ICTE Journal

Volume 6 2017/1

International Journal of Information and Communication Technologies in Education

editorial

articles

ICTE Journal

International Journal of Information and Communication Technologies in Education

ISSN 1805-3726

Volume 6, 2017/1 (issued on March, 31, 2017)

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ICTE Journal Has a New Look

Dear Readers,

After five years, we have decided to drastically change the look of (y)our ICTE Journal, especially the individual papers. A new template has been created which can be found on the Journal's website (https://periodicals.osu.eu/ictejournal). We hope that you will appreciate the new look, and that it will not only enhance your reading experience, but also help present your papers in the way they deserve. And since your opinion is very important to us, please do not hesitate to let us know what you think of the new design. Now let's take a closer look at the current issue.

The research of many authors is aimed at the use of basic principles of blended learning at different levels of education. In the paper "*Problems Affecting Successful Implementation of Blended Learning in Higher Education - the Teacher Perspective*", the authors describe the impact blended learning has on teachers. The paper presents the results of a quantitative study of a sample of high school teachers. The paper introduces four problematic areas teachers encounter in blended learning environments.

Not knowing the advantages of ICT that not result directly from its use prevents exploiting its full potential for educational purposes. The second paper in this issue presents the results of research on how user accounts and network drives could be used by elementary and high school students. The research was aimed at interviewing teachers and school network administrators in selected elementary and high schools.

However, ICT does much more than just help both teachers and students improve their knowledge and skills. Effective use of ICT resources is one of the ways to transform education in a dynamically developing society. ICT enables updates, repairs and modification of the characteristics of all interested parties with their resources and processes in real time. The paper "*Quality Hybrid Education Evaluation: Academic Staff Performance Assessment*" analyzes these possibilities in detail.

The factual and structural accuracy of concept maps can be automatically verified through well-known algorithms. Another important characteristic of a concept map is its cognitive efficiency. The paper "*Non-linear Forms of Knowledge Representation in Teaching and Their Evaluation According to Moody's principles of Graphical Dimensions*" is aimed at using Moody's principles for evaluating cognitive efficiency of a concept map.

The paper "*Teaching and Learning English at Grammar School supported by Mobile Touch Technologies*" describes the implementation of the iTunesU tool into English language instruction at a grammar school using Komenský's principles and Koole's FRAME model. The paper presents advantages and recommendations concerning the use of mobile touch screen devices in foreign language instruction.

The results of a study on digital skills of 532 students of the Faculty of Education of the University of Prešov are presented in the paper "*Pilot Testing of IT Skills of Preschool and Elementary Education Students by the IT Fitness Test*". The study used the 2015 IT Fitness Test to determine the level of digital skills in five domains (the Internet, safety and computer systems, collaboration tools and social networks, office tools, performing more difficult tasks).

We hope that the aforementioned papers have not only caught your attention, but will also inspire you in your future endeavors.

Tomas Javorcik

Executive Editor

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ICTE Journal

2017, **6**(1): 4–13
DOI: 10.1515/ijicte-2017-0001

PROBLEMS AFFECTING SUCCESSFUL IMPLEMENTATION OF BLENDED LEARNING IN HIGHER EDUCATION - THE TEACHER PERSPECTIVE

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ABSTRACT

An increased use of blended learning environments in higher education has been an emerging trend in the 21st century. Sometimes the definition of blended learning has been so broad that it makes it hard to find any learning environment in higher education that would not be included. Many research studies have been reporting the pros and cons of blended learning from the university perspective and the learner perspective. There are less studies on the teacher view of blended learning environments. This study had the aim to explore, analyse and discuss teachers' perceived problems and barriers to a successful implementation of blended learning at university level.

The used research strategy was a qualitative cross-sectional study where data has been collected with semi-structured interviews. Six teachers that all are subject matter experts and instructional designers for courses on computer science were interviewed. In a computer assisted thematic analysis found codes and keywords was grouped together to create themes.

Four themes or problematic areas were found, and that they combined could give an explanation to what teachers experience as problems when implementing blended learning environments. First theme is documentation and support, where teachers find the scarcity of documentation in their virtual learning environment a problem for implementing extension modules. Second theme is introduction and training, where teachers find it problematic that they rarely get a proper introduction or further training on the use of tools and modules. Third theme is the time aspect, teachers suffer from the lack of time to implement blended learning thoroughly in their courses. Last found theme is didactics, where teachers do not feel that they have the required knowledge or skills to apply the appropriate instructional design for blended learning environments.

KEYWORDS

Blended learning, Virtual learning environment, Technology enhanced learning, Higher education, E-learning

1 INTRODUCTION

Blended learning in higher education is a widely discussed phenomenon that rapidly has increased in the 21st century and as pointed out by Garrison & Kanuka (2004) the adoption of blended learning approaches in higher education is an inevitable fact. From being an experimental concept in distance education courses, blended learning environments are today part of mainstream education. In a broader definition blended

learning could be described as the mix of traditional face-to-face learning and the use of technology enhanced learning tools and techniques in virtual online environments (Watson, 2008).

Technology enhanced learning is in this study seen as information and communication technology (ICT) used in educational contexts with the aim to enhance students learning and interaction. Blended learning is mainly implemented in a virtual learning environments (VLE) where the VLE in this paper is an adapted variation of the Moodle platform. The prime objective in the implementation of blended learning environments should be to create a richer learning process with motivated students by combining face-to-face sessions with according online activities (Bourne & Seaman, 2005) with a multimodal overload that could satisfy the needs for various study techniques and learning styles (Picciano, 2009).

The design of blended learning should always be based on the learning context, the specific subject and its actual learning objectives (Neumeier, 2005). Furthermore, it has been pointed out as an important factor to include student interaction in blended learning environments (Garner & Rouser, 2016), but not all blended learning courses need to require students to do group work or rely entirely on reflective activities (Picciano, 2009). Despite the ambition to combine the best parts of the two worlds the blend sometimes ends up with a mix of the worst features of the two (Bonk & Graham, 2012).

As pointed out by Chen and Yao (2016), a tendency in previous studies on blended learning has been to identify and discuss factors with a prime focus on technology. On the other hand there are several studies promoting the idea of focusing on pedagogy and learning objectives instead (Hoffman, 2006; Garrison & Vaughan, 2008; Alammary et al., 2014; McGee & Reis, 2012; Shand, Glassett-Farrelly & Costa, 2016). There are less studies on university teacher's view of the implementation of blended learning.

Problem

The described potential of blended learning have in many cases not been successfully implemented. According to a Swedish case study carried out by Garrote (2012), teachers use VLEs mainly to distribute documents, send messages and for course administration and not to enable interaction and collaboration. Previous research also indicates that teachers' perception of an online tools' ease of use is directly connected to the teachers' sensation of lack of time and lack of support to implement it (Lonn & Teasley, 2009).

Research question

The main question to answer in this study is: *Which are university teachers' perceived problems and barriers to a successful implementation of blended learning in courses on computer science?*

2 EXTENDED BACKGROUND

As highlighted in a study by Garrison & Kanuka (2004) the implementation of blended learning in higher education is inevitable and a global shift involving most regions in the world (Raphael & Mtebe, 2016; Mozelius, 2014; Fleming, Becker & Newton, 2017). With the constant hype of blended learning in the 21st century hype in the 21st century the definition has sometimes been so wide that it makes it hard to find any learning system in higher education that is not included (Graham, 2006). The straightforward one-dimension broadly definition could be as described by Watson (2008), "The convergence of online and face-to-face Education". A for this study more interesting definition is the one depicted in the multimodal conceptual model by Picciano (2009) that is depicted below.

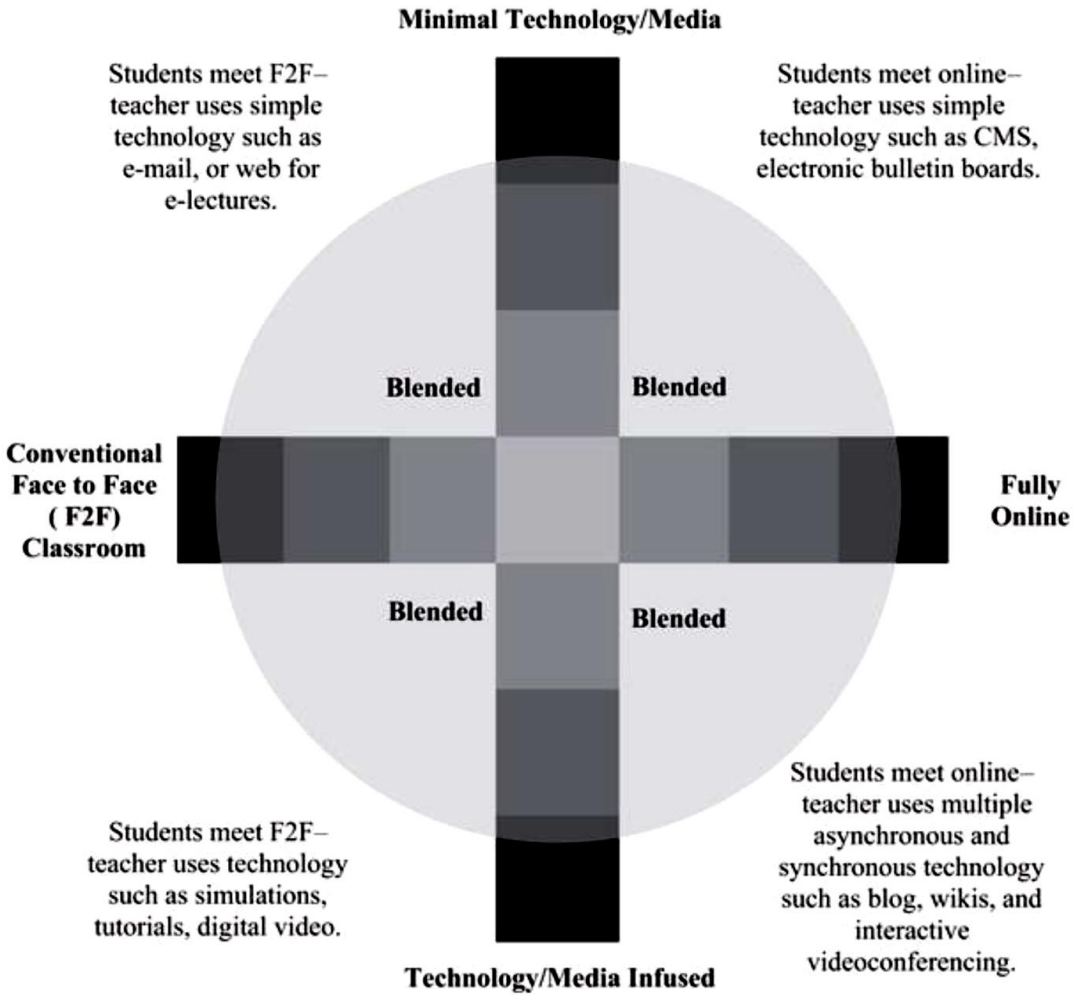

Figure 1 Picciano's multimodal conceptual blended learning model

One of Picciano's multimodal concepts is the idea of a high degree of media infusion has the potential to meet different needs and different learning styles in today's heterogeneous student groups. Other research studies indicate that students tend to be more socially engaged if the virtual learning environments involves dynamic and interactive media formats. Techniques to use could be discussions fora, facilitating interaction and resources in forms of graphics and audio or video files. (Kim, Kwon & Cho, 2011) Another promising interactive blend is to use the motivational effect of game-based learning which also is possible to implement as collaborative learning with student interaction (Babu et al., 2016).

Trends or hypes

Like most other phenomena blended learning has its trend and hypes. One trend that makes sense is when blended learning, that originally was started to enhance traditional learning, today is used to balance pure online distance learning with face-to-face activities (Garner & Rouser, 2016). Two other hyped trends today are the Massive Open Online Courses (MOOCs) and the well-discussed concept of 'The Flipped Classroom'.

MOOCs that initially, when the concept was launched, were praised have later been criticised for the focus on reducing costs for mass education (Waldrop, 2014), and also for high drop-out rates and poor learning outcomes (Holland, 2016). A more promising concept seem to the idea of a flipped classroom (Herreid, & Schiller, 2013; Thai, De Wever, & Valcke, 2017) involving students' self-preparation before plenum activities. The concept shows many of the problems earlier seen in instructional methods that depend on

students preparing outside of ordinary class (Herreid, & Schiller, 2013), but the majority of blended learning researchers seem to view the flipped classroom as a strategy worth implementing (Slomanson, 2014).

Blended learning perspectives

Like in many fields successful outcomes can be achieved with multi-stakeholder approach with benefits for all involved stakeholders. This study is based on the teachers' perspective, but there are at least two other important perspectives.

1. The University perspective

There exist multiple reasons for universities to involve and invest in blended learning. Firstly, the potential for pedagogical variety and technology enhanced didactics combined with the increased access to knowledge, anytime and anywhere. Secondly, important reasons like cost effectiveness and the ease of revision must be mentioned as well (Graham, 2006). Finally, another reason is to open up for lifelong learning and that older students tend to enjoy the flexibility of asynchronous online activities (So & Brush, 2008).

Furthermore, one of the most obvious advantages of technology enhanced learning is that courses' enrolment, administration, delivery and assessment all could be automated and put online. A fact that practically removes the upper limits of student enrolment in online education (Holland, 2016). To be compared with the student perspective where increased social presence and learner satisfaction are important (Garner & Rouser, 2016).

2. The Learner perspective

Blended learning education must live up to the same standards as traditional educational settings, otherwise it is not an interesting alternative for most learners. Updated high quality course content is always essential for the learning outcomes (Lin & Wang, 2012) and the same goes for the quality of the virtual learning environment (Lin & Wang, 2012; Al-Busaidi, 2012).

Furthermore blended learning must not only be about the distribution of course content or learning activities (Graham, 2006), there should also be a concern about including students' social and emotional needs (Picciano, 2009). Finally, the recommendation is to keep a learner centred design (Watson, 2008), and to care about learner needs such as discussions, collaboration and emotional support (So & Brush, 2008).

3 METHODOLOGY, DATA COLLECTION AND ANALYSIS

This study has been conducted as a qualitative cross-sectional study with data collected from a representative subset of university teachers at a specific point in time. A pointed out problem with cross-sectional studies is that they are snapshots where the inquiry may provide differing results if another time-frame had been chosen (Levin, 2006). An advantage with cross sectional studies are useful at identifying associations that later can be followed-up and more thoroughly studied (Mann, 2003). The vast majority of cross-sectional studies have a quantitative design with a use of structured interview and questionnaire research, while studies on the qualitative side tend to use semi-structured interview (Bryman, 2006).

Given the goals and logic of the qualitative approach, purposive sampling is often the employed strategy to enhance understandings of selected individuals or groups' experiences. To accomplish the research goals, a purposive sampling strategy should build on a selection of individuals or groups that provide the greatest insight into the research question (Devers, & Frankel, 2000). For this study six university teachers that all are subject matter experts and instructional designers for courses on computer science were interviewed during 2016. They all work at a department for computer and systems sciences and data was collected by recording semi-structured interviews.

Recorded interviews were transcribed and analysed thematically. The first part of the analysis was carried out with help of the computer-assisted qualitative data analysis software (CAQDAS) tool NVivo. A CAQDAS tool facilitates the identification of keywords and patterns in unstructured qualitative data (QSR

International, 2016). The output from the CAQDAS tool was also further analysed manually before the presentation and discussion in the following chapter 4.

4 FINDINGS AND DISCUSSIONS

Interviewees' earlier experience and usage of blended learning environments show large variations which can be illustrated by the answers to the following three questions:

Question 1: What is your earlier experience of blended learning?

Informant 1	"Not much"
Informant 2	"I have used blended learning to various degrees in my courses"
Informant 3	"I have used it, but not consciously or with purpose"
Informant 4	"I use it in all my courses"
Informant 5	"Blended learning is something that I always use in my courses"
Informant 6	"Yes, I've used it a bit in my courses"

Question 2: *How do you use blended learning in your courses?*

Informant 1	"Not much, I've tried to use parts of the 'Flipped classroom' concept such as the idea of providing students recorded material before lectures. But I prefer to not record my lectures, I think it gives a worse outcome. We also use online submissions of assignments with feedback during the course"
Informant 2	"With variations in the various courses. Mostly I use the VLE for course structure and time framing, but also video recorded tutorials"
Informant 3	"I record my lectures and put all course content online"
Informant 4	"I have synchronous chat and/or asynchronous fora. Fora in the VLE are also used for supervision and facilitating sessions of student groups. Every group in a separate thread that all groups have access to"
Informant 5	"All the course content including recorded lectures is uploaded online. The major part of the teacher – student interaction is conducted in online fora."
Informant 6	"Adapted ad hoc to the course conditions. Lectures / workshops are followed up online like student postings in VLE fora. Also online surveys that that later are discussed on lectures. Mainly a primitive use"

Question 3: *What is your idea of how blended learning should be implemented?*

Informant 1	"My idea is to increase not only the student–student interaction but also the student-teacher interaction. That's when the most exciting things turn up, and without this interaction the course could be in distance mode only." "Try to find tools that supports this with high 'communication bandwidth', where video chats and F2F have the highest bandwidths'.
Informant 2	"You must always design based on the given resources. My courses are not meant to have a blended learning design. Lectures are recorded during F2F sessions which works ok. But if you should learn from the video only the demands on the recording are much higher." "The question is what is possible to have in distance mode and must be in F2F sessions. This depends also on the number of students"
Informant 3	"No idea, I think you should learn more Pedagogy and not only the technical side." "It's also very subject matter specific."
Informant 4	"My personal opinion is to keep the F2F sessions where you can read the students' faces and understand when they don't understand or when they are bored." "I think a 50-50 mix works and to use the F2F feedback

	channel that you miss online. Some teachers feel comfortable when they skip all lectures, I only take away half." There's no eye contact online"
Informant 5	"Recorded lectures, and teacher led facilitation sessions online to answer to students' questions."
Informant 6	"It depends on the course and the specific subject. Hard to generalise."

After the further analysis of all answers to all interview questions, found patterns and subthemes were grouped into four main themes:

1. Documentation and Support
2. Introduction and Training
3. The Time Aspect
4. Didactics and instructional design

Documentation and Support

The first theme is Documentation and Support, or rather the lack of documentation and support. Several informants brought up the problem that if the documentation for a certain VLE module is insufficient it gives you an insecure feeling in the implantation. "It feels hard to get an overview of what's available. If there is someone who has used this module earlier you can ask, otherwise it's hard to find out how new nodules work." (Informant 1).

If situations where there is no colleague that can explain or help out there is a risk that the module will not be installed, and sometimes modules are interdependable. "There is one thing that would need support, a grading system where the reports should be shared among teachers. We have used another module as a workaround, but that causes another problem." (Informant 4). Another teacher said that: "My wish is to get a proper introduction to the existing tools and modules. Like it is now you're supposed to know this. It's a lot of trial and error and if you're lucky you find a tutorial on the net." (Informant 6).

It has earlier been highlighted in the study by Christie & Garotte (2011) that the lack of support is a barrier to reach the full potential of the blended learning environment. Their idea of a support model is a combination of contact persons and documentation that explains both the implementation process and the advantages of using tools and extension modules. This is also aligned to the next found theme indicating the importance of introduction and training.

Introduction and Training

Another way to make teachers more familiar with tools and techniques would be to provide some training that introduces new technology. One teacher mention that: "There is a reason that I haven't implemented all the technology support I want, I haven't got any introduction on how to use them". A colleague points out that: "It's mainly stuff that I use frequently that I implement since I then know how they work" (Informant 2).

Several informants brought up the lack of training and introduction to things that they are expected to use. "What can be stressful is when you don't understand a tool properly, this can have negative consequences later in the course and generate extra workload" (Informant 6). This also brings us over to the next theme, the time aspect where one informant claims that:

"There are certainly many useful modules, but it's hard for me to estimate how long it takes to get a grip. And for that reason I sometimes skip the implementation." And the same informant adds that: "The lack of information combined with the difficult time estimation keep me away from embracing new technology".

Blended learning environments have been described as the opportunity to combine the best from traditional classroom education with technology enhanced learning (Bourne & Seaman, 2005), but without adequate introduction and training the implementation risks to be poor.

The Time Aspect

Another important factor that was found in the analysis is the time aspect. Even in cases when teachers have a strong motivation to implement new tools and techniques, the start-up time learning how to implement the actual tool or technique can be too long and a critical factor. One teacher said that "When I can't estimate the time it takes to get familiar with a tool, I hesitate" (Informant 6) and another interviewee told that "Even if I've got support with some training, the actual time for implementation is so long so it is never done" (Informant 1).

It is obvious that the time aspect matters but there are sometimes a combination of lack of time and motivation: "I haven't had the time, neither the motivation to get familiar with all parts". If the personal effort is very time consuming or if there is too few hours given for self-studies is hard to tell from the answers. However findings support the results in the study by Lonn and Teasley (2009) indicating teachers' perceived lack of time and lack of support is aligned to the implementation and use of a tool in a course. This can also be aligned to the previous theme 'Introduction and Training'.

Didactics and instructional design

A frequently cited reason for implementing blended learning is the possibility for more effective didactical practices, but the implementation has not always been successful in blended learning environments (Graham, 2008). A study by Garrison and Vaughan (2007) points out that blended learning should not only be an administrative support opening up for a higher intake, but also be a part of the instructional design. But according to the interviewed teachers this is not always easy to achieve.

In particular Informant 3 saw this as a problem: "I'm afraid to involve in this since I don't know which formats that suits which types of students. My experience is that most discussions get stuck in technical details, while I feel that it is the pedagogical situation that I can't handle." Furthermore he claims that: "I find it important to learn more about pedagogy and its practical implications" (Informant 3).

The natural follow-up question was to ask how much support and training that are provided by the department or by the university. There exist some courses but according to Informant 3: "We had mandatory courses on computer assisted teaching and learning but unfortunately they were not about what I wanted, pedagogy. They were mostly about meta-perspectives, about the future of universities and about tools for online learning. How pedagogy and instructional design affects the students were not brought up. Here I think we have a knowledge gap".

CONCLUSION

This study has been conducted at a department of computer and system sciences with a cross-sectional design for a relatively small sample. It is hard to generalise, but the answer to the research question about university teachers' perceived problems and barriers to a successful implementation of blended learning is the four found themes:

1. **Documentation and Support:** The lack of documentation and support has resulted in that certain tools and VLE modules never have been implemented.
2. **Introduction and Training:** Teachers' perception were that they have not got the appropriate introduction and training to implement blended learning successfully.
3. **The Time Aspect:** There existed a perceived time shortage hampering the implementation of blended learning tools and techniques.
4. **Didactics and instructional design:** Teachers did not feel safe and well-informed when it comes to pedagogy, didactics and instructional design for blended learning environments.

Themes can be compared with the findings in the study by Christie and Garrote (2011) where lack of time and lack of support were reported as barriers to a successful use of VLEs. The absence of training in pedagogy, didactics and instructional design has also been highlighted by Garrison and Vaughan (2008).

Finally, the recommendation is to address the described teacher problems before experimenting with trendy phenomena such as MOOCs or complex flipped classroom implementations.

FUTURE WORK

This study had a focus on teachers' perceived problems and barriers to the implementation of blended learning at one institution for computer and systems sciences. Interesting future studies would be to: a) a similar study at another department of computer and systems sciences, b) a similar study at a department in the field of humanities or c) a large scale survey targeting a multitude of departments at various universities. Another fourfold research idea would be to dig deeper with separate studies for each of the found themes.

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ICTE Journal

2017, **6**(1): 14–24
DOI: 10.1515/ijicte-2017-0002

USING LOCAL ICT SERVICES TO SUPPORT LOWER SECONDARY AND PRIMARY SCHOOL TEACHING

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ABSTRACT

The article looks at the ways lower secondary and primary school pupils and teachers make use of ICT services (particularly user accounts and network drives). The description of implemented approaches is complemented by a discussion of the factors that influence schools in their choice of a particular solution. Attention has been devoted to both the various benefits that a chosen solution has brought to teaching and the complications that have been encountered during lessons. Our research has covered a wide range of schools that use services provided by servers to a varying extent as well as schools that are not in possession of servers. In-depth, semi-structured interviews have been carried out with school network managers. Our investigation has been supported by triangulation, consisting of interviews with teachers selected from the given schools. Data gained from the interviews has been processed using open coding. The results show that despite user accounts being found to be beneficial to teaching and lesson management, not all schools have access to such a solution. As well as being able to use personal and shared network drives, this solution can make it easier for schools to monitor their pupils' Internet activity. Schools have their own specific procedures to deal with pupils that forget their login details, which could lead to lessons being disrupted. Schools that do not make use of user accounts have developed methods to overcome such a problem. It does not seem to be a lack of suitable solutions that prevents the more effective use of ICT in teaching. The problem is more likely to lie in the fact that many teachers lack knowledge of the various possibilities offered by available solutions and are often unwilling to make use of such solutions.

KEYWORDS

Teaching support, ICT services, primary school, lower secondary school, user accounts, data storage, data sharing.

1 INTRODUCTION

Information and communication technologies (ICT) used in schools are currently undergoing extensive change. Mobile devices are to replace traditional desktop classrooms (Neumajer, 2013) and some schools have become very interested in the use of cloud services.

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell, & Grance, 2011). Leipert (2013) considers the use of cloud-based tools in school practice to be very helpful indeed. The main reasons are their very good accessibility and financial savings. Pechanec (2014) adds that the user does not have to seek, install and learn a new special tool but accesses a generally available tool through the Internet and a common browser.

Chopra, Mungi & Chopra (2013) remark on the safety and security implications of using cloud tools. They claim that, in many cases, cloud computing providers can provide better security than the educational institutions can. The risks of cloud computing are that educational institutions no longer have as much control over the personal data. They must rely on the cloud computing provider to have the appropriate practices and policies to ensure that data is properly maintained, handled, used, or disclosed (Chopra, Mungi, & Chopra, 2013).

From a legal perspective, incorporating cloud computing in primary and lower secondary school teaching may prove to be problematic, as under 13's are prohibited from registering for a number of cloud services such as G Suite or DropBox (Google, 2016a; DropBox, Inc., 2015). This does not apply to the use of tools specially designated for schools. These have usually no age limit, provided specific conditions are met (Google, 2016b).

Cloud services can be useful for teaching word processing, structured data processing or graphics creation. They can also be used to support pupil collaboration, information sharing and cooperation (Leipert, 2013). García-Valcárcel, Basilotta & López (2014) consider the advantages of collaborative learning to be those related to developing transversal skills that stimulate social skills, problem solving, self-reliance, responsibility, and the capacity for reflection and initiative.

The question is whether cloud computing does actually bring new possibilities into lessons. As far as teaching with thin clients (e.g. ChromeBooks), tablets and mobile phones is concerned, cloud computing clearly extends their range of use. However, there do seem to be difficulties with connecting these mobile devices to cloud services. Nagyová (2015) draws attention to the fact that only one sixth of primary and lower secondary schools in the Moravian-Silesian region have a sufficient Internet connection and an appropriate number of wireless network access points to enable mobile devices to be used in lessons.

If lessons are based on using traditional desktop personal computers or laptops, cloud computing is more of an alternative to locally installed software and data sharing via a local network. This approach does not usually allow data to be accessed outside the particular local network. However, data accessibility is not dependent on the quality of the school's Internet connection, discussed above.

Nagyová (2015) claims that the potential of local computer networks is not fully exploited at primary and lower secondary schools. Her findings reveal that only a quarter of those schools have individual user accounts for every teacher and student.

Studies by Klubal (2015) have found that while almost all of the surveyed lower secondary and high school teachers use ICT to prepare lessons, only a quarter of them have ever used cloud computing services (e.g. G Suite, Microsoft Office Online) to do so. File hosting services (e.g. DropBox, OneDrive) are used to store some of the teaching materials by around two fifths of teachers (Klubal, 2015). Teachers most often pass on their materials to pupils via email or in printed format (both types used by more than half of the teachers). For sharing teaching materials, around a fifth of the teachers use file hosting services and around an eighth of them publish their materials via learning management systems (e.g. Moodle) (Klubal, 2015). It is still uncommon for Czech lower secondary schools to use learning management systems for their teaching – only 1 in 30 pupils aged 15 have ever attended an online course (OECD, 2014).

Motivation and Aim of the research

The above stated findings lead us to believe that the use of cloud computing and learning management systems in primary and lower secondary school teaching is not fully developed in the Czech Republic. Therefore, we are of the opinion that it is currently impossible to carry out an in-depth study into the impact of these technologies on teaching. On the other hand, the use of a school computer network is understood as a traditional and exploited way to support teaching. However, a number of schools make only marginal use of local ICT services. For that reason, we have decided to chart how these services are used in schools to support teaching.

The aim of the research is to chart ICT services available at schools to support teaching, the way they are used in lessons and the benefits and drawbacks they bring.

2 METHODS

Our research was designed and carried out as qualitative. This approach was chosen because it was intended to find schools with greatly differing approaches to ICT and to chart in detail the widest possible range of strategies implemented by these schools in the issue of teaching with ICT. On the contrary, it was not intended to obtain a representative sample of schools and to interpret the results statistically.

Table 1 A summary of schools included in the research. Those schools that have the same external computer manager are marked with an asterisk

School No.	Number of pupils	Town size (number of inhabitants)	Number of computer labs	Type of school internet connection	Server ownership / Use of domain user accounts	Number of subjects (other than ICT) in which computer labs are used
1	890	93500	2	Optical fiber	Yes / Yes	Many
2	730	93500	3	Optical fiber	Yes / No	Many
3	650	16100	2	Optical fiber	Yes / Yes	Many
4	610	50700	2	Optical fiber	Yes / Yes	All
5*	569	5800	2	Optical fiber	Yes / Yes	Majority
6	550	93500	2	Optical fiber	Yes / Yes	Majority
7	400	3100	2	Municipal Wi-Fi	No / No	Some
8*	357	5500	2	Optical fiber	Yes / Yes	Some
9	350	16100	2	Optical fiber	Yes / Yes	Minimum
10	180	850	1	4Mbit ADSL	No / No	Some
11	140	1060	1	Municipal Wi-Fi	Yes / Yes	Minimum
12*	110	1830	1	Municipal Wi-Fi	Yes / Yes	Many
13*	40	760	1	Municipal Wi-Fi	No / No	Some

Participants chosen for the research were people in charge of computer networks at primary and lower secondary schools, particularly ICT coordinators and internal and external computer network managers. The research involved questioning participants from 13 various schools. These were chosen according to several factors. Some of them are associated with the technologies a school has available (e.g. server ownership or the use of domain user accounts) and the way they are made use of in lessons (e.g. the use of computer labs in subjects other than ICT). Other factors concern schools from a general perspective (e.g. school size or town size).

Three schools were chosen as schools without their own server, varying in pupil numbers (from 40 to 400). Other schools were selected from schools with their own server. Four of them were chosen due to the fact that their computer networks are all administered by the same external manager but there are great differences in terms of each school's ICT facilities. The other schools were selected according to whether their computer labs are used in subjects other than ICT, pupil numbers (from 100 to 900) and town size (from small towns to regional centres). Table 1 provides a detailed summary of schools that were included in the research.

Data collection

Data collection involved individual meetings with each research participant. A semi-structured in-depth interview formed the basis of each meeting. The interview concerned the technical aspects of using a server and the anticipated applicability of a particular solution in teaching and its support.

The triangulation concept was incorporated into data collection (Švaříček, 2007b). One teacher was chosen from each school (mainly ICT teachers were chosen). He was questioned on the practical use of possibilities provided by a computer network in teaching and its support. So-called follow-up and confrontational questions were included in the interviews (Švaříček, 2007a), adding depth and explaining any possible difference in the description of how the computer network works provided by its manager or the chosen teacher.

Research participants were informed of the aims of the study and assured anonymity. They were subsequently requested to take part in the research and to agree to have their interview recorded on a voice recorder.

Data analysis

Analysis of acquired data was based on the open coding method. The analysed text was divided into units and these units were allocated a certain code that represents a certain type of reply and differentiates it from the others (Šeďová, 2007). Codes from the generated list were subsequently grouped into categories according to internal similarity (Strauss, & Corbin, 1999). The principle of constant comparison was included in the process of overall analysis (Šeďová, 2007). The aim of this comparison was to find differences within data sources relating to one research participant and within data concerning various participants.

3 RESULTS

Analysis of the interviews identified several categories related to local network services at primary and lower secondary schools. The most important categories are Available local ICT services to support teaching and Application of the chosen solution in teaching. The following text goes on to describe individual categories mentioned above.

Available local ICT services to support teaching

The category Available local ICT services to support teaching addresses the following issues: the kind of equipment that runs the server at primary and lower secondary schools, network services provided by school servers to support teaching and the alternatives that individual server functionalities can be replaced by. The paper will go on to describe the various approaches that schools use in each of the issues.

The kind of equipment that runs the server. There are great differences in the type of equipment schools use to run the server. While some do not have their own server at all, others run their server on a powerful desktop computer. Other schools own one or more classic servers, some of which may be virtualised: "*(...) that's actually 5 servers in a virtual environment plus 3 other servers and one more is being prepared so there are actually 9*".

Network managers at schools that do not own a server are not united in their opinion on server acquisition. While some would welcome the possibility of acquiring a server, others consider server acquisition to be an unnecessary investment: "*Not really, I don't suppose we would make use of server functionalities*" or believe in using cloud computing as an alternative to the server: "*In any case, we should be looking more towards the cloud (...), rather than mapping drives (...)*".

Network services provided by school servers. Schools use their server to run various network services. As shown in Figure 1, these services can be divided into three main groups: Tools to support teaching, School management tools and Tools for network maintenance. Schools vary in availability of particular

types of service. While a domain controller and file server are available at almost all schools, use of a RADIUS server is rather an exception.

Despite mail server and web server appearing in Figure 1, there are differences in the way schools run their email and web services. While some of them run some of these services on their own server, others make use of services provided externally: "*We have our domain on Google and we use desktop or web clients*" or "*We have the main (school) email under the Town Council's domain and the other emails are on Seznam.cz*".

A similar situation is related to the learning management system Moodle. Although only a few of the addressed schools use this tool, there are differences in the way it is deployed. While some schools run Moodle on their own server, there was also an example of a school that uses Moodle running on an external server: "*We have Moodle, which is on the City Council's network, where the City Council has given us space on their server and we have been using it for several years, about 8 years*".

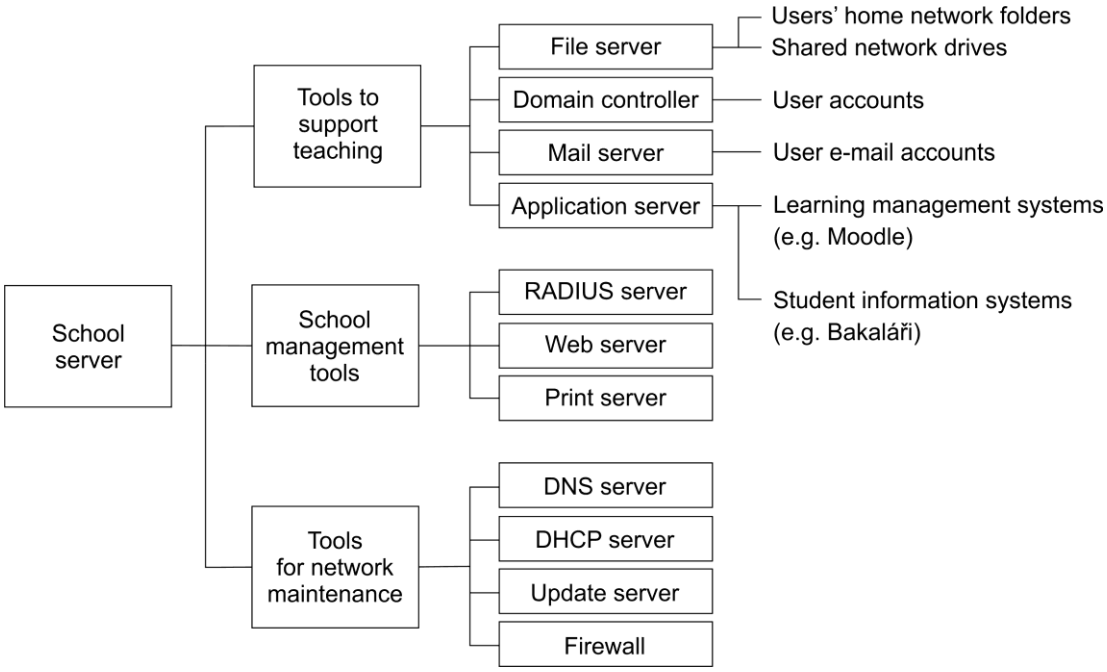

Figure 1 Network services provided by school servers. Tools to support teaching can be understood as those services that at least some schools use to teach

The following text concerns the services that have a large impact on teaching, particularly domain provision, user accounts, users' home network folders and shared network drives.

Network domain. Whether schools run network domains themselves is narrowly linked to server ownership. Almost all of the addressed schools that are in possession of a server have created their own network domain, connecting most of the school's computers. Users are divided into groups – usually Administrators, Teachers, Pupils (and possibly School management).

However, there was an example of a school that, despite owning its server, did not have its own network domain. According to this school's computer network manager, this is due to the high expertise needed by the manager of such a network and the lack of time for its management: "*This (establishing a domain and user accounts for pupils) might be a nice idea, but impossible for us due to time constraints. We used to have accounts in Active Directory but I had to reduce and cut them down because I had no time whatsoever to manage them*".

User accounts. Schools have differing policies as regards user accounts for teachers and pupils. At most of the addressed schools, each teacher and pupil has his own account on the server, which can be used to log into any of the school's computers. If a school did not want to create user accounts for every single pupil, there would be separate accounts just for teachers and all of the schoolchildren would access one account: "*Pupils have one shared account (…)*".

Schools without their own server usually have a policy where each teacher has his own local user account set up on computers he uses and all pupils using a certain computer log into a shared local account: "*Pupils do not have user accounts. They just use a local 'pupil' account on any of the computers. This means they are users without admin rights*".

User's home network folder. Schools differ in their policy of providing ICT users with home network folders (usually set as H: drive). Most schools provide their teachers and pupils with private home network folders: "*Everyone has his own folder, his H: drive, for storage and it's on the server*". However, there was also the case of a school where teachers have their private home network folders on the server but pupils can only use shared network folders.

Schools have differing policies regarding users' permission to access another user's home network folder. There are some schools where only the server administrator has such permission. At others, school management and possibly teachers have permission to access certain home network folders: "*Admin has the right to access all folders and so do teachers, except their colleagues' folders*".

User's home local folder. Schools without their own server cannot offer users a home network folder at all. In this case, users usually store their data on a computer's local drive: "*Pupils store their data on the local D: drive*". This data is not usually protected from other users who can abuse or damage it. However, this need not be a rule as there has also been the case of a school where pupils' data located in a shared work folder cannot be destroyed: "*Pupils have write-only permission. They cannot modify anything in pupils' folders. So they can't delete anything*".

Shared network drives. There were various forms of shared network drives at all schools with their own server. These drives are used primarily for users to share files with each other. However, they may be used as a space for storing school management software data (e.g. economic software) or as a place for storing educational software that does not need to be installed on computers' local drives. These drives can be divided into several categories according to the way they are expected to be used, as shown in Table 2.

Table 2 Shared network drives used in schools to support teaching

Use of drive	Teacher permission	Pupil permission	Occurrence in schools
Conveying teaching materials to pupils	For reading and writing	For reading	Common
Pupils' collaborative work	For reading and writing	For reading and writing	Common
Storing educational software	For reading	For reading	Less common
Cooperation and data exchange among teachers	For reading and writing	No	Less common
Handing in pupils' assignments	For reading and writing	For writing	Uncommon

Schools without their own server have varying policies as regards sharing user data. While some schools at least allow users to use shared folders, others do not permit sharing at all in their network: "*So far everything has been offline and they all carried memory sticks with them. (…) They can't share anywhere, not even teachers*".

Application of the chosen solution in teaching

The category named Application of the chosen solution in teaching investigates the impact various decisions about network infrastructure and available services have on teaching and examines how teaching can benefit from particular choices. There is also a discussion on its drawbacks and possible measure taken by schools to deal with these drawbacks. The paper will go on to describe schools' various experience of using such approaches.

The main advantage of having separate user accounts on a server is the possibility for the user to access identical school network facilities from different places. Users appreciate being able to access their data stored in the home network folder and work with it on any computer in the school: "*It doesn't matter which class I'm teaching in, and I always have my presentations in one place and I don't have to think about which flash drive I saved it on*". From a network manager's point of view, there is a secondary benefit of storing data in a users' home network folder - lower risk of hardware damage due to frequent equipment switching: "*We wanted to put a stop to teachers carrying hardware into lessons and possibly damaging connectors. They switched it from PC to notebook and it suddenly stopped working*".

The risk of separate user accounts. Schools where teachers and pupils do not have their own user accounts are concerned that users would forget passwords if separate user accounts were introduced: "*The main problem is that pupils are unable to remember their email password, let alone remember the password for their school PC account*". Schools using separate user accounts seldom report experiencing this problem: "*It doesn't happen very often, perhaps two people a year, so that's okay*".

If a user forgets his password, it is usually reset by the network manager or ICT coordinator. As this cannot be done immediately, the pupil concerned will probably not be able to fully participate in the lesson. For that reason, some schools have developed specific resources to minimalize such disruption. These include a universal account which would enable a pupil to log into the network, if necessary: "*A user is set up (on the server), which every pupil can access*" or lists of pupil passwords made available to teachers: "*I have all the passwords printed out and teachers have their pupils' passwords too*". Pupils themselves try to cope with (or cover up) having forgotten their user password by asking their classmate to let them use his user account to log into the network: "*They use one account (their friend's) so they don't have to admit to having forgotten their password*".

The risks of shared user accounts, which a certain group of users share (usually all of the school's pupils), primarily concern security. One user's data can be damaged or destroyed (intentionally or unintentionally) by another user: "*(…) anyone can come and delete it (some data) because they all log into one account and have the same permissions for all files*". Schools try to prevent this primarily through appropriate pupil guidance and efforts to promote a responsible approach to data backup: "*I teach them to back up on cloud (…) and I say: »Haven't you backed it up on Google Apps? You can't expect it to wait for you here for a week«*". Teachers usually recommend USB flash drives or file hosting services as a suitable storage location: "*Now we have started to use Google Apps, where pupils have their own online storage space*".

Apart from that, schools using shared user accounts try to encourage pupils to act considerately: "*Pupils have their own folder and nobody else is allowed to enter it. They are led to respect their schoolmates' privacy*". This approach seems to be relatively effective. None of the addressed managers of school networks configured in such a way has experienced pupils damaging each other's data or signing into one another's accounts to access particular online services.

There is the certain complication of users' data being stored only locally on the drive of the computer they have been using. For users to be able to access their previous data, they have to work on that particular

computer. As far as pupils are concerned, seating arrangements must be strictly adhered to: "*The problem is that they have to sit in the same place every time, otherwise they don't have the data from the previous lesson*".

The benefits of shared user accounts have not been recorded in an explicit way. However, they may be deemed to be pupils adopting good data backup habits and respecting others' privacy (as described above).

To transfer study materials to pupils, teachers can use shared network drives, where they have read/write permission and their pupils only read permission. Schools use this type of drive in different ways. While being used only on occasional basis at some schools, others find them almost essential: "*Of course I use them and not only for ICT lessons. There are other subjects where we might need to store animations, images, videos and so on. And the easiest way is to upload it to the server*". Teachers cite speed and convenience as an advantage (see previous citation) but one of the drawbacks is that data is only accessible within the school network perimeter.

Some teachers prefer more modern solutions like file hosting services or an appropriate learning management system (e.g. Moodle). Other teachers would rather keep to more conservative solutions like using flash drives to transfer materials, sending materials via email or publishing materials on a website developed for that purpose: "*I personally have a website where I offer it (study materials) to them*". However, there is a large number of teachers who, for various reasons, do not send materials to their pupils in electronic form at all.

For collaborative pupil learning such as group projects, where pupils need to share data with each other, shared network drives with read/write permission for both teachers and pupils can be used. Some schools regularly use these drives for doing projects: "*They do collaborative projects in ICT lessons and sometimes in Czech lessons as well*". But others do not: "*They can use this shared drive but I don't think anyone uses it*". If a school had no such shared drive available, they could use cloud computing services as an alternative: "*Up until now, they've all being working on their own project but when they need to collaborate, they'll work on Google Apps*".

Shared network drives can be used for **teachers to share data with each other**, where they have read/write permission and their pupils do not have any permission: "*We have an R drive called a database, where (…) teaching materials, presentations, written exams, tests, etc. are stored*". However, some teachers prefer to use flash drives: "*Primary teachers have flash drives where they keep their lesson preparations. They share their files on it and then they hang the flash drive up on the notice board in the staffroom*".

Learning management systems are used by schools not only as a place where pupils receive study materials and hand in assignments but also as a solution to organisational matters: "*On Wednesday, there will be a project day where the pupils should go to visit various trades (…) and the pupils can sign in here (in Moodle). They sign up for various activities and we will just print out Excel lists for each of these activities*".
As suggested above, some teachers are more inclined to continue to use conservative methods of sharing data (both with pupils and other teachers) like using flash drives or communicating via e-mail, despite the availability of more effective solutions like shared network drives or learning management systems. There is a question why these more effective solutions are not being used. One reason may be that many teachers are unaware of the available solutions: "*This building is full of uninitiated users and rather than teaching them all the sharing it's easier for me to tell them (how to solve it without network drives)*" and possibly unwilling to use these possibilities.

Pupil monitoring. Schools differ in their approach to monitoring pupils' ICT work. Some schools use software to monitor pupils in real time: "*We use a program to monitor pupils in the computer room, where teachers can view pupils' screens to see what they are doing or block screens (…)*" or software tools for logging users' activity: "*(We use) GPO, which enables us to set up various permissions for all users and to view a history of what a particular user has done and how*". Other schools have maintained traditional

supervision practices in their lessons. These can be supported by emphasizing seating arrangements in order to reveal who was working on a particular computer at a certain time: "*Because we make a note of who was sitting at which computer and when, we can look at the history to find out who did what*".

Restricting access to websites. Schools have differing attitudes to restricting access to certain websites. While some schools use software tools to block particular websites: "*Pupils are not permitted to use Facebook, websites featuring inappropriate (erotic, violent, etc.) content (…)*", other schools simply tell their pupils they are not permitted to go onto such websites. If a pupil breaks such a rule, he will be talked to or reprimanded: "*If it happens, a verbal warning is issued*". There were also schools which, in more serious (or repeated) cases, denied a particular pupil access to the school computer network outside lesson time: "*We let them come in (to the computer room) during their free lessons. (…) Even though we showed him his history so he could see where he had been, he denied it. So he was banned (…)*". Pupils at schools which block certain websites make efforts to evade such measures: "*But they still use mobile data to get onto it (Facebook)*".

Schools which use software tools to restrict access to websites usually explain that such measures were taken to take pressure off teachers: "*Well, Facebook is banned but for certain practical reasons, so we don't have to keep an eye on what they're doing on it*". Schools which do not use software tools to restrict access to websites have not had to deal with pupils violating the rules so far, according to their school network managers. However, there was also one school whose ICT coordinator refused to block websites for moral reasons: "*We try to explain the risks to pupils and if a porn site appears, there's nothing we can do about that. It's essential to explain that it's not something they should be doing at school and discuss the risk that's involved. But for me to ban something here, that's not the right way*".

Conclusion

Our research was carried out to investigate the use of local ICT services to support primary and lower secondary school teaching. Our aim was to find schools with very different approaches to teaching with ICT and to chart the widest possible range of strategies implemented by schools in this issue. We did in-depth semi-structured interviews with school computer network managers and with a number of teachers chosen from a particular school. Data obtained from the interviews was processed by open coding.

Our findings indicate that schools are mostly satisfied with the solutions they have applied. This is also true of schools that do not have their own server and cannot provide their pupils with standard network services. Schools using a server and separate user accounts on this server particularly appreciate users' easy access to data in the home network folder and the possibility to share data via the school network. In schools without a server, the advantage of shared user accounts may be the fact that pupils learn to adopt good data backup habits and respect others' privacy. If a school feels the solutions it has applied might have a negative impact on teaching, it takes measures to overcome such a problem. In schools that use separate user accounts on a server, this might be pupils forgetting their login details. As a solution, these schools make lists of pupil passwords available to teachers or enable pupils to login via universal accounts. The risk of data loss in schools with shared user accounts is eliminated by teaching pupils to back up data and by using special permissions settings in shared folders. Problems associated with data sharing are overcome by using portable drives and cloud computing services.

It could be said that teachers are able to teach relatively effectively when using current ICT technologies. Perhaps it is not the unavailability of appropriate solutions that prevents ICT from being used more effectively in teaching. As suggested by our study, the reason for this could be the fact that a number of teachers are unaware of the available solutions and possibly unwilling to use these possibilities. For that reason, we may be led to consider that not even the gradual arrival of cloud computing, which could make teaching much more effective, will significantly change this state and that these new technologies will only be used by teachers who are interested in them. This state is relatively well documented by the following citation: "*Each of the pupils has his own Google account and I use Google Sites to share learning materials. Nevertheless, I'm the only one who does that with them and nobody else bothers about it because nobody*

else actually knows how to use it". For that reason, it may be appropriate for future studies to focus on what kind of guidance teachers need to encourage the use of new technologies such as cloud computing or learning management systems in support of their teaching.

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ICTE Journal

2017, **6**(1): 25–34
DOI: 10.1515/ijicte-2017-0003

QUALITY HYBRID EDUCATION EVALUATION: ACADEMIC STAFF PERFORMANCE ASSESSMENT (CASES: BORYS GRINCHENKO KYIV UNIVERSITY AND THE UNIVERSITY OF SILESIA)

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ABSTRACT

The process of adjusting transformation of education to dynamics of civilization development requires from systems of education to respond to constant corrections from all the stakeholders, agents and processes to upgrade its elements and parameters, which can be facilitated by real-time feedbacks at all levels of systems. Studying quality education in the context of the goals that the mankind has been setting for its sustainable development helps realize the changes in the attributes of educational system and subsystem elements, given quality of education reflects a level of disorder providing objective data on interactions of system elements and their discord with normative goals forecast for certain educational systems. The paper analyzes hybrid education as a form of education which is being determined by transformation of educational systems under applying ICTs for educational processes and by external factors connected with determining sustainable development and with hybridization of environment, which requires new instruments for quality assessment that are currently being under development.

KEYWORDS

Hybrid education; e-Environment; e-portfolio; academic staff quality assessment; ICTs.

1 INTRODUCTION

Quality education is a core issue due to the fact that systemic understanding of systems of education and educational systems as open social systems triggered a more profound scientific interest in doing research on their internal and external communication processes, as well as environments in which the abovementioned systems undergo certain organizational phenomena – emerging, forming, developing, transforming, etc. The process of adjusting transformation of education to dynamics of civilization development, namely a shift from getting qualifications in the first part of life to lifelong acquiring of new knowledge, skills and competences, is one of the key quality education characteristics. The transformation requires systems of education to be responsive to constant corrections from all the stakeholders, agents and processes to upgrade its elements and parameters, which can be facilitated by real-time feedbacks at all levels of systems. Moreover, being an open platform for organized and disorganized human activities, relations, communication and interaction, educational systems are multivariable systems that integrate the

complex dynamics of living into human conscience to let people realize themselves as personalities and social agents.

2 PROBLEM STATEMENT

Hybrid education is a form of education which is being determined by transformation of educational systems under applying ICTs for educational processes and by external factors connected with determining sustainable development as the main goal for the mankind, as well as with hybridization of environment, where e-Environment has been turned from artificially created environment into a constituent part of environment that serves as a platform for saving scarce resources and optimizing resource allocation, both on the national and global levels. Hybrid education preconditions emerging new communication and interaction forms and processes among new and old elements of educational systems/systems of educations at different levels. Quality hybrid education requires new instruments for quality assessment which are currently being under development. Openness and transparency of HEI outputs, regarding inputs, is one of the indicators of quality education [Barton 2004; Morze, Buynytska, Kocharian, 2015; D'Antoni 2009]. Academic staff performance should be measured and assessed applying new requirements for being competitive under e-Environment and hybrid education. Hence, e-Environment of the University should include e-portfolio as an open decentralized constituent part containing web-pages of agents with qualitative and quantitative indicators of their academic performance. The indicators should be prioritized in accordance with objectives of HEI. The case study of Borys Grinchenko Kyiv University shows that using wiki-technology for e-portfolio to be created and filled in is one of the most efficient considering the data about academic performance of the academic staff, structural units, divisions and subdivisions, and the University to be transparent and openly accessed. The case study of the University of Silesia proves that Academic Teacher's Sheet reflects a flexibility of the process of adapting the performance assessment tools to the new requirements for quality education [Morze, 2010; Morze, Buynytska, Kocharian, 2015].

Purpose of the study is to analyze e-portfolio as a tool for quality hybrid education assessment.

Research methods applied are comparative, analyses, systematization, logics and other general research methods.

3 DISCUSSION

"E-portfolio" as a tool for academic staff quality assessment (Case Study: Borys Grinchenko Kyiv University).

Various quantitative and qualitative indicators of educational interaction in the digital space of HEI are supposed to be evaluated in order to determine a role of virtual part of the educational environment. Providing virtual educational processes in digital space is impossible without improving HEI technical information infrastructure, along with evaluating simultaneously the effectiveness of its use. In functional digital learning space all agents (students, teachers, administration) possess special profiles. Complex learning systems provide the facilities for collaboratively creation, cataloguing, publishing, editing and tracking content, for managing user's database, for student behavioural tracking. There are different approaches to the evaluation of the quality of a virtual learning environment. Formal methods analyse information system data using conventional statistical methods or utilizing the advanced data mining methods. Among relatively new, closely related, contemporary research areas are Educational Data Mining and Learning Analytics, comprising systematic harvesting of data generated during the interaction of stakeholders with the virtual learning environments [Drlik, Svec, Skalka, 2014].

It is necessary to analyse objective data describing availability of electronic resources and the way they are used, openness of environment, virtual communications activity, effectiveness of evaluation and control mechanisms in a virtual educational environment [Morze 2010]. Yet, objective data analysis of the functioning system might not contribute to the quality of educational outcomes evaluation in all cases. Considering the European standard of quality in higher education (ESG), it is possible to distinguish the main directions of university virtual environment quality assessment.

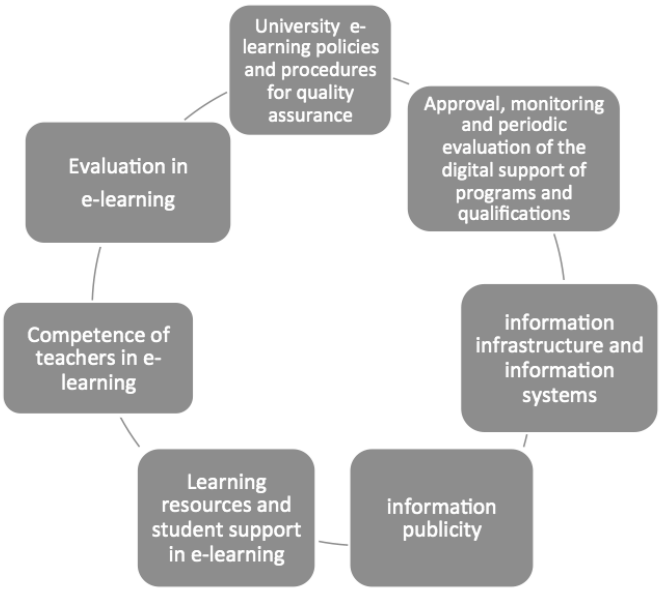

Figure 1 Direction of assessing the quality of higher education in accordance with ESG (Source: http://www.eua.be/Libraries/quality-assurance/esg_2015.pdf?sfvrsn=0)

To understand quality of such agents of educational process as academic staff of HEI, and Borys Grinchenko Kyiv University, in particular, as well as quality transformation due to the requirements and challenges of nowadays, we need to refer to the Law on Higher Education which states that quality and presence of the openness of universities are a priority. Implementing it as a legal framework for reforms in higher education, we have to develop a system of internal ratings BGKU staff – E-portfolio (http://e-portfolio.kubg.edu.ua). The system displays all the activities of scientific and pedagogical staff that affect the performance of quality assurance of the University in line with the European standards. The relationship among the indicators of "e-portfolio" with e-Environment and quality standards of education is shown in Figure 2 [Morze, Varchenko-Trotsenko, 2014].

The key indicators of the system "e-portfolio" from which an internal rating of the scientific-pedagogical staff of BGKU calculated, is scientific research activity (40%) containing profile data scientist at Google Scholar, the number of publications in international journals, monographs, textbooks, participation in international and national research projects; teaching activity (40%) - developed and certified electronic training courses, participation in international, national games and competitions; professional development (20%) - training, training, grants, scholarships, copyright, etc.

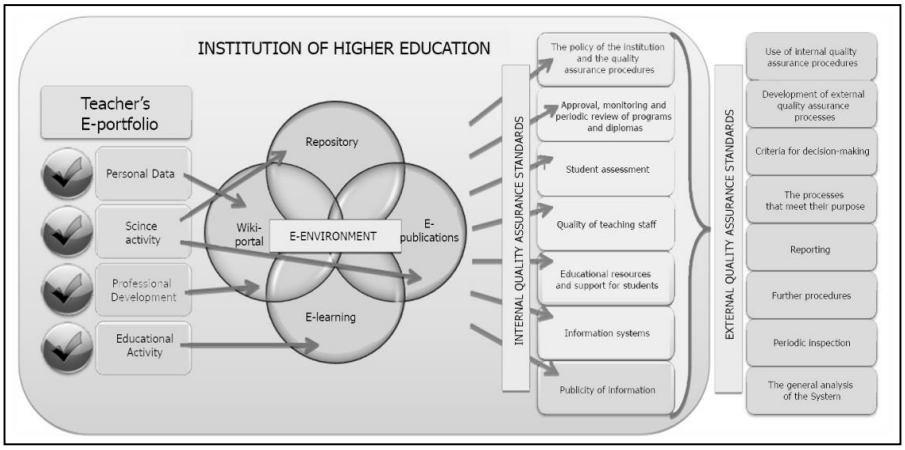

Figure 2 Relationship between e-portfolio, e-Environment and quality standards of education (Source: Morze, Varchenko-Trotsenko 2014)

As it was approved by the Academic Council of BGKU, weighting coefficients automated system is operated counting points of each employee. The system provides the ability to update points over a period of such year. The system allows scientific-pedagogical staff to rank for institutions, units, departments, positions, academic titles, which, in our opinion, will promote competition between the scientific-pedagogical staff of BGKU and enhance all types of employees.

The main stages of the implementation of the system "e-portfolio" at BGKU are the following:

1. analysis of the international and national experience of portfolio in systems of education;
2. working out the structure for e-portfolio adopted by the Scientific Council of the University;
3. adoption of weighing coefficients;
4. survey of the academic staff about their attitude towards e-portfolio;
5. designing the system "e-portfolio" and testing it;
6. seminars for the academic staff about e-portfolio model and the instructions for filling it;
7. filling e-portfolio and consultations;
8. survey of the academic staff about conveniences/inconveniences while filling e-portfolio;
9. consultations on the structure of e-portfolio and its weighing coefficients with representatives of the structural units of BGKU;
10. modification of the structure of e-portfolio and its weighing coefficients;
11. regulations on e-portfolio.

The incentives for the implementation of the system "e-portfolio" are;

1. rating of the structural unit;
2. increasing recognition among the academic staff;
3. assessing academic staff performance and achievements.

All the members of the academic staff of BGKU have a possibility to make their offers on the structure of weighing coefficients using common tables for different groups of experts: administration, heads of departments and chairs, professors, associate professors, lecturers, tutors, etc. The regulations on e-portfolio are modified at real time mode considering the outcomes of common discussions, applying the methodology of expert evaluation.

4 FINDINGS

The use of ICTs is affecting the process of transformation of quality of education under new changing conditions of the human existence, i.e.:

- knowledge accumulation and new improved technology of its further creation, distribution and implementation as a constituent part of the economic growth and a priority objective of sustainable investments;
- redefinition of the concept of property with a further rethinking of possibilities for using intellectual property as a source of opportunities for social mobility (both vertical and horizontal);

- new understanding of the mission of education in modern conditions under which education is both the most important component of the economic growth and strategic resources of the country, the quality of which often determines its sovereignty and national defense;
- transformation of knowledge into social resources and education activity into a process of providing education services which defines quality of education as a degree of satisfaction of wants and needs of the agents with a correspondent and adequate diversification of forms and techniques of education quality management;
- egalitarian education as a key factor in overcoming the gap among the developed countries and the developing ones (quality of education is an ongoing process of development and transformation of education systems in order to make them achieve a desired ideal state in a temporal projection);
- a brand new concept of the role of government intervention into education regarding contradictions between freedom and responsibility of an individual for exercising their right to be free in a democratic society, as well as contradictions between authority and freedom during individual development considering freedom of individual development to be an axiological determinant of education;
- unlimited/limited access to information and ICTs;
- development and implementation of lifelong education;
- shifting education from the national priorities to global ones with the integration of the national systems at the global level, which makes it possible to assess quality of education applying common indicators to enable the mobility of the agents of education;
- development and implementation of distance learning, e-learning and hybrid education as one of the forms of egalitarian education;
- diversification of education functions and development including a wide range of various kinds and forms of the existing education systems' diversification (with a number of diversified education institutions); diversification of training programmes (diversified education services); technological diversification (diversified components of training processes; diversified methods and techniques of education and training, etc.);
- democracy and mass education;
- humanization and liberalization as a priority for the development of all the forms of social consciousness in the context of which the mission of education is to form fundamental principles allowing a person to solve their outlook problems, to make ethical, legal, or ideological choices, to adequately react in a socio-cultural situation;
- multicultural education to ensure harmony during the implementation of humanistic principles and ethno-cultural orientation of training process in order to secure individual, social and humanity progressive development.

IES of HEI presents (or is to present) an adaptation model of the global and national informative spaces and inherits its most prominent functional properties: in the communicative aspect, IES is presented as the space of common teaching activity on the ICT basis, in the integrative aspect, it is assumed as realization

of common actions via installation of the corresponding rules and the adoption of normative documents, i.e. the space can be formed and developed only in accordance with the goals and the tasks of the abovementioned spaces, regarding the normative base of informational policy at the international and national levels, the condition and the perspectives of development of the informational interaction means, the features of teaching realization in educational institution [Bykov 2008, Izvozchokov 1999]. The analysis of science-pedagogical sources has led to distinguishing the following features of such space formation:

- IES is a multicomponent pedagogical system that includes informational, technological and organizational resources;
- when forming IES, it is necessary to solve the problem of the correlation of the traditional components of educational process and ICTs;
- in the informational space, the role of teacher IC-competence increases because, namely, the professor (docent, senior teacher, assistant) decides in which quality, volume and with what purposes IES resources could be used, i.e. the teacher is the one of the most active participants of such space formation.

The open information and education e-Environment of HEI contributes to efficiency and quality of learning processes, intensification of scientific research, an increase in efficiency and effectiveness of university administration and the education system as a whole, integration of national educational information systems in the global network that facilitates access to international information resources in education, science and culture. An obligatory condition for its use and development is openness and transparency.

To ensure the quality of the educational activities of the university, it is necessary to adhere to standards and guidelines developed by the European Association for quality assurance. Key quality indicators are used in the most authoritative world rankings of universities. Analysis of world rankings and using them to implement internal rating systems makes it possible to identify weaknesses, activities to develop further and to develop strategies to improve management decisions and the intensification of structural units and employees to improve the quality of educational services at the university. Improvement of the problem of quality indicators of educational activities is a necessary condition for the development and compliance with the education policy of the university and its corporate standards.

Internal ratings system makes it possible to determine the place of a teacher, department, Institute of the University as a whole and their contribution to creating a positive vector of development activity of academic staff of the university influences the formation and development of e-environment, which is essential to ensure the quality of educational activity.

E-portfolio is a tool for academic staff performance and quality assessment, being one of the indicators of HEI quality education and quality hybrid education at the same time. It is essential for the academic staff to use that tool for self-assessment to understand their level of competitiveness on the market of educational services, as well as to realize their places in the hierarchical structure of HEI. Filling e-portfolio that is based on certain weighing coefficients bears tangible and intangible consequences. E-portfolio indicators should include those indicators that are crucial for HEI development at the real time, whereas such indicators should coincide with the ones that are used by reliable international rating systems.

Assessment based on e-portfolio should be extended to the overall assessment of quality of all agents of educational processes, including students and other stakeholders, which will give an opportunity to estimate and correlate educational systems for them to respond real time to urgent challenges the humanity could face.

5 QUALITY EDUCATION ASSESSMENT AT THE UNIVERSITY OF SILESIA USING ACADEMIC TEACHER'S SHEET.

At the University of Silesia an electronic system "Academic Teacher's Sheet" was introduced and launched (http://sojk.us.edu.pl/karta_nauczyciela/?page=main). The purpose of this system is to enable academic teachers to gather in the computer system all information regarding their professional and academic careers. Due to the amendment to the Law on Higher Education and its secondary legislation and the need to adapt the tools to the new requirements, the effective date of the Charter of the Teacher Academic was suspended until the end of the summer semester 2014/2015 by a decision of the Academic Team for Quality of Education. The "Academic Teacher's Charter" electronic system comprises several categories and items to be filled in by each academic teacher, via the teacher's personal account and profile in the system:

Education and career record

- Academic promotions
- Professional experience;
- Prizes and awards
- Results of periodic evaluations
- Comments by PKA / UKA
- Other achievements

Research activity

- Scientific publications
- Books
- Chapters of monographs
- Artistic activity
- Conferences/artistic events
- Research trips
- Research projects
- PhD students that have been successfully graduated
- Reviews of research/publication/academic promotions
- Reviews of work for print
- Reviews and discussions – review journals
- Scientific speeches/ lectures
- Patents and inventions
- Development of scientific advice
- Other scientific achievements
- Teaching activities/popularizing activities

- Teaching classes
- Successfully promoted papers
- Mentoring for students
- Reviews of work
- Development of teaching aids
- Popular science lectures and talks
- Promotional activities
- Other teaching achievements (e.g. e-learning courses)

Organizational activity

- Functions at the University
- Promotional Events
- Preparation of teaching plans
- Preparing schedules of classes
- Functions in scientific societies
- Functions in magazines and journals
- Other organizational measures

All personal data, as well as didactic, scientific and organizational achievements of the academic teachers (e-portfolio), is collected and available in USOS system. Bibliography of the publications of the academic staff of the University of Silesia is available and open on the web-site of the university library. Every year each academic teacher should submit a completed Academic Teacher's Sheet for evaluation by the Faculty Commission for Quality. Such sheets are assessed according to relevant scores reflecting the teacher's research, didactic and organisational achievements. Some other faculty and university services were described in several other publications [Smyrnova-Trybulska 2012, 2015].

CONCLUSIONS

The open information and education e-Environment of HEI contributes to efficiency and quality of learning processes, intensification of scientific research, an increase in efficiency and effectiveness of university administration and the education system as a whole, integration of national educational information systems in the global network that facilitates access to international information resources in education, science and culture. An obligatory condition for its use and development is openness and transparency.

To ensure the quality of the educational activities of the university, it is necessary to adhere to standards and guidelines developed by the European Association for quality assurance. Key quality indicators are used in the most authoritative world rankings of universities. Analysis of world rankings and using them to implement internal rating systems makes it possible to identify weaknesses, activities to develop further and to develop strategies to improve management decisions and the intensification of structural units and employees to improve the quality of educational services at the university. Improvement of the problem of quality indicators of educational activities is a necessary condition for the development and compliance with the education policy of the university and its corporate standards.

Internal ratings system makes it possible to determine the place of a teacher, department, Institute of the University as a whole and their contribution to creating a positive vector of development activity of academic staff of the university influences the formation and development of e-environment, which is essential to ensure the quality of educational activity.

The experience of the Borys Grinchenko Kyiv University shows that to ensure qualitative educational activity, a strategy and plans of the University along with section "Assurance of Quality Education" should be adopted; indicators for assurance of internal quality standards should be developed; corporate standards of a university should be developed and a qualitative open electronic informational and educational environment should be created. The experience of the University of Silesia proves that flexibility of the process of adapting the performance assessment tools to the new requirements for hybrid quality education is facilitated by ICTs used for designing, maintaining and servicing Academic Teacher's Sheet.

ACKNOWLEDGMENTS

This research study received, within the framework of the IRNet project, funding from the People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme FP7/2007-2013/ under REA grant agreement No: PIRSES-GA-2013-612536.

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ICTE Journal

2017, **6**(1): 35–43
DOI: 10.1515/ijicte-2017-0004

PILOT TESTING OF IT SKILLS OF PRESCHOOL AND ELEMENTARY EDUCATION STUDENTS BY THE IT FITNESS TEST

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ABSTRACT

The present paper reports on the testing of digital skills of students of the Faculty of Education, Univerity of Presov within their undergraduate training with the aim to estimate the level of digital skills in five defined domains. The IT Fitness test 2015 consisting of 25 items was used as the measure of the target skills. The sample comprised 532 students in bachelor and master study programs. The paper provides an interpretation of the selected research findings (mean total scores, mean scores for the given domains, discrimination power of items and domains). The results of digital skills testing point at the overall overestimation of Digital Natives Skills. With respect to the challenges brought by the educational practice itself by means of the implementation of digital technologies into pre-primary and primary education, it is necessary to modify the curricula of math- and IT-oriented subjects and include further activities allowing for the development of the lacking "Digital Skills", since these are needed not only for students' own study but also due to increasing demands related to the use of digital technologies in primary and pre-primary education.

KEYWORDS

digital natives, preschool and elementary education, digital skills, IT Fitness test.

1 INTRODUCTION

The generation of young people studying at universities has been termed by several names, Millenial Generation – for those being born between 1982-2000, coined by Howe and Strauss (1991), Net Generation – which, according to Tapscot (1997) is a generation of grown-ups surrounded by digital media, or Digital Natives – the „native speakers" of the digital language of computers and the Internet (Prensky, 2001). In the literature, one can also get across the term Y Generation – first appearing in the AdAge magazine in 1993 (Zhao and Liu, 2008), as a term to identify the generational cohort following Generation X, which just finished the university studies and gradually substituted by the Z Generation consisting of students born between the mid-1990s and 2010.

Regardless the given name, young people are generally considered to be fit working with digital technologies. However, there are also findings to the contrary. Gallardo et al (2015) claim that, following an analysis of literature and conducted studies, there is little support for the view "that digital natives are – by default – digitally competent and that these skills transfer to the academic environment. In fact, there is no evidence that they want to use these technologies for academic purposes. Despite their digital confidence and digital skills, their digital competence – the ability to assess and learn from resources – may be much lower than those of their teachers". Aberšek (2016) claims that the common opinion in digital natives' e-learning competence shows a very high opinion of their so called 'digital literacy'." His view is based on the results of a study on online learning competences, which were defined in following aspects: basic skills (computer basics, web searching basics, general navigation basics), the ability of locating information, finding a suitable website, locating the information on the website, critical evaluation of the information according to its reliability and its relevance for the science class assessment. The research involving three groups of students at age 14-18 years shows that although the Digital natives grew up in an online world and spent thousands of hours in online gaming, texting and socializing, they have limited skills in computer basics and even more limited skills in searching for the information on the Internet, navigating on web sites and evaluating the information they have found". A sociological study of Hargittai (2010) points at sociological differences in users' Web-use skills. The findings suggest that even when controlling for basic Internet access, among a group of young adults, socioeconomic status is an important predictor of how people are incorporating the Web into their everyday lives with those from more privileged backgrounds using it in more informed ways for a larger number of activities. In one of his papers, Buckingham (2006) states a rhetoric question: "Is there a digital generation?". In fact, the technological boom affects all of us, while there are differences in how distinct social and age groups use digital technologies.

Of course, there are distinctions in what adults do with technology and what young people do with it; however it is important to note that the meanings and uses of technology are so variable, that we need some quite fine distinctions in order to capture what is happening here. Based on a sample of 2096 Australian university students, Kennedy et al. (2010) identified four distinct types of technology users within the net generation age group: power users (14%), ordinary users (27%), irregular users (14%) and basic users (27%). Advanced technology users (power users) were in a minority, and the largest group of students were the basic users these students are characterized by extremely infrequent use of new and emerging technologies and less than weekly or monthly use of standard Web technologies. They are regular users of standard mobile features. The studies conducted by Jones and Hosein (2010a, 2010b) compared whether older Net Generation students (21-25 years) used technologies differently to the younger Net Generation students (≤ 20 years). The younger students used information and communication technologies (ICT) for social and leisure purposes more frequently than older students. The older students were more likely to use it for study. In relation to the present generation of students, there is a growing need for the use of the term "Digital learners" in the context of education since it offers a broader global vision of a 21st century student. The perception of this term varies among individuals as well as from the standpoint of societies, regions, countries and time (Morgan and Bullen, 2011).

Based on the above stated, it can be concluded that there is a wide array of different variables (like the age that is essential for the definition of the present generation) that need to be taken into account so that it is possible to understand students' use of digital technologies. Even though the present generation of students is since early age surrounded by technologies, it cannot be expected that young people intuitively know how to use technology and hence have no need for digital education or training.

2 PRESENT STUDY

Past experience with the undergraduate training of future teachers in primary and pre-primary education at the Faculty of Education, University of Presov indicates that the digital skills of the Digital Natives is usually being overestimated. The latest interim results of pretesting the students within the course "ICT in preschool and leisure time education" in February 2017 (students required to modify a document in a word

processing software using basic tools) point at students' lacking skills. Moreover, direct experience of lecturers employing computers or tablets in at least part of their courses (allowing for direct observation of how students work) points at the absence of skill in working with word processing software, graphics editors, presentation tools, or cloud solutions. In a recent (last year) study, the aim was to examine the use of mobile devices by the students of the faculty. For study purposes, student mostly used notebooks and mobile phones, while accessing freely available study materials on the Internet most of the time. These devices were used to find study-related information on Google+, LinkedIn, scholarly-oriented discussion groups far less frequently (Adamkovičová and Burgerová, 2016).

Due to above stated reason, there was a need to monitor students' digital skills on a regular basis and to examine their propensity to employ digital technologies for study purposes. A further incentive to carry out the testing was the fact that the graduates will be confronted with digital technologies that get integrated into educational practice and they will have to manifest not only the user skills but also competent didactic skills.

For that matter, we set out to carry out a pilot testing of students in bachelor and master study programs in 2016, yielding the following results.

3 METHOD

Participants

Testing was carried out on a total sample of 532 students with a modal age range of 19-22 years. The participants were sampled from the all the students studying at the Faculty of Education, University of Presov, by means of including all the study groups that had their math and IT courses. The final sample comprised 8 boys and 524 girls.

Procedure

Prior to testing, students were instructed in person about the testing procedure. Place and time of testing was up to the students as the expected testing time took approximately 60-120 minutes. Students solved all the test items via LMS MOODLE for which they had a unique enrolment key. They could log in also on external devices. After completion, MOODLE immediately generated a report of the result for the student as well as all the data needed for subsequent analyses. Time to complete under 30 minutes was regarded impossible; the given subjects were removed from the analyses (n = 28).

Measurement

The IT Fitness test 2015 was used to measure students' digital skills. In 2017, the test was made accessible for a public national testing following the registration on the official site eSkills.sk. The test contained 25 multiple choice items (4 to 16 possible answers) with only one answer being correct. The items of the IT Fitness test 2015 could be summed up to obtain a score of the following domains: Internet, Security and computer systems, Collaborative tools and social networks, Office tools, and Complex tasks. Each of the mentioned domains was reflected by five items. Following a consent from the IT Association Slovakia (IT AS, 2015a), we used the identical test for our testing, however, (1) it has been implemented in LMS MOODLE and (2) we used a fixed set of items so that every participant got the same questions instead of randomly sampling 25 question from a larger pool of items used for the national testing.

Results

The mean achievement score in the 25-item IT Fitness test was at M = 14.5, representing a 58.0% success rate. At the same time, the scores of the current sample had rather large variability, SD = 5.3 in raw score units (21% in in percentage units). The full distribution of scores can be seen in Figure 1. The distribution shows a moderately positive skew, z-skew = 2.7, and it has a rather platykurtic character, z-kurtosis = 3.2.

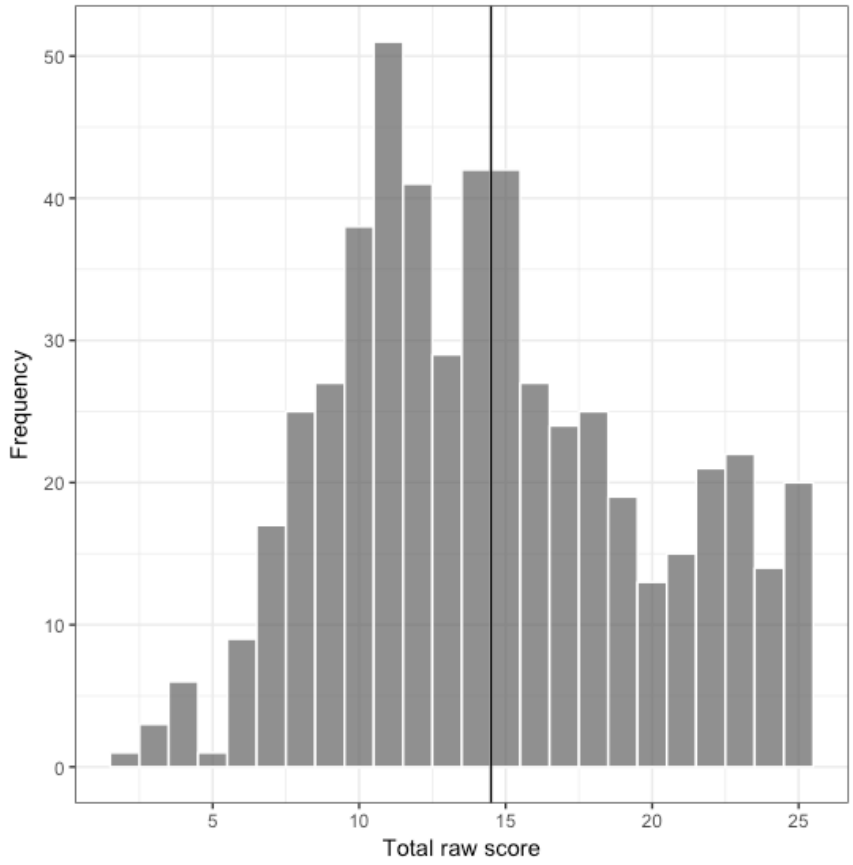

Figure 1 The distribution of scores in the IT Fitness test. Vertical line represents the mean.

The mean success rate in the current sample was significantly higher than the estimated mean of 19-22 years-old female students in the Slovak population, as the reference group (IT AS, 2015b), at 43.98%, $t(531) = 15.4$, $p < .001$. The mean difference was approximately 14 percentage points, representing a standardized difference of 0.67 standard deviations, i.e., medium effect size.

Table 1 Mean difference in overall success rates

	Test	**Statistic**	***df***	***p***	**Δ**	ES	**95% CI LB-UB**	
Success rate in %	t-test	15.37	531	< .001	14.02	0.67	56.21	59.79

Note. Δ = mean difference. *ES* = effect size in Cohen's *d* units. *CI* = confidence interval.

In comparison to the reference population of female students with mean age 19.8 years, the students of the Faculty of Education correctly solved 3.5 tasks more in average. students of the Faculty of Education correctly solved 3.5 tasks more in average. Should the estimate of the overall population mean be taken as the reference value (45.79%), the mean of the present sample is also significantly higher, given $t(531) = 13.4$, $p < .001$ for a mean difference of 12.2 percentage points and a corresponding medium effect size of $d = 0.58$.

In the national representative research, a substantial quantitative increase in overall success rate during the transition from 19th and 20th year of age was observed. In the present sample, we set out to test the relationship between the year of study and overall score. The scores increased proportionally with the year of study (from 1st to 3rd year, 56% – 62% – 65%, respectively), however the analysis of variance indicate the inability to reject the null hypothesis of equal means across the five years of study, with a negligible effect size of $\eta 2 = .03$. The data thus did not provide enough empirical evidence to back up the interpretation of proportional increase, probably due to small number of participants in 3rd to 5th year of study and rather

high variability of scores across within each year of study. Despite apparent increase, without additional data, the mean scores for distinct years of study should be formally seen as equivalent.

The test items were divided into 5 thematic domains. Figure 2 displays mean success rate in the given domains. As evident, the domain "Internet" was the relatively easiest. On the other hand, domains "Security and computer systems" and "Complex tasks" proved to be the most difficult.

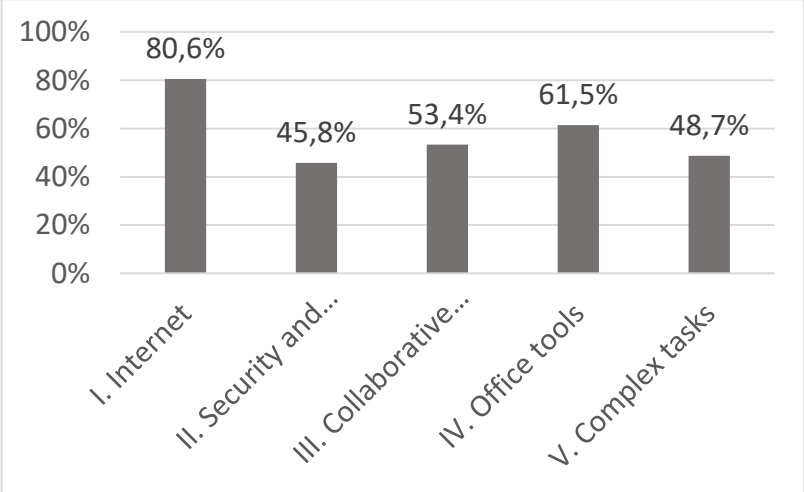

Figure 2 Success rate in individual domains

To assess the measurement properties of the given test, it was more important to look at the sensitivity parameters, i.e., the discrimination power. Sensitivity reflects the ability of the individual test items any of the sum scores to discriminate between participants having good IT knowledge (participants above the 80th percentile) and participant with a rather poor level of knowledge (those below the 20th percentile of the overall distribution). Numerical estimate of sensitivity thus reflects mean percentage difference between those two groups of participants. As shown in Figure 3, sensitivity was inversely associated with the overall success rate, i.e., domains with the relatively lowest success rate showed the highest sensitivity. On the other hand, the domain "Internet" coined from less difficult items couldn't sufficiently discriminate participants with good and those with poor knowledge of IT, since the individual items were answered correctly even by a substantial proportion of participants with poor knowledge.

Figure 3 Sensitivity in individual domains

The following two figures (Figure 4, Figure 5) show similar descriptive statistics for individual items. As can be seen, there is a large variability with respect to the difficulty of the items. While some items were answered correctly by the great majority of participants, the success rate in other items did not exceed chance level.

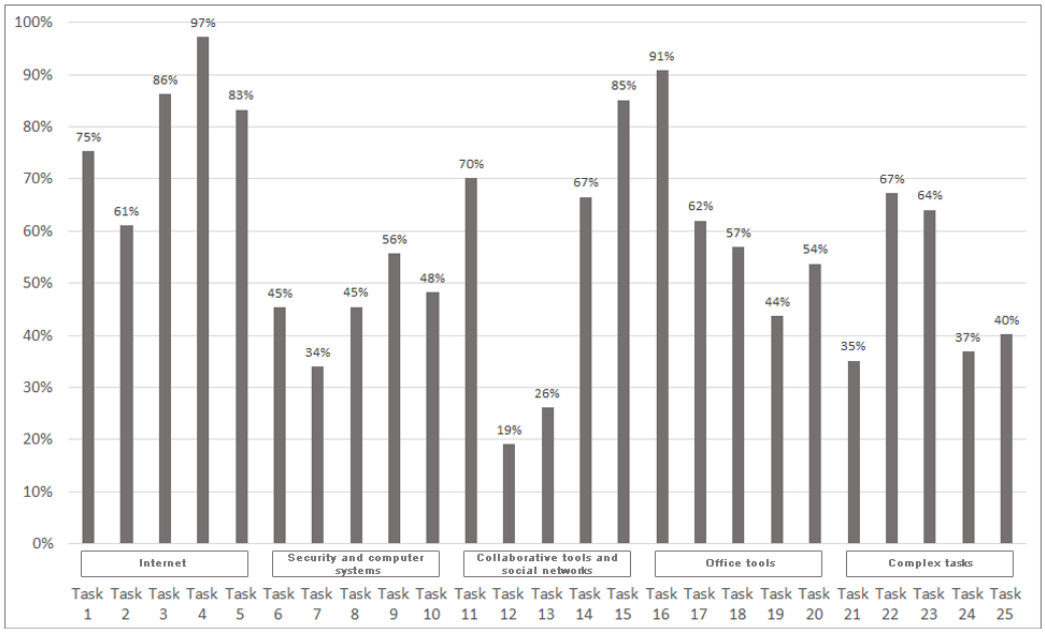

Figure 4 Success rate in individual items

The interpretation of the sensitivity parameter is similar like with the analysis of thematic domains. Observed percentages reflect the difference in success rates for groups of participants with good and poor IT knowledge. In general, the highest sensitivity can be expected in items with approximately 50% success rate. In the present study, the best discrimination power was manifested by slightly more difficult items. Most of the items, however, showed sufficient level of sensitivity (> 30%). None of the items had negative sensitivity indicating its defective functioning (situation when the "poor" participants have a higher success rate than the "good" participants).

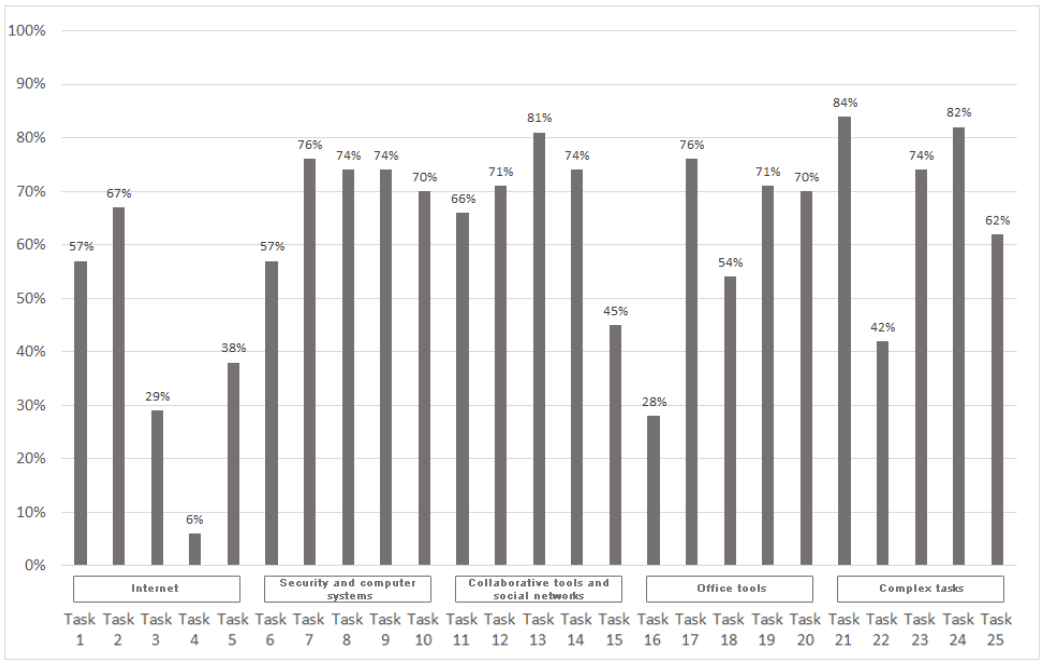

Figure 5 Sensitivity in individual items

With respect to consensual psychometric criteria (Ebel & Frisbie, 1986), it can be concluded that the test showed satisfactory discrimination power. Mean value of biserial correlation between the individual item and overall sum score was at r = .46, while values above .40 are generally regarded as good. Regarding the

reliability of the test scores, the overall sum score manifested a satisfactory internal consistency with Cronbach's α at .85. At the same time, the success rates in the given five domains generally inter-correlate positively, with polychoric correlations ranging from rpol = .38 to rpol = .57 (mean rpol = .49)

CONCLUSION

The highest success rate was observed for the domain Internet, which can be due to the frequent use of internet by university students – according to the results of national testing, searching for study-related information via search engines is one of the favorite activities among university students (IT AS, 2015b). Activities related to IT that we devote more time to, are then expected to be mastered more easily. Another possible reason for the high scores in this domain is that it comprised less difficult items. Domain with the least success rate has been shown to be Security and computer systems. Given the university students sample, it was surprising that a task related to intellectual property law yielded the lowest success rate (only 34%, the third least overall). According to Ariu at al (2014), the results of a study on Italian university students also showed deficient skills in the domain of internet security (42% of the students are not adequately aware of the risks of a free Wi-Fi, 40% of them do not protect the access to their phones and 50% of students never or rarely check permissions that the application requires before installation).

The success rate in Collaborative tools and social networks at 53,4% can be considered relatively low, given the findings of another study (Burgerová, Adamkovičová 2016) where out of 473 participants, 381 had a Google+ account, all the students used group mail accounts, and all five tasks within this domain tackled Google+ and Google Drive. The research by Šimonová and Poulová (2015), Kostolányová at al (2015) examined the use of social networks by students of tertiary education in the Czech environment. Both studies confirmed the popularity of social networking among students. According to the authors, however, the question remains as to what challenges for formal education the social networks will bring in the future.

Office tools represented by spreadsheet software showed the second highest overall success rate, however, in e.g., item 19 requiring applying a more complex formula, the success rate dropped to only 44%. Moreover, item 16 from this domain had only 28% sensitivity what is beyond acceptable. Based on testing as well as in-class experience which provides for direct observation of students' work with word processing, spreadsheet and presentation software, we lean towards the conclusion that the students are more or less capable of using these tools but fail when faced with more elaborate demands. Similarly, a study carried out on a sample of 1000 participants who had left school in the past three years, 85 percent of university graduates learned to use PowerPoint software while in school but only 39 percent reported using it at work, 88 percent learned to use spreadsheet software, but only 65 percent use it as part of their job. According to the study, "many young adults are confident in their digital skills, survey finds, but businesses are not making the most of their tech savvy" (Lomas, 2008). The Chartered Institute for IT (2017) points out that the employers regard email, word processing and spreadsheet skills necessary for most roles in the work place.

The domain Complex tasks was a combination of search tasks and other knowledge where the participants were required to carry out a series of steps to resolve the tasks. This domain was marked with the second lowest success rate indicating a long-term issue which we face in education: tasks requiring higher-order cognitive functions are usually those in which the students fail.

Based on our findings, we concur that the digital skills of the digital generation tend to be generally overestimated as shown by numerous other studies. Apart from the above mentioned, the report by the ECDL Foundation (2014) shows that in Austria, only 7% of 15-29-year-olds has very good computer skills. A German study pointed out an alarming fact that the young people are capable of everyday tasks as bookmarking a webpage, whereas less than 20% of them can apply paragraph styles in text processing documents or change a chart type in spreadsheets. Moreover, a study by Kennedy (2010) concludes that only 15% of the student population are advanced users of ICTs and 45% students were rudimentary digital technology users.

What follows is the conclusion that favorite digital lifestyle skills of digital natives such text messaging, playing games, watching videos, listening to music are arguably not sufficient for study and work purposes of the future. Digital skills needed for study and preferred by employers can be quite specific and it is necessary to systematically and understand learn them. At the same time, it is important that the students develop skills needed for complex tasks where it is necessary to link pieces of knowledge within a broader context while making use of higher-order cognitive operations (analysis, assessment, creativity) (IT AS, 2015b). The combination of the development of digital skills and higher-order cognitive functions is offered by numerous applications. One of the most helpful tools is, e.g. iPedagogy Wheel (Padagogy.cz, 2017), which – based on Bloom's taxonomy – categorizes mobile applications according to the following criteria: remembering criteria, understanding criteria, applying criteria, analyzing criteria, evaluating criteria, creating criteria.

With respect to the studied sample of participants, it is important to mention that the educational practice continuously provides for new challenges by implementing digital technologies into pre-primary and primary education. That is why it is important to implement into courses with math and IT leaning activities allowing for the development of lacking study-related Digital Skills as well as activities leading to the improvement of teachers' competences to use digital technologies in primary and pre-primary education. Of importance is also the fact that much of the acquired competences to work with digital technologies is a subject to self-study. The role of institutional education is to complement the acquired skills with systematic approach and professional development. Present students are those who will soon face a responsible role to prepare the next generation for the future which we do not know much about yet. However, what we already know is, as Ken Robinson (2017), expert on education, creativity and innovation put it, that the best way how to tackle that challenge is to foster the children in a complex way, support their creative skills and imagination so that they will be able to face the future which we may not experience, but they will.

The paper was written with the support of the KEGA 013PU-4/2015 project called Application of Cooperation and Communication Tools in E-learning Courses for the Primary Education Teachers.

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2017, **6**(1): 44–55
DOI: 10.1515/ijicte-2017-0005

NON-LINEAR FORMS OF KNOWLEDGE REPRESENTATION IN TEACHING AND THEIR EVALUATION ACCORDING TO MOODY'S PRINCIPLES OF GRAPHICAL DIMENSIONS

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ABSTRACT

At present, there are many methods how to evaluate the structure quality of concept maps; however, there is no tool which would evaluate the cognitive effectiveness of graphic notations in concept maps. One of the possibilities how to evaluate concept maps is to use the principles of graphic notation design. These principles, which were developed by Daniel Moody, are based on experience from various fields of study, such as cognitive psychology, human-computer interaction, semiotics, communication etc. This article presents the use of Moody's principles for the evaluation of the effectiveness of graphic notation in concept maps.

KEYWORDS

concept map, visual notation, cognitive effectiveness, visual representation, principles of graphic notation.

1 CONCEPT MAPPING AS A REPRESENTATION OF NON-LINEAR FORMS OF KNOWLEDGE INTERPRETATION

Concept maps are graphical structures which are becoming more and more popular in teaching. They are used for the improvement of remembering and understanding of new education content, as well as for revision or evaluation in teaching.

Concept mapping is based on the fundamentals of cognitive psychology. One of the key ideas is the Assimilation Theory by D. Ausubel (1963), who based his theory on the structuring and organisation of individual's mental field. Concept maps are well-known thanks to J. D. Novak and D. B. Gowin (Novak, Gowin, 1984), who dealt with the structuring of education content in the 1980s.

According to Novak (Novak, 2010), a concept map can be defined as a hierarchical structure of concepts and relations between them. Each concept is in relation to one or several concepts, where individual concepts can interconnect in various hierarchies. Such a connection is called vertical, or a vertical relation. In concept maps, there are also concepts in the same hierarchy and they form horizontal relations. Therefore, concept maps are generally called hierarchical. There are also other types of concept maps, such as spider

maps, chronological maps, or cyclic maps. Nonetheless, more details about these maps and their structure are beyond the scope of this article.

Concept mapping is based on the underlying assumption that students learn new concepts by searching for relations to concepts already learnt which are tightly integrated in the concept net in their brains. It is necessary for students to be able to evaluate the importance of a new concept in their minds, and then to possibly rebuild their net based on new knowledge (Keprtová, 2011).

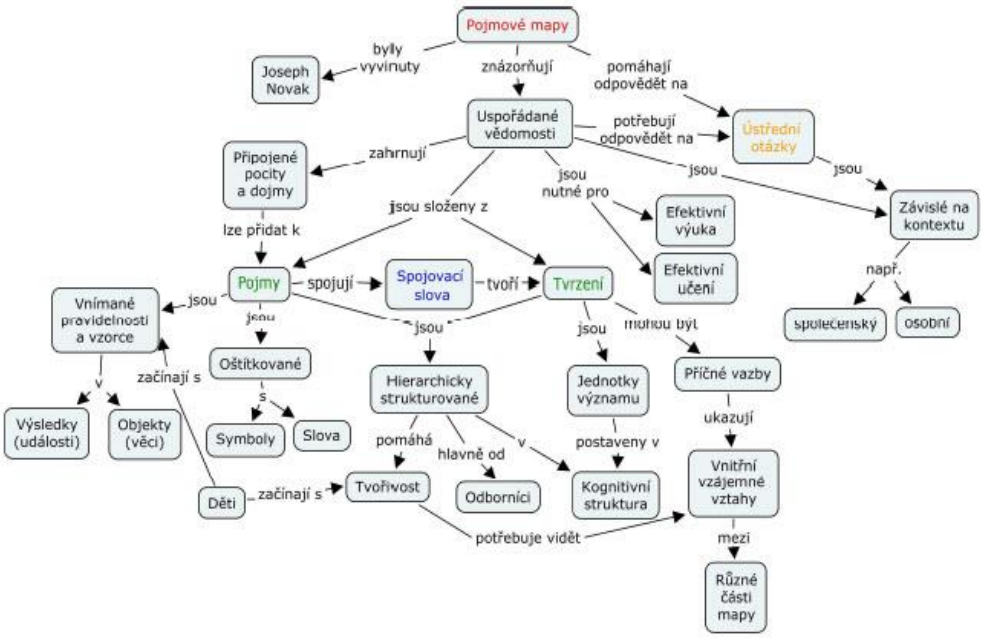

Figure 2 Hierarchical concept map (source: Keprtová, 2011)

Concept maps are a constructive tool for expressing individual thought processes, a tool for collective dealing with problems and primarily for the structuring of knowledge and concepts, which is then elaborated further.

The main advantages of concept mapping are definitely a hierarchical structuring of concepts and visualisation. Supposing that a student cannot remember education content linearly but structurally, concept mapping, as a non-linear tool for knowledge representation, is ideal. Some authors say (Vaňková, 2014) that a creation of a concept map is a creative activity and it significantly enhances thinking about a given problem. It is also important to mention that concept mapping creates connections between new pieces of knowledge and it also develops abstract learning.

Nevertheless, this kind of representation is not always an advantage. The main precondition for the effective use of concept maps is a student who prefers a visual type of learning and has creative abilities. There are also other limiting factors, such as a bad applicability of concept maps for very gifted students, for young learners, or student and teacher's inexperience with concept mapping. Lastly, it is necessary to realise that this method does not answer the basic questions such as: Why? Where? How? Under what conditions?

Concept mapping or concept maps actively increase the amount of understood and remembered knowledge. It is reported that the increase in remembered knowledge is in tens of percent, also in students who are considered as weak or mediocre (Janík, 2005). There is a provable relation between the brain, where new information is stored, and the method for increasing the capacity of remembered knowledge, i. e. concept mapping. Remembering and storage of new knowledge is managed by a cell in the brain - a neuron. A neuron consists of a cell body and a number of axons, which have the ability to create physical connections with other axons from different neurons. To put it simply, these physical connections create the basis for remembering knowledge and information in the human brain. All information is thus stored in the form of

neural connections, which form a neural network. The human brain has difficulties to remember information presented in a usual way, i. e. in the form of definitions, propositions, a sequence of words, or a linear text. In the human brain, there is a more effective way to store information - through concepts and relations between them (Janík, 2005). This will only work if mutual semantic connections between the concepts are respected. Student's brain thus has to transform the sequence of words (a linear text) into a hierarchical structure *concept → relation → concept*, i.e. a proposition of a text[1]. These propositions form a deepened propositional net through associations with already existing propositions (Eysenck, Keane, 2008). Given that students form this hierarchical structure by themselves, often without knowing individual relations between concepts or other concepts related to the given education content, remembering of knowledge is ineffective and created mental schemata can be wrong. A question is whether this process can be enhanced. It is possible to think that this structure should resemble neural networks in the human brain. Therefore, the concept map should respect and support the ability of the brain to store and understand concepts and relations between them (Janík, 2005).

2 AIM OF THE RESEARCH

The main aim of the research is to find out how to write education content into a concept map so that the graphic notation is in accordance with cognitive mental processes which take place in students' brains during learning.

For this purpose, Moody's evaluation principles of physical notation of visual programming were used and adapted for the evaluation of the cognitive effectiveness of graphic notation in concept maps.

3 MOODY'S PRINCIPLES – A POSSIBLE WAY HOW TO DEFINE PRINCIPLES FOR CONCEPT MAPPING?

One way how to evaluate concept maps is an analysis of their physical dimensions. Physical dimensions, developed by Daniel Moody, are commonly used for the evaluation of graphic notation of visual programming.

How can we create better concept maps from the graphic notation point of view? A possible solution can be to determine rules (criteria) for a physical notation of concept maps, which would respect the hierarchical structure, relations between concepts and other factors for the creation of concept maps. Opponents of this solution could argue that the uniformity and bounds (of rules) hinder creativity of an individual. However, it is important to realise that we are not dealing with the development of creativity, but we want to increase the effectiveness of a method, which should help students remember concepts and understand relations between them better.

In 2009, Moody came up with a new approach to the evaluation of the cognitive effectiveness of graphic notations in a theory called the Physics of Notations (Moody, 2009). The model of human perception and processing of graphical information is divided into two parts: perceptual processing (vision, perception) and cognitive processing (comprehension). Perceptual processes are automatic, very quick, and parallel in many cases, whereas cognitive processes occur during a conscious control of attention and are relatively slow, taxing and occur in parts.

[1]Proposition is a representation of knowledge in the long-term memory, which does not have a linguistic form of a sentence, but which represents a relation, connection between concepts (Hartl, Hartlová, 2000).

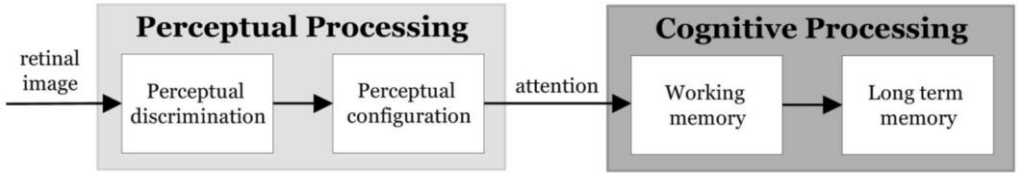

Figure 2 Maximizing cognitive effectiveness means optimizing notations for processing by the human mind (source: Moody, 2009).

This theory consists of a system of principles, which have to be followed in order to create a cognitively effective notation, see Table 1. These physical dimensions are commonly used for the evaluation of graphic notation of visual programming. The principles (nine at present) are organised in such a way that the central Principle of Semiotic Clarity is the fundamental and initial principle for further evaluation according to neighbouring principles (Figure 3). They are listed in the diagram in form of a 'honeycomb' consisting of nine hexagons. This structure was designed for an easy removal or addition of principles with regard to modifiability and expansion of principles in the future.

Table 1 The Physics of Notations theory: Principles for the design of cognitively effective visual notations (Moody, 2009).

	Název v angličtině	**Název v češtině**
1	Principle of Semiotic Clarity	Princip sémiotické čištoty
2	Principle of Perceptual Discriminability	Princip fyzické rozlišitelnosti
3	Principle of Semantic Transparency	Princip sémantické jednoznačnosti
4	Principle of Complexity Management	Princip řízení složitosti
5	Principle of Cognitive Integration	Princip kognitivní integrace
6	Principle of Visual Expressiveness	Princip visuální expressivity
7	Principle of Dual Coding	Princip duálního kódování
8	Principle of Graphic Economy	Princip ekonomie grafiky
9	Principle of Cognitive Fit	Princip kognitivní vhodnosti

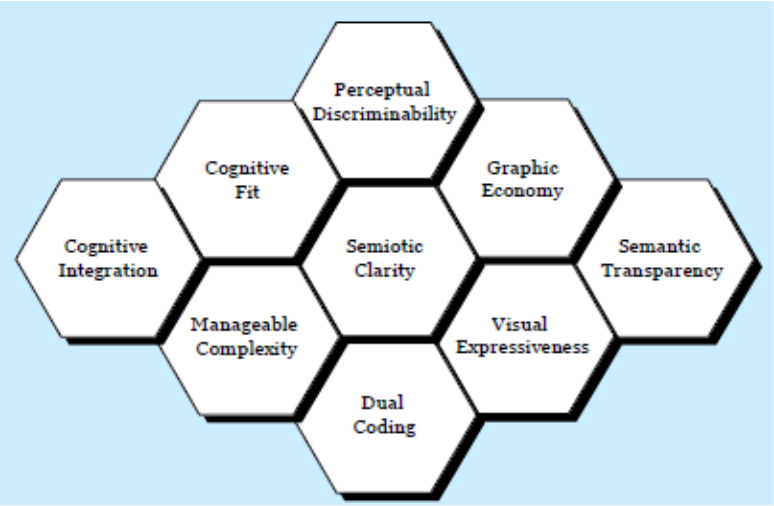

Figure 3 Principles of evaluation of graphic notations according to Moody (Moody, 2009)

4 EVALUATION OF CONCEPT MAPS USING MOODY'S PRINCIPLES

A concept map, which is dependent on so-called components, is evaluated by an evaluation mechanism. At present, two basic tools are used: structural and relational. The structural method, which emerged in the 1970s and whose author is J. D. Novak, is based on the examination of the organisation of a concept map and focuses on individual parts of the map structure. A usual structural evaluation measures the number of concepts, relations, hierarchical levels, examples and crossed relations. Authors state that this method is popular thanks to its mathematical popularity and objectivity. However, it is important to mention that it does not deal with the quality of a component as such. The evaluation of concept maps (and not only them), i. e. the use of evaluation principles according to Moody, seems to be promising. The following analysis will clarify a possible application of Moody's principles for the evaluation of graphic notation in the field of concept mapping.

Principle of Semiotic Clarity

The requirements of character systems force available language expressions to maximise their accuracy and expressiveness, which are required aims of notation designs in software engineering. The Principle of Semiotic Clarity evaluates the correspondence between a semantic element and graphic symbol of syntax at the ratio of one to one. If there is no correspondence between elements, one of the four following errors may occur in the graphic notation:

- Redundancy symbol – occurs when one element can be expressed by several graphic symbols of syntax.
- Overload symbol – occurs when several elements can be expressed by one graphic symbol of syntax.
- Excess symbol – occurs when there is no element for a graphic symbol.
- Deficit symbol – occurs when an element is not represented by any graphic symbol.

Application of this principle is better visible in concept maps in Figure 4 and Figure 5, where we can see 'overload' and 'redundancy' error.

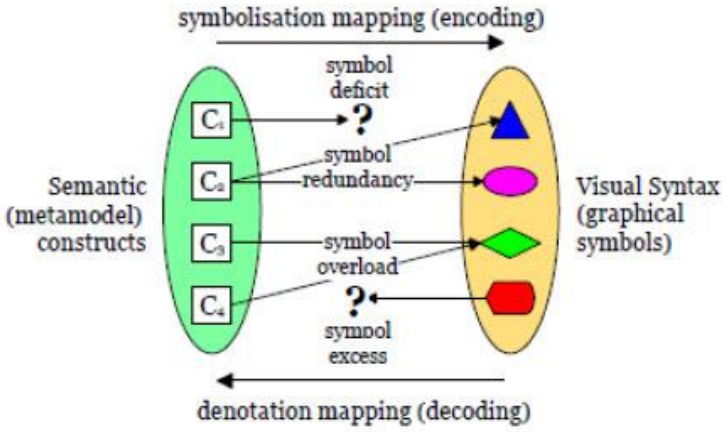

Figure 4 Principle of Semiotic Clarity (Moody, 2009)

Figure 5 'Overload' and 'redundancy' error in a concept map (source: http://1url.cz/9tNkK, modified by authors)

Principle of Perceptual Discriminability

Physical (perceptual) discriminability expresses ease and precision with which individual graphic symbols can be distinguished. This principle is related to the first phase of human perception and graphic information processing. The difference between symbols is primarily determined by a visual distance. This is measured using a number of visual variables which distinguish the symbols and also the difference between them. The bigger the visual distance between symbols, the faster and more accurate their recognition. Among the visual variables, a shape plays an interesting role in the discrimination of symbols. We also distinguish objects according to a shape in real life. The shape should be used as a primary visual variable for distinguishing between various semantic elements. Several visual variables can be used for the extension of the visual distance between symbols. For instance, a colour (apart from shape) is used to accentuate differences in ER diagrams. This method is called redundant coding. In some graphic notations, a text is used for the differentiation between symbols. They use various typographic characteristics (bold, italics, underline) to distinguish various kinds of elements (e.g. relations). This method is common but ineffective, in terms of an excessive complexity of a notation or diagrams.

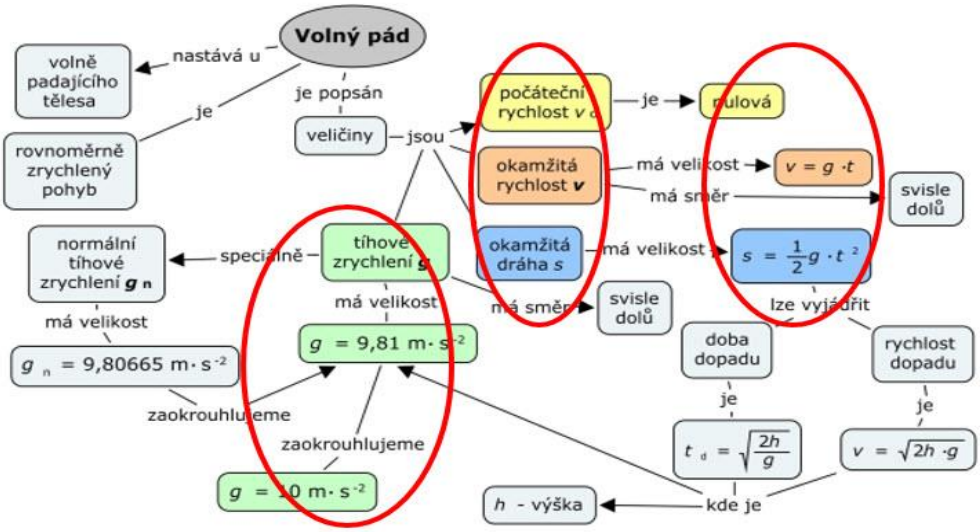

Figure 6 Error of perceptual discriminability. (source: Keprtová, 2011, modified by authors)

Principle of Semantic Transparency

While perceptual discriminability distinguishes only individual symbols, this principle evaluates whether the symbol provides evidence and signs for the derivation of its meaning. The semantic derivation is defined as an extent to which the meaning of a graphic symbol can be derived from its appearance. This principle does not only apply to graphic symbols of individual semantic elements but also to bonds and relations which exist between them.

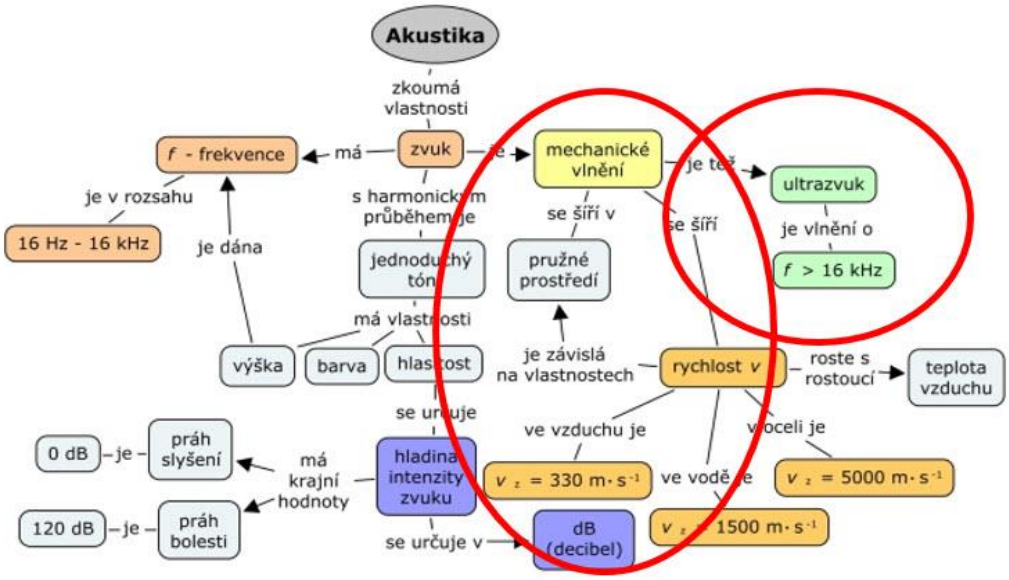

Figure 7 Errors of semantic transparency (source: Keprtová, 2011, modified by authors)

The illustration above aptly demonstrates incomprehension of this principle. Probably in good faith to point out all possible relations between them, concepts are closed cyclically and students cannot guess even intuitively where the beginning and end of a relation between concepts are. The connecting lines between relations sometimes end in an arrow and sometimes not, which can mislead the student.

Semantic transparency can be enhanced using an appropriate alignment of the diagram. However, the spatial arrangement of the diagram depends solely on its author and is very subjective (Šimoník, 2014). The author can indicate the logical hierarchical structure of the map to the student by using an appropriate

alignment. The illustration above implies certain hierarchy; nonetheless, we can ask a question how it will be perceived by students with worse spatial and visual imagination.

Principle of Complexity Management

Complexity is one of the problems which is difficult to resolve when designing graphic notations. This principle deals with the complexity of a diagram and it is given by a number of elements in the diagram. Complexity influences effectiveness in an important way because the amount of information which can be presented effectively using one diagram is limited by people's perceptual and cognitive abilities. Effective management of a diagram is particularly important for people inexperienced in software engineering, who do not have sufficient knowledge for the comprehension of diagram complexity. Excessive complexity is one of the main obstacles which end users have to overcome to comprehend diagrams (Šimoník, 2014).

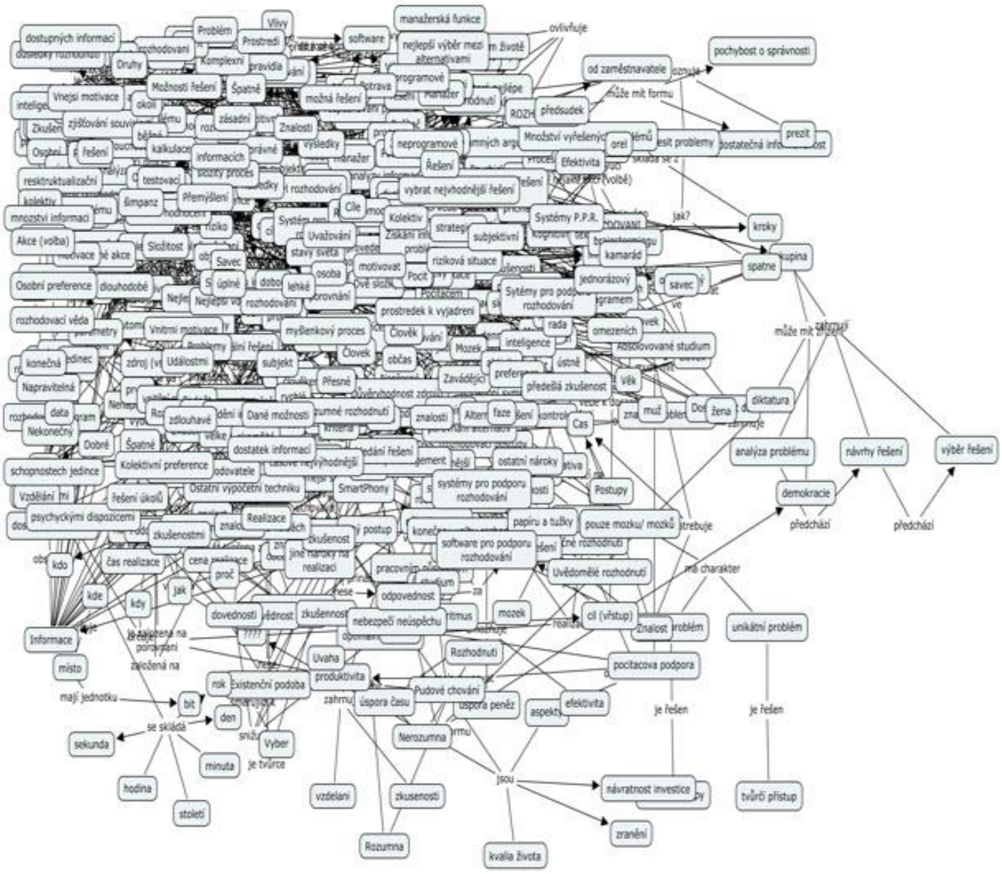

Figure 8 Error of complexity – a real concept map (source: http://1url.cz/9tNkK)

Principle of Cognitive Integration

This principle is used when several diagrams represent a system of diagrams. A representation using a system of diagrams is more frequent in software engineering than a representation using one diagram. We distinguish two types of diagram integration: homogenous (diagrams of the same type) and heterogeneous (diagrams of different types). The principle evaluates the involvement of explicit mechanisms which support and help integrate a diagram into a system of several diagrams. We believe that this principle is irrelevant when dealing with the problem of concept mapping.

Principle of Visual Expressiveness

Visual expressiveness is defined as a number of visual variables which are used in graphic notation. While visual distances, a part of perceptual discriminability, evaluate differences between two symbols, visual expressiveness evaluates differences among all symbols of graphic notation. Visual expressiveness distinguishes two groups of visual variables: variables carrying information and free variables (not

containing information). The majority of graphic notations in software engineering are one-dimensional notations, which use only one visual variable to communicate information. This variable is most often a shape, which is one of the weakest visual variables in this respect and can be only used for nominal data.

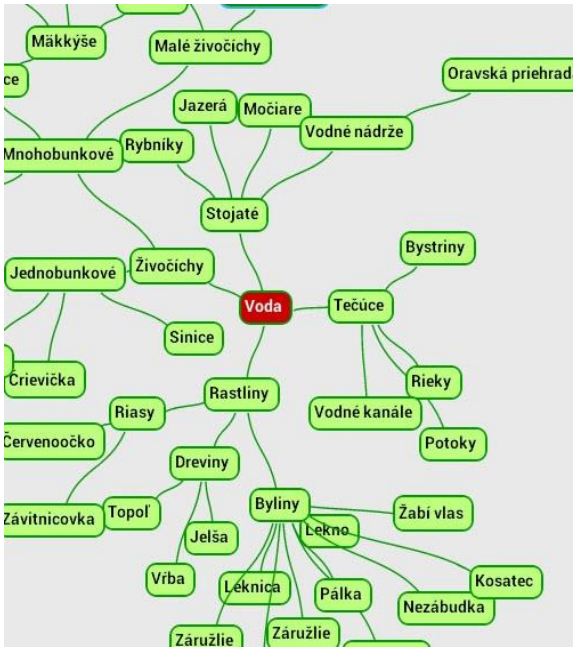

Figure 9 Error of visual expressiveness (source: http://1url.cz/ntNku)

This concept map contains one visual variable (one-dimensional graphic notation). Other visual variables were not used (shape, size). When noticing two symbols differing in size, the human mind perceives a difference between them, which then represents a difference in their importance or hierarchical position (Šimoník, 2014).

Principle of Dual Coding

The combination of a text and graphics is more effective in conveying information than when they are used separately. If the information is interpreted verbally as well as visually, these pieces of information are processed separately by the human mind, which enhances the connection between them. It is this principle that supports and evaluates dual coding, which recommends combining graphic symbols with text. Symbols which consist of a graphical and textual part are called hybrid symbols. Dual coding does not influence discriminability, and the addition of a text does not influence a visual distance either (Šimoník, 2014).

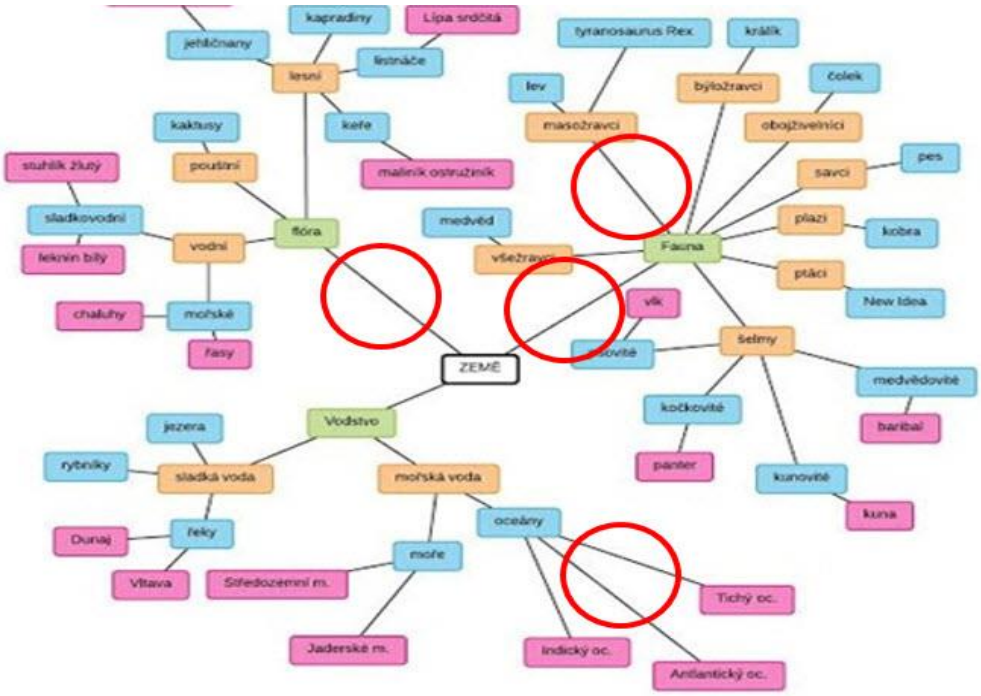

Figure 3 Error of dual coding (source: authors)

This map contains a number of above-mentioned errors. From the dual coding point of view, it is necessary to point out that graphic symbols contain textual information. In this case, the error of dual coding is considered to be the absence of a description of relations between concepts on individual connecting lines.

Principle of Graphic Economy

This principle states that the number of various graphic symbols should be cognitively 'manageable'. It determines the number of symbols in graphic notation, i.e. the size of its visual vocabulary. The more symbols a notation uses, the more complex the resulting diagrams, and they then influence users in their interpretation, especially those with less experience in the field. A human mind is able to distinguish around six perceptually different categories (Miller, 1956). This sets the upper limit for graphic complexity. Nonetheless, many graphic notations exceed the upper limit for graphic complexity. For instance, graphic notation of UML diagrams contains up to 40 different graphic symbols and is therefore very complex. On the other hand, two most frequently used graphic notations (DFD and ERD) respect this limit, and it is probably one of the reasons why these two graphic notations are used so often (Moody, 2009). We believe that this principle is not usually used in concept mapping. In most cases, one or two symbols (different categories) are used.

Principle of Cognitive Fit

The theory of cognitive fit is widely accepted in the field of information systems and has been tested in a wide range of tasks - from decision-making processes to software maintenance. This theory determines whether the method in which information is presented fits given tasks and a given group of users. The ability to solve problems, in this case finding and interpretation of information, is dependent on the way in which the information is represented, the nature and difficulty of tasks and user's skills for solving this problem. Moody recommends using more visual dialects, where each of them is suitable for different types of tasks and different users according to a current situation (Moody, 2009).

It is also necessary to mention negative features of concept mapping:

- They use declarative knowledge.
- Maps cannot be used universally.

- Maps are not beneficial for those who lack previous knowledge, those who prefer a visual type of learning, who are text-oriented, or without creative thinking.
- Maps do not support declension and conjugation when using the Czech language (Vaňková, 2014).

5 CONCLUSION

As for graphic notation, nowadays the majority of authors create their concept maps rather intuitively, without set rules or suitable methodology. In publications, there are many methodologies for the evaluation of the structure quality of concept maps; nonetheless, there is no tool which would evaluate the cognitive effectiveness of their graphic notation. Principles of graphic notation developed by Daniel Moody are commonly used for the evaluation of graphic notation of visual programming. On the basis of Moody's physical dimensions, authors demonstrated how to use these principles for the evaluation of cognitive effectiveness in concept maps.

We suppose that a methodology for the creation of effective concept maps from the point of view of cognitive effectiveness will be made on the basis of Moody's principles.

The article will attempt to show some basic aspects of graphic notation:

- The association method is beneficial in learning, but only under certain conditions.
- In large measure, concept maps are often created intuitively, without clear rules.
- According to authors, Moody's theory of graphic notation is an ideal theory for the creation of a specific methodology for creating concept maps.
- Authors and their assumptions and hypotheses will be tested in practice.

The authors tried to show that it is possible to use partially modified Moody's theory for concept mapping.

The connection of Moody's theory and concept mapping is undoubtedly a new approach in this area.

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DE GRUYTER OPEN

ICTE Journal

2017, **6**(1): 56–64
DOI: 10.1515/ijicte-2017-0006

TEACHING AND LEARNING ENGLISH AT GRAMMAR SCHOOL SUPPORTED BY MOBILE TOUCH TECHNOLOGIES

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ABSTRACT

The article deals with the implementation of iTunesU in English lessons at the secondary grammar school. The content is structured into three main parts. First, the theoretical background for the appropriate use of mobile devices is introduced reflecting the Comenius´principles and Koole´s FRAME model. Second, a strategy for practising English pronunciation is described. Third, a set of three lessons enhanced, or not, by mobile touch technology was described and learners´ feedback displayed. Finally, authors´ recommendations are provided.

KEYWORDS

iTunesU, mobile devices, mobile learning, m-learning, secondary grammar school, English

1 INTRODUCTION

Reflecting the latest trends in technical and technological development, mobile devices have become standard didactic means both in foreign language and other subjects' instruction on all levels of education. The use of wireless, mobile, portable and handheld devices is gradually increasing and diversifying across every sector of education in both the developed and developing worlds. Currently, mobile learning has been exploiting handheld computers, mobile/smart phones and other devices that work on the same set of functionalities. The use of handheld computers is obviously relatively immature in terms of both technologies and its pedagogies, but mobile-assisted learning is developing rapidly (Traxler, 2009, in Ally, 2009).

Until now traditional e-learning (using non-portable devices) has been widely implemented into education in the Czech Republic reflecting the fact mobile devices were not available to such an extent as in developed countries. Within the last two-three years the situation changed substantially and mobile learning can be applied on all levels of education, gradually moving from small-scale, short-term trials to larger, more sustained and blended deployment.

Current students, ´digital natives´, as defined by Prensky (2001), think and process information fundamentally differently from their predecessors. These differences go further and deeper than most educators are able to realize. "Different kinds of experiences lead to different brain structures and it is very likely that students' brains have physically changed and are different from their parents´ brains their

thinking patterns have changed" (Perry, Pollard, 1997). This state is rather clearly visible in daily contact with students, and, of course, it should be reflected in teaching and learning within all subjects. That is why this study focuses on the *use of mobile touch technologies in foreign language learning, particularly English at the secondary grammar school*.

2 THEORETICAL BACKGROUND

It should be admitted students´ learning behavior has changed, either we agree, or not with results by Prensky, and modern technologies, mainly mobile devices and relating learning strategies, particularly networking, have strong preference among learners, when applied in education.

In the Czech Republic, until recently the traditional e-learning using non-portable devices has been widely implemented into the education. This situation reflected the fact mobile devices, defined as very small items to accompany users anytime and anywhere, autonomous from the electrical supply (Rochelle, 2011; Liang et al., 2005), were not available to users to such extent as in developed countries. The situation changed substantially within last few years and now mobile learning can be applied on all levels of education, gradually moving from small-scale, short-term to larger more sustained and blended deployment.

Despite numerous current designs on how to teach efficiently reflecting learner´s preferences

in teaching methods, organizational forms, approaches to assessment and other closely relating matters, basic rules were defined centuries ago (in the 17th century) by a Czech scholar, philosopher and educational reformer Jan Ámos Komenský (Comenius). He was the first one who formed basic principles which have been valid for centuries. His approaches to the system of education and the entire process of instruction introduced revolutionary changes in education; his theorems even now sound (and really are) modern. Comenius formed fundamentals of didactics, disregarding which philosophical paradigm is currently trendy (cognitive science, behaviorism, and constructivism) (Comenius, 1964). His main methodological principle, the "schola ludus", which represented the edutainment approach, was the main motivator. His didactic principles cover (Comenius, 1930):

- *purposefulness*, i.e. why to reach learning objectives;
- *system approach*, i.e. structuring the learning content and process of instruction into logical system leading to methodological, systematic way of learning – ´Let everything what comes after be an objective, everything what comes before be means targeting to the objective´, Comenius stated (1967);
- learner´s activity, arising from cognitive, emotional and volitional processes and stimulating interests and motivation, leading to new knowledge application and creative approaches to all learning activities;
- *clearness*, i.e. activating as many senses as possible, i.e. using visual aids, explanatory examples, motoric training, symbols and schemas, and modern technologies these days;
- *awareness of intentional activities* within the educational process, which leads to understanding why and how to use knowledge creatively in practice;
- *retention of knowledge*, which is kept by practicing and training;
- *adequacy*, particularly in setting and pacing the learning content according to the student´s age and level, and the successiveness of all educational steps
- *emotionality*, covering warm teacher-learner communication and enthusiasm spread from the teacher to the learner and back, thus creating th positive education climate;

- *joint approval and the consensus* of the family, educational institutions and other organizations participating in the process of individual´s upbringing and instruction.

All the above mentioned principles should be kept both within the traditional and ICT-supported processes of instruction. Generally, Comenius´ ideas have been widely accepted and applied. But these days, some situations may appear, when didactic principles are not correctly applied in the process of instruction where didactic means running on the ICT or mobile technologies are applied. Important shifts have been detected in how and where the information and communication technologies were used in education within the last period. Ten years ago the computer was the only digital device in the family or on workplace, currently its role and services are taken over by other ones – smart TV, smartphones, tablets, e-readers, PDAs etc. The general education, professional and private lives are changing under the conditions of e-society and i-society. The institutional education has been the core of the education process but new current demands lead to developing new approaches despite it is often difficult to imagine future situations and requirements students should be prepared for.

For m-learning, the FRAME (Framework for the Rational Analysis of Mobile Education) model was designed by M. Koole (2009) (figure 1). Equipped with a mobile device, the learner can choose to consult a web page, access audio or video tutorials, send a query via text message to peers, or contact an expert/tutor for guidance. But, how can such a learner take full advantage of the mobile experience? How can practitioners design materials and activities appropriate for mobile access? How can mobile learning be effectively implemented in both formal and informal learning?, Koole asks. The FRAME model offers some insights into these issues as it describes a model of learning in which learners may move within different real *and* virtual locations and thereby participate and interact with other people, information, or systems – anywhere, anytime. The interaction with information is mediated through technology. Within this context, the FRAME model is represented by a Venn diagram (figure 2) in which three aspects (circles) intersect. The three circles represent the device (D), learner (L) and social aspects (S). The intersections where two circles overlap contain attributes that belong to both aspects. The attributes of the device usability (DL) and social technology (DS) intersections describe the affordances (i.e. availability, called the ownership in our research) of mobile technology (Norman 1999). The intersection labelled interaction learning (LS) contains instructional and learning theories with an emphasis on social constructivism. All three aspects overlap at the primary intersection (DLS) in the centre of the Venn diagram. Hypothetically, the primary intersection, a convergence of all three aspects, defines an ideal mobile learning situation. The model can/should be used to design a more effective mobile learning process (Koole, 2009). The FRAME model takes into consideration the technical characteristics of mobile devices as well as social and personal aspects of learning, thus referring to concepts similar to those found in psychological theories, e.g. in the Activity Theory by Kaptelinin and Nardy (2006) and especially pertaining to the work by Vygotsky (1978) on mediation and the zone of proximal development. In this model, the mobile device is an active component in equal footing to learning and social processes. This model also places more emphasis on constructivism: the word ´rational´ refers to the "belief that reason is the primary source of knowledge and that reality is constructed rather than discovered" (Smith and Ragan, 1999, 15).

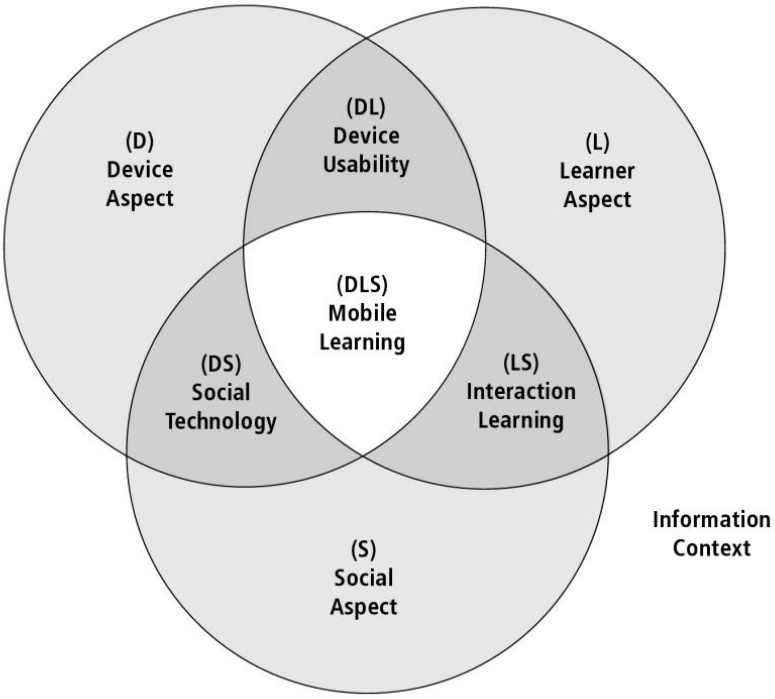

Figure 4 The FRAME Model (Koole, in Ally, 2009, 27)

Under the new conditions such competences should be developed which prepare graduates for succeeding on the labour market. The required competences are often reached with the support of latest mobile technologies which are of high interest of young people, working as a motivator towards learning. Mobile technologies supported learning (m-learning) is understood as "learning across multiple contexts, through social and content interactions, using personal electronic devices" (Crompton, 2013); it is concerned with a society on the move, particularly with the education of "… how the mobility of learners augmented by personal and public technology can contribute to the process of gaining new knowledge, skills and experience" (Sharples et al., 2014). Quinn (2014) has given a definition of M-Learning from a technical perspective stating m-Learning is a digital learning method realized through Intelligent Apparatus equipment. These Intelligent Apparatus equipment include Palms, Windows CE equipment and digital cellular phone etc. Chabra and Figueiredo (2014) have given a broader definition stating m-Learning means to be able to use the task equipment to acquire knowledge at any time and any place. Current m-learning, i.e. using mobile devices for educational purposes, is an approach how to reach the same objectives as Comenius did. Currently, the ICT-implementation in the process of instruction has become standard; online courses are currently being developed towards MOOC (Massive Open Online Course) and latest technologies, which are of high interest of young people, are being implemented in education so that m-learning was activated.

3 MOBILE TOUCH TECHNOLOGIES AT THE SECONDARY SCHOOLS

At the Wichterle Grammar School, Ostrava, tablets with iTunesU appliCation have been exploited for several years. Both the teachers and students use them within everyday instruction in various subjects, including English lessons.

From numerous services offered through this mobile device, practising English pronunciation is often supported.

As widely heard, English pronunciation skills of Czech English teachers are often of poor quality, as well as of low importance. This fact can even demotivate students (Toni Lai, 2015). The state was partly influenced by historical factors, as during the communist regime there were only limited opportunities to

have contact and learn from native speakers. Despite the generation of English teachers who studied in the last quarter of the 20 century is gradually leaving Czech schools, it will still take some time to improve the situation.

When taking a detailed insight in the Framework Educational Programme for Secondary Schools (Framework, 2007), only a little is written about expected outcomes in the field of pronunciation and the phonetic aspect of the language in the Productive Language Skills section of the Foreign Language chapter: ´learners should understood, using correct grammar, spontaneously and coherently; reproduce freely and coherently an authentic text with vocabulary and language structures characteristic of a rather demanding text which they have read or listened to´ (Framework, 2007, 16). Thus only the general terms ´coherently´ and ´in such a way that the learner is understood are used in the document ´compared to the definition of the correct use of grammar, which is mentioned explicitly: ´to receive information of a rather complex content with a good degree of comprehension and be able to convey it in such a way that he/she is understood while using grammar correctly´ (Framework, 2007, 17). This little emphasis on the development of correct pronunciation skills is reflected in the teaching process of in-service teachers and in curricula and practice of pre-service teachers. It can be stated that (1) numerous native Czech teachers of English either lack proper pronunciation and intonation skills, or they lack self-confidence in terms of this aspect of language, (2) majority of native Czech teachers of English omit teaching pronunciation skills as an integral part of language acquisition and often do not even correct pronunciation mistakes made by learners; probably from lacking the knowledge/skill with themselves. So, to minimize mistakes caused by teachers´ pronunciation imperfections mobile devices and their services can be exploited.

Choosing the proper tools

There definitely exist ICT tools suitable for teaching pronunciation. Their use, however, is mostly time consuming and it is very difficult to implement them in regular lessons. In language labs where students are equipped with headphones, they can practice speaking model sentences. However, the efficient pronunciation training requires an immediate analysis and response of any spoken text. If a student makes a mistake, the mistake should be corrected immediately and the student should try to pronounce the word correctly again.

Regarding what has been said about the pronunciation skills of many Czech English language teachers, this might not be the best solution. Above all, teachers are often aware of their own imperfections and, as a consequence, they neither practise pronunciation with their students, nor correct their mistakes. To develop students´ correct pronunciation, following conditions should be met:

- *students should be given an immediate feedback concerning his/her mistake, or improvement;*
- *student´s pronunciation should be analyzed in an objective way immediately and compared to the standard;*
- *single sounds should be analyzed and total improvement presented to the student.*

To meet the above mentioned requirements, the iTunesU application can be exploited. With the spread of mobile touch technologies, new applications appeared which can bring the desired effect. Special tools were for example created to test the potential impact of two distinct visualization styles for the learning of English pronunciation with the results recently published (Dibra et al., 2014). As there are quite few, below one of them was introduced as an example of the workflow. The iTunesU application for practising pronunciation allows the teacher to type any English word and then play and records the correct pronunciation. The application analyzes the recording, divides it into individual sounds and compares them as the whole to the original. If the mobile device you run the application on is connected to a proper visualisation and audio device, this process can be followed by the whole class. The whole process is structured into several steps.

First, a word is typed in the application. The play button plays the standardized pronunciation, the microphone button allows to record another trial. Student´s voice is analyzed and single sounds are graded from A to D (A – excellent, D – completely incorrect). Student´s voice can be heard again, and the recording is visualized, which helps the student understand the mistake. The student records the word several times, until the optimal sound is reached.

Exploiting th iTunesU application the whole process of pronunciation mistake correction takes about 2 minutes. It can be either included in the lesson (students work individually or in pairs, it does not break the lesson), or pronunciation can be practised individually at home. Moreover, there is another outcome – as mentioned above, the motivation to practice pronunciation is generally very low, both in case of teachers and students. The event happened during the first of a double lesson which was divided in two by a 15-minute break. As this class was taught in the one to one format (every student had one tablet to use), 12 out of 15 of them did not leave the classroom and spend the whole break practising the pronunciation of various words, including some swearwords, of course.

Assessment of students´ knowledge

Once the work with iPads with iTunesU application is included in any learning activity (either in face-to-face lesson or into autonomous work), the detection of increase in learners´ knowledge is required. Traditionally, multiple-choice or other types of tests are applied, which measure the entrance and final level of knowledge, calculate the difference between the experimental and control groups and consider the statistical significance of the received value. Our approach to monitoring learners´ knowledge was different, easy and no pre-prepared testing tools were required. The research sample included 30 5th-grade students (15-year old) of the 8-year course of Wichterle secondary grammar school in Ostrava on B1 level of English.

Students were to describe a set of three lessons which were taught in May 2015 and tablets were used in one of them.

- In lesson 1, which was rather theoretical, a ´story´ format was analyzed from the point of the structure, parts, vocabulary, grammar items, characteristics of figures etc. Tablets were not used in this lesson.
- In lesson 2 learners were equipped with tablets, worked in pairs and created a story reflecting their imagination. All stories (text and illustrations) were included in the e-book.
- In lesson 3 (without tablets) students learned to describe how the application works, thus practising the zero conditional sentences.

The students´ feedback included two parts: (1) to describe the lesson 2 where tablets were implemented in the process of learning; (2) to describe the lesson 1 or lesson 3 where tablets were not used. The feedback was collected four months later, in September 2015.

The results clearly demonstrate that the extent of lesson 2 description, where tablets were exploited, is significantly longer, providing more details, students expressed their thoughts in full sentences, using appropriate vocabulary and grammar items, including those they learned in these lessons. The descriptions of lessons 1 or 3 are shorter, mostly providing an incomplete list of vocabulary, fragmentary and vague flashbacks (see figures 2, 3, 4).

What can be concluded from the above described short feedback?

The results did not prove that the lesson with tablet was “better”. Avoiding the unclear, non-specified expression “better”, the more precise is to state the lesson 2 was *different*; and as such, it was more easily remembered. It is highly probable that if tablets are used more frequently, e.g. in each lesson, the one without them will be different, and thus a more easily remembered lesson. To sum up the above mentioned,

the main contribution of this technology is its *appropriate use*. And this is the "*art of teaching*" defined hundred years ago by Comenius (1930).

CONCLUSION

The above described iTunesU application is capable of analysing not only individual words but also phrases and whole sentences comparing even the rhythm of the whole clause. There are model sentences according to the topic or you can enter your own. However, its greatest advantage in the above described process of giving the students an immediate feedback of correct/incorrect performance. Also, there are other applications able to analyse your pronunciation and compare it with the original. This work is not meant to be a review of any application, its goal was to highlight the strength of a tablet/smartphone for pronunciation training. The advantages described in this article do not merely come from the application but rather from the device itself, as it can be used as a recording tool but also a tool for playing the correct pronunciation plus (using the right app) tool capable of analysing and comparing the pronounced text. The pronunciation, feedback and correction processes take only a couple of minutes, which allows the teacher to implement this activity in any lesson. Pronunciation mistakes can be corrected immediately, even in the case, when the teacher is not confident enough and does not have the required pronunciation skills. Finally, the motivation aspect of mobile touch devices should not be forgotten. Teaching and learning pronunciation has always been the boring part of language education and no tool capable of increasing the motivation of all participants should not be omitted. Mobile touch technologies may serve as such a tool, for some period, as proved in the feedback monitoring learners´ knowledge.

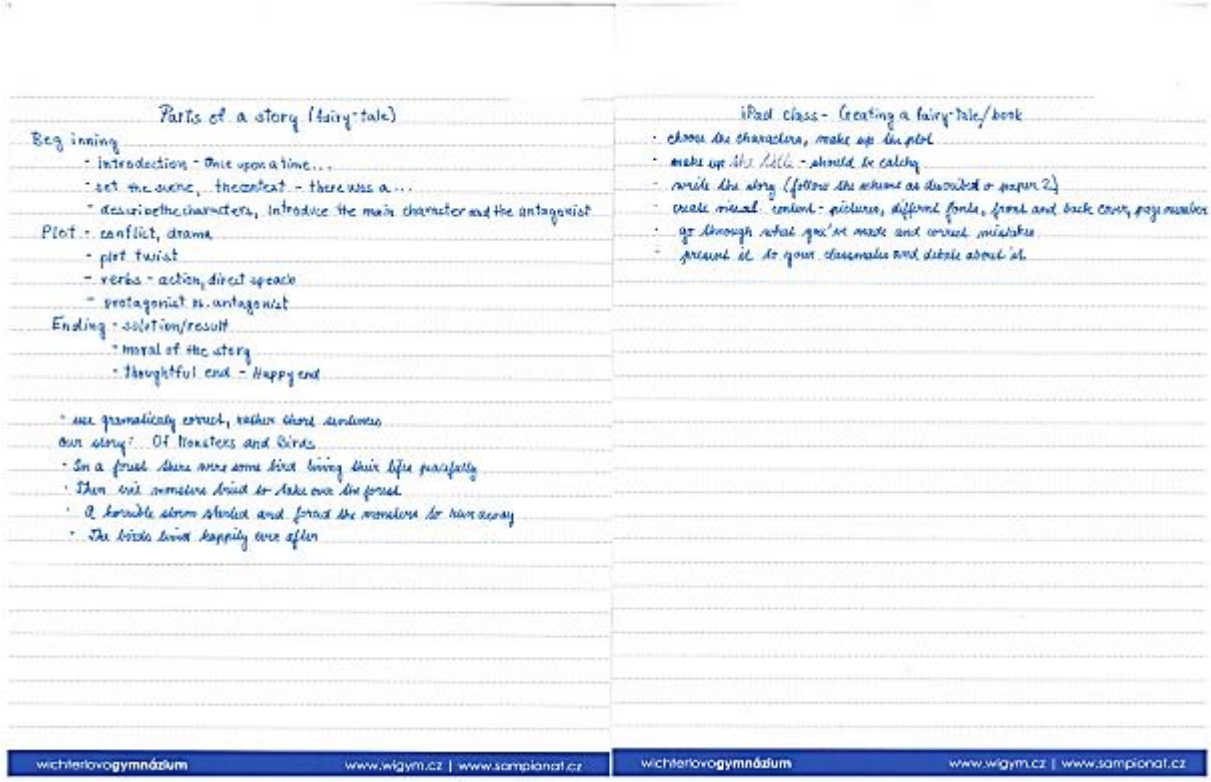

Figure 2 Student 1: comparison of knowledge feedback with/without tablets

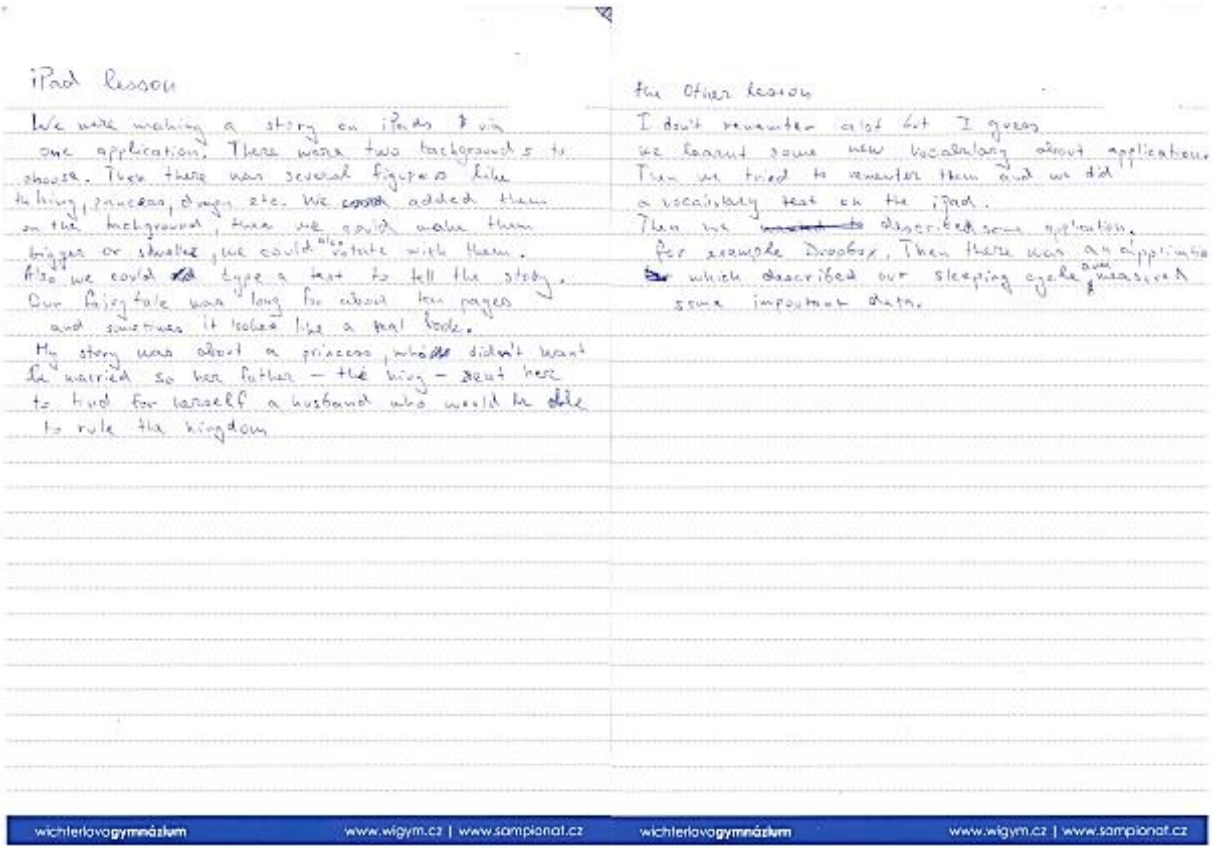

Figure 3 Student 2: comparison of knowledge feedback with/without tablets

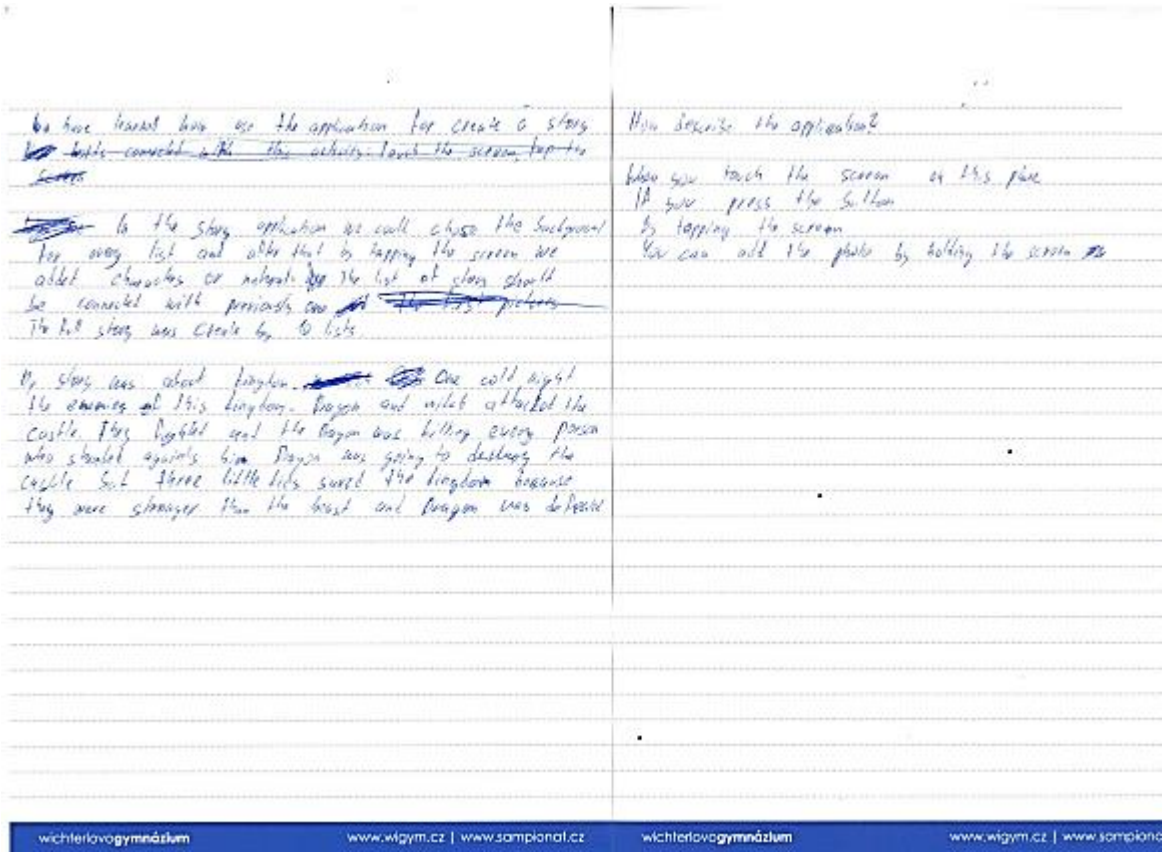

Figure 4 Student 3: comparison of knowledge feedback with/without tablets

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