



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

Václav Šimandl¹, Jakub Novotný²

¹*Department of Informatics, Faculty of Education, University of South Bohemia, Czech Republic*
{simandl@pf.jcu.cz}

²*Department of Informatics, Faculty of Education, University of South Bohemia, Czech Republic*
{novotj28@pf.jcu.cz}

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 (Šed'ová, 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 (Šed'ová, 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”.

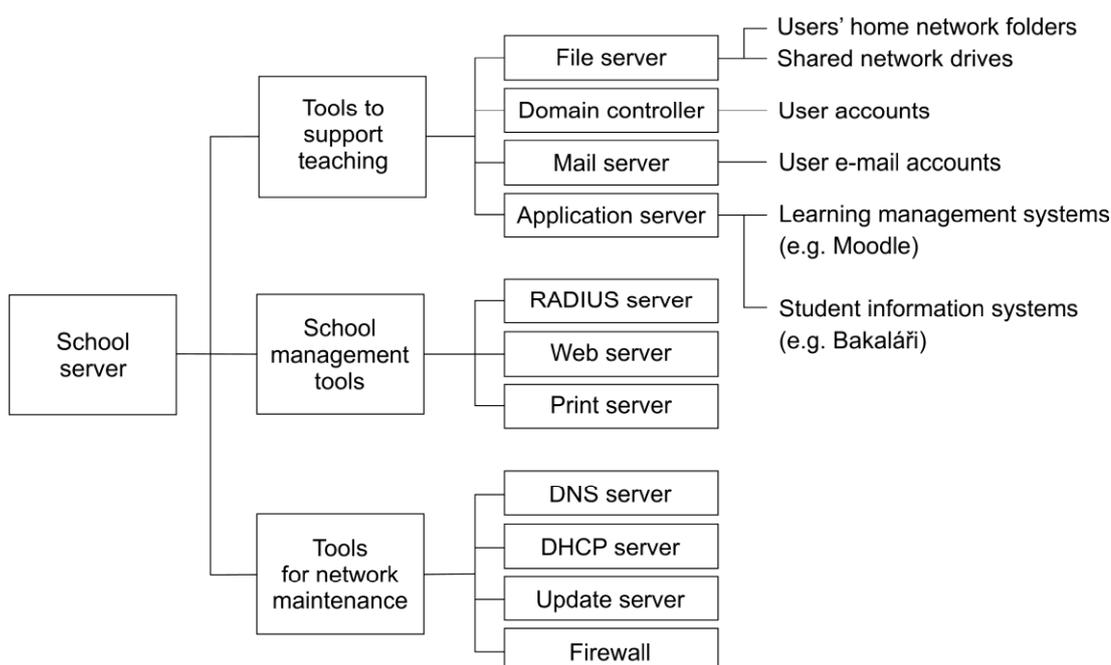


Figure 1 Network services provided by school servers. Tools to support teaching can be understood as those services that at least some schools use to teach

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 minimize 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 been 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.

References

- Chopra, M., Mungi, J., & Chopra, K. (2013). A survey on use of cloud computing in various fields. *International Journal of Science, Engineering and Technology Research*, 2(2), 480–488. Retrieved from <http://ijsetr.org/wp-content/uploads/2013/07/IJSETR-VOL-2-ISSUE-2-480-488.pdf>
- Dropbox, Inc. (2015). *Dropbox Terms of Service*. Retrived from <https://www.dropbox.com/terms2014>
- García-Valcárcel, A., Basilotta, V., & López, C. (2014). ICT in Collaborative Learning in the Classrooms of Primary and Secondary Education/Las TIC en el aprendizaje colaborativo en el aula de Primaria y Secundaria. *Comunicar*, 21(42), 65–74. Retrieved from <http://search.proquest.com/openview/e5576c934574c6abb15e1d8eb916d45d/1>
- Google (2016a). *Age requirements on Google Accounts*. Retrived from <https://support.google.com/accounts/answer/1350409>
- Google (2016b). *G Suite for Education (Online) Agreement*. Retrived from https://gsuite.google.com/intl/en/terms/education_terms.html
- Klupal, L. (2015). Ways to Share Materials Between Teacher and Student. In *Information and Communication Technology in Education. Proceedings* (p. 60–64). Ostrava: Ostravská univerzita, Pedagogická fakulta, Retrived from <https://konference.osu.cz/icte/dokumenty/2015/proceedingsICTE2015.pdf>
- Leipert, J. (2013). The evolution of cloud platforms for learning. In *Information and Communication Technology in Education. Proceedings* (p. 143–147). Ostrava: Ostravská univerzita, Pedagogická fakulta. Retrived from <https://konference.osu.cz/icte/dokumenty/2013/proceedingsICTE2013.pdf>
- Mell, P., & Grance, T. (2011). *The NIST definition of cloud computing*. Gaithersburg: National Institute of Standards and Technology. Retrived from <http://faculty.winthrop.edu/domannm/csci411/Handouts/NIST.pdf>
- Nagyová, I. (2015). ICT in Northern Moravia Elementary Schools. In *Information and Communication Technology in Education. Proceedings* (p. 155–161). Ostrava: Ostravská univerzita, Pedagogická fakulta. Retrived from <https://konference.osu.cz/icte/dokumenty/2015/proceedingsICTE2015.pdf>
- Neumajer, O. (2013). Trendy ve vzdělávání s ICT v roce 2013. In *Počítač ve škole 2013. Sborník příspěvků*. Nové Město na Moravě: Gymnázium Vincence Makovského se sportovními třídami Nové Město na Moravě. Retrived from http://www.pocitacveskole.cz/system/files/uzivatel/9/clanky/neumajer_pdf_26635.pdf
- OECD (2014). *Measuring the Digital Economy: A New Perspective*. Paris: OECD Publishing. doi: 10.1787/9789264221796-en
- Pechanec, V. (2014). The benefits of geospatial cloud for educational process. In *Information and Communication Technology in Education. Proceedings* (p. 179–186). Ostrava: Ostravská univerzita, Pedagogická fakulta. Retrived from <https://konference.osu.cz/icte/dokumenty/2014/proceedingsICTE2014.pdf>
- Strauss, A., & Corbin, J. (1999). *Základy kvalitativního výzkumu: Postupy a techniky metody zakotvené teorie*. Boskovice: Albert.
- Šedřová, K. (2007). Analýza kvalitativních dat. In R. Švaříček, & K. Šedřová, et al., *Kvalitativní výzkum v pedagogických vědách* (p. 207–247). Praha: Portál.

Švaříček, R. (2007a). Hlubkový rozhovor. In R. Švaříček, & K. Šed'ová, et al., *Kvalitativní výzkum v pedagogických vědách* (p. 207–247). Praha: Portál.

Švaříček, R. (2007b). Triangulace. In R. Švaříček, & K. Šed'ová, et al., *Kvalitativní výzkum v pedagogických vědách* (p. 207–247). Praha: Portál.