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Teachers' attitudes in terms of using ICT at school

Many are discontent about today's education. Some criticize the available devices; others think that their teachers are not prepared enough, and many urge the transformation of the teaching environment. Consequently, they have different pictures of the development trends; however, everyone agrees that digital technology will play an important role in this process. As Warlick put it: "We need technology in every classroom and every student and teacher's hand, because it is the pen and paper of our time, and it is the lens through which we experience much of our world" (Warlick 2006, 1). However, "in Hungary, less than 20 percent of the teachers use ICT tools at more than 25 percent of their school lessons" (Digital Education Strategy of Hungary 2016, 8).

Incorporation of digital technology into the education process can be obstructed by several factors; Mumtaz arranged these elements into three groups. He distinguished between obstacles of economic, school and teacher level (Mumtaz 2000). Economic level obstacles do not only include the costs of buying, maintaining and permanently renewing the new technology but producing digital content that needs much of financial resources, as well. School-level obstacles include insufficient support (e.g. to rectify technical problems or acquire new methods) and the lack of time necessary for getting prepared and planning the teaching process. The previous one appears as a problem mainly for those not self-confident enough in solving a problem situation (Rosen – Weil, 1995), and the latter one is mentioned in this group because in many cases the institutions require so much work of the teachers within and outside the classroom that they will have very little time left to get to know ICT opportunities and practice new solutions (Robertson et al. 1996, Ertmer 1999). However, according to Mumtaz, the most dominant factor is the third one, the teacher level; similarly to Veen (Veen 1993), he thinks that the impacts of this are far stronger than those of the institutional or school factors.

It can easily be seen, for example, that the teachers' attitudes about technology exert considerable impact on their activities. Be the most modern ICT tools available in the classroom, "adequate basic knowledge will be in vain if one is not motivated to use it and does not possess positive attitudes; his/her knowledge apt to be utilized will not become operating" (Hercz et al. 2010, 1). The depth of computer knowledge and the self-confidence or vagueness arising from this as well as the feeling of personal effectiveness mean a kind of motivational basis in using digital technology at school. Therefore, in many cases, the problem is the teachers' technophobia; many of them are afraid that the digital tools and programs will break down or not work properly (Rosen – Weil 1995). However, ICT tools and the knowledge necessary to use them provide only the essential – necessary but not enough – starting conditions of change. According to several types of research and studies (e.g. OECD 2000, Csákó 2001, Nikolov 2010, Makrakis 2010, Kadocsa – Gubán 2014), the digitalization of the learning environment with sufficient tools does not automatically bring about the transformation of the education process. The change depends on the participants', and especially the teachers' "capability to adapt, willingness, motivation and activity" (Török 2007, 45). The teachers' attitudes determine the methods used at the lessons; they even affect what solutions and tools of the digital world the teachers notice at all, which of these become important, decisive and motivating for them from some aspect (Juhász – Takács 2006).

Attitudes of the teachers of Debrecen

Below I will present the results of a research series that give us a picture of the attitudes of teachers concerning the adoption of ICT tools at school. During the researches, we did not only try to explore the personal features but also touched upon mapping the opinions about colleagues and the educational environment itself. The teachers do not work in isolation in a narrow and static environment but as parts of a community, in close interrelation with others and under varying environmental conditions. The developments at their schools have various impacts on their work; for example “seeing that their colleagues or students use computers as something natural in solving their everyday problems improves the performance of certain teachers” (Török 2007, 145).

The research series was started in 2006; this was the year when we first asked the teachers working at the primary and secondary schools of Debrecen to answer our query. In the survey repeated in 2009, 2013 and 2016 altogether 2411 persons (1886 women [78.2%] and 511 men [21.2 %], 14 people did not tell their sex) answered our questions. Thus in our survey, men are somewhat over-represented; while according to the national data, the proportion of women amongst teachers has not deviated much from 82 percent since the early 2000s (Varga 2015), in our researches the rate of female respondents was slightly lower each time.

We examined the attitudes of the respondents in terms of using or adopting ICT tools basically with a four-grade Likert scale (4=fully agrees, 3= rather yes, 2=rather not, 1=does not agree); we asked for their opinions about various statements. The statements were arranged into two groups. One included the statements the respondents evaluated about themselves, and the other one included those worded about their colleagues and work place.

Table 1: Teachers' attitudes in terms of ICT tools and using them at school
Rate of the answers 3 (rather yes) and 4 (fully agrees) (%)

Statements	2006	2009	2013	2016
I like teaching. *	98,01	98,95	97,90	98,14
I permanently refresh my teaching methods and tools. *	94,26	90,59	88,99	94,48
I am interested in technical novelties. *	76,97	85,31	79,16	87,45
I feel prepared to apply computers in teaching. **	na.	69,82	68,94	79,67
I am interested in applying ICT tools in teaching, but I am not prepared enough. *	66,42	65,26	61,28	64,67
Besides teaching, I have time for self-education. *	61,50	53,31	41,69	51,47
I am good at using computers. *	58,20	77,97	75,23	87,25
The school consumes all my spare time. *	55,70	65,85	71,96	72,61
I prefer the traditional teaching method of “blackboard and chalk”. **	34,58	24,73	32,47	23,33
My school has good technical equipment. *	63,48	64,11	46,73	66,98
My colleagues use computers successfully in their everyday practice.*	52,32	47,54	53,21	66,67
At staff meetings, we do not touch the issue of using computers at lessons.*	43,84	30,63	37,29	31,30
At our school, there are only a few people who are interested in using computers in teaching. *	42,55	29,72	28,57	17,76

* p = 0,00; ** p < 0,01 Kruskal-Wallis test

The statement “I like teaching” stands out of all of them; agreement with this was above 95 percent in each of the four types of research. From this respect, teachers did not change; the Kruskal-Wallis test did not show a significant difference between the results of the various surveys. Unfortunately, there were some who did feel very bad in their jobs: four people in 2006, one in 2009 and two in 2013 and 2016 rejected this statement. (It is a question then why they kept on teaching.)

The query included two more statements that were agreed by the decisive part of the respondents (at least 75 percent) in each survey; both indicate the positive attitudes of the responders towards (technological) innovation.

Moreover, it was only the statement about methodological renewal (in 2009) that no one rejected fully. So all of the respondents strived to exert some level of methodological changes, even the teacher who did not like teaching. This positive attitude is also reflected in the fact that the respondents did not keep themselves fans of the blackboard-chalk method. Only 99 persons (4.1%) gave contrasting responses during the four surveys, i.e. they said they preferred traditional tools. The decisive part of the teachers was interested in technical innovation; concerning them, the question was whether it was a superficial, observing interest or deeper, manifesting in actions, as well. In the latter case, it was an important aspect whether it was their characteristic as private persons or as teachers, as well.

During the ten years between the start and the end of the researches, the biggest change took place in handling computers; according to the data, the teachers of Debrecen thought they were better at using computers in 2016; agreement rate had been 58.2 percent in 2006, which rose to 87.25 percent by 2016 ($p=0,00$). Development in this field was only interrupted in 2013, otherwise, in each of the other years, comparison by pairs indicated a significant ($p=0,00$) positive trend. At the same time, it is also worth mentioning that out of the sentences relating to personal attitudes or feelings it was only the statement “The school consumes all my spare time” in terms of which a change indicating one clear direction could be detected: teachers felt more and more burdened. In 2006, it had been only 7.6 percent of the respondents who thought they did not have any spare time left besides their work; this rate grew to 17.3 percent by 2016. This is an essential issue because if there is no possibility to take rest and get refreshed, it will sooner or later exert a negative impact on the quality and effectiveness of one’s work. Since more time must be spent on working, it is not surprising that less time can be used for self-education ($p=0,00$). However, this is essential in keeping up with the permanently changing digital technology.

The responders formed better and better opinions during the consecutive researches not only of themselves but their colleagues, as well. They thought their colleagues were more and more prepared to use computers and that the issue of using new technology at lessons was more and more often discussed at staff meetings. Perhaps this is also a reason why the rejection of the statement “At our school, there are only few people who are interested in using computers in teaching” was continuously growing stronger during the surveys; in 2016, 82.24 percent of the respondents rejected this statement or agreed very little. We experienced the lowest agreement value of the query at this statement; it remained under 20 percent (17.76%) only in this case. It is important to note that according to our responders, the technical equipment of their schools did not improve so it was not better availability that generated higher interest!

After presenting the results relating to the whole sample, let us examine the differences and similarities that can be seen between the attitudes of the various sub-groups of the respondents (Table 2).

Table 2: Teachers' attitudes in terms of ICT tools and using them at school – by sex
Rate of answers 3 (rather yes) and 4 (agrees) (%)

Statement	men	women
I like teaching. *	96,99	98,43
I permanently refresh my teaching methods and tools. *	90,36	93,66
I am interested in technical novelties. *	89,94	78,38
I am at good at using computers. *	79,03	68,07
I feel prepared to apply computers in teaching. *	80,28	71,75
Besides teaching, I have time for self-education.	55,94	54,17
I am interested in applying ICT tools in teaching, but I am not prepared enough. *	40,33	58,23
The school consumes all my spare time.	60,24	64,85
I prefer the traditional teaching method of "blackboard and chalk.	27,77	30,94
My school has good technical equipment.	59,68	61,68
My colleagues use computers successfully in their everyday practice.	52,74	55,75
At staff meetings, we do not touch the issue of using computers at lessons.	37,96	38,22
At our school, there are only a few people who are interested in using computers in teaching.	35,77	31,90

* $p = 0,00$

In terms of sexes, it is obvious that concerning seven of the thirteen statements, there is no significant difference between men and women. For example, both sexes gave similar answers about their work load, their colleagues and the technical equipment of their institutions. It is, however, noteworthy that according to our results, women are more keen on the teaching career, they like teaching more and also refresh their teaching methods more often than men. However, almost two-thirds of them said that although they were interested in using ICT tools in teaching, they did not have the necessary skills. This feeling might obstruct the work of many to some extent since in case one is not self-confident in using a new tool or methods, (s)he will probably prevent applying it (Hadley – Sheingold 1993).

Since at the various types of schools, different stress is put on the teachers' certain activities, we wished to examine what similarities and differences can be shown between the persons teaching at primary (1363 people) and secondary (913 people) schools. Of course, there might be some differences between the secondary institutions of various profiles but to prevent excess and – about the number of data, disproportionate – polarization we finally ranked each of the secondary institutions into one comprehensive category. On the whole, the rate of those teaching at primary schools and secondary institutions almost equals to the national data; according to the National Statistical Office (KSH 2017), during the latest years, 61.3 percent of the teachers worked in primary educational institutions in average.

We found differences between the attitudes of the teachers of the various types of schools in several fields (Table 3).

Table 3: The teachers' attitudes in terms of ICT tools and using them at school – by institution types
Rate of answers 3 (rather yes) and 4 (agrees) (%)

Statements	primary school	secondary school
I like teaching.*	98,35	97,98
I permanently refresh my teaching methods and tools.*	94,67	91,27
I am interested in technical novelties.*	79,91	82,62
I am at good at using computers.*	64,97	77,67
I feel prepared to apply computers in teaching.*	70,25	77,37
Besides teaching, I have time for self-education.	58,00	50,11
I am interested in applying ICT tools in teaching, but I am not prepared enough.*	56,97	50,34
The school consumes all my spare time.	63,87	64,09
I prefer the traditional teaching method of "blackboard and chalk".	30,82	30,10
My school has good technical equipment.	62,66	59,87
My colleagues use computers successfully in their everyday practice.	54,60	57,13
At staff meetings, we do not touch the issue of using computers at lessons.	38,93	36,24
At our school, there are only a few people who are interested in using computers in teaching.	35,68	28,80

** 35,68; 28,80

* $p = 0,00$; ** $p < 0,05$

Since at primary schools, the rate of woman teachers is higher than it is at secondary schools, the differences between the two sexes are reflected in the data gained in terms of the school types. Those working at primary schools like teaching more and according to the average data of the responses, they are more likely to refresh their teaching methods and tools. The latter one, however, is less extended to digital technology although they agree with the statement "Besides to teaching, I have time for self-education" to a greater extent. Therefore, it seems they search for new solutions not used formerly rather within the set of traditional methods, and they are less likely to involve computers into this process. (Even though primary school teachers are more content with the technical equipment, which is a starting condition.) Although their values are of a bit lower level, renewing methods is important for secondary school teachers, as well, and they are more likely to use computers in this process. The reason for this may also be that they are more interested in technical novelties than primary school teachers, and also keep themselves more prepared to use ICT tools in teaching.

Generation theories connecting to age (e.g. Strauss – Howe 1997, Prensky 2001, McCrindle – Wolfinger 2009) often serve as bases for the examination of digital differences even though these theories have been offended several times. Those who counter this opinion usually refer to the point that these are not uniform or homogenous groups but only “pseudo-communities” (Pankász 2016). Several types of research (e.g. Bennett et al. 2008, Hunya 2008, Buda 2010, Fehér – Hornyák 2011) indeed proved the fact that the students equally considered digital natives do not for a homogenous group. With the data collected during our research, we wished to prove the supposition that the teachers, too, had various relations to the application of ICT tools at school; therefore, we examined whether there were any differences between the attitudes of the various age groups of the teachers equally considered as digital immigrants (Table 4). To maintain the relevance of the analysis, we strived to form sub-groups with similar numbers of elements. Thus we made three age groups. The first one included those younger than 40 (751 people), the second one the persons between 40 and 49 (818 people) and the third one those aged at least 50 (750 people).

Table 4: The teachers’ attitudes in terms of ICT tools and applying them at school – by age groups
Rate of answers 3 (rather yes) and 4 (agrees) (%)

Statements	below 40	40-49	50 or more
I like teaching.*	98,16	98,17	98,24
I permanently refresh my teaching methods and tools.*	94,01	92,72	91,85
I am interested in technical novelties.*	84,25	78,38	79,78
I am at good at using computers.*	82,52	71,02	58,38
I feel prepared to apply computers in teaching.*	82,22	77,17	65,10
Besides teaching, I have time for self-education.	54,67	50,34	60,70
I am interested in applying ICT tools in teaching, but I am not prepared enough.*	47,46	54,68	60,57
The school consumes all my spare time.	54,06	66,74	68,44
I prefer the traditional teaching method of “blackboard and chalk”.	27,04	29,05	35,29
My school has good technical equipment.	57,45	62,90	62,55
My colleagues use computers successfully in their everyday practice.	51,01	53,12	61,49
At staff meetings, we do not touch the issue of using computers at lessons.	42,99	36,42	35,72
At our school, there are only a few people who are interested in using computers in teaching.	36,14	32,98	29,48

* p = 0,00; ** p < 0,05

According to these results, younger teachers are more interested in using digital technology in education than the older ones. They think they are good at using ICT tools, they keep themselves more prepared, and to maintain this, they permanently refresh and develop their knowledge. The older ones feel more burdened and less interested or prepared but are more content with their colleagues than

their younger peers. They have a more positive picture of the technical equipment of their schools, too. However, this might be a consequence of the fact that they prefer the traditional method of “blackboard and chalk” at a larger rate than the younger ones. For those preferring blackboard and chalk, it is in fact of no importance what digital tools are available at the school; from this point of view, even some – not very up-to-date – equipment might seem many.

In terms of the age groups, it was an important result that there was not much difference between them concerning love for teaching and the efforts made for methodological renewal; thus our respondents did not fight the often mentioned burnout of teachers (pl. Skaalvik – Skaalvik 2017, Iancu et al. 2018).

Factors and clusters of attitudes

The answers given to the attitude statements were also examined by factor analysis; at the end of the process, we gained five distinguishable factors. These together explain 61.6 percent of the total variance.

Table 5: Result of the factor analysis done with the variables of the attitude statements (KMO=0,730)

	Factors				
	1	2	3	4	5
I am good at using computers	,812	-,024	,178	-,085	,062
I am interested in applying ICT tools in teaching but I am not prepared enough	-,724	,045	,334	-,109	,042
I am interested in technical novelties	,596	,019	,386	-,158	-,011
At our school, there are only a few people who are interested in using computers in teaching	-,002	,832	-,046	-,098	-,033
At staff meetings, we do not touch the issue of using computers at lessons	-,045	,798	,016	-,034	,008
I like teaching	-,098	-,031	,724	,069	,037
I permanently refresh my teaching methods and tools	,292	-,036	,673	,077	-,132
My school has good technical equipment	,105	-,087	,134	,692	-,153
My colleagues use computers successfully in their everyday practice	-,082	-,345	,132	,610	,029
I prefer the traditional teaching method of “blackboard and chalk”	-,262	,270	-,202	,565	,107
The school consumes all my spare time	,120	,012	,147	,078	,858
In addition to teaching, I have time for self-education	,136	,052	,339	,199	-,692

(The variables of the certain factors are indicated in grey colour.)

In the first factor, we can see the manifestation of the attitudes of those “prepared” for digital challenges; they were the ones who were self-confident in using computers and other digital tools in which their interest in technological innovation played an important role. The second factor could be

characterized by “elusion”. The statements belonging here presented an attitude pushing responsibility for the neglect of digital technology to the staff. Namely, in case there are only a few colleagues interested in using computers in education and the issue is not mentioned at staff meetings, either, those not interested in the topic and lacking the sufficient knowledge to apply the new tools can perceive these phenomena as excuses. The third factor indicates the attitude of those “loving to teach”; they, although in theory, permanently improved their teaching methods, still thought they were not prepared enough to use digital technologies. The fourth factor includes “contented conservatives”. They were satisfied with the technical equipment of the school and the colleagues’ habits of using computers, however, they preferred blackboard and chalk. The fifth factor shows the attitude of the “burdened”. They thought that the school consumed all their spare time, so much that they did not have any time left for self-education.

By making a factor analysis, we can present the hidden system of relations between the variables; using this process we get new, artificial variables (factors) that will show the examined phenomenon more simply than the original variables. The factor structure that evolves from the variables of a reduced number can be interpreted in itself, too – as presented above –, however, the final result will be less informative in terms of the queried persons. To typify our data, and so achieve more detailed information, we also examined our statements measuring the attitudes by using cluster analysis.

Of the various cluster creating processes, several papers (e.g. Székelyi – Barna 2004, Sajtos – Mitev 2007) propose to use the K-center process in the case of surveys with a high number of elements. However, this process requires the knowledge of the number of the clusters. Therefore, we first used hierarchic clustering (Campbell-Hunt 2000) to determine the optimal number of clusters to which our starting point was the five factors we had gained as a result of the factor analysis. After having performed the hierarchic process with several methods and using the dendrograms drawn as a result of the process, it showed to be reasonable to choose a structure containing seven elements. Accordingly, during the K-center clustering process, we set the creation of seven clusters as the starting parameter.

Table 6: The final cluster centres of the K-center clustering process in terms of the attitudes

	Clusters						
	1	2	3	4	5	6	7
1. Factor	-,72345	1,01972	,17965	-,90582	,07890	,36449	-,13275
2. Factor	-,89663	-,59581	-,32882	-,06331	,93050	,17341	1,14607
3. Factor	,31878	,32524	,31505	-,41433	,29550	-1,87986	,57750
4. Factor	-,57350	,53973	-,67513	,98555	-,73527	-,37496	,73624
5. Factor	,46007	,24944	-1,30873	,15846	,77549	-,12495	-,59845

Cluster 1: Resigned “backwards” (N=330)

The most important characteristic of the cluster is that its members are interested in applying ICT tools in education only seemingly, and they do very little to satisfy their curiosity. Therefore, the reality is that they lack the competences to use new solutions, and are weak in handling even a computer. They could improve their situation because staff meetings at their institutions touch the topic of the

educational use of new technologies quite often, and they also assess their colleagues as open and interested, however, they are not convinced that using the new technology would be fruitful, and they also say they do not have time for self-education anyway. Therefore, their backwardness in this field appears evidently.

Cluster 2: Interested “eminent” (N=394)

The members of the group are not only extremely interested in new technologies but are very good at using computers and permanently improve their educational methods, as well. No doubt, they are the “engine teachers” (Báthory 2000) of the digital world. Moreover, they have a positive picture of their colleagues both as individuals and as teams.

Cluster 3: “Hobby teachers” with plenty of time (N=290)

The most typical feature of the members is that they have plenty of spare time out of school since teaching does not mean a great burden to them. However, they do not use the time available for self-education or the development and learning of new teaching methods, but some other activities were not connecting to school. According to their answers, they possess an established repertoire of methods that, however, does not include the classic pair of blackboard and chalk.

Cluster 4: Refusing “hidebound” (N=323)

The members of the cluster are resolute fans of using blackboard and chalk. Their motivation for teaching is not vocation or love but routine, and they are not only uninterested in new technologies but also refuse to use them. Meanwhile, they are contented with the technical equipment of their schools, which is a direct consequence of the fact that they only need a blackboard and some chalk.

Cluster 5: Discontented “overloaded” (N=336)

The members of this group feel that the school eats up all their spare time, so in addition to teaching – which they do not like so much – they have no time left even for self-education. As they give negative answers about elements concerning which leaders have a decisive role, they implicitly criticize the school management. On the one hand they keep the technical equipment of the school insufficient, and think that staff meeting hardly touches the issue of using computers at lessons on the other. They are very much discontented with their colleagues who are, according to them, not interested enough and they do not or not adequately use new technologies in teaching.

Cluster 6: Apathetic “burned-outs” (N=233)

This cluster has very negative attitudes. Its members do not find any joy in teaching. Therefore, they do not make any efforts to develop their teaching methods. They are not interested in using ICT tools in teaching and are not satisfied with the school’s technical equipment. Neither traditional means of education (blackboard and chalk), nor new ones (computers) are important for them. It would be worth examining the reason why despite the many negative attitudes they are still teaching in new research.

Cluster 7: Observing conservatives (N=256)

Although they keep themselves, devotees of the traditional “blackboard-and-chalk” etching method, they do not fully reject innovation. They are still unpractised in using digital technology, but as they have some time left for self-education, they might be able to catch up. Although they could do more to improve themselves, they expect much more interest in their colleagues and more staff meetings dealing with digital technology and methodology.

Conclusions

The teachers' relation to computers and digital solutions determines processes at schools and especially the lessons. This is why we thought it was essential to get to know the teachers' attitudes: our research series was focused on the teachers working at the public education institutions of Debrecen.

One of the outstanding lessons learnt from our results is that more attention should be paid to forming the attitudes of teachers and to-be-teacher students as well as to their preparation in terms of using ICT tools in education. This is not an easy task since the range of tools and programs is very wide and it is continuously growing, so it is almost impossible to keep up with the changes. And in case someone is trying to meet supposed or real requirements desperately, distress or even fear may easily evolve about the new technological solutions. Because of tenseness, many might feel insecure and think they are permanently lagging since they do not know much about digital technology. This is exactly why this point of view or attitude must be changed.

First, the teachers must accept the fact that they cannot be up-to-date in everything. It is impossible to know all the tools, programs, and websites and be immediately informed on each real or unreal scientific discovery and invention. They should, however, make efforts to utilize the available opportunities as fully as possible, and should also be open to innovation and changes. They must be aware that applying new solutions hides plenty of risks, too (e.g. a technical problem should not paralyse them), but they should not look at these problems as obstacles impossible to overcome but as challenges to be met.

The teachers should also accept that their role in the teaching process has changed; they are not any more the only sources of knowledge (Molnár 2011). Many students think that by some clicks on the internet they can gather much more information than they could from their teachers, and also they do not have to wait until the teacher directs his/her attention at them, everything is available "at once". Of course, the student's searches do not always lead to success, and not all of them can select between the results, so impatience resulting from unsuccessfulness will appear about the net, as well. This, again, might give a new chance to teachers. They can support and help their students as mentors or consultants to prepare them for the challenges of the 21st century, including the conscious, targeted and safe use of technology. However, they also need help to be able to do this.

Literature

- Báthory Zoltán (2000): A maratoni reform (2. rész). Iskolakultúra. 10-11. sz. pp. 3-26.
- Bennett, Susan J. – Maton, Karl A. – Kervin, Lisa (2008): The "digital natives" debate: A Critical Review of the Evidence. *British Journal of Educational Technology*, 39 (5). pp. 775-786.
- Buda András (2009): Attitudes of Pedagogues to ICT Devices. *Jampaper* 2009. 4. sz. 129-142. pp. <https://bit.ly/2rLYxBa> (2017. 11.10.)
- Buda András (2010): Attitudes of Teachers Concerning the Use of Ict Equipment in Education. *Journal of Social Research & Policy*, Volume 1, Issue 2. pp. 131-150. http://www.jsrp.ro/content/JSRP-Nr2_BUDA (2018. 04.19.)
- Buda András (2017): IKT és oktatás: Együtt vagy egymás mellett? *Belvedere Meridionale*, Szeged.
- Campbell-Hunt, Colin (2000): What have we learned about generic competitive strategy? A meta-analysis. *Strategic Management Journal*, Volume 21, Issue 2. pp. 127- 154.

- Csákó Mihály (2001): Informatika – internet – pedagógusok. Iskolakultúra, 11. évf. 1. sz. pp. 56-74.
- Ertmer, Peggy A. (1999): Addressing first- and second-order barriers to change: Strategies for technology integration. Educational Technology Research and Development. Volume 47, Issue 4. pp. 47-61.
- Fehér Péter – Hornyák Judit (2011): 8 óra pihenés, 8 óra szórakozás, avagy a Netgeneráció 2010 kutatás tapasztalatai. In: Ollé János szerk. III. Oktatás Informatikai Konferencia. Tanulmánykötet. ELTE Eötvös Kiadó. Budapest.
- Hadley, Martha – Sheingold, Karen (1993): Commonalities and Distinctive Patterns in Teachers Integration of Computers. American Journal of Education, 101, pp. 261-315.
- Hercz Mária – Nguyen Thanh Nikolett – Petró Tímea (2010): A tanári szövegértés-fejlesztő és az IKT-kompetencia vizsgálata. Anyanyelv-pedagógia, 2010/2. <http://www.anyanyelv-pedagogia.hu/cikkek.php?id=259> (2018. 05. 13.)
- Hunya Márta (2008): Országos Közoktatási Informatikai Felmérés 2006. Országos Közoktatási Intézet, Budapest.
- Iancu, Alina Eugenia – Rusu, Andrei – Măroiu, Cristina – Păcurar, Roxana – Maricuțoiu, Laurențiu P. (2018): The Effectiveness of Interventions Aimed at Reducing Teacher Burnout: a Meta-Analysis. Educational Psychology Review. Volume 30, Issue 2. pp. 373–396.
- Juhász Márta – Takács Ildikó (szerk.) (2006): Pszichológia. Typotex Kiadó, Budapest.
- Kadocsa László – Gubán Gyula (2014): A szakmai tanárok módszertani kultúrájának vizsgálata. In: Tóth Péter – Ősz Rita – Várszegi Ágnes (szerk.): Pedagógusképzés - személyiségformálás, érték közvetítés, értékteremtés: IV. Trefort Ágoston Szakmai Tanárképzési Konferencia tanulmánykötet. Óbudai Egyetem Trefort Ágoston Mémorokpedagógiai Központ, Budapest. pp. 21-38.
- KSH (2017): Köznevelési adatok, 2016/2017 (előzetes adatok) https://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_zoi010b.html (2017. 11. 14.)
- Magyarország Digitális Oktatási Stratégiája 2016. <http://www.kormany.hu/download/0/cc/d0000/MDO.pdf> (2017. 02. 04.)
- Makrakis, Vassilios (2010): Strategies to reinforce the role of ICT in teaching and learning for sustainability. In: Witthaus, Michele – Candless, Karen – Lambert, Rebecca (eds.): Tomorrow Today, Tudor Rose on behalf of UNESCO, Paris. pp. 169-171.
- McCrindle, Mark – Wolfinger, Emily (2009): The ABC of XYZ: Understanding the Global Generations, University of New South Wales Press, Sidney <https://bit.ly/2L4to4W> (2018. 05. 17.)
- Molnár Gyöngyvér (2011): Az információs-kommunikációs technológiák hatása a tanulásra és oktatásra. Magyar Tudomány, 172. évfolyam – 2011/9. pp. 1038-1047.
- Molnár György (2010): A technológia és hálózatalapú alapú tanulási formák és attitűdök az információs társadalomban, különös tekintettel a felsőoktatás bázisára. Információs társadalom: Társadalomtudományi folyóirat 3. pp. 61-76.
- Mumtaz, Shazia (2000): Factors affecting teachers' use of information and communications technology: a review of the literature, Journal of Information Technology for Teacher Education Volume 9, Number 3. pp. 319-342.
- Nikolov, Roumen (2010): Teacher Education in the Global Campus. In: ICT in Teacher Education: Policy, Open Educational Resources and Partnership, UNESCO Institute for Information Technologies in Education, Moscow, pp. 44-59.
- OECD (2000): Knowledge Management in the Learning Society. OECD, Paris.

-
- Pankász Balázs (2016): Online oktatási környezet és IKT tényezők összehasonlító vizsgálata a felsőoktatásban. Pécsi Tudományegyetem. Pécs.
 - Prensky, Marc (2001): Digital Natives, Digital Immigrants In: On the Horizon. MCB University Press, Volume 9, Number 5. October 2001. pp. 1-6.
 - Robertson, S. Ian – Calder, J. – Fung, P. – Jones, A. – O’Shea, T. – Lambrechts, G. (1996): Pupils, Teachers and Palmtop Computers, *Journal of Computer Assisted Learning*, 12, pp. 194-204.
 - Rosen, Larry D. – Weil, Michelle M. (1995): Computer Availability, Computer Experience, and Technophobia Among Public School Teachers. *Computers in Human Behavior*, 11. pp. 9-31.
 - Sajtos László – Mitev Ariel (2007): SPSS Kutatási és adatelemzési kézikönyv. Alinea Kiadó, Budapest.
 - Skaalvik, Einar M. – Skaalvik, Sidsel (2017): Dimensions of teacher burnout: relations with potential stressors at school. *Social Psychology of Education*. Volume 20, Issue 4. pp. 775–790.
 - Strauss, William – Howe, Neil (1997): *The Fourth Turning: An American Prophecy, What the Cycles of History Tell Us About America's Next Rendezvous with Destiny*. Broadway Books, New York.
 - Székelyi Mária – Barna Ildikó (2004): *Túlélőkészlet az SPSS-hez*, Typotex Kiadó, Budapest.
 - Török Balázs (2007): *Az információs és kommunikációs technológiák iskolai integrációja – IKT-metria mérőeszköz*. PhD értekezés. ELTE, Budapest.
 - Varga Júlia (szerk) (2015): *A közoktatás indikátorrendszere*. Magyar Tudományos Akadémia Közgazdaság-Tudományi Intézet, Budapest.
 - Veen, Wim (1993): How Teachers Use Computers in Instructional Practice: four case studies in a Dutch secondary school, *Computers and Education*, 21(1/2), pp. 1-8.
 - Warlick, David (2006): Curriculum is Dead. <http://2cents.onlearning.us/?p=420> (2018. 07. 29)
 - Zerényi Károly (2016): A Likert-skála adta lehetőségek és korlátok. *Opus et Educatio*, 3. évf. 4. sz. pp. 470-478.