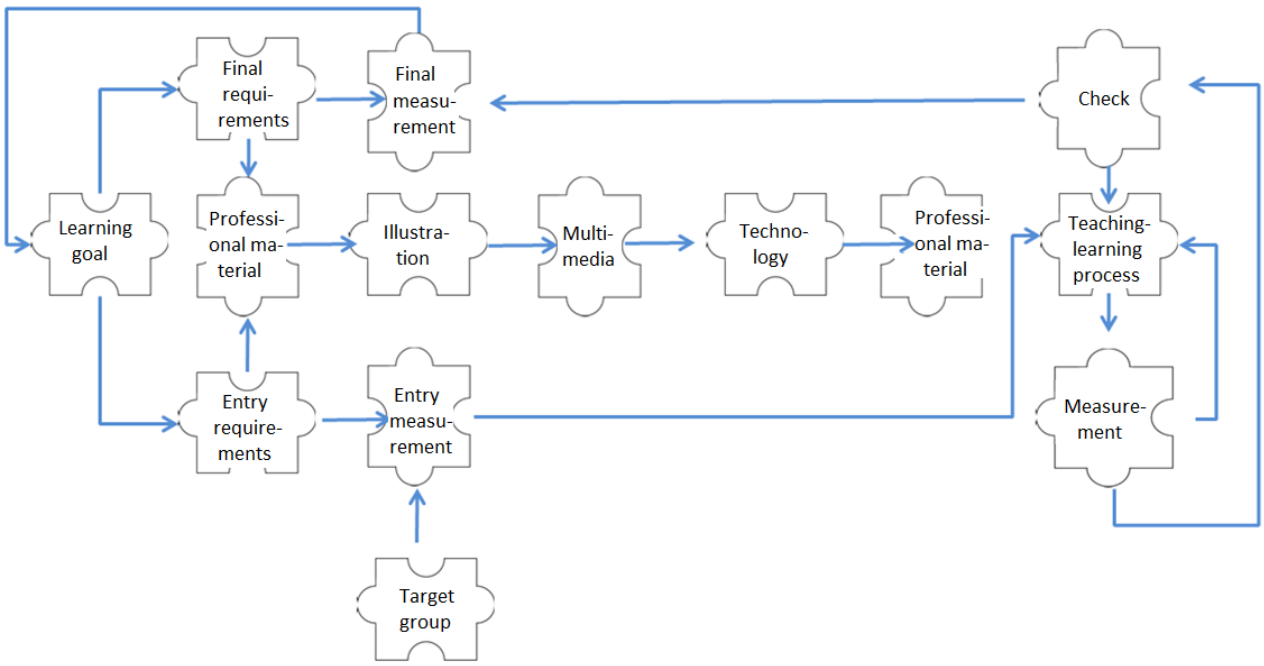

Figure 10. Model of the Life Tailored Learning process [31, p. 94]

The model of the life tailored learning process ensues from its methodology. The elements of the model:

- competence-based learning: measurements and assessment,
- the subject matter: a transparent and interoperable module (lesson),
- the curriculum: motivating a student,
- roles and activities of learning: lecturer, consultant, tutor, mentor.

Most steps of curriculum making and the learning process: denomination of a part of the curriculum; definition of learning goal; description of the target group's motivations; description of the final conditions; description of the entry conditions; preparation of the professional material; selection of the multimedia aid (what to illustrate and how); check that the goal is available from the beginning; preparation of curriculum; entry testing; learning process with self and teacher testing. If test is negative, → back to learning process; if test is positive, → next lesson, or → final test; if final test is successful → new learning goal can be set (Figure 10) [31].

Other interesting competence based learning model is e-book model of Szegediné. The individual lifelong learning is also emphasized next to competence based learning in this model (Figure 11). Unique feature of this model that "connection between two actors of the learning process is established by e-books, therefore mediators of knowledge are the e-books, they are presenting unity of content, devices, methodology and learning management tools, they are carriers of learning success." [32, p. 18]

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

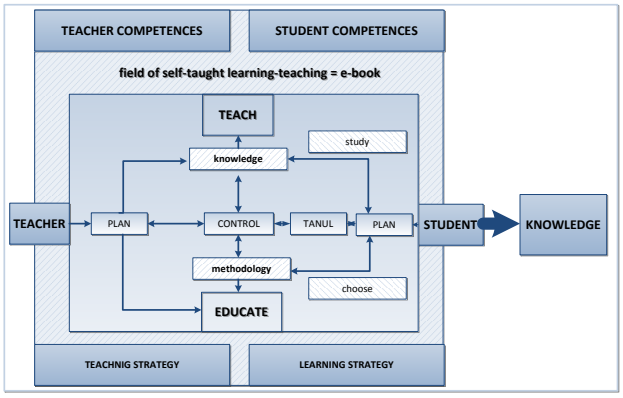

Figure 11. E-teaching–learning theory: LLL circuit [32, p. 19]

The e-books are experience-based, interactive, education-aid electronic curriculums. Main concept of its making "personal tailoring of knowledge", therefore maximum consideration of personal skills and opportunities. That's why mediation of knowledge takes place by several methodologies [32, p. 16].

XIV. Intelligent Tutoring Systems

Knowledge base of the Intelligent Tutoring Systems (ITS) belongs to specified area. Their function is knowledge transfer in interactive and individualized form. The ITS process emulates the guidelines of real teacher or tutor. Their acceptance and popularity is growing for several reasons. Using an ITS increases the student's performance, deepens cognitive development and reduces the time spent on learning in acquiring knowledge and skills.

At least the following three models work together in ITS: specialization, learning and pedagogical.

ITS adapts to needs of individual students. Pedagogical strategies define order of content, forms of feedback and method of tutor's visualization and explanation of tutor content (problem, definition, examples, etc.). The software systems with the adaptive e-learning approach adapt the displayed curriculum and the linked curriculum-structure according to each student's knowledge and behavior. This is based on the fact that learners have different learning features for which different educational settings are appropriate for each learning type, so that their results are optimized (see [33] in 1977, [34] in 1999 and [35] in 2003).

One of the biggest difficulties in e-learning systems and platforms is the structuring of their content and extractable information through the present pedagogical models. Specifications have also been made to solve the problem, some of they have become standardized to provide more widespread educational systems and better teaching quality [36]. Technological level of ITS's development grants that they complete the traditional education. Traditional learning management systems (LMS) can be expanded with intelligent features, too.

Task Agent-Based ITSs (ABITS) are advanced programs or precursors of learning objects. Their task is to satisfy the different student needs in a tailor-made manner. Autonomous agents detect environment, and react, following their own schedule, and they create a perceptible effect in the future. Their four attributes are: autonomy, social sensitivity, reactivity and proactivity. Using of intelligent agents allows creation of unique tutor systems in ITS, which adapt to needs and characteristic of individual students.

Agent based ITS [37] adapts courses to both teachers and students. One of its aims to enable students to learn more and better; the facilitating learning material to be structured. Therefore ITS applies concepts to learning styles. For example it takes into account learning tempo of students, and shows more or less practices or tests. It indicates mistakes or correct answers e.g. by text messages or sound signals. Teachers do not know what their students are familiar with, so they have to prepare a comprehensive curriculum and provide additional materials to allow students to choose from them to supplement their knowledge and interest.

ITS presented in [37] is not specifically related to a course. If you want to apply it you only need to divide the course into theory, exercises and tests. Its general architecture is shown in Figure 12.

The pedagogical model serves the pedagogical strategy, providing mechanisms for efficient learning material for students. The pedagogical model includes four agents: preferences, login, exercises, and tests. They monitor the progress of the students and provide suggestions for new tasks. Agents are implemented as apps.

- Preferences agent controls the user-preferred look style (font and its size, colors, margins, etc.). The user's modifications to the display are stored on personal style sheet. The information collected is stored in the Profile KDB (Knowledge Database).
- The login agent takes note the student interface interactions associated with the pages of theoretical curriculum (e.g. the names of the pages visited, the time he/she spend on them).
- The test agent selects the questions to be generated in the test questionnaires for the topic being studied. The test questions are stored in the learning KDB.
- Practice agents work alike, select the recommend exercises belong to learning curriculum for the students, and stores the selected exercises in the learning KDB.

The education model provides features for teachers to use the system with. It recommends displaying, confirms to the students, viewing the statistics with its help, consulting can be continued. Through this, the curriculum content can be varied based on the information provided by the student and the specialist model.

In the student model, the knowledge gained from the student (profile and interaction with the system) is collected in three KDBs:

- Personal Information KDB stores the login information.
- Profile KDB stores the level and display styles of student. Students can be assigned to different levels depending on their learning style.
- Learning KDB stores data such as exercises and tests suggested so far, the time spent with them, the data of the visited pages of the theoretical curriculum and the times spent on the pages, the reinforcement materials prepared by the pedagogical module.

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

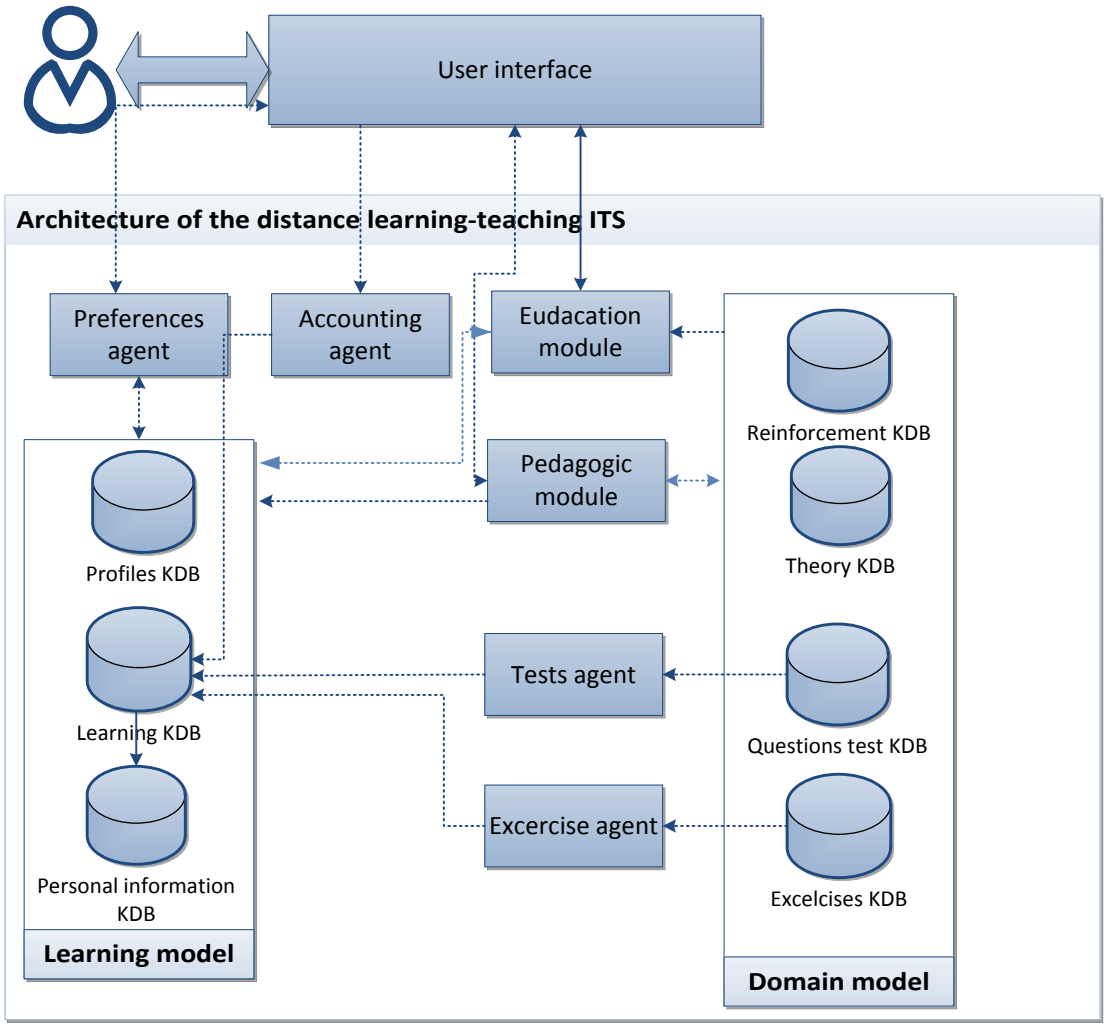

Figure 12. Architecture of agent-based ITS [37]

In the domain model is the knowledge about the content to be taught. This model contains four KDBs:

- Confirmation KDB contains information about the pedagogical module used. This information are used when are preparing the material to be displayed for the student when the student requests confirmation.
- Test questionnaire KDB stores test questions related to the curriculum.
- Exercise KDB stores the exercises of the curriculum.
- Theoretical KDB cooperates with the pages of the theory curriculum.

The pedagogical module provides mechanisms to make the curriculum effective for students. This module has to perform three main tasks:

- Providing teaching guidelines for students (this includes reinforcements provided by the system).
- Update the statistics of the exercises and tests shown to the students in the domain model.
- Storing confirmation data from learning KDB, answers of the students to exercises and tests, used scoring and time spent on solutions.

Most advanced form of this category is the Adaptive and Intelligent Web-Based Educational Systems (AIWBES), which uses adaptive hypermedia and intelligent tutor-technology.

XV. Models for Measurement of E-learning Systems

This chapter first shows success-measurement models, than technology-efficiency models in two subclass.

A. Models for Measurement of Success

Models for measuring the success of e-learning models also have great literature. They have been classified into two major groups and have given a classification system for them by Assiri, Berri and Chikh in 2012 [38]. According to the authors, when evaluating e-learning systems, they often focus on two broad aspects: [38]

- IT aspect: Includes system, service, and learning quality. It includes human–computer interaction evaluation and user satisfaction as well.
- Educational, pedagogical aspect: It covers the content and its classification is based on two directions:

1. Using environment of an e-learning system with four dimensions:

- Teaching: Related to pedagogical aspects and methods of teaching and learning.
- Technical: Focus on the technologies used to develop the e-learning system.

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

- Engineering: Deals with the development of the e-learning system through system development lifecycle.
- Socio-economic: It addresses the implementation of the system in terms of acceptance by a broad community of sources and users.

2. Evaluation through four criteria (abbreviated as 4W):

- Who? It deals with stakeholders and participants in the learning system.
- What? The evaluated e-learning components.
- When? The development phase of the e-learning system in which the evaluation takes place.
- Which? The method used to evaluate the system.

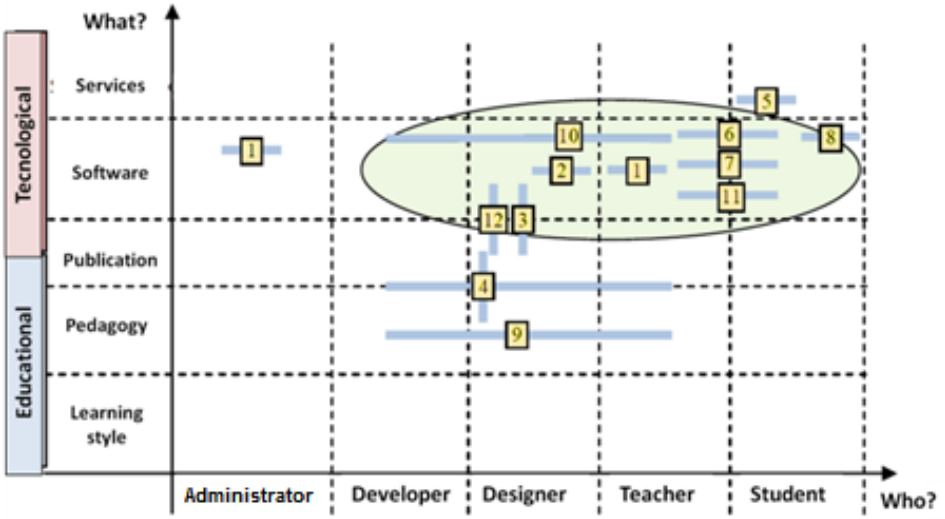

Figure 13. Evaluation phases and participants with 12 e-learning systems evaulating models [38]

[38] points out that most evaluations are made by designers, trainers, and students, and focus on the software side of e-learning systems. The studied 12 evaluated models are shown in Figure 13.

On the x-axis, we see the involved roles, where the learner is most involved, since he/she is the main user. The manager is the least, he is not placed in the figure. The y axis shows what the models evaluate; five key criteria have been identified for IT and education. In the yellow boxes, the numbers are the serial numbers given for the models that are examined in the article. The horizontal and vertical slim blue bars indicate which role evaluates which criterions for each model.

The big ellipse directs our attention: focus is on software in evaluating e-learning systems. The educational dimension is only taken into account by some authors. It can also be seen that evaluations are done by designers, educators and students, and are not involved developers and administrators. Furthermore, in these models there is no evaluation of the early stage of the system development lifecycle, but it is possible to filter out projects that do not fit into their environment or lack of sufficient resources.

B. Models for Effectiveness of Technology

Models for the effective use of technology are linked to the IT aspect of the previous subchapter, "Models for measurement of success".

„The foundations of the Technology Acceptance Model (TAM) were laid down by Davis (1989) [39], based on the book by Ajzen and Fishbein (1975) [40]. The investigation of technology acceptance studies people's psychological attitude to the use of a certain technology, in voluntary and mandatory settings. The area of study is IT and information systems (use of computers, software and their acceptance in a working environment). It has been further developed several times and has been applied to other areas as well.

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

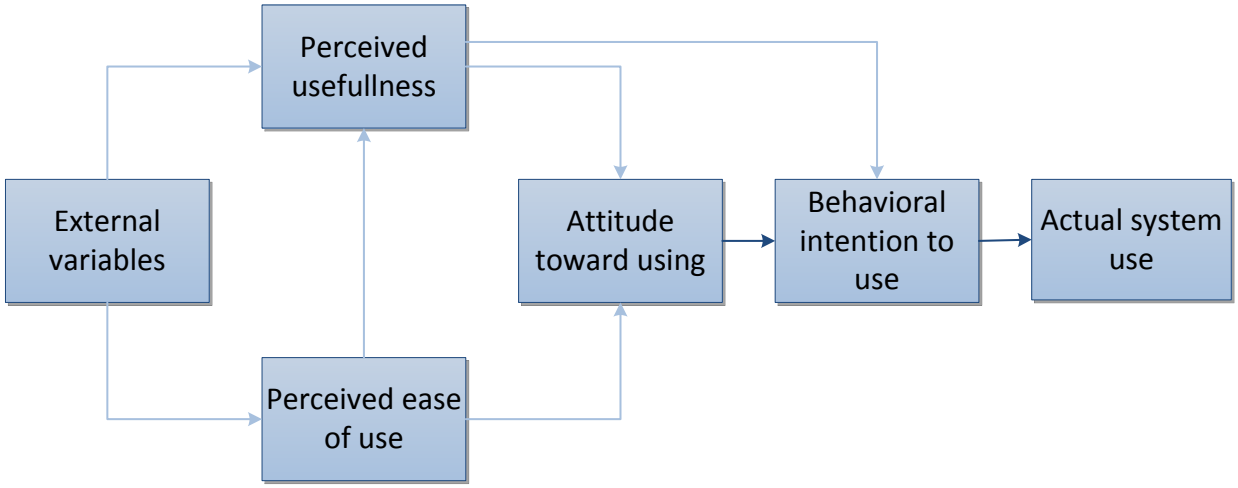

Figure 14. Technological acceptance model (TAM) by Davis in 1989 [39]

The Unified Theory of Acceptance and Use of Technology (UTAUT) was published by Venkatesh et al. (2003) [41]. Its validation found it to account for 70% of the variance in BI (Behavioral Intention to use). It has been widely used with success and it has been upgraded, also in the area of mobile learning by many [40] [42] [43], who expanded the model.

The TAM was widely criticized, e.g. Nyirő (2011) [44] in his summary. One of the critics of the UTAUT and its extensions was Bagozzi (2007) [45], who was involved in creating the TAM model. He thinks that, although UTAUT is well-meaning and thoughtful, it presents a model with too many independent variables. He proposes instead a unified theory that coheres the "many splinters of knowledge" to explain decision making. His suggested model consists first of a decision making core (goal desire → goal intention → action desire → action intention) that is grounded in basic decision-making variables / processes of a universal nature. The decision core also contains a mechanism for self-regulation that moderates the effects of desires on intentions. Second, added to the decision making core, are a number of causes and effects of decisions and self-regulatory reasoning, with the aim of introducing potential contingent, contextual nuances for understanding decision making. Many of the causal variables here are contained within TAM or its extensions; but also consider new variables that are grounded by emotional, group / social / cultural, and goal-directed behavior research." [4]

Donaldson improved his own model (2011) for examining acceptance of the mobile learning and use of the mobile phones with their determining factors for students of the two years college preparatory education at a US university [43]. Its results cannot be generalized, they are verified only for this group of students. Donaldson found the following (see Figure 15):

- Behavioral intent for mobile learning is significantly affected by
  - performance expectancy;
  - facilitating conditions;
  - social influence;
  - perceived playfulness of learning.
- Behavioral intent for mobile learning is a little affected by
  - effort expectancy;
  - self-management of learning.
- Behavioral intent for mobile learning significantly negative affected by
  - voluntariness of use.
- Behavioral intent for mobile learning is not affected by
  - age;
  - sex.

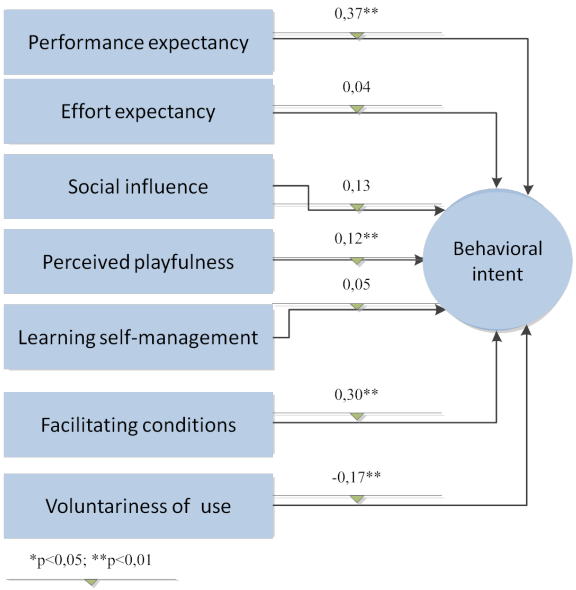

Figure 15. Student acceptance model of mobile learning [43, p. 46]

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

XVI. MULTIDIMENSIONAL MODELS

This class includes models which has been made for "in full width and dept" design e-learning systems of complete organizations or countries. In each dimension are created few subdimensions, and may be are created few sub-subdimensions in the latter. One example of multidimensional e-learning models is the Malaysian e-learning project, and second example is the eight-component framework of Badrul Huda Khan, which can be used effectively in small and big trainings and organizations.

Malaysian specialists started with the model shown in figure 16 to develop an e-learning framework for their higher education with focus groups from stakeholders (students, teachers, and administration staff). Target date is 2020, when country becomes a developing, knowledge-based economy. There are two or three categories in four dimensions and two or four criteria in the categories (the criteria are listed in parentheses in the list). These are: [46]

- Dimension of users: People (students, teachers, stakeholder). Interactions (community interactions, student interactions, personal learning environment [PLE]).
- Dimension of technology: Technology (web3.0, cloud computing). Data (big data, linked data, data driving). Drivers (distributed programming, collaborative intelligent filtering, 3D visualization and interactions, advanced smart mobile technology).
- Dimension of teaching principles: Pedagogy (methodology of teaching and rating, conditioning, personalizing, collaboration). Curriculum (coequal learning, evaluation and feedback, developing and practicing personal skills, personal mentoring, university and curriculum).
- Dimension of learning: Learning styles (formal, informal, community, personalized). Learning theories (pragmatic, connectives).

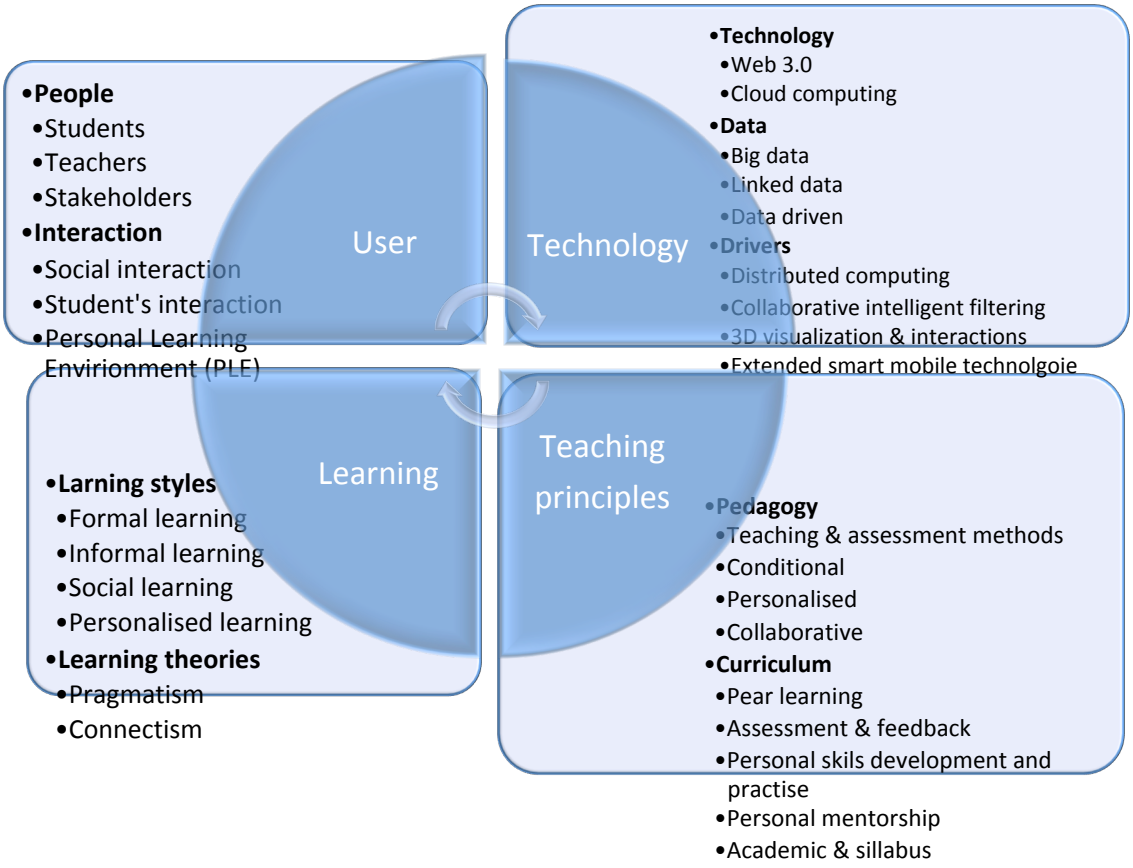

Figure 16. The initial e-learning 3.0 framework (EL3F) [46]

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

The other example is the widely known eight component framework of Khan is a global education design method [47]. This is classified to educational design models by [26]. Khan recommends his framework for planning, developing, implementation and evaluation of online courses, e-learning environments, distance learning programs, virtual universities and LMS.

The main factors or dimensions that cover a wide range of online learning issues: pedagogical, technological, user interface design, evaluation, management, resource support, ethics and organization (see Figure 17).

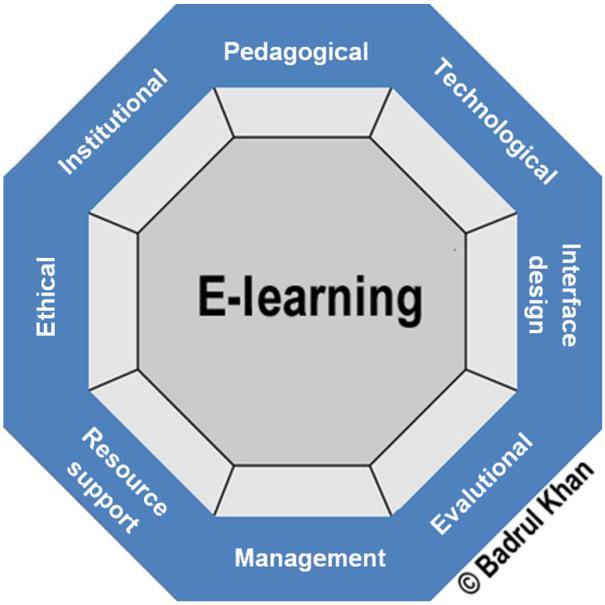

Figure 17. Khan's e-learning framework. Its goal to help overcame all the needed aspects for designing e-learning. [47, p. 77]

Design work is leaded by eight dimensions or main factors. Main factors and their sub-factors are the followings.

Pedagogical dimension: This dimension focuses on teaching and learning. It deals with issues such as goals, content, design approach, organization, methods and strategies, and issues related to e-learning environments. Methods and strategies are varied, such as presentation, demonstration, practice, tutorials, games, story-telling, simulation, role play, discussion, interaction, modeling, collaboration, discussion, study trip, professional practice, case study. But this includes, inter alia, facilitation and motivation. Dimension subfactors: content analysis, audience analysis, goal analysis, media analysis, design approach, organization, methods and strategies.

Technology dimension: Investigates technology infrastructure of the e-learning environments. Dimension subfactors: infrastructure design, hardware and software.

User interface design dimension: It deals with the general appearance and mood of e-learning programs. Dimension subfactors: page and site design, content design, navigation, accessibility, usability testing.

Evaluation dimension: Dimension subfactors: students, trainers, educational environment evaluation.

Management dimension: The learning environment and the distribution of information belong here. Dimension subfactors: developing e-learning content, maintaining e-learning.

Budget support dimension: Provides online support (such as education / counseling support, technical support, career support services, other online support services) and resources (online and offline) for helping the learning environment. Dimension subfactors: online support, resources.

Ethical dimension: In e-learning, ethical considerations address issues of social and cultural, prejudicial, geographical diversity, student diversity, information access, etiquette and legal regulation (such as guidelines and guides, privacy, plagiarism, copyright). Dimension subfactors: social and political impact, cultural diversity, prejudice, geographical diversity, student diversity, digital distribution, etiquette, legal issues.

Organizational dimension: It deals with three main areas. The first is administrative affairs such as organization and change, accreditation, budget, return on investment, information technology services, education development and media services, marketing conditions, completion of studies and alumni). The second area is for university affairs, e.g.: support for faculty and staff, educational affairs, workload, class size, compensation, intellectual property rights. The third area is the provision of student services, such as pre-enrollment services, course and program information, orientation, counseling, financial support, registration and payment, library service, bookstore, social support network, tutoring services, professional and employment services and other services. Dimensions: administrative matters, university affairs, student services.

The design of e-learning is broad-based, needs to be taken into account in many related external and internal areas, and it must be ensured that we are dealing with all the necessary subdimensions in a complex dimension. During extensive preparatory work, one-to-one tasks and complex teamwork have to be done. Khan's e-learning framework is therefore worthwhile, because we ensure that no fundamental and important factor is left behind in designing e-learning. The area is complex and our world is changing. Khan may also feel it necessary to carry out further research in the field of e-learning design after substantial factors.

XVII. Experience Based Models

Do not miss at least mentioning innovative education strategies such as digital storytelling, gamification, which are not inherently salvific but enriches the methodological repertoire of teaching. Now a gamification model is shown.

According to many, playing is a solution to the motivational crisis that may arise as a common problem during training. With this method, a wide audience of students can be attracted. Research has shown that most of the students are playing on a computer or mobile and think that they will learn more effectively through play. It is important to emphasize that great emphasis should be placed on stories and techniques. Also, do not use too many player items and pay attention to rewards because users do not like virtual money collecting [48], e.g.

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

Urha et al. (2015) summarized factors of their model in seven areas that should be considered when introducing gamification: [48] (see Figure 18)

- User experience.
- E-learning management. It also includes the "Important e-Learning Factors" group.

The three areas below (in the middle of each other) interact directly with the last two and last areas:

- Elements of gamification in eLearning.
- Game mechanics.
- Gaming dynamics.

Last Area:

- Effects of gamification on students in e-learning.

The areas in the left side of the figure highlight the cyclicality of the steps of e-learning development.

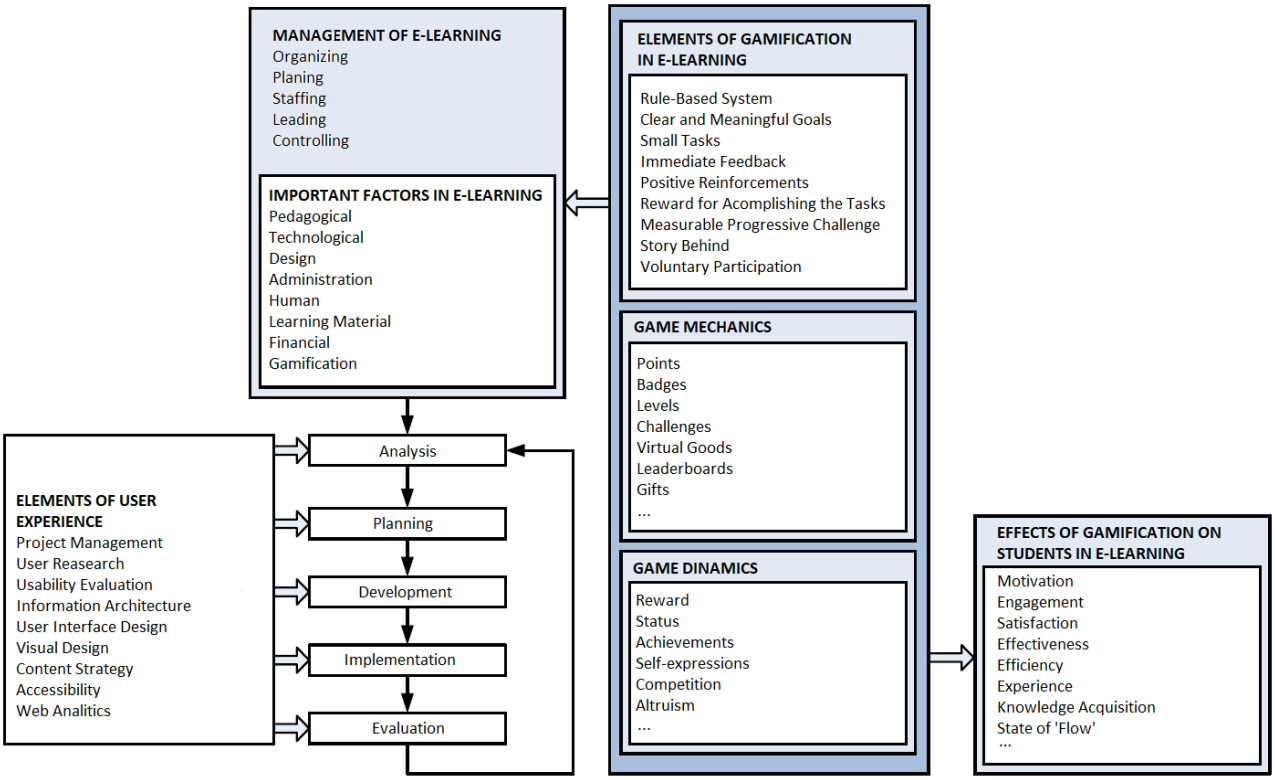

Figure 18. Model for introduction of gamification in e-learning [48]

XVIII. SUMMATION

My overview has attempted classification of the models of the constantly evolving e-learning by classifying them. This systematization can support orientation among models, based on a variety of criteria, aspect, choosing one or more appropriate us models, to measure success and efficiency our models as well as create new e-learning system models or new way of classification.

The overview was started with the technology-based models which included the launch of e-learning, and closed with fashionable new trends and models.

The categorization of e-learning models is not an easy area, and constantly evolving technologies give us new and new opportunities to expand our toolbox, increase the efficiency and effectiveness of learning – therefore we need to further develop the models of our existing, well-functioning e-learning systems too.

Further purposes of this research: inserting of model classes and sample models into the system; creating focused on actors model-groups (including administration and manager roles); to determine which models to use in the stages of the educational process (task specification, analysis, design, implementation, control, evaluation).

XIX. ACKNOWLEDGMENTS

Supported by the code ÚNKP-17-3-III-NKE-15 New National Excellence Program of the Ministry of Human Capacities.

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

XX. REFERENCES

[1] Szn.: *Theories & Models Used for eLearning*, én., p. 9. Virginia Tech http://www.itma.vt.edu/courses/efund/lesson2/eLearningtheoriesmodels.pdf, visited 10.05.2017.

[2] A. D. Wilson: „Categorising e-learning", *Journal of Open, Flexible and Distance Learning*, 16(1), 2012. pp. 156–165. www.learntechlib.org/d/147979, visited 10.05.2017.

[3] T. Mayes and S. de Freitas: "Stage 2: Review of e-learning theories, frameworks and models", in *JISC e-Learning Models Desk Study*, Original 2004, p. 43. https://www.webarchive.org.uk/wayback/archive/20081225020952/http://www.jisc.ac.uk/uploaded_documents/Stage%202%20Learning%20Models%20(Version%201).pdf, p. 43, visited 10.05.2017.

[4] A. Berecz and Gy. Seres: „Mobilizing e-learning", in *Journal of Applied Multimedia 2./VIII./2013, Journal of Applied Multimedia* 2./VIII./2013, Kiadó: Neumann János Számítógép-tudományi Társaság, Multimédia az oktatásban szakosztály, 2013.08. pp. 53–62. ISSN: 1789-6967 http://www.jampaper.eu/Jampaper_E-ARC/No.2_VIII._2013_files/JAMPAPER130202e.pdf, visited 10.05.2017.

[5] C. J. MacDonald, E. J. Stodel, L. G. Farres, K. Breithaupt and M. A. Gabriel, „The demand-driven learning model: A framework for web-based learning", in *The Internet and Higher Education*, 4, 2001. pp. 9–30.

[6] Gy. Seres, K. Fórika, I. Miskolczi, P. Lengyel and P. Gerő: "Hipermédia az oktatásban – avagy felhőpedagógia. Hogyan vált az elektronika az oktatás tárgyából annak színterévé?", *Hadmérnök 2010. V. évfolyam 2. szám*, pp. 3339-365., Zrínyi Miklós Nemzetvédelmi Egyetem, http://hadmernok.hu/2010_2_seres_etal.pdf, visited 10.05.2017.

[7] J. Ferriman: *„300 Years of Distance Learning Evolution"*, 2013.05.01. http://www.learndash.com/300-years-of-distance-learning-evolution-infographic/, látogatva .2017.05.10.

[8] Ministry of Education: 2009 Single data return: A manual for tertiary education organisations and student management system developers: Specifications of the Ministry of Education and Tertiary Education Commission data requirements for the single data return for the 2009 academic year, 2008. http://cms.steo.govt.nz/NR/rdonlyres/8F4D8AE3-03B6-4FA1-B3F4-D7472FF35752/0/SDRManual2009v111.pdf, Not available, Wilson quotes.

[9] S. Weber and J. Rech: „Chapter 2: An Overview and Differentiation of the Evolutionary Steps of the Web X.Y Movement: The Web Before and Beyond 2.0", in *Information Science Reference*, 2009, ISBN 978-1-60566-384-5 (hardcover) | ISBN 978-1-60566-385-2 (ebook) 1., pp. 12–36. http://joerg-rech.com/Paper/BC_WeberRech_WebX%20Y-Classification_cameraready_final.pdf, visited 20.07.2017.

[10] J. Wijayarathne: WEB 1.0/2.0/3.0/4.0, 2015.02.25. http://jayathriwijayarathne.blogspot.hu/2015/02/web-10203040.html, visited 10.05.2017.

[11] S. Murugesan: „Get Ready to Embrace Web 3.0.", *Business Technology & Digital Transformation*, 7, no. 8, Cutter Consortium, p. 21, 2007. http://cutter.com/article/get-ready-embrace-web-30-400576, visited 20.07.2017.

[12] É. Gyarmati: „Tehetség és tehetséggondozás a 21. század elején Magyarországon", *Neveléstudomány, Oktatás – Kutatás – Innováció*, 2013. 2. kötet, pp. 90–106, Eötvös Loránd Tudományegyetem Pedagógiai és Pszichológiai Kar, ISSN: 2063-9546, http://nevelestudomany.elte.hu/downloads/2013/nevelestudomany_2013_2_90-106.pdf, visited 20.07.2017.

[13] G. Bodnár: „2. A különböző tehetséggondozó modellek (nemzetközi és országos kitekintéssel), a tehetséggondozás útjai, célja," in A tehetséggondozás elméleti és módszertani kérdései a szakmai pedagógusképzésben, BME Tanárképző Központ, 2015. http://www.tankonyvtar.hu/hu/tartalom/tamop412b2/2013-0002_a_tehetseggondozas_elmeleti_es_modszertani_kerdesei_a_szakmai_pedagoguskepzesben/TM/stmjs23g.scorm, visited 20.07.2017.

[14] G. Bodnár: „A tehet séges fiatalok menedzselése a felsőoktatási intézményekben," in *Tehetségmenedzsment*, 9. kötet, szerk. G. Bodnár, Budapest, Magyar Tehetségsegítő Szervezetek Szövetsége, 2011, pp. 9–49. http://tehetseg.hu/sites/default/files/19_kotet_net.pdf#page=9, visited 20.07.2017.

[15] D. N. Jr. Roberson: *„Self-Directed Learning – Past and Present"*, http://files.eric.ed.gov/fulltext/ED490435.pdf, visited 20.07.2017.

[16] I. Miskolci: *Virtuális intranet hálózat alkalmazási lehetőségei a polgári és a katonai távoktatásban*, Nemzeti Közszolgálati Egyetem Katonai Műszaki Doktori Iskola, 2011. p. 157.

[17] J. Ollé: *Bevezető előadás: Az oktatási környezetek tipológiája, eLearning és távoktatás értelmezések 2013febr*, 2013.02.20. https://www.youtube.com/watch?v=yTjfWC8s4S8, visited 10.05.2017.

[18] E. Georgieva, A. Smrikarov és T. Georgiev, „A General Classification of Mobile Learning Systems", in *International Conference on Computer Systems and Technologies - CompSysTech' 2005*, IV.14-1–6, http://ecet.ecs.ru.acad.bg/cst05/docs/cp/siv/iv.14.pdf, visited 10.05.2017.

[19] A. Berecz: „Egy fegyveres küzdelem modell átalakítása e-learning modellé", *Hadtudomány és a 21. század* doktorandusz konferencia, 2015.02 25-26., ISBN: 978-615-80044-8-0, pp. 145–161.

[20] Allen R. Team, *„Learning Theories,"* https://www.learning-theories.com/, visited 10.08.2017.

[21] D. Newton and A. Ellis: „Effective implementation of e-learning: a case study of the Australian Army", in. *Journal of Workplace Learning*, vol. 17, iss. 5/6, 2005. pp. 385–397. http://www.qou.edu/arabic/researchProgram/eLearningResearchs/effectiveImplementation.pdf, visited 10.05.2017.

[22] D. Newton, S. Hase and A. Ellis: „Effective implementation of online learning: a case study of the Queensland Mining Industry", in *Journal of Workplace Learning*, 2002. vol. 14, No. 4, pp. 156–65.

[23] D. R. Garrison and T. Anderson, *E-learning in the 21st century: a framework for research and practice*, London, RoutledgeFalmer, 2003.

[24] D. R. Garrison, T. Anderson and W. Archer: „The first decade of the community of inquiry framework: A retrospective", *Internet and Higher Education*, 13. kötet, pp. 5–9, 2010.01. Elsevier, doi: 10.1016/j.iheduc.2009.10.003, visited 10.05.2017.

[25] P. R. Lowenthal: „Social presence", in P. Rogers, G. Berg, J. Boettcher, C. Howard, L. Justice, & K. Schenk (Eds), *Encyclopedia of distance and online learning*, 2nd ed. Hershey, PA: IGI Global, 2009. pp. 1900–1906.

[26] D. K. Schneider (ed.): *Educational (instructional) design models*, 2014.11.10., http://bigbook.or.kr/bbs/data/file/bo02/1535291005_MQ8Nsgjn_Education-al_28instructional29_design_models_Daniel_K._Schneider.pdf, visited 10.05.2017.

[27] E. Engelbrecht: „A look at e-learning models: Investigating their value for developing an e-learning strategy", in *Progressio*, 25(2), 2003. pp. 38–47.

[28] *„18/2016. (VIII. 5.) EMMI rendelet"*, Magyar Közlöny, 116. kötet, pp. 10408-11971, 2016.08.06. pp. 10408-11971, Magyar Közlöny Lap- és Könyvkiadó http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A1600018.EMM&timeshift=fffffff4&txtreferer=00000001.TXT, látogatva visited 20.07.2017.

[29] P. Gerő: *Az élethelyzethez igazított e-tanulás (e-learning) alkalmazása a katonai felsőoktatás példáján*, NKE Katonai Műszaki Doktori Iskola, 2011. p. 127

[30] P. Gerő: „Az élethelyzethez igazított tanulás módszertanának összefoglalása, érvényességi köre, hiányosságai, továbblépési lehetőségei", in *XX. Multimédia az oktatásban konferencia előadások,* 2014. június 5-6. Neumann János Számítógéptudományi Társaság, DOI: 10.26801/MMO.2014.1.020., pp. 97–102. http://www.mmo.njszt.hu/Kiadvanyok/2014/MMO2014_Proceedings.pdf, visited 10.08.2017.

Received: 17 December 2017
Accepted: 28 December 2017
Published: 15 January 2018

Journal of Applied Multimedia 4./XII./2017
DOI: 10.26648/JAM.2017.4.001

[31] Gy. Seres: „A tanítási-tanulási folyamat élethez szabásának módszertana. Hogyan készítsünk lego-ndolkodót?" in *XX. Multimédia az oktatásban konferencia előadások,* 2014. június 5-6. Neumann János Számítógép-tudományi Társaság, DOI: 10.26801/MMO.2014.1.020., pp. 94–96. http://www.mmo.njszt.hu/Kiadvanyok/2014/MMO2014_Proceedings.pdf, visited 10.08.2017.

[32] L. P. Szegediné: *Az e-könyvekből való e-tanulás első tapasztalatai a felsőoktatásban*, Nemzeti Közszolgálati Egyetem Katonai Műszaki Doktori Iskola, 2011. doktori disszertáció, p. 143.

[33] L. J. Cronbach, és R. E. Snow: *Aptitudes and Instructional Methods: A handbook for research on interactions*, New York: Irvington, 1977.

[34] P. Brusilovsky: „Adaptive hypermedia: from intelligent tutoring systems to web-based education", in *Künstliche Intelligenz*, 4, 1999. pp. 19–25. http://www2.sis.pitt.edu/~peterb/papers/KIreview.html, látogatva visited 10.05.2017.

[35] P. Brusilovsky and C. Peylo: C. Adaptive and intelligent web-based educational systems. in *International Journal of Artificial Intelligence in Education*, 13, 2003. pp. 156–169.

[36] D. Wiley: „Connecting learning objects to instructional design theory", in D. Wiley (Ed.): *The Instructional Use of Learning Objects*, http://wesrac.usc.edu/wired/bldg-7_file/wiley.pdf, visited 10.05.2003.

[37] J. M. Gascueña and A. Fernández-Caballero: „An Agent-Based Intelligent Tutoring System for Enhancing E-Learning / E-Teaching", *Insructional Tehcnology & Distance Learning*, 2. No. 11, 2005. ISSN 1550-6908, http://www.itdl.org/journal/nov_05/article02.htm, látogatva visited 20.07.2017.

[38] A. Assiri, J. Berri and A. Chikh: „Classification and tendencies of evaluations in e-learning", in *Education and e-Learning Innovations* (ICEELI), 2012 International Conference on, Kiadó: IEEE, 2012, ISBN: 978-1-4673-2225-6, pp. 60–65.

[39] F. D. Davis: „Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", in *MIS Quarterly*, 13(3), 1989. pp. 319–340.

[40] M. Ajzen and M. Fishbein: *Belief, attitude, intention and behavior*, London, Addison-Wesley, 1975.

[41] V. Venkatesh, M. G. Morris, G. B. Davis and F. D. Davis: „User Acceptance of Information, Technology: Toward a Unified View", in *MIS Quarterly*, vol. 27, No. 3, pp. 425-478, 2003. szeptember, https://nwresearch.wikispaces.com/file/view/Venkatesh+User+Acceptance+of+Information+Technology+2003.pdf, visited 10.05.2017.

[42] H.-W. Wang and S.-H. Wang: „User acceptance of mobile Internet based on the Unified Theory of Acceptance and Use of Technology: Investigating the determinants and gender differences", in *Social Behavior & Personality: An International Journal*, vol. 38, no. 3, 2010. pp. 415–426.

[43] R. L. Donaldson: *The Florida State University College of Communication & Information Student Acceptance of Mobile Learning*, Summer Semester 2011, Ph.D. értekezés, http://diginole.lib.fsu.edu/, visited 10.05.2017.

[44] N. Nyirő: *Médiatechnológiai innovációk elfogadása és terjedése*, Budapesti Corvinus Egyetem Gazdálkodástani Doktori Iskola, Ph.D. dolgozat, 2011, http://phd.lib.unicorvinus.hu/585/1/Nyiro_Nora_dhu.pdf, visited 10.05.2017.

[45] R. P. Bagozzy: „The Legacy of the Technology Acceptance Model and a Proposal for a Pradigm Shift", in *Journal of the Association for Information Systems*, vol. 8. issue 4. article 7, pp. 244–254., 2007. április, http://www.eduneg.net/generaciondeteoria/files/2007-bagozzi.pdf, visited 10.05.2017.

[46] A. Binti M. Sofiadin and T. Issa: „An Initial E-learning 3.0 Framework for Higher-Education Universities in Malaysia", IADIS232, DOI: 10.13140/RG.2.1.1279.1764, ISBN: 978-972-8939-77-9, in *IADIS International Conference on Internet Technologies & Society 2012,* pp. 232–236. 2015 november, https://www.researchgate.net/publication/283472550_AN_INITIAL_E-LEARNING_30_FRAMEWORK_FOR_HIGHER-EDUCATION_UNIVERSITIES_IN_MALAYSIA, visited 10.05.2017.

[47] B. H. Khan: *Web-Based Training*, Education Technology Publications, B. H. Khan, Szerk., New Jersey: Englewood Cliff, 2001, Hardcover ISBN 0-87778-302-0, Softcover ISBN 0-87778-303-9, LC 00-051384, p. 624.

[48] M. Urha, G. Vukovica, E. Jereba and R. Pintara: „The model for introduction of gamification into e-learning in higher education", in *7th World Conference on Educational Sciences*, 2015. február 5-7. Novotel, Athens Convention Center, Athens, Greece. in *Procedia – Social and Behavioral Sciences 197*, 2015, pp. 388–397., https://www.researchgate.net/profile/Marko_Urh/publication/282599647_The_Model_for_Introduction_of_Gamification_into_E-learning_in_Higher_Education/links/56e6845f08ae65dd4cc1a0ba.pdf?origin=publication_list, visited 10.05.2017.