Collaborative Technological Applications with special focus on ICT-based, networked and mobile solutions

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Abstract: The classical teaching-learning environments have dramatically changed, which is marked by the buzzword of atypical modes of learning. The changed learning environment related to these modes of learning can be characterized by the powerful support of ICT.

In our present fast-transforming world the new layers of the information society are forming in the environment of the most uptodate tools, consequently these layers can be called digital natives. They are familiar with IPTV, intelligent mobile phones and homes, 3D TV, IPv6 network, thin client terminals, social networks (facebook, twitter, hi5, linkedln) and the web 3.0 protocolls.

The paper gives an insight into the world of new learning theories characterized by technical integration, networking, realizing knowledge construction instead of knowledge transfer. The author focuses ont he connectivist characteristics based ont he most prevailing technology-based learning as a consequence of his practical experience acquired in higher education, where learning occurs in a social environment by means of the interactions (cooperation, collaboration) of networked learning communities.

Key-Words: ICT, learning support systems; Moodle, e-portfolio; web 2.0; online learning, m-learning

1 Introduction

One of the basic conditions of technology-based learning, networking, the formation of knowledge networks is the appropriate level of digital literacy of those wishing to learn, which as the most important key competence of adult learners (higher education students) should be highlighted by state, social and educational institutions as well providing the frames of formal and non-formal education and training.

On the part of teachers and lecturers in addition to digital literacy the improvement of ICT competence is essential for applying networked, interactive learning modes. It is understandable if we take into consideration the social media applications favoured by Y and Z generations, such as blogs, twitter, facebook, hi5. These non-formal applications, learning networks are increasingly usable, connectable to formal learning environments. Of course first it is essential to understand the functions of social media, the limitations of their application, users' needs, adaptaion possibilities before introducing a new methodological culture including social media applications into the formal learning environments.

2 Description

Various networks are used today at macro, mezzo- and micro level as well. At macro level it can be a traffic network topology, a social network, at mezzo level it can be each member of this knowledge network who connect through the neural network of the human brain (by means of 1018 neuron connection points) to the mezzo- then the macro level networks. The point of networked information exchange, that is the operation of knowledge networks, is the fact that each tiny terminus connects a new knowledge network to the already existing one.

The mathematical model of the description of network structures has long been available, e.g. the Erdős-Rényi model came into being in the 60s. This model was used for the description of the random networks, consisting of nodes and connecting wires, and was characterized by means of Poisson distribution. The BACON game was based on such an algorithm, which was mainly popular in the USA.

In the sense of the recent research work and in accordance with Albert-László Barabási it is only possible to understand the operation of complicated networks by means of structures implying the

interpretation of complex systems, which needs the preparation of maps. All this needs a paradigm shift in human thinking to be able to interpret the available data bases appropriately. These complex systems mean more than the behaviour of one network. Such a system can be the human brain or an economic system or the system of learning processes. Furthermore, the given complex system changes over time, and we need to understand how it changes. The measurement, examination of human behaviour patterns, learning modes can help with understanding. This involves the measurement of human movements and learning spaces. The examination of ICT tools, social webpages, electronic learning environments can contribute to it [4]. These complex systems can be modelled as scale independent networks – such are the worldwide web and the learning network – whose precise measurement can be performed by means of ICT tools, only needing modern theories. The definition of these theories is our task today. This is the science of the future, and the paper means to help this model by presenting the ICT environment and student behaviour patterns. [1], [2]

2.1 ICT tools supporting instruction and learning

The paper discusses a technological stage of the development of mobile communication having a significant influence on the future of our learning and knowledge, whose focus is a new dimension of informal learning. The new learning environment can be characterized by m-learning, which means a novel impulse in LLL forming a learning potential. iPads – a very rapidly developing family - have been chosen for presentation out of the mobile communication devices usable for supporting learning.

The first part of the paper describes the physical, technical parameters of the device, then a few good practices of general and learning-oriented use. In the last part a few Hungarian and international practical examples in the field of concrete application are presented. The use of the iPad is the most widespread among teachers from the Y generation, but is relatively common among those from early X generation and previous generations. The statistical data showing the fast spread of Apple IOS devices as opposed to Microsoft Windows devices prove this fact.

2.1.1　M-learning

M-learning can be defined as access to course content by means of mobile devices and the related learning activity. Or rather the type of learning in the course of which an online CMS, LMS system can be accessed by means of a networked mobile communication device. This sort of use is provided by smart phones, and tablet PCs. Such a smart phone is Samsung GalaxyTab touchscreen device with Android Browser, which makes it possible to download optional web content and provides full scale multimedia. The intelligence of mobile communication devices limits the scope of downloadable content (web 2.0, flash, audio, video). The smart phones available today use different operation systems, which makes compatibility a bit hard. Such a system is the long known Symbian, the Windows phone, the new Android, Apple IOS, the Bada and Blackberry platforms. The other main challenge is problem free content managements requires web feature optimized for mobile screens (unique CSS, optimized contents). In addition to these points of view, m-learning possibilities are increasingly used, furthermore a great part of the developments focus on this direction, e.g. the official Moodle mobile client will soon be available to complete the well-known Moodle LMS system. The paper and our research work focus on such a mobile communication device, the iPad, which is suitable for supporting m-learning. [5], [6], [17]

2.1.2　The iPAD as a device

The general characteristics and physical parameters of iPads are the following:

- 9.7" touch screen monitor (1024x768)
- 10-hour battery
- Thinness: 8.8 mm
- Weight: 613 g
- Built-in Wi-Fi (and 3G)
- 16, 32, 64 GB inner memory
- MAC OS X operation system
- Built-in camera
- Phone function, SIM card slot
- Types: iPad 1., 2., and 3. soon to be released
- Fast booting and standby time

Figure 1: Ipads, Source: Csaba Landesz: IPADs in Education TDK (Students' Study Circle) paper

The use of iPads has been increasing rapidly as opposed to the use of Microsoft-based systems in everyday, work and learning environments as well. MAC operation systems used by iPads are absolutely different from Micsrosoft platforms. In spite of their openness the file system of the operation system cannot be accessed to directly and fully, thus the direct basic file operations cannot be realized, which is common in the case of MS platforms. Special applications need to be used, such as iTunes, drogbox and teamviewer. So the MAC based iPad platform is not compatible with the most commonly used Microsoft operation system, which means that iPad applications cannot be used on MS platforms. However, Microsoft applications or respectively their equivalents can be run on iPads. After registration, the users can download iPad applications by means of the App Store using their Apple ID usernames. This way, applications can be upgraded, one account can be used for upgrading five iPads. This is similar to that of the android smartphones, in the case of which a Google ID is needed to be able to use the Market. Each iOS operating system is connected to an Apple ID, which can be used for the iTunes Store, iCloud and the App Store.

In the case more than one device is connected to the same Apple ID, then the formerly purchased applications can be download to other iOS devices free of charge. Furthermore, they can be set to automatically download the upgraded applications to each device. In addition to the Apple Store a huge collection of music, films, TV programs, books, podcasts and university courses are available for the iOS devices. The other huge repository is the Apple ID iCloud, which provides a storage capacity of five GB for each user, which can also be used for security saving. This process can be automatically algorithmized, so if the given device is connected to a WiFi network, a security copy of its operation system is saved by the iCloud. Consequently, in case of any problem the security copy can be used. These devices can be synchronized with any PC by means of the iTunes application, which is suitable for storing downloaded programs, media content and security savings. E.g. the iPhoto, a part of the operation system, can easily be used on an iPad. When connected to Microsoft Windows, the system recognizes the iPad as a driver and the automatic play discussion panel pops up, by choosing "Importing videos and pictures" photos and videos can be imported by means of the Windows Photo

Gallery application. iTunes synchronization can be carried out by means of an USB cable, or Wi-Fi, if the PC and the iOS (iPad) is connected to the same Wi-Fi network. The iPad applications of international importance are the following:
• the iPAD as a source of information in addition to its GPS and navigation functions can be used by employees of United and Continental Airline
• the knowledge base and the connected 3D programs of anatomy can be used by employees of outpatient departments, hospitals, certain diagnostic measurements are also supported
• by employee of labour market enterprises

2.1.3 Using IPADs in teaching and learning
The adaptation of iPad s in education is still in its infancy except for a few developed countries. Their application in education can be realized by means of two methods:
• iPad s are distributed to the students before classes, prepared for performing a given task, then they are collected when the class is over. This way the iPad devices can be fully controlled in the school learning environment. The Apple provides a solution for such application: the so called Bretford PowerSync Case (See Figure 2) can store, upload and synchronize 30 iPad s at the same time. This mechanism should be used when pupils/students require more teacher attention. In such a case the same programs, applications run on the iPad.

Figure 2: Bretford PowerSync for iPads, Source: Apple iOS Learning Solutions. 2011 [cited 2011; Available from:
http://images.apple.com/education/docs/

• The iPads are handed out to the pupil/studentss for individual use, either at class or after class. In this case each pupil/student has an iPad and an Apple ID of

his/her own, and use them as a personal device. This approach requires a bit more school organization to synchronize the the necessary programs and applications. This method can be useful as the pupils/students can learn the use of the device more quickly. This approach should be used in the case of students over 18.

In the following practical educational applications of iPads will be presented categorized by task type. Electronic textbooks, auxiliary materials, classroom note taking, content and activity management, group work, pair work, online tasks and independent learning are to be used in classroom environments. The kno, inkling and dropbox programs support electronic course materials, while the elements, notes plus and iannotate pdf are used for note taking. The iStudiez pro and iTeacher Book program support activities, iWork and Quick office Pro HD are used for preparing documents, the SketchBook Pro, iMovie and Garageband applications are used for media management. In addition to independent learning, pair work is also supported by means of skype for iPad, GoToMeeting, iThoughts HD or Share Board. The last can realize working on several iPads at the same time to be shown by means of a Wi-Fi device. In addition of general application, job specific programs can also be downloaded such as software supporting studies in Anatomy, Maths, Chemistry, Mechanics, Electrical Engineering. The use of blackboard is on no secondary importance either. Figure 3 shows iPad learning management programs. And not neglected the possibility of using the blackboard program either.

Figure 3: IPAD learning management programs, Source: Own figure
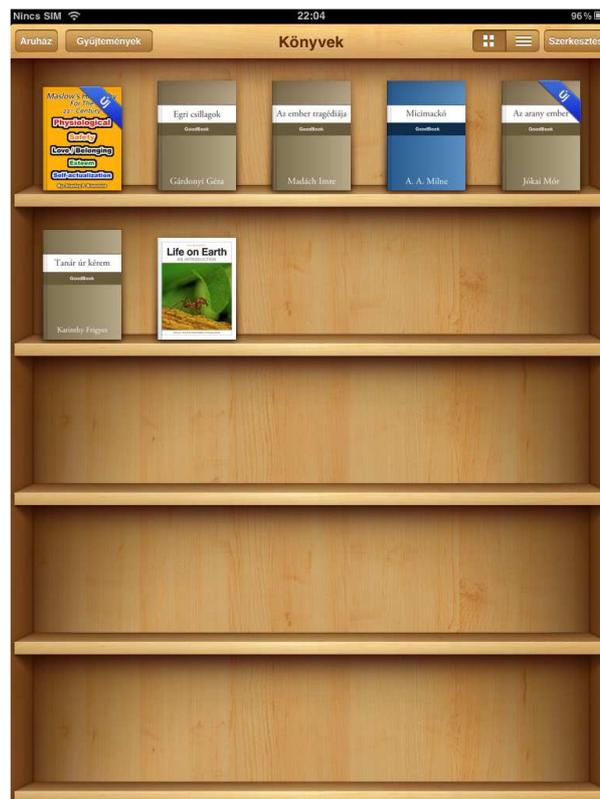
Figure 4: iBooks application on IPAD, Source: Own figure
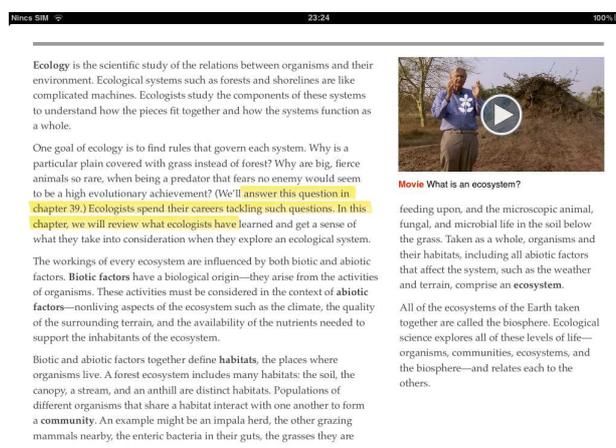
Figure 5: e-learning course on IPAD, Source: Own figure

2.1.4   IPAD-related surveys, researches

The statistical data concerning the use of iPads are primarily to be found in international literature and sources. A good example is the statistical data of US Abilene Christian University showing our laptop and iPad uses and frequencies, such as:

- 50% of the lecturers use the iPad every lesson, 84% of them regularly
- The efficiency rate of knowledge transfer has increased to 79% by means of the iPad

- A much more frequent use of the course material was characteristic when these devices were used.

In conclusion, it can be stated that the use of the iPad means a bigger experience for the lecturers of the institution, both from the viewpoint of lecturers and students. The devices are said to have been received positively by the students. This urged teachers to recognize the fact that this technology can be used in an efficient way at class. Other statistical data show that educational institutions all over the world are interested in the integration of mobile devices into the teaching-learning process.
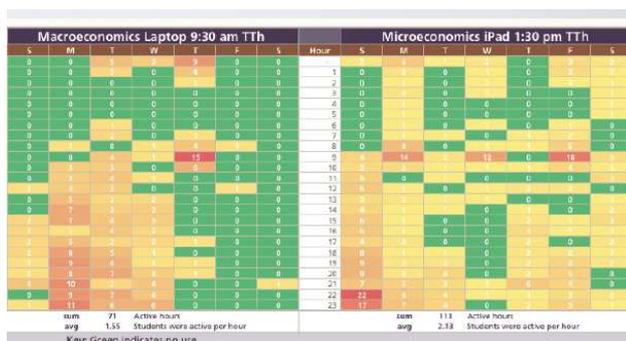

Figure 6: IPAD application in tertiary education, Source: Dr. Ian Sheppard

In Hungary, a methodological experiment of novel approach was introduced in the academic year of 2011/12 by Károly Eszterházy College and the Teacher Training Primary School of the College. The device in the focus of the research is the iPad. The pupils and teachers of class 8c started the academic year in an electronic learning environment involving iPad table devices and a touchscreen interactive whiteboard.

Figure 7: IPAD application in Primary School, Source: http://www.ipad.ektf.hu/?q=gallery

The course materials – Hungarian Literature, History, Physics, Biology, Maths, Informatics, Geography and English Language - to be used by the table devices were provided by the Mozaik Publisher. The process of knowledge transfer and acquisition is enriched by new interactive applications in addition to the course materials and the collections of activities in this up-to-date learning environment. The result will be available at the end of the academic year. A survey carried out by Simna Net focused on the high schools.

Analyses carried out and experiences acquired so far suggest that classroom-based teaching and learning supported by iPads is more useful and efficient than otherwise. The iPad is an extremely innovative device when its proper services and applications are utilized. Naturally, when such a device is introduced in a school, appropriate technological background, staff and course materials need to be provided. The most recent iPad-based developments have just been released. They are available here: http://events.apple.com.edgesuite.net/1201oihbafvpi hboijhpihbasdouhbasv/event/index.html. Such a new development is the iBooks application, which automatically upgrades the content of the downloaded i-books in the e-library when the authors have changed the content. This program is only available on iPads and i-MACs. A similar new application is the iBooks author only developed for MACs. Finally, iTunes U application is one of the latest programs being suitable for designing complete courses featuring audio, video, books, and other content by means of e-learning course design. All in all, the iPad tablet PCs are perfect for m-Learning learning environments, which cannot only be used by the Y and Z generation learners, but by lecturers, educationalists as well for supporting learning in addition to maintaining motivation.

2.2 Networked learning and its characteristics

The constructivist approach to learning includes in a hidden form the networked character, e.g. the iwiw social webpage. By the common using of content by means of networks the characteristics of the new constructivist approach can be got to known, whose example might be the facebook portal. Several such media applications are available as shown in the following figure.

Figure 8: Social media applications.
Source:http://www.flickr.com/photos/fredcavazza/2
564571564/

The Moodle system introduced in 2006 at the Department of Technical Education, Budapest University of Technology and Economics can be considered a formal social network, which has significant results both in the field of learning management (LMS) and content management (CMS) according to national and international special literature and statistics. The system provides the possibility of teacher-student communication, the measurement of activity, the operation of social forums, measurement and evaluation of performance in an electronic environment in addition to access to downloadable instructional material. The behaviour of almost 3,500 students of the system noticeable in the Moodle learning management system can be monitored by means of different statistical measurements. One of them is the built-in statistical measurement system of Moodle, which can monitor all students' activities and differentiated students' activities. The system provides detailed report of the statistical data of the student activity of those using the system. The following figure shows the activity tendency of three years, red colour showing students' activity. It is noticeable that the maximal amplitude was to be found during the periods of testing such as assignments were due or written tests were due. (See Figure 9.)
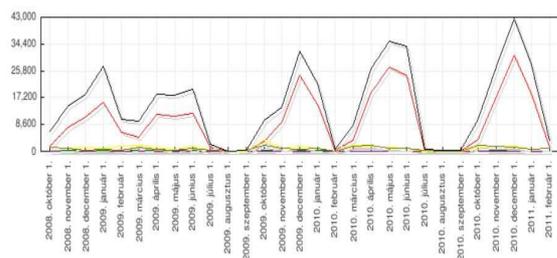
Figure 9: The activities of the Moodle platform of the Department of Technical Pedagogy. Source: Own diagram

The other such means of measurement was the Google analytics system, which used for the Moodle courses can also provide useful, informative statistical data, as the following figures show (See Figures 10 and 11.) of a selected course (Digital Pedagogy).
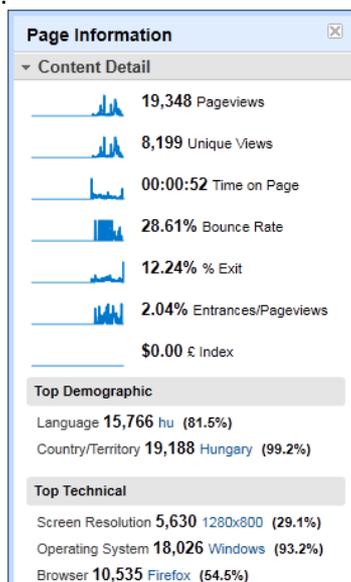
Figure 10: The activity of the participants of Digital Pedagogy course. Source: Own diagram
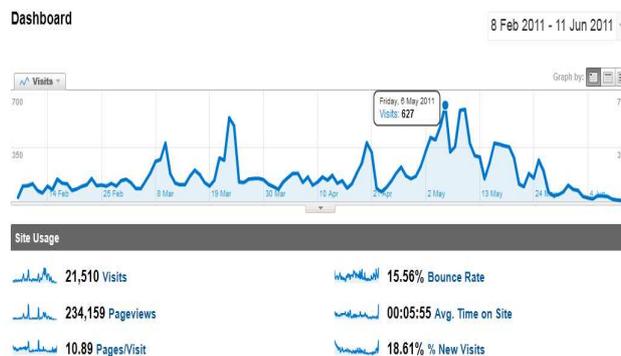
Figure 11: The activity of the students of Digital Pedagogy course with google analytics measuring device. Source: Own diagram

Out of the administration blocks of a given course the points report is an excellent way of having information about the full performance of a student in a given semester in a given course – assignments, topic selection, on-line tests, - with given points and comments. It also provides an opportunity of monitoring the student-student and student-lecturer horizontal and vertical communications. All student activities can also be summarized.

Our experiences of several years show that while the lecturers are mainly active in the daytime, the students are active more often than not late in the evening or at night. Since the system is connected to the participants' e-mail systems, most of the students stay online for 10-12 hours a day, so interactivity and quick feedback can be realized. The scope of activities to be carried out suggests that the students prefer the new generation activities, such as microcontent/related activities or the e-portfolio. The assignments are stored by the system, consequently they can be found any time. The following figure is an example of microcontent. The students' activities are stored at a delegated page, and are used to prepare an illustrative collection of them (see Figure 12).

Figure 12. An example of microcontent, Source: Own photo

The e-portfolio integrated into the Moodle system is very popular among the students. Each student was required to log in and join the group of students of Digital Pedagogy. After entering, the participants could share the uploaded materials and their contributions. The e-portfolio group was used by 253 students in a course, and each of them prepared 4-5 files and introductory portfolios in their profiles.

Both the e-portfolio and the profile editions are user-friendly, as they can be prepared easily and fast, e.g., by means of the clicking and dragging technique (see Figure 13).
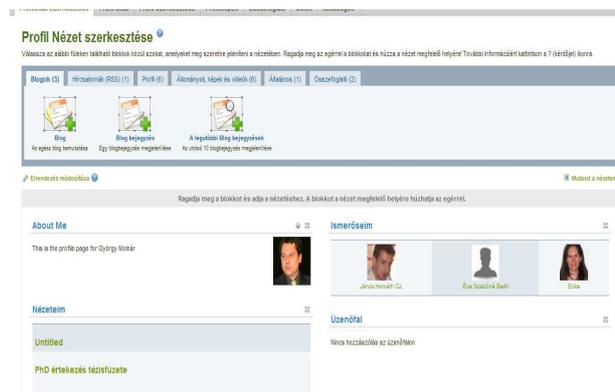

Figure 13. Editing e-portfolio profiles, Source: Own photo

The students can view their own uploaded and edited contents, on the other hand their own introductory profiles with the photos, as well as the students' acquaintances, groups, notice boards, which are the main forces of the new connectivity learning theories for the participants. By using them, the students can discuss important questions, requirements, solutions related to the course with their peers and their lecturers as well. [7]

2.3 Web Mining Algorithms

The main objective of the investigation was to explore the most important characteristics of student behaviour or, in other words, the learning activity over the semester by means of web mining methods. The results presented in the previous chapter do not describe classic e-learning but blended learning integrating networked learning phases into the mainstream face to face education and combining the best of both forms of teaching and learning.

In introducing learning activities, two approaches were followed. On one hand, the role of the students' learning process was explored (macroanalysis), and on the other hand the microstructure of processing electronic syllabuses was investigated (microanalysis).

So-called offline web mining methods such as Google Analytics and SPSS Web mining for Clementine [7] and its web mining node are able to provide the possibility of a more profound, more comprehensive and more scientific analyses, far beyond descriptive statistics. It is an aggravating circumstance for the application of online tools that within the virtual learning environment several simultaneous courses are running. The isolation of related results as well as their survey is often too

complicated. It is also difficult to perform analyses concerning the levels of the objects comprising the module and the pages comprising SCORM module and the html - based syllabus. Clementine is also capable of extracting related data from the log file. [9].

The application of web mining in VLE is an iterative cycle in which the excavated information and data should "enter the loop of the system and guide, facilitate and enhance learning as a whole, not only turning data into knowledge, but also filtering mined knowledge for decision making". The CRISP-DM (CRoss Industry Standard Process for Data Mining) as a well-known process model consists of six phases (See Figure 14) [12], [14].
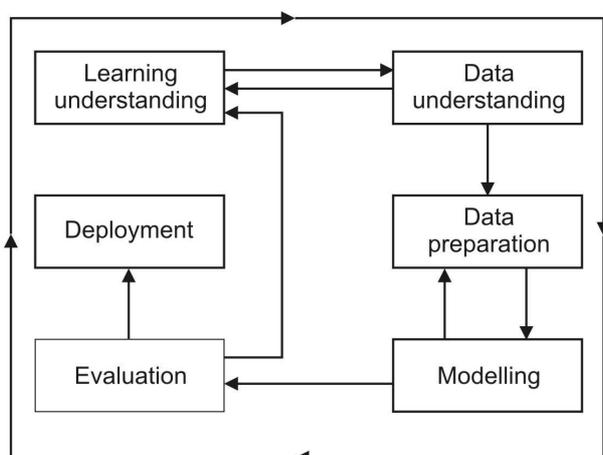
Figure 14. The CRISP-DM model [15]

3 Conclusion

The report on one single student's performance is an interesting and useful set of statistical data, as it contains the student's points collected during the course on the basis of his/her performance. By means of this, student performance can be evaluated individually and in a realistic way.

Both the students and the lecturers have the opportunity to have access to the detailed report of a student's activity in the function of actual measurements and their points and total points. This is also useful from the viewpoint of the students and the lecturers.

When running a course, all activities of the learning environment are recorded and stored in an appropriate database. Thanks to this data mass, the learning environment becomes suitable for preparing simple statistics without involving any special knowledge. For obtaining reports based on more complex data-correlations, additional data filtering and data combinations need to be done. Therefore, we used data mining techniques for

deeper data analyses (SPSS Clementine 12.0 software with WebMining for Clementine) [7].
Using the SPSS Clementine data mining software the content of the log files produced during the use of course sheets can be processed. By doing so, more information can be obtained on the students' behaviour, their learning patterns and the usability of the interface to the electronic learning environment. By means of data mining it is possible to obtain information that could not be gained through other usability tests or queries. By the utilization of the results coming from data mining supported analyses of course sheets and curricula usage we are likely to identify effective education and learning processes and we will able to use the outcome during the development of the electronic curricula as well.
First of all, we formulated questions that could not be answered by means of integrated statistical tools of the learning environment. Then we attempted to answer these questions by using the appropriate data mining software (SPSS Clementine 12.0 software with WebMining for Clementine).
Most LMS have a built - in statistical module which makes possible the fixing of particular items of user activities. Such items can be entry data or download figures per subject item. However, these analysing methods are not qualified for revealing deeper relations or prediction of learning/related events. This latter fact is of utmost importance for us, as it makes the learning process more predictable pedagogically. The user interface and usage of the program do not require IT or mathematics skills but that scope of interest could be an advantage (see Figure 15) [11], [13], [14], [16].
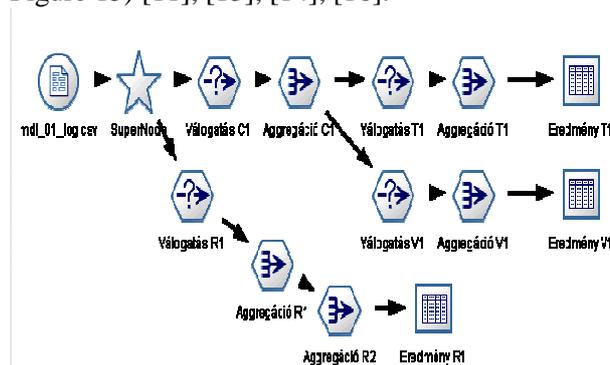

Figure 15. Data analysis with SPSS Clementine 12.0 , [12]

The students can directly communicate with each other in the system by means of e-mailing, chatting or using forums, the direct communication channels are primarily built around the teacher-student relationship in the electronic earning environment. Our hypothesis, that on one hand the discrete flash-

like momentums of networked learning are increasingly becoming continuous and steady, on the other hand the independent branches of the network will also be interrelated, is underlined by our experience and the earlier theories of learning.

We also made an interesting observation that a great deal of the services provided by the electronic learning environment, such as the communication channels of chatting and blogging were not at all used by the students during the learning process. On the contrary, the same services of informal social networking homepages, such as chat module, noticeboard, were used daily, furthermore every one-two hour. For example in the case of facebook, the content of the message can also be related to course content. In addition, the informal network-based learning processes in most cases are carried out either in an open or in a close group in relation to, e.g., a course [3].

Focusing on the future, the Department plans to integrate new forms of network-based communication, that is, community homepages preferred and frequently used by the new generation, such as, e.g., facebook, Hi5, Twitter. These can offer opportunities for fast and wide information provision for the students, furthermore by means of such a channel they like using. This way they learn in an informal way without it seeming to be some sort of external motivation. The Twitter has already been integrated both into the homepage and the Moodle system as well by the Department of Technical Education.

The tools described in the paper and the students' activity help understanding the scale independent networks, by means of which we can get to know the behaviour patterns of students, which can contribute to the orientation in the field of defining future routes of educational development. Educational policy could lead to the formation of a new learning model to be adapted to the new learning environment, based on networks and taking into consideration the learners' characteristics as well. Educational institutions could adopt this model.

Our experiences and our students' opinion suggest that this new – type networked learning support is needed log the present – day student population. Its signs are to be scan in the greatest student activity and in the continuous student – teacher interaction, which had a positive impact on student performance.

A significant student attitude, learning process noticeable in higher education is the fact that students fail to use a great part of the services, such as chatting and blogging communication channels,

provided by the electronic learning environment (Moodle) to be considered as a formal system, during the learning process or measurement and evaluation, however, these services are provided. They fail to use them, although they tend to use this type of services of informal social media, such as chat module, walls daily, furthermore hourly, e.g. in case of faceboook, whose content can also relate to learning. These networked informal learning processes in most cases occur inside an open or closed group in relationship to a given course.

The tools and the student activity described in the paper help us understand the scale-independent networks, which can result in our understanding the behavioural patterns of the learners' society. This can orient us towards the future routes of educational development. By means of educational development a new learning model could be formed to be adapted in the new learning environment, based on the structure of networks and taking into consideration learners' characteristics as well.

Today the so called virtual networks, such as the Second Life or Virca 3D environment are well-known. The latter, an interactive virtual environment for collaborative manipulation of robots, is a Hungarian technological development making possible operations at a distance. (See Figures 16 and 17)

Figure 16: Virtual Second Life space of virtual course. Source: own photo

Figure 17: The 3 D space of VIRCA.
Source:
http://www.youtube.com/watch?v=aZ4ZTT0iNyE,
downloaded 04.07.2011.

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