

# Digital Turn in the Schools of Estonia: Obstacles and Solutions

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**Abstract.** Schools from all over the world are moving into the direction of using more e-learning, digital gadgets and BYOD (*Bring Your Own Device*). In the Estonian Strategy for Lifelong Learning 2020, the switch to 1:1 computing in classroom is called “Digital Turn”. The strategy relies on expectations that smarter use of personal digital devices will improve not only digital literacy of pupils, but also their academic achievements in various subjects. The Estonian government plans to allocate 47 million Euros of national and EU structural funds until year 2020 for this purpose. There is also interest in improving digital skills of school-leavers on the side of the industry, as the Estonian ICT sector expects to double the turnover within the next 4–5 years. The sectoral analysis estimated the need for 8000 new employees in ICT companies. To achieve this, the industry has supported various educational programs like the Look@World Foundation’s Smart Lab project, Samsung Digital Turn project for schools, using Raspberry Pi-s at school supported by TransferWise, Microsoft’s Partners in Learning projects and so on.

Challenges for the digital turn are related to people’s involvement (teachers, school leaders, students, parents, officers); resources (gadgets, time, salary, maintenance); promises (this is beneficial for improving the students’ skills and competences and also is the only way); lack of analysis (act more, measure less). In this article we will study the Samsung’s Digital Turn project applications for the schools 2014 and 2015 in order to understand what are the goals for the schools when they think of digital turn; we also have asked school ICT administrators, educational technologists and school leaders to list seven issues that come into their mind that should be death with in the process, and surveyed teachers of one school over a 4-year period, tracking the changes in using technology as well as learning and teaching.

We will analyze the data to understand the trends and difficulties schools will face during this journey. This information is needed to train all other 450 schools that have not started their digital turn change yet, but are forced to act soon. The trends in digital turn projects will tell us the maturing process and goals that the schools have as opportunities and strengths while the list of difficulties shows the project’s weaknesses and threats. Looking at one school over 4 years will help us to understand the change, especially the areas that have changed in teachers’ practices.

In the conclusion we propose a list of actions that can be used to meet the challenges that can ruin the digital turn for most schools. We also propose an area of measures where the digital turn is the most visible.

**Keywords:** Digital turn · Digital skills · Innovation at schools

## 1 Introduction

Digital media, digitalization and e-learning changes our behavior, transforms the way we do and experience things, work life and also education [28]. New literacy practices are arising that will benefit from current solutions in many fields [20]. Trends of the internet shows us that computer-oriented solutions are designed ‘one size fits all’ (like television) rather than more interactive ones (see also Gilster [7]).

Digital divide is not only a challenge of old vs new generation, it also lurks between students - over the years, there are many interesting studies pointing out that tech-savvy students rely more on internet to finish homework or experience social interactions [14]. Whether today’s students learn differently or not is heavily debated - while common understanding is that “world and learning has changed”, some researchers point out that it is not so [26]. At the same time there are socio-economic issues stemming from background and culture one comes from [10]. The PISA study also looks at connections between background and academic results and they show that this key difference is present in some countries, while in others (like Estonia) it is not that problematic [24].

In Estonia, some interesting discussions have been taking place over changed learning and teaching in the context of development of national curricula. Challenges that have been pointed out are related to student’s focus, skills of planning, communication and presentation skills, problem solving, and motivation [14]. The Estonian Lifelong Learning Strategy provides guidelines for schools to emphasize students’ special needs, cooperation with the industry and digital skills [5]. In 2015 there was coexistence of different learning theories at schools - some teachers lean towards older, more traditional approach, others being more liberal. The need to train teachers in both technological and theoretical aspects of learning has been stressed [1].

### 1.1 Situation in Estonia

#### 1.1.1 Strategies

In Estonia, the sights have been set to the period of 2020–2050, attempting to predict what will happen in the world and what kind of students/workers will be needed by that time. At the same time, strategic plans and scenarios are often developed thinking of only near future, or even according to political election results. The Estonian Lifelong Learning Strategy mentioned above is one of the key documents that all of the stakeholders have agreed with. It includes ideas of changed learning, relearning and unlearning; motivating school leaders and teachers; benefits or effects of lifelong learning on workforce, digital turn and equality. Another strategy that focuses more on knowledge-based Estonia states that it is important to have good-quality, diverse and internationally competitive research sector to support economy and society [25].

The digital turn focuses mostly on schools improvements - there are many workgroups that discuss digital literacy skills of the students and teachers as well as ways of measuring them. For example, the EU Commission has published guidelines that all states can use to compare digital skills [6]. The Estonian Ministry of Education and Research website contains the Digital Turn Programme 2015–2018 that points out three directions: digital culture integration with teaching and learning; development and accessibility of digital teaching materials, and equipping the schools (network and technology) [4]. The Information Technology Foundation for Education (HITSA) has assured that they have means and goals to improve digital skills on every level (kindergarten to university), are able to support special digital education needs at vocational and university level and maintain the information system and structure needed [9].

### 1.1.2 Research

Research involving Estonian teachers, students and digital skills gives us a controversy - student's state that teachers do not use technology in class and teachers disagree. The common issue is that teachers in fact do use a lot of technology to prepare lessons and use presentation tools, but students in the classroom are considered active participants allowed to use technology. Also from TALIS research [29] we learned that school leaders are not that worried about lack of possibilities concerning computers and software. It is confirmed further when we look at the PISA 2009 [17] and PISA 2012 [11] results suggesting that school leaders do not see digital improvement as a priority task for their schools.

Overall the national curricula from 2012 supports digital technology use at schools and points out that every subject has its own commitment. For example, study of languages (Estonian, English, Russian, German or other) is meant to introduce digital communication tools, translation, using forums, email, social networks and blogs, and textual analysis; mathematics is to also promote cooperation, using different statistical programs, simulations and models, visualization and research; national sciences (Estonian language, history and culture) should include maps, videos and use of learning environments; social sciences should support individual or group activities, international cooperation, diagrams and data analysis; art and music are also obliged to teach about online museums, archives and databases, Creative Commons, sharing data, creativity as 3D, video and animation; and finally, informatics (which is voluntary) should focus on virtual identity, web meetings, wikis, podcasts, internet safety and security etc. [18].

The Digital Turn workgroup at the Ministry of Education and Research has also asked Norstat to survey teachers, students, parents, school leaders and local authorities to understand attitudes towards increased use of digital devices at school. The results are not published yet, but overall sentiment is that the respondents were positive about schools starting to use more technologies (mobile devices, laptops, develop WiFi and digital materials). There are some challenges regarding health, concentration and class management issues, manual skills development, support and training, or cost of tools. Also, teachers expect that the chosen solution rather leans towards using school devices than BYOD, and government should provide free learning and teaching materials for everyone. At the same time, students and parents are more or less interested of using their own devices.

Due to prominence of the ICT sector in Estonia, there are many different studies regarding ICT students and their profession. The Tartu University study shows that 20–25 % of all applicants are women - this ratio stays the same throughout the university and later work life, even if the probability to get accepted is 12 % higher than for men. The decision to go to the IT sector is often related to an earlier experience solving problems or doing something practical like creating a website or a game; other factors include IT lessons or personally knowing someone from the field [13]. The Praxis study predicts IT sector developments and workers need towards year 2020 [12]. According to that, there is a need for more support, database and system administrators and developers, a slightly smaller need is for leadership and design professions. Of people currently active in the sector only 57 % have some kind of academic degree, and 16 % have vocational education. According to the study, the IT Sector currently needs 2500+ new employees (the number for other sectors combined is estimated to be 4000), of which 2/3 should be specialists with higher education. In order to raise interest in the ICT field, many companies have started to run or support different educational programs.

### 1.1.3 Supporting Innovations and Projects

‘Digital jumps’ are characteristic to Estonia. Projects backed by the Tiger Leap Foundation have been present in our education starting from 1997. At first, the main goals were to change the way of thinking and harness the digital world - to get schools connected, teachers to develop their own materials and create their own training courses, also providing teachers with laptops. Since then, the Tiger Leap has moved into many other sectors in Estonia where innovation and change is needed. Today the project is managed by HITSA and they offer several training to teachers and school leaders regarding the digital turn. For example, the “Leadership in teaching and learning process” is a school team challenge where 4–6 people (principal, main teacher, ICT manager and teachers) set their school’s goals and solve the problems with the help of external experts. The program lasts 6 months [8]. For teachers they offer various trainings starting from basic computer lessons to programming and from 3D printing to webinars. HITSA also provides support for coding, robotics and other technology use in classroom via the Progetiiger program and runs the Digital Innovative Classroom “Smart Lab”.

From the university aside there are two-three major players - the Centre for Innovation in Education at Tallinn University (provides teacher training, project days and training for working teachers), the Pedagogicum at the University of Tartu provides their own training and solutions via the Network of Innovation schools, and the Mektory Innovation Centre at Tallinn University of Technology provides schools with training for students and teachers about science. There is also the “Noored kooli” (Youth to Schools) initiative that is similar to “Teach for America” in the US.

The local authority has to maintain the schools’ technical equipment and network connections as well as provide tools and services that help to improve education. Some authorities have stepped up to do even more. Usually they make a competition and let schools compete for the prize money. For example, some Pärnu area schools started their own Digital turn project [16]. Also the council of Tartu has started to test out “open learning area” and digital school implementations with assistance from EU funds

[21]. In Tallinn, the Department of Education initiated the “Digi-idea” project giving out three prizes for innovative projects [22].

Likewise, IT industry has pushed schools to reach higher quality standards and activeness level of changing the education and implementation of technologies. For, example, starting from 2009 Microsoft has run several projects under the aegis of their Partners in Learning program [19]. BCS Training has a Creative Classroom project that has been funded by Erasmus+ [3]. Samsung Baltics started several Digital Turn projects in Estonia and Latvia starting from 2014, with the common idea to train 6 members of the school (including school leaders) who will proceed to innovate the rest of the school and community. At the end of every year, there will be a prize of 10 000 euros for one of the schools [23]. Also, the SmartLab project that is funded by Estonian Association of Information Technology and Telecommunications runs small-scale projects focusing on robotics, coding and engineering education as extracurricular activity [27].

In conclusion, there is a drive from the industry as well as from the government to make education more digital and innovative. Yet, schools are worried about possible setbacks. We have followed the Samsung Digital Turn schools project over 2 years in order to find out which steps have the schools taken to implement various technological and theoretical aspects, what are the challenges, how to measure success, and what are suggestions to others.

## 2 Methods

During the last four years, we have seen different ways for schools to handle the digital turn. In this study we have collected data from experts to learn about current challenges, also looking at project proposals addressing the digital turn prepared by schools over the last two years and the published results and changes from a number of schools over several years.

Our aim is to find out:

- what are the first steps when they start to implement changes, what do they envision to be the catalyst for actual change?
- what are the changes that can happen in one school over 4 years?
- what are the common mistakes and problems that experts point out in the digital turn projects and how to avoid or solve them?

The first answer could be found through qualitative data analysis the Samsung Digital turn projects from 2014 and 2015. In this project, 109 schools applied (43 first year, 66 more schools joined later). The application consisted of information of their activity level in digital turn preparations, their dream project for 9 months. Every year 8–12 schools are chosen for the full training program and competition where the first prize is 10 000 euros. The program content and training is provided by Tallinn University experts - professors, lecturers and researchers. We also we studied the published data from three schools that have documented their digital turn over several years. These are large (over 700 students) schools from all over Estonia, known for their innovation and digital drive. The data was collected from their websites.

The second question was answered using input from ICT technologists, ICT managers, school leaders and active teachers that participated in open discussion about “what are the 7 mistakes that school can do regarding digital turn”. Their ideas were collected in 7 days using a social media discussion board. Everyone was able to say something, comment others’ sayings and ask questions. 26 people shared their thoughts, 12 of them provided a full list of difficulties. The respondents were identified (rather than anonymous) and they were experts in the area. We annotated given sentences using Open Coding method 2–3 people and analyzed the results using grounded theory to discover categories [2].

### 3 Results and Discussion

The results show that the schools that joined the project during its first year were already active or very active in the field, while 19 % of the late joiners were newcomers (no previous significant digital turn project experience). It should be noted that there was no visible correlation between the schools overall activity level in digital turn and technological steps like implementing online shared folders, mobile technology usage, public WiFi, also the size of the school did not matter.

Thus, while all the applicants had good idea what should be done to implement 1:1 computing, using and developing digital materials or creating more student-centered learning processes, there was difference regarding BYOD - most active schools were more willing to test out new gadgets brought in by students and implement them into everyday schoolwork.

The more active the school was in digital turn, the more higher and complex goals they were aiming at. Less active schools wanted to solve extracurricular and informal learning related challenges (setting up a robotics lab, improving WiFi quality in library etc.), while the active ones focused on more general categories like international relations, value-based learning, immersive language learning, qualitative feedback, developing their own materials and learning systems etc.

We also found that the manageable amount of students participating was in the range of 50–350. Thus small schools were able to engage in whole school projects, larger ones had to focus on a specific age or area group.

Most popular topics in 2014 were development of e-learning materials and using mobile technology, but also creating videos, cross-curricular activities and systematization of technology usage and improvement of digital skills of the students. In 2015 the focus shifted to teacher training and most important keyword was digital skills of teachers and students, but also learning stories, community involvement, nature trails etc. Thus we notice an evolution - at first they started with narrow, specific requirements, moving ahead to the community level later on. A follow-up of the three schools from a year after the Digital Turn project can be found at <https://goo.gl/jkp7uv>.

The second part of the study looked at the mistakes preventing the digital turn was the topic of a discussion involving school experts (mainly educational technologists and ICT managers, but also school leaders and active teachers), the main outcomes are listed below:

- **Lack of resources** - while the problem seems to be endemic in education, it is possible to find funding for digital turn activities if supporters can see the actual impact. While there is a need for mobile devices, new PCs, software and networking to start the digital turn project, schools make the abovementioned mistake of ‘thinking too small’, stating the specific need but failing to show its greater impact. Many schools obtain technology sporadically (“we have the sum X and have to spend it by the end of the year”), the fact that most local authorities are unaware of the actual needs of schools in their area does not help either.
- **Technology malfunctions resulting from misuse** - most smart gadgets of today are meant to be personal by definition, yet many schools designate e.g. tablets to common use (citing their small numbers). There are several maintenance issues that makes the school-owned tablets a security risk. This kind of “digital communism” results in devices being unmaintained (“if it belongs to everyone, who should care for it?”), there is also a serious lack of guidelines and lists of which applications should be used and which ones avoided. In addition, school WiFi networks are often designed with small loads in mind (as small is cheap) and do not handle the spiking workloads from BYOD well (e.g. a network designed for 120 users is actually used by 400).
- **Missing support** - this includes several aspects from general school management to tech support to training. This is exacerbated further by serious overload of teachers - as they are supposed to use their leisure time to familiarize themselves with the new technology, lack of support will result in ‘dropping the ball’, disillusionment and letting go.
- **Teachers are not on board** - due to the reasons mentioned above, many teachers are afraid of ‘rocking the boat’ - both fearing the unknown and an ever-increasing overload play a role here. Many teachers do not own the devices, using a shared one at school has but a limited training effect. Due to this, many teachers are actively against any increase of digital technology at school.
- **Lack of community involvement** - as digital skills and knowledge of students often exceed the teacher’s, they will sometimes ‘test’ the teacher during classes or switch to other activities as the teacher is unable to manage the situation. One solution to instill the proper ‘digital etiquette’ could be at home, but parents often display the same symptoms as teachers (no time, ignorance and negativism, fear of costs etc.).
- **Immeasurable benefits** - this is possibly the most important factor in understanding the obstacles of implementing digital turn at school. Currently the impact measurement has mostly been limited to quantitative aspects (number of devices, speed of networks etc.) while it should become much more qualitative (impact on learning, changes of attitudes etc.).
- **Other issues** - this was the area with many different variables, e.g. school culture and its effect to the change; understanding of national curricula goals; digitalization of the sake of digitalization; going digital for a campaign not because there is a real need. Also some schools said that they are not motivated by being average in the field as then they will not benefit as much (as most projects and funding go to the ‘stars’). And there is also lack of constructive criticism - while nobody dares to say that is a “bad thing”, the discussion moves to the level of “is it for me” (in short, the

question is whether the digital world is ‘just for geeks’ or everyone). In comparison, looking at the government programs and strategies, all of them assume that the matter is long settled.

We see that Estonian schools are quite independent in the things they do - they look for guidance from outside partners, national curricula and strategies, but decide their actions by themselves. The challenge is that also the teachers are so independent that sometimes even the school leaders and school goals can be overruled. This means that attempts to do the rapid digital turn by forcing it with strategies, programs and events (and even money) has a short-lived effect. So the key is to find a common ground with the schools, let them choose their own path and set the overall goals. If the schools get more people on board the chance to succeed is much greater than if starting alone and doing the digital turn with just a small group of people.

We have formulated the following suggestions:

- **Governmental stakeholders and ministries** should analyze strategies and the curriculum, refraining from politicizing action plans. For all important decisions, clear communication should be provided about where the funding comes from, what are the metrics and what are the expected roles for all sides. Partners on all levels should be included in this.
- **Local authorities** should accumulate knowledge about governmental level strategies and possibilities and share that information to school leaders in their area. Again, these activities should be inclusive, involving not only the top schools but also less successful ones.
- **Industry** should provide insights about future developments, employment and expectations to future employees. School need help in determining the goals and developing curricula, especially from practical perspectives.
- **Universities and research facilities** should provide academic insights of the development in schools and analysis of both positive and negative trends. They are essential in supporting schools in becoming able to develop the ‘big picture’ and setting the goals larger than just ‘improve the WiFi in cafeteria’.
- **Schools** should focus on plans that are not only directed to acquiring technologies, but to change and develop learning communities and culture. They should strive to train teachers, students and parents about future learning perspectives and benefits on the school level.
- **Teachers** should become more welcoming towards new learning methods, seeing beneficial tools and methods that can be used to activate students. They also should provide an example by being lifelong learners themselves.
- **Students and parents** should strive to be part of learning culture rather than bystanders or opponents. Inclusion from both sides is the key.

## 4 Conclusion

In carrying out the digital turn, the most successful schools are dealing with the human resources. They discuss issues and developments with the wider community – their goal is to include everyone and aim high. Lack of technical resources can be dealt with

the help of industry, local authority or various projects. A more difficult problem is the learning community and ideas about the curricula where new and old way of doing things clash. In order to solve them, a balanced approach is needed where all involved sides will be able to contribute. We set goals to explain obstacles and solutions to the digital turn program in Estonia and we have accomplished that by including real digital turn best exemplary schools stories and ICT technologists, ICT managers, school leaders and active teacher's ideas about what is wrong and how we can fix it inside out.

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