Standing at the Crossroads: Mobile Learning and Cloud Computing at Estonian Schools

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This paper studies the impact of mobile learning implementation efforts in Estonian school system – a process that has created a lot of controversy during the recent years. Best practices in mobile learning are available from the entire world, forcing schools to keep up the push towards better connectivity and gadgetry. Even in the best cases where the schools are provided with the necessary tools, the process has met a lot of scepticism from teachers who are afraid to implement new methods. Teachers are often cornered with the 'comply or leave' attitude from educational authorities, resulting in a multi-sided battle between involved parties.

We have surveyed students, teachers, parents and management at five Estonian frontrunner schools to sort out the situation. The results show different attitudes among students, school leaders and staff – while all of them mostly possess necessary tools and skills, teachers almost completely lack motivation to promote mobile learning. We propose some positive and negative scenarios – for example, we predict major problems if teacher training will not change, e-safety policies are inadequately developed or authorities will continue the tendency to put all the eggs into one basket (e.g. by relying solely on closed, corporate solutions for mobile learning platforms).

1. Introduction

The aim of our research is to analyse the current situation of mobile and cloud-based learning as well as Internet safety policy at Estonian schools. In Estonia, even innovative schools are struggling to implement the new national curriculum with its prescribed new methods, gadgets, improved interaction, mobile tools and cloud-based learning. The current school situation reflects a cross-section of the whole society with colliding extremes – eager but careless students with mobile gadgets, almost unlimited Internet connectivity and teachers with their old learning methods where the leadership and wisdom are considered to be the teacher's domain. Some schools consider blocking the Web or all use of Internet or mobile gadgets - even when it goes against the Constitution. At the same time we see growing threats and risks when schools open themselves up to the "Brave New World" without critical thinking (e.g. some schools have blind faith in iPads – no other tablet will do). However, while students from Asia and Africa are learning through innovative projects like the "Hole in the Wall" experiment started by Sugata Mitra, Europe appears to be somewhat left behind, often still struggling at pilot project stages – even if every child already has got the mobile tools (provided by their parents) and they should just be brought to school.

Our first hypothesis (H1) is that schools are afraid to open the school environment to mobile gadgets because of presumed extra expenses, safety issues (expensive software, privacy, viruses) and lack of discipline. For the second (H2) we suggest that the increasing individuality of learning process will inevitably change the teacher's role, but this is not accepted yet.

2. Background

According to Pingdom (May 2012), mobile device use has risen in the world by 192,5% in just three years (2010-2012), with top countries in Africa and Asia. Also, it is predicted that in India, mobile Web traffic will overtake its PC counterpart during this year (Bosomworth, 2012; Pingdom, 2012).

The 2001 report by Pew Research Centre "The Digital Revolution and Higher Education" claims that 29% of adult population and 50% of college students consider online courses to be on par with offline ones. Likewise, it has been suggested that the next generation of e-learning will be cloud-based learning (CBL) (Dong, 2009). Youngsters who are used to have the opportunity to learn anytime and anywhere find it hard to accept that they have a limited access to school information and learning. To address that need there are several different learning systems developed to go beyond just sharing materials, adding blogs, discussions, group work etc. These virtual learning environments also function as personal learning environments and social networks (Soumplis, 2011; Syvänen, 2009; Patil, 2011).

As mobile devices (e.g. tablets) are increasingly used at school, it raises several new issues, e.g. how these tools can be connected to local systems. Sometimes implementing these solutions is either impossible or very costly (Warschauer, 2011). New cloud-based learning platforms are considered more flexible and easier to implement as people use similar tools in their everyday life anyway (Wang, 2012). Some institutions provide private cloud services for their staff and students as well as external people for collaboration purposes (Doelitzscher, 2011).

Among other things, cloud computing allows cutting the expenses on disk space. As Microsoft and Google provide schools with free services capacity building for no extra cost, it is an option schools and local authorities are considering moving to in the near future (Noor, 2010). CBL provides an option not only to mirror and store data on the Net but also easier user administration and single-password login to different services. CBL is becoming increasingly common worldwide as it is easier and seems to be a perfect solution to bring schools into the new age of teaching and learning (Al-Zoube, 2009; Pocatilu, 2010).

2.1. Estonian situation

The Pisa 2009 results in Estonia report higher usage of ICT tools at home (96%) than at school (53%). Students who use ICT and mobile phones just for leisure tend to get lower grades than those who use ICT also for home- or classwork (Lorenz, 2011).

The status of e-learning in Estonia at the high school level has experienced various developments lately, some of which have been somewhat controversial. The new National Curriculum states an obligation for every school to use an e-learning environment (National curriculum, 2011). The local authority usually provides centralized Internet service; sometimes it also tries to support schools by buying computers. In Tallinn, schools have an option to use a centralized web server, email and domain service (Infotehnoloogia, Tallinna Haridusameti IKT nõukogu protokollid ja arengukava, 2012). At university /vocational school level, there are many open and non-open solutions to choose from, e.g. Wikiversity, Moodle, Blackboard, IVA, LeMill, WordPress, etc (Estonian Information Technology Foundation, 2012). Using cloud solutions is still in a beginning phase, but there are some schools that have already done some testing in this field. Some restrictions to implement these tools stem from the data protection law and its interpretation by schools (Lorenz, 2012).

M-learning is not yet implemented on the K-12 level in Estonia, but there are several good initiatives from Tallinn University Centre for Educational Technology for training teachers (Laanpere, 2011) and Estonian Information Technology College opened a software development laboratory for mobile devices (Puusaar, 2011) in 2011. Still, the training in these areas is lacking continuity. As Tiger Leap Foundation (foundation whose main purpose is to implement new technologies into schools in Estonia) has pointed out that mobile software should be in Estonian language rather than English to get better implementations for secondary schools. The cost of hardware and broadband has also been mentioned as a reason why mobile learning is not implemented at schools yet (Zova, 2012).

The Estonian Personal Protection Act states the need to secure data: access can only be granted to relevant persons, changes have to be logged and data can only be processed in the European legislative area - yet some cloud service providers don't specify where the servers are located (Personal Data Protection Act, 1995). At the same time, the Data Protection Inspectorate states that due to the problem being common to the whole Europe (not only Estonia), they will not ban companies from using cloud systems, at least for time being. Estonian government institutions are also required to analyse their services to be in accordance with the IT Baseline Security System (ISKE) (Infosüsteemide turvameetmete süsteem ISKE, 2012).

The rising interest of using clouds at school is understandable as it provides savings from server costs simplifies maintenance over the Internet and improves usability for teachers and students (they can use it everywhere and any time, both with computers and mobile devices). The main problems seem to be the possibly conflicting level of implementation (national vs local), possible security risks and the danger of re-inventing the wheel' at every school due to the lack of coordination. In textbook and e-learning area the Ministry of Education (MoE) has sent a proposal to change the law about books and textbooks being ready to access in online (Smutov, 2012).

Recent results from the general education assessment reports indicates that possibilities for professional development are good, but teachers lack motivation (Ojakivi, 2012). An important factor is low salary, but also overloading – working overtime is commonplace (Timakov, 2012). Also, recently there are examples of techno-scepticism: some schools and even Tallinn University of Technology have in some places implemented policies banning mobile phones (Kahro, 2011) and even laptops (Filippov, 2012). Problems inside the teacher training and delays of educational reforms play also a big part how new technologies are not implemented yet (Toots, 2012).

3. Methods

We carried out a three-stage study at five Harju County schools in 2012. The schools were selected for their use of mobile technologies in classroom (laptops, tablets or phones). We compared various factors like management principles, funding options, ideologies for managing and using technical gadgets, training etc.

Stage I: We surveyed students and teachers using Limesurvey (survey application tool). Lists, Likert scale and open-ended answers were used in the questionnaire.

- In spring, 345 students aged 10-16 conducted a survey about mobile usage and trends at school. The study was divided into five sections: background, technical skills, learning environment at school, future e-textbook, policy;
- In autumn, 29 teachers from the same schools conducted a similar survey.

Stage II: in autumn we interviewed ICT specialists, educational technologists or principals of these schools. Two schools also allowed parents to participate in the discussion.

Stage III: in autumn we gathered an expert group (ICT, education) of five people to discuss the results and predict the trends in the field. We also used students from grades 8 and 9 (26 students) from one of the schools as experts to discuss what the future learning should look like.

4. Results

4.1. Leadership and management

A common denominator in all the schools is the feeling that they are pathfinders in the field with only foreign examples to look upon. In addition to this, we found some other similar features but also some notable differences.

Similarities – the leaders at all the schools use smart devices, have spoken openly in the press about their school mobile tools usage, have a vision how to implement cloud, gadgets and BYOD (*Bring Your Own Device* - the approach that favours using one's own personal devices at school/work) in school life. The schools have an ICT specialist or educational technologist on board and at least two people supporting staff and students. In teacher training options, all the schools had some kind of extra ICT methods training provided to the teachers during the last year. The schools had a roadmap for ICT usage as well as lists of services provided by the school to teachers and students. They also monitored their ICT development and used the experiences to implement new things. All the schools had some project-based experience working with private or government funding. Finally, cloud-based learning options were available at every school (Google, Dropbox or Live@edu).

Differences – first of all, the tools used were different: some used only iPads, others a laptop-based lab some used only smartphones and some schools combine all those. One school also forbids use of student's mobile phones at class time, but allows computers. Some schools stressed that parents and students should bring the devices and school should not provide new gadgets for learning. Some schools shared more responsibilities with students - e.g. one school had an ICT support group for teachers and students. In management, two schools had given the right to choose tools and means to some privileged teachers, while others implement things based on grades – e.g. "we implement new things only in the gymnasium stage and therefore our ICT specialist will be responsible for all the implementation". The largest school had 1100 students, the smallest had 300. Some schools select students through tests, while oth-

ers accept everyone. Schools also differ in funding options: some schools had extra funding to implement ICT and train teachers or students. Finally there was a difference in attitude towards implementing free wireless connection: two schools allowed it, others restricted it (quoting problems with bandwidth).

4.2. Teachers, students and innovation

A typical student owns a smartphone and a laptop; usually they have also extra tools for the family at home. Tablet PC-s is still rare, but already visible as Christmas wishes. Using mobile phones during classes is normal, but students feel that they could do more with it than just calculate, visit school web or search information. They feel they are experts in using technology, but they need help in setting goals. They are not happy with teachers still trying to restrict the use of modern technology.

Students think that they should have the option of BYOD. The school should provide some regulations (to maintain discipline and prevent cyber bullying) and provide training about educational use of devices. When we asked about the future "e-school bag", they felt that it should be a mix of interactive e-books, e-textbooks, and teachers' web pages containing whatever is needed. At the same time, the ideas of a "school memory stick" and a school video channel got fewer votes.

Regarding methods used in class, students favoured labs, outdoor learning, individual or peer learning and watching videos. Some methods seemed more frightening than others, e.g. acting in a play, introducing one's study results to the others or other kinds of public performance.

Meanwhile, the typical teacher is a female who has worked as a teacher for more than 12 years. She uses her personal laptop as well as a PC in the class. 1/3 of the teachers have also a smartphone (those who have been working less than 7 year at school). She has been participating in various e-learning and technical courses about eTwinning (collaboration platform for schools in Europe), e-learning tools and services even when she is not an ICT teacher. She feels that she is average or skilled in using computers in class. All teachers know how to use projectors and computers; usually only 1/3 allow students to be active computer users in lessons.

Typical tasks include searching for information, using different media (pictures, graphs and videos) and e-mail. Some know how to upload files, but it is not commonly mentioned. Mobile tools were not used in classes and teachers were unable to name any educational applications. They mostly used phones as their personal tools to send SMS and call family and friends, but some also play pre-installed games, surf the web or watch videos with them (10 out of 29). They also strongly agree that the school should provide both teachers and students all the gadgets they need, but 72% are also in favour of the idea that students will bring their own devices as these tools are likely more modern than what the school could ever provide.

In studying various activities in-class involving mobile learning, we outlined seven types of tasks: homework, group work with or without supervision in class, work outside the classroom, in international groups and individual tasks with or without supervision. Student activity level, opportunity to do their own things and interest was monitored.

- Activity level - we found teachers overestimating it; while teachers stated that students work hard in their lessons regardless of methods, students felt that when teacher is absent form class, or when teacher is in class but is assisting others, they don't have to be active. An example: 76% teachers think that when they temporarily leave the class, students will continue working - students say that only 20% do that. To make things worse, when teacher is in class and students may turn to him/her for help, the teacher usually gets overwhelmed with questions. As a result, most of the class (78%) will still feel as left on their own - compared to the teacher being physically absent (82%), there is very little difference;
- Homework - when teachers feel that students have the freedom to choose whether to do or not to do the homework, the students say that they are obliged to complete the tasks with no choice;
- Interest - students were most interested in group assignments and tasks outside the class. However, teachers were less interested in these tasks.

The common tools and methods used in lessons are books, textbooks, e-materials (videos, texts and presentations), lab equipment, and individual or peer tasks. Teachers felt little use for gaming consoles, presenting group work analysis to the whole school, play, projects with partners inside and outside the school, distance learning or Skype lessons. At the same time, 1/3 or the students were very interested in using gaming consoles or Skype during the lessons. All in all, students tend to prefer more active, outdoor or technology-related assignments while teachers don't like them that much (see Figure 1).

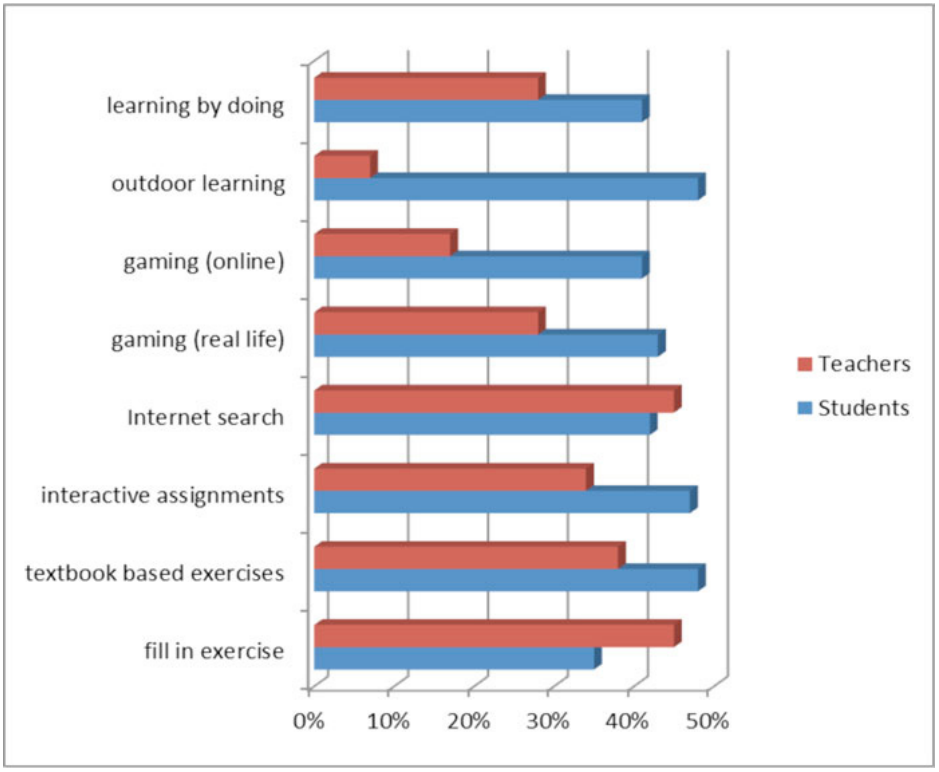

Figure 1: Tools and methods considered attractive

One of the greatest divides between the opinions of teachers and students was about whether to allow BYOD (31% teachers, 75% students) and using equipment lent to students for personal use. Teachers felt that it's only applicable where really needed and 97% suggested that the devices should be centrally managed by the school.

4.3. Restrictions and policy

When asked about policies and regulation, all the teachers were convinced that the rules and regulations are needed, as they are aware of new problems (illegal picture taking, cheating during tests etc).

While all the teachers supported policies for using computers, mobile tools networks, only 55% of considered it their task to teach students how to use mobile tools in an educational setting. At the same time, students feel that as the area of BYOD and new technology is still in developing stage, there should not be firm rules yet, only recommendations or agreements would be useful. 79% of the students feel that there should be more learning materials and guidelines how to use technology in class.

We also noticed that students considered the rules and policies only applicable in classes but not during the breaks or otherwise in the school premises but outside lessons (see Figure 2).

4.4. To BYOD or not to BYOD?

The teachers' view on BYOD is somewhat contradictory. On the one hand, many of them sounded at least moderately optimistic:

- "Students are responsible of their own gadgets, also when it stops working or gets lost/stolen."

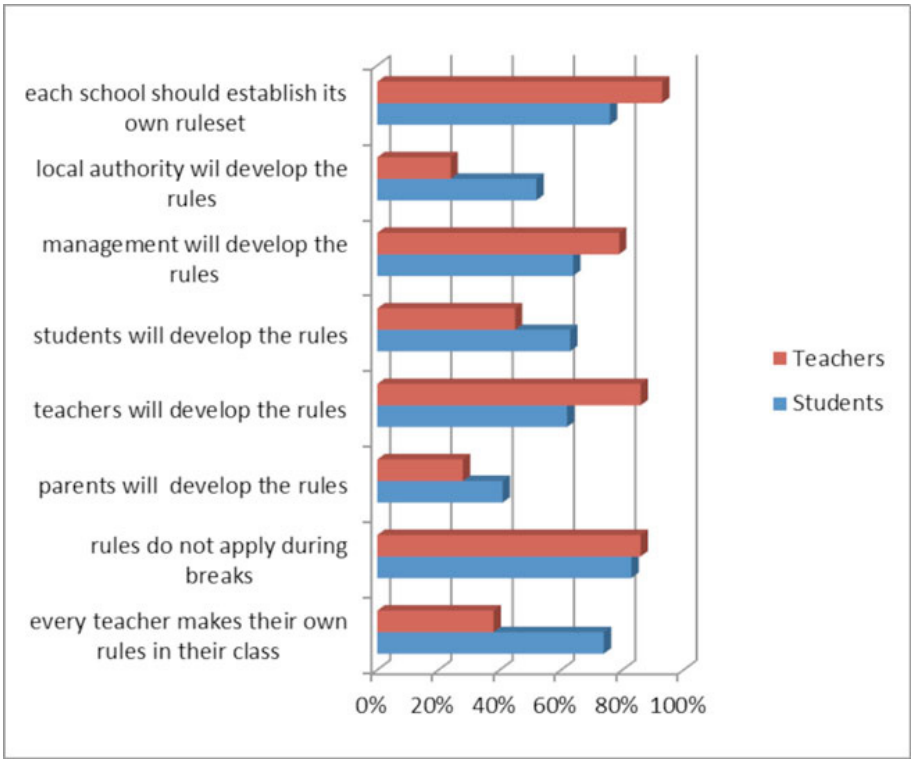

Figure 2: Views on rules and regulations – teachers vs students

- "Without policy and rules, these kinds of lesson cannot be controlled - I have an experienced it myself as we had a 2-year project with students using laptops."
- "Let the students bring their tools and we teach them to use them in an educational setting."
- "When parents buy these tools and allow bringing them to school, I am not against it."
- "it is possible only when the teachers are willing to use them."
- "Interaction would make the lessons more interesting, I have more ideas and options to teach."
- "When students use their own tools it is better as then they know the technical solutions and I don't have to deal with it."
- "The use of gadgets must remain voluntary and it only makes sense for a suitable topic."

On the other hand, they were unwilling to take responsibility:

- "Parents, children and management are more interested than the teachers."
- "Some tools are also provided from the school, but no help is being offered."
- "Rules and regulations give students the knowledge and skills, tools are not a solution *per se* (it does not matter whether I use them or not);
- "These tools are not usable in my language learning classes; I don't have methods and room for these tools."
- "Some students have the devices, some do not. I may not have it either. So the solution is to use school's tools only"
- "We have all the materials we need: books and textbooks, computers and projectors. We do not need students bringing in anymore."
- "Not every school can provide these tools for everybody."

The views of management and experts also differ. Technical side the school worries about losing money as some tools eg. iPad asks to type in your credit card number to use the Apple AppStore. ICT specialists also complain that these new tools are a headache to manage - installing applications, dealing with software, privacy problems, backing up data, poor WiFi networks etc. They also fear that the full potential of the devices could not be used - the tablet PC would degrade to being a media player or substitute for a book.

School leaders point out problems regarding personal usage of the tools, as student can use different and lose some important work during the transition (especially if the information is considered too sensitive to save in cloud). There is also a widespread belief that the only real tool for mobile learning is iPad and others don't meet the needs - the problem is that companies selling devices, and books as well as textbook publishers have managed to successfully plant the idea of "One Right Platform", resulting in no competition and high prices in the long run. School leaders are also ambivalent about using the cloud, citing concerns about data protection

From the parents' side, the main concerns were the initial cost of the device, but also whether the school can be trusted with their children's expensive tools - young children may get bullied or robbed, and the older ones are just too careless (e.g. leave the device unattended or drop it). Nevertheless, 43% of parents are willing to think about it if the experience could really help students to learn.

4.5. Trends and best practices in the field

Experts say that every school is a bit different, but they see a trend in how innovative schools have started to implement new technologies and tools. In Estonia, the new national curriculum has also provided some input and support the idea that teachers should update their teaching methods.

Recommendations from school leaders and ICT specialists could be outlined in five phases:

- introduction - visit other similar schools in Estonia and abroad, also ask technology companies present their ideas to the school staff to raise the interest towards using cloud-based or mobile learning;
- involvement - teachers themselves should gather information about using the tools in their respective subjects;
- practice - the tools should be provided to the teachers for testing. Some schools have started to involve students – however a substantial digital divide between students and teachers (in favour of the former) often causes teachers to feel being attacked;
- implementation – as the funds are limited, schools are often forced to decide which level to start on (primary, secondary, gymnasium). Some schools have started from the gymnasium level as it is also a good way to attract better prospective students, yet others feel that in order to allow

teachers to learn alongside students it is best to implement it from the first or second grade;

- sharing – as new content and exercises is needed, it is paramount to get teachers to share their work (at the moment, fears concerning authorship etc. are still widespread).

We see this step being taken in innovative schools, but other schools are still on standby (as if they would like to learn from others' mistakes) and the educational content prescribed buy the new curriculum is still scarce. Experts warn that although there is a substantial learning curve, the schools that wait for too long will put themselves into weaker position by losing the trust of students (as the technological gap between school and home grows further).

When we discussed the future classroom and mobile learning with our students involved as experts, they pointed out that the average lesson is too academic and static, they never make use of interesting tools, go outside or do practical exercises to solve "real-life problems". They emphasized that the usage of computers in classroom is low and there are no e-textbooks. Also, they are ready to use more cloud-based services as they already are using school e-mail provided through Google Scholar or Microsoft Live@edu system (see Figure 3).

Figure 3: Keywords for future learning as suggested by students

Other best practices outlined were using videos and applications in science, mathematics and language classes and using GPS. At the same time, students do not feel that the mobile tools are "learning devices" yet as the teachers do not see them that way. Student have more skills and more smart tools than ever (it is even difficult nowadays to find a "non-smart" phone in the market!). Yet another issue is the language - teachers would like more Estonian-language applications, while students are happy with English as long as the tool itself is intuitive enough.

5. Discussion

When we first started to study mobile and cloud learning we presumed Estonia to be pretty well-developed, as people is using social networks, different e-tools and a lot of people already possess smart devices – our first idea was to share the best practices about what innovative schools are experimenting with. However, the survey results showed a different picture. While Estonian youth can be seen experiencing the increasingly modern, speedy and interactive life, already the Pisa 2009 pointed out that Estonian homes are well-equipped, but not schools. Now in 2012, we see that not much has changed in three years in the methodical sense.

We see a large digital divide between teachers and students. Overall the teacher who has worked at school for 12 years feels that new technology and media is pushing him/her to a direction where there is no "rock to hold on". The world has changed, yet ordinary teachers still feel that students can be controlled by developing even more rules and regulations, hoping for a regulation that scares technology off the classroom.

Various literary sources suggest that education will be more interactive and personal when these new tools get introduced in classes, yet a significant number of people are completely against using mobile devices at school. There should be a middle ground (as using the technology cannot be compulsory), but the rejection and reluctance of the teachers should be seriously addressed.

Management wise, the innovative schools have implemented new technology in different ways – bottom up (starting with allowing the students to use it at school) or top-down (train teachers, provide tools, leaders as role models). All the schools have provided an opportunity to use school gadgets (laptops, smart phones) and learning environments (closed or open learning environments, cloud computing). Still, where the management sees the bright future, teachers reach for sunglasses - even younger teachers are not exactly applauding on new technology. We'd see some ice melting as the way of thinking changes – 55% of teachers feel the responsibility to do something and provide support for the students, but only 31% really allow it to happen.

As mentioned above, teachers feel more in control over the classroom than the real situation shows – when the teacher leaves the classroom, most students will not continue to work on the assignment as they have not experienced freedom and

self-responsibility. Estonian teachers are often very strict and everybody is learning exactly what the programme or book offers – experiencing new tools, methods and ways should be much more a priority. Another problem is the stark difference in task preferences – student would like more group work, but teachers feel uneasy in this, promoting traditional individual homework instead.

On the methodological side, students are eager to test out and learn new methods but teachers feel too "worn out or tired" to even test out things like outdoor or practical learning, internet or real life gaming or even interactive assignments – in all these, students' interest is far higher than teachers' willingness to give this kind of tasks. A serious problem likely behind this is teachers being overworked, underpaid and having low social status as reforms have been delayed from the government part (Toots, 2012).

Teachers seem to be more interested in controlling the tools and environment the students are working with (as only 31% supported BYOD and 28% smart phone use in-class). Another clear difference is seen in attitudes towards regulations - 100% of teachers are voting for the clear rules, while only 61% of students support them. At the same time, teachers feel unable to help the students, even if 79% of them state the need of help in order to use new technology in a meaningful and educational way.

Parents seem to feel "caught in the middle" and lack understanding of the cost, usefulness and responsibility issues. They also feel that not all of the parents will have the resources to provide all the gadgets that may become outdated in just two years. And school leaders and ICT staff have their own challenges in how-what-when-whether the school needs these tools.

Our suggestions to change the situation for the better are:

- reorganize teacher training as soon as possible – both for training the new teacher generation and re-training the older ones;
- provide working policies for teachers in order to use new technology in classrooms in a safe way;
- recognize best practices in the innovative schools to first introduce the gadgets to teachers and let themselves to investigate the opportunities for in-class use, as opposed to blindly "buying in" solutions that may or may not work in the particular school environment;
- include parents and students to the educational processes as partners to allow them to provide their expertise and funding to buy and maintain the tools;
- the MoE should strive to change the legislation on e-textbooks and also form a committee where publishers, educational and technical experts are working together to provide guidelines to open educational content development.

If the guidelines are not in place, more friction will result between students and their parents who are open to new tools and the "old-fashioned" teachers. On the one hand, teachers will keep feeling attacked, on the other hand the students will largely be left on their own, resulting in being open to various online risks (e.g. cyber-bullying). And without the counsel of a broad expert committee the MoE has but very little idea about how to solve the problem.

6. Conclusion

To conclude, we feel the situation being controversial. We see a danger that Estonia will be running blindly towards restrictions and closure – teachers favour policies that can seriously hammer new technologies in classroom. Students need new tools and methods, adults do not know how to provide them and a lot of teachers are simply not ready for them.

To close the gap, we see some potentially good initiatives from innovative schools, at the same time they are still struggling to involve teachers – this is the key factors students are already experiencing and using the new solutions daily.

In the longer run, only the fast ones will pass though the learning curve relatively painlessly and reach the state of mobile learning. A very important player will be the state (MoE) – whether they take an active role by including experts to address the issue, or they do nothing and "let the salesmen work". The latter scenario will result in schools choosing shiny non-open solutions with steep prices which will likely grow over the head of most schools soon. Future work in this field should also pay more attention to the risks involved (e.g. health) as well as both technical (development and maintenance) and content issues.

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