Thematic Article

Tablets in Hungarian Primary Schools: An Empirical Study of Institution-level Application

Balázs Czékmán,[1]Judit Kocsis[2], Kálmán Abari[3]

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Abstract

The increasing interest in introducing tablets into education as well as many countries' education policies (see Digital Education Strategy) support the integration of the above-mentioned mobile devices (Mulet, van de Leemput & Amadieu, 2019). Accordingly, several governments are presently procuring or have already supplied a significant number of students with these devices (Tamim et al., 2015). Similar to most international large-scale initiatives, there are remarkable variances in tablet-supported education. The different school conditions (infrastructure, framework, human resources) result in the diversity of technological integration. In our research, in order to learn more about the infrastructural conditions at schools' institutional levels, with online questionnaires we examined 145 primary schools using tablets in their education. We were looking to answer the following, questions: (1) what kind of infrastructural conditions are characteristic of the different institutions? (2) What kind of differences in infrastructural conditions are there between the schools in different settlements? To sum up the results, we can observe significant differences in the number of tablets, their hardware, accessories and software, along with differences in internet access and the regulation thereof.

Keywords: tablet; primary school; infrastructure

Introduction

Tablets in education

Mobile technology could very well signify remarkable changes and effects regarding the global trends; in today's world mobile devices (smartphones, notebooks, laptops and some other electronic devices) ensure permanent connectivity due to the spread of GSM coverage and Wi-Fi access points (hotspots) (Johnson et al. 2010). Mainly smartphones and tablets emerge from mobile devices as the frontrunners, which is confirmed, on one hand, by the number of sales (the rate by which tablet sales have exceeded laptop- and desktop sales since 2013), on the other hand, by the rate of devices used for browsing the internet (since 2016 the rate of browsing on mobile devices has surpassed desktop PCs). The Horizon Report, published by NMC (New Media Consortium) in 2010, predicted one year or less for the adoption of mobile technology into education. Horizon's 2015 report, dealing with international trends, informed us about the common integration of tablets. Johnson and his colleagues (2010) also affirmed that tablets were getting more and more important not only in everyday private life and at workplaces, but also in education and learning (Johnson et al. 2010). Due to the appearance of the first Android, and iPad tablets (2010) their popularity has risen (as it was apparent in the number of sales), therefore great interest was shown toward the integration of mobile applications into education, particularly into the public schools (Major, Haßler & Henessy 2017). As a result, more and more state-financed, large-scale technology-based initiatives were launched at both the international and national levels, aiming to provide

[1] Kispesti Puskas Ferenc primary school; czekman.balazs@puskasiskola.hu
[2] Kispesti Puskas Ferenc primary school; czekmannekocsis.judit@puskasiskola.hu
[3] University of Debrecen, Department of Social and Work Psychology; abari.kalman@arts.unideb.hu

tablets for primary and secondary school education. One of the largest initiatives was the FATIH, which was launched in 2012 in Turkey using 1400000 tablets (Akcaoglu et al., 2015). Besides, other large-scale tablet programs were in the UK (about 721000 tablets in 2015; Connor, 2015), in the school district of Los Angeles in California (640000 tablets; Tamim et al., 2015) and in Brazil (600000 tablets; Farias et al., 2013–2016). There was only one international initiative („One Laptop Per Child"), which aimed to support the education of developing countries with 2,5 million devices. Of the smaller projects –covering mainly few institutions – are Australia, France, Kansas (the USA) (McCrea, 2013) and Arizona (the USA) (see Tamim et al., 2015) with about 350-15000 devices. The above-mentioned initiatives were the first ones that used tablets for educational purposes. Afterwards, in the recent years there have been rather smaller-scaler programs, like in Estonia where both school-provided tablets and students' devices (BYOD) take part in education (Fehér, 2021).

As of yet, we can find no similar state-financed tablet projects of such a scale in Hungary. There are self-supporting single initiatives, pilot projects proposed by institutions of higher education, as well as projects launched by big multinational corporations at the national level. Based on the literature, there are four that are worthy of mention. The tablet-based methodological experiment of Eszterházy Károly College spanned only a few classes of students (Kis-Tóth, et al. 2014). "Hipersuli", sponsored by Telenor, used 1500 tablets in 6 institutions (DIA, 2016). "Samsung SMART School" was present in 25 classrooms nation-wide (Samsung, 2017), providing about 30 tablets to each classroom. Lastly, the "Vodafone Digital School Program" passed out 1300 tablets in 25 schools (Vodafone, 2016).

Infrastructure was given a priority within the process of institutional integration providing stable wireless networks (see Bannister, 2015; Heinrich, 2012; Henderson and Yeow, 2012), along with facilitating the purchase of the appropriate tablets and their accessories (see Heinrich, 2012). Truth be told, the considered and well-developed infrastructure could either facilitate (see "Samsung SMART School", Rimanyi, 2015), or prevent the setup of tablet-based educational environments (see Heinrich, 2012; DIA, 2016a; 2016b). Beside the advantages, different challenges of the devices (e.g. maintenance, software) have been justified by several researches (see Heinrich, 2012; Henderson & Yeow, 2012). Beside the support of the appropriate technological background, it is also highly important to train the participant teachers properly in the usage of these devices, to assist and mentor them continuously (see Goodwin, 2012; Herzog & Racsko, 2016; Montrieux et al., 2014; Rimanyi, 2015).

Research design and Methods

Aim of the research

The conditions of the introduction at the institutional level may largely contribute to the success or the failure of applying tablets in teaching and learning. In our research, tablets are studied at the institutional level. We divided the conditions of the institutional implementation and integration into three categories on the basis of the relevant literature and the experiences of our long-term tablet project during practicum (see Czekman, 2018). The categories are as follows: infrastructure background, supportive-framework background, and human resources background. In our research the supportive-framework background (access to devices, teachers' opportunities to use tablets) and the human resources background (teachers' tablet usage; support of school management; the existence of special human conditions; trainings) are analysed in greater detail.

Participants

Our research was carried out in such primary schools where tablets have been used in some way or another for both learning and teaching before and during the period of data collection. As there was no database about schools using tablets available while conducting the research, we took the participants into the research with the use of nonprobability sampling. However, our sample is not considered to be representative due to the applied nonprobability sampling, but it does give an overall picture of the tablet-supported education in primary schools. First of all, we applied professional sampling, and we got in contact with every institution that we knew was using tablets in education. As a second step we applied snowball sampling, so the persons responsible for tablet usage (e. g. headmaster, project leader) were asked to suggest other institutions. Furthermore, we sent out our questionnaire to the principals of all Hungarian school district centres asking them to forward it to each and every primary school. We asked one representative from each school to fill out our questionnaire. By the end of the sampling period, 145 completed questionnaires had been returned from eighteen counties (out of nineteen), which represented 145 Hungarian primary schools.

Data collection and analysis

Our research examining integration and implementation at the institutional level was qualitative, as this cross-sectional research applied single sampling. A self-administered questionnaire has been used for data collection online, which lasted from early May 2019 till late September 2019 (before the COVID-19 pandemic). We compiled our variables examining the institutional conditions in the questionnaire on the basis of the results of our previous research and observations (see Czekman, 2017). Beside the institutional conditions/terms we gathered some background information about all the institutions, as the number of teachers, students and classes (lower and upper classes). Our questionnaire had mainly close-ended questions, though in some cases we used open-ended questions, most requiring numerical data, the rest letting the respondents express their own opinions. To process all data, we used SPSS Statistics version 22.

Research questions

- Question 1: What kinds of framework conditions are characteristic of the institutions using tablets for educational reasons? What kind of differences in framework conditions are there between schools?
- Question 2: What human resource conditions are characteristic of the institutions using tablets for educational reasons? What kind of differences in human resources are there between schools?

Results

Characteristic features and differences of the framework conditions

Access to tablets

One of the most crucial issues in the case of an institutional-level framework regards the extent to which schools can provide access to tablets for students and teachers. While studying class access, we were examining what proportion of all classes had a chance to use tablets. Slightly more than two-thirds (69,26%) of all schools provided tablets for teaching and learning, and only one-third of the participant schools could provide these mobile devices to only a small group of students. Regarding the access to tablets at the institutional level, we've been analyzing the data by grades (ISCED 1, ISCED 2). However, there have been significant differences between the class years in tablet-usage, the rate was high both in lower and upper classes (61,9% and 91,55%). In lower classes the institutions gave increasingly more access year by year. While barely more than half of the first graders had a chance to use tablets during the classes, three-fourths of the fourth graders had access (Table 1).

Table 1. Opportunities to use tablets by classes (years)

		yr1.	**yr2.**	**yr3.**	**yr4.**	**yr5.**	**yr6.**	**yr7.**	**yr8.**
total	**N**	78	87	92	102	139	134	128	130
	%	**53,79**	**60,00**	**63,45**	**70,34**	**95,86**	**92,41**	**88,28**	**89,66**
	%		**ISCED 1: 61,9**				**ISCED 2: 91,55**		

One of the most important things about mobile devices in education is 1:1 access. However, it has also been apparent, while studying the access to tablets in lessons, that one-fifth of the schools quite possibly could not provide tablets for all students. Some of these institutions got students to work in pairs, some of them made them work in groups in order to use tablets. There are several reasons why some schools prefer pair and group work; on one hand it is possible that the schools may not supply whole classes with these devices, on the other hand the above-mentioned schools support classroom cooperation and collaboration directly because of pedagogical reasons (Table 2).

Table 2. Access to tablets in lessons (%)

		1:1 access	pair work	group work	total
total	N	116	15	14	145
	%	**80,0%**	**10,3%**	**9,7%**	100,0%

It was shown when we were analyzing the opportunities for tablet use given the different class years (see Figure 1) that pupils in lower classes used tablets less, their chances limited – probably due to pedagogical consideration –, whereas almost all upper-class students were given tablets in lessons. That is not really the same in case of teachers, though the difference between the two remains, the variance is less. Lower-level primary teachers have slightly more chance to make use of tablets than students (64, 46% versus 61,9%), but upper-level primary teachers' chances are 10% lower than that of the student (78, 34% versus 91,55%). This means that theoretically all upper-class students have opportunity to use tablets, whilst for teachers this number does not reach even 80% (Table 3).

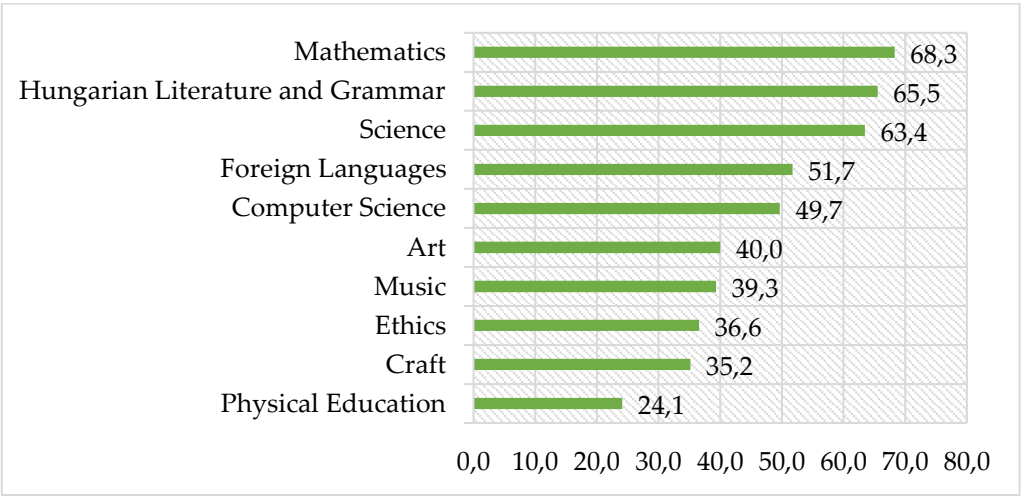
Table 3. Teachers' chance to use tablets (%)

		lower primary classes		upper primary classes		total
	N	**mean**	**std. dev.**	**mean**	**std. dev.**	**mean**
total	145	**68,48**	37,26	**78,34**	30,51	**73,41**

Regarding the institutional-level framework conditions – beside the students' and teachers' tablet-usage opportunity – we've also been examining which subjects saw tablets used in lower-level and upper-level primary school lessons. For instance, there was no distinction between Sciences and Humanities; there was more chance for tablet-usage particularly in those subjects which are taught in a higher number of lessons. Mathematics (68,3%), Hungarian Literature and Grammar (65,5%), and Science (63,4%) were preferred by the institutions, while in the case of Foreign languages and Computer Science, this number was around 50%, followed by Fine Art subjects and Physical Education (Figure 1).

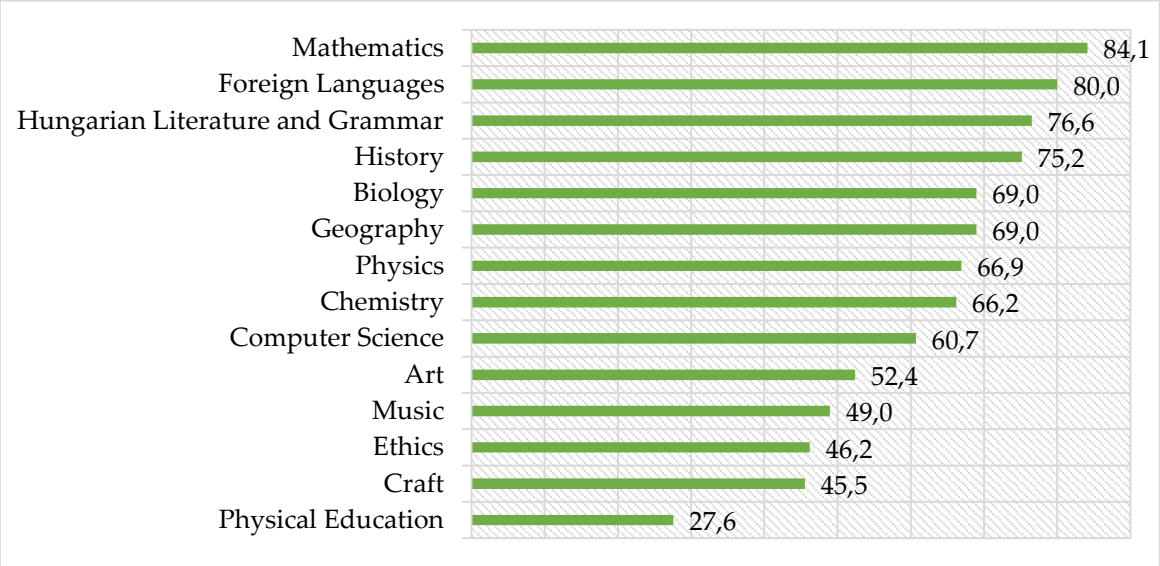
The open-ended answers broadened the list of the mentioned subjects,the applied fields, and developed skills, while also highlighting the obstacles presented by tablet-usage. Some responders emphasized the unrestricted tablet-usage opportunity, referring to that *"in all fields, if necessary", "they can be used at any lesson", "in every subject"*. On the basis of some specific answers tablets were used for SEN education, teaching communication, projects and social behaviour. Among the obstacles some technical factors have been mentioned, namely *"we cannot use tablets because there are two buildings, thus we cannot move the tablets", "the lack of Internet access"*. It was also observed regarding teachers that *"everybody has the opportunity, it depends on the teachers if they are willing or not", "if the teacher would like to use tablets, every subject is appropriate for it"*.

Figure 1. The chance of using tablets in the case of different subjects (%, lower-level primary classes; more answers were available)



The chance for schools to use tablets in subjects taught in upper-level primary classes is 20% higher than in lower-level primary classes. The order of the subjects was quite similar; subjects taught in higher numbers had priority. The most competent ones are Mathematics (84,1%), Foreign languages (80%), Hungarian Literature and Grammar (76,6%), and History (75,2%), then comes Science, Fine Arts and Physical Education (Figure 2). The open-ended answers added others to the list like "Health Science", "Special Needs Education", "Financial Studies", "Schoolroom Activities", "Graphic Design" and "Communication, Project Days and Social Behaviour".

Figure 2. The chance of tablet-usage in the case of different subjects (%, upper-level primary classes; more answers were available)



Forms of scheduling tablets

Institutional tablet-usage is being affected by the way tablet availability is arranged. If their utilization is high, it can often occur that several teachers would like to use tablets at the same time; therefore it is worth defining who gets to use them, when, and for how long. Nearly three-quarters of the participating institutions had a set of agreements, less than one-quarter did not. However, the oral agreement was most preferred in the examined schools, though this informal regulation may have led to conflicts and difficulties while planning the lesson and later when actually using these mobile devices in the lesson. Relatively few schools adopted the paper-based timetable and even less used some kind of online solution (Table 4). Regarding some other regulation methods (15 out of 145) the open-ended answers also confirmed that in the majority of schools the distribution of tablets takes place *"after previous consultation with IT teachers, system administrator", "on the basis of discussion", "oral agreement on the same school day", "on the basis of previous, personal agreement"*. There are stricter regulations in those institutions, where they *"write the distribution of the tablets in a notebook with a fixed appointment" or "the devices are attached to classes or classrooms"*. Several schools make rules *"according to the instructions of the application"*, in other institutions "*the teachers announce their requests on the previous day – how many tablets are needed on which lesson*" or "*on the basis of the system administrator's registry"* or simply *use"teamup.com"*.

Table 4. Distribution of tablet-usage (%)

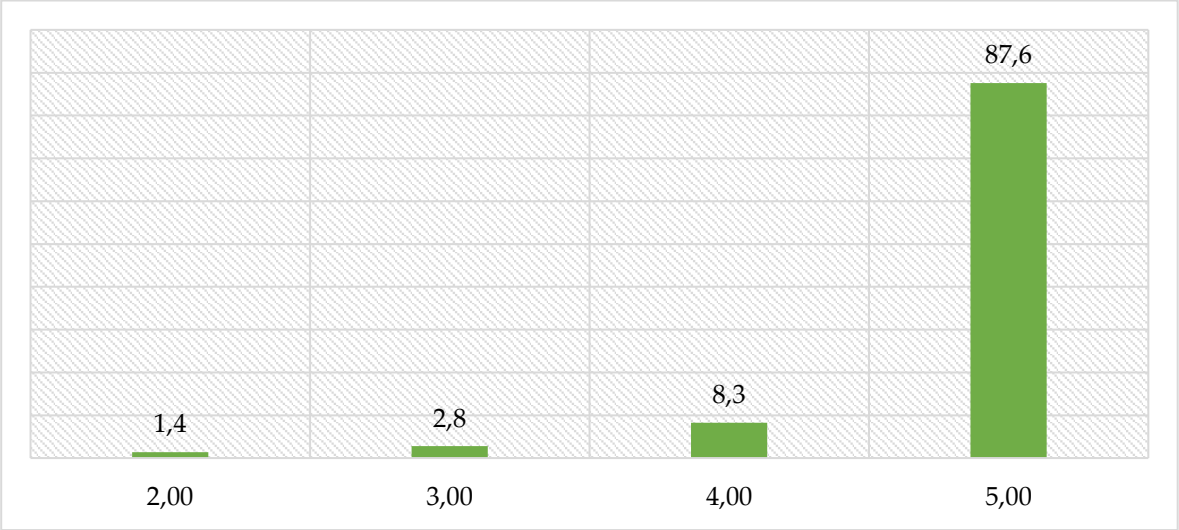
		no rules	**verbal negotiation**	**timetable posted in the staff room**	**online timetable**	**others**	**total**
total	N	34	74	21	1	15	145
	%	**23,4%**	**51,0%**	**14,5%**	**0,7%**	**10,3%**	100,0%

The characteristics of and differences between human resource conditions

School management support, personal conditions

An involved school management plays a key role in the fulfilment of tablet-supported education at the institutional level. The participating schools gave their opinions about tablet-supported education to the school headmaster with the help of a five-point Likert scale (1- refuse, 5- support). The tablet-supported education was warmly greeted by school management, 87,6% gave a rating of 5, only 8,3% gave a rating of 4 to the leaders' approach; less than 10% of all reflected a neutral or negative view. The rate of average support on the five-point scale was 4,82. Based on the data it was evident that the majority of the participating schools gained the management's support, in contrast to the teachers' attitudes (Figure 3).

Figure 3. School management support of tablet-supported education (%)



On one hand it is essential to have the support of the management; on the other hand tablet-supported education needs a system administrator, who knows these mobile devices, a dedicated teacher who controls and sets up this type of education or holds teacher trainings for their colleagues. While almost three-quarters of the schools employed a system administrator (111 out of 145), only one-third of them charged a teacher with the responsibility of tablet-supported education (56). Because there are no available system administrators or different schools or settlements have one employee they share, schools suffer from difficulties like regular maintenance, setting modification, application download or removal, etc.. Less than half of the schools appoint a teacher for tablet-supported education, in most cases according to the rate of support the principal is responsible for this program (Table 5).

Table 5. System administrator and tablet project leaders in schools

		system administrator		**tablet-project leader**		
		yes	**no**	**yes**	**no**	**total**
total	N	111	34	56	89	145

Teacher training attendance

The form and effectiveness of tablet-supported education is affected remarkably by teachers' attendance of teacher trainings and their level of digital competence. We are demonstrating the frequency of attendance of teacher trainings on the basis of the view of the respondents, who filled out the questionnaire. This number does not reach 30% both in the case of accredited and non-accredited trainings. There was a slight difference between lower-level and upper-level primary teacher attendance of accredited trainings (22,07% and 23,38%). Teacher attendance of non-accredited trainings was a bit higher in comparison with accredited ones (24,18%

versus 22,73%), The variance between lower-level and upper-level primary teacher attendance of non-accredited trainings was very low (Table 6).

Table 6. Teacher-attendance of accredited and non-accredited trainings about tablet-supported education (%)

		lower primary classes		upper primary classes		total
accredited trainings	**N**	**mean**	**std. dev.**	**mean**	**std. dev.**	**mean**
total	145	**22,07**	26,16	**23,38**	26,33	**22,73**
non-accredited trainings	**N**	**mean**	**std. dev.**	**mean**	**std. dev.**	**mean**
total	145	**23,59**	27,12	**24,76**	27,31	**24,18**

Beside the formal trainings, the schools can hold internal teacher training courses under the direction of their own teachers. This is also true for schools applying tablet-supported education, because nearly half of the schools organized internal trainings relating to tablets. In general, 38,6% of the schools arranged internal trainings every six months, less than 10% held trainings more often. Thus it can be surmised, the smaller number of ambitious teachers, and the lack of digital competence may both lead to non-attendance in these courses.

Table 7. Internal teacher trainings about tablets / tablet-usage

		no trainings	**half a year**	**some times in every half a year**	**monthly**	**some times in a month**	**total**
total	N	78	56	7	3	1	145
	%	**53,8%**	**38,6%**	**4,8%**	**2,1%**	**0,7%**	100,0%

Digital Competence of the Teacher

One of the most important conditions for implementing tablet-supported education is the level of the teachers' digital competence, to which teacher trainings contribute a lot (this was explained in details in the previous part). We asked the respondents to assess the digital competence of teachers. The respondents had to evaluate with a five-point Likert scale to what extent they had the necessary competences (1-none at all, 5 – totally). Generally speaking, based on the aggregated data, the digital competence of the teachers was a bit higher than the average in the schools participating in the research (3.16). Comparing lower-level and upper-level primary teacher competences, the results of the latter were slightly higher (lower-level: 2,99 (sd: 0,93), upper-level: 3,32 (sd: 0,87)).

We wanted to get a more comprehensive view of the level of the teachers' digital competence which is absolutely necessary for putting tablets in their lessons; therefore, we converted the five-point Likert scale into a three-point scale: 1-2 points meant "poor", 3 points were "average", 4-5 points were "good". The aggregated data referred to the fact that the majority of the teachers' digital competence was around or above average. Obviously, there was some difference between the lower-level and upper-level primary teachers' digital competence; however, the "average" category was quite the same for both. More than one quarter of the lower-level primary teachers (41 out of 145) did not have the right competences while this rate was smaller (21) among upper-level primary teachers (Table 8).

Table 8. The level of teachers' digital competence necessary to use tablets (%)

		lower primary			upper primary			total
		poor	**average**	**good**	**poor**	**average**	**good**	
total	N	41	**65**	39	21	**66**	**58**	145
	%	**28,28%**	**44,83%**	**26,90%**	**14,48%**	**45,52%**	**40,00%**	**100%**

Discussion

In our empirical research we attempted to give a complete picture about the institutional-level application of tablet computers, with special focus on the supportive framework background and the human resource background. The extent of generalization of the results is limited but some trends and directions can be observed. The analysis of the supportive framework background confirms that the access to tablets is different in the lower and upper primary classes, but the ratio of the access is rather high. In the background of the

differences various reasons could hide, from pedagogical-methodological considerations to the lack of digital competence of both students and teachers. The majority of students have access to tablets but 1:1 device usage in some of the schools is limited; one fifth of the schools are handing out mobile devices for pair and group work. The reasons for the practice could be both pedagogical (e.g. to improve collaboration and cooperation) or technical (e. g. lack of devices, poor Wi-Fi connectivity). The data also suggests that the range of subjects supported by tablets is diverse. There was no notable difference between lower-level and upper-level primary school class groups, mainly the subjects with more lessons (mathematics, literature, science, foreign languages) had more possibilities for digital learning. It may be that those teachers who work with the students regularly have more time to shape up a proper tablet supported learning environment. The results confirm that the researched schools in this study are on different levels of institutional-level usage. Even different rules and policies can show the level of experience in ICT-supported learning; about one quarter of the examined schools have no regulation on scheduling the tablet usage for teachers. About half of the teachers can take the mobile devices if they are available, and only a smaller ratio of the schools are using more sophisticated methods (e. g. offline, online timetable).

Beside the supportive framework background, human resource background also has a key role in the implementation and integration of tablet-supported learning. School leaders can have an important role in the fulfilment of tablet projects. In our research the majority of the school principals were supportive with their tablet initiatives, only a minor percentage were neutral or dismissive. The approach of the school boards can also influence tablet project leaders and system administrators who are important persons in this kind of initiatives as well. A responsible project leader can empower the faculty, take part in teachers' personal development (PD) as well as mentoring the colleagues. While the majority of the schools employs a system administrator for working with the tablets, only one third of the schools have a supportive project leader. Even though a school has supportive employees, professional development can be necessary. The data shows that the ratio of the participation in registered and non-registered PDs is relatively low; neither lower-level nor upper-level primary school teachers achieve 30%. The reasons can be different; on the one hand prices and the location (mainly in the capital) of the courses can be inadequate, on the other hand the number of professional groups on social portals is rising continuously, so self-sufficient learning is an option for many teachers. However the participation ratio of PDs is fairly low, the digital competences of teachers are average. Mean score is 3,16 (Five-point Likert-scale), but there is a slight advantage for the upper-level teachers comparing to the lower-level teachers. As the results show the practice of the tablet-supported learning in Hungarian primary schools is diverse; many schools are taking their first steps onto the field of ICT-supported teaching.

From our research some trends can be discovered in the institutional-level implementation and integration, it shows an overall picture of tablet-using primary schools before the COVID-19 pandemic. It is worth noting that digital education changed completely when remote education started. Therefore, further research questions are needed to get a broader view (e.g. "What kind of effect could have been experienced in tablet using (and mobile learning) due to the current situation (remote education)?"; "Is it possible that teachers were more prepared for remote education due to the increased use of ICT devices?").

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Conflicts of Interest: The authors declare no conflict of interest.

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