Knowledge Society Failure? Barriers in the Use of ICTs and Further Teacher Education in the Czech Republic

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Abstract: The study investigates barriers of Czech secondary school teachers in the use of Information and Communication Technologies (ICTs) in teaching and in further education in ICTs. The Czech Republic is used as an example of a post-communist country with an evident gap between the digital competencies in general and teachers’ didactic skills necessary for their implementation in teaching. To explore how teachers deal with the challenges of digitalization of the education system, an online questionnaire was created to analyze the use of ICTs in teaching, as well as barriers teachers encounter when using digital technologies and when participating in further education. The results indicate that respondents have average understanding of ICTs and use them rather occasionally in teaching. Data show gender and age differences in the use of various digital means and in the barriers, the importance of social support in using ICTs in teaching, and also the necessity to eliminate prevalent gender stereotypes. Systematic further education that focuses on lowering computer anxiety and the distrust in new technologies might be also a major key in successful digital transformation of schools.

Keywords: ICT; digital competencies; secondary school teachers; barriers in the use of ICT; further education; computer anxiety; knowledge society

1. Introduction

The topic of this article is digital technologies and digital competencies in teachers. We focus on secondary school teachers in the Czech Republic, among whom we conducted research that examined their use of digital technologies and barriers that prevent them in using them and in further education in Information and Communication Technologies (ICTs). To a large extent, the findings from the Czech Republic can be applied more broadly to the former post-communist area, at least to the neighboring countries of Poland and Slovakia, which show that the educational process is also unable to respond effectively to changes related to digitalization of the public sphere. As studies suggest [1–3], digital technologies have a dominant role in current society, but in the Central and East Europe region, the level of digital literacy of students and teachers is rather mediocre and does not adequately correspond to the educational and social changes at all [4].

According to reference [5], in 2018/2019 there were 420,814 students in secondary schools and 38,223 full time teachers (23,022 were women). Of the 1290 secondary schools, 22.8% are private. In 2002, the Ministry of Education, Youth and Sports launched the Internet for Schools project. For more than 3600 school facilities, the project meant the opportunity to acquire the necessary technology and involve it in teaching. Nowadays, practically all schools are already equipped with computers and connected to the Internet, and 93.2% operate their own wireless network or information system [6]. The ICILS international comparison of computer and information literacy [7] states that Czech schools...
have above-average computer classrooms in relation to the participating countries. According to reference [8], in secondary schools there are 26.6 computers with an internet connection per 100 students, and a total of approx. 108,000 computers available. Most computers (74%) were acquired three to nine years ago, and 8.6% of them are even older than ten years. In 28% of secondary schools, not every second teacher has a computer. In 13% of secondary schools, not even one in four teachers owns computer at school. However, there are schools with a much more advanced approach to ICTs. For example, the Karlovy Vary Region has fully digital classes, though only to support science education.

The key element for the effective use of digital technologies at each school is the creation, fulfillment, evaluation, and updating of the relevant concept. Unfortunately, such intentions often focus on certain currently popular technologies under the influence of available funding support programs, while they are detached from the real needs of schools. Often, the real authors of such school strategies are commercial suppliers of some technologies. A concrete example may be the overestimated importance of interactive whiteboards acquired widely in all classrooms, without sufficient and effective support for teacher education. A similar initiative came in 2015 with the program “Tablets to schools”. A total of 888 teachers participated in the program focused on the use of tablets in teaching; however, only a few of them actually incorporated tablets into education [9]. Many projects focus on improving students’ skills and access to technology. In reaction to the impact of COVID-19 on education, the Computers for Children initiative was founded to provide families in need with computer technology that will allow their children to study from home and use technology to increase computer literacy.

The introduction of digital technologies into teaching was promised in the Czech Republic by the Digital Education Strategy until 2020 six years ago. However, the actual process of adopting technologies into daily life is very slow. The Ministry of Education, Youth, and Sports planned 43 activities within the Strategy, but according to references [10,11], the key activities still have not been met. The Ministry still has not specified what knowledge students should acquire and what competencies teachers should have, it did not provide educational materials for them, nor did it create an offer of in-service training for teachers. The Strategy fails especially in supporting the integration of ICTs into schools, creating digital infrastructure, and supporting digital literacy and competencies of students and teachers. For example, in the area “Ensuring sustainable financing of schools and school facilities in the field of infrastructure”, the analysis and proposal of financing have not yet taken place, and the same applies to supporting sufficient internet connection for schools in all regions of the country. Regarding the education of pre-service and in-service teachers, an analysis of existing university syllabi is underway, and possibilities for the future integration of ICT competencies into the training of future teachers have been analyzed. This is marked as “a significant progress” for fulfilling the priority “Inclusion of didactics of digital literacy development and students’ computer thinking in teacher education” [11]. For the area “Preparation of a widely available offer of in-service teacher education in the field of digital competences development and pupils’ IT thinking, including the creation of massive open online courses (MOOC) with the possibility of certified completion”, the Ministry reports a significant progress in the implementation in the form of preparation of voluntary MOOC courses. The paradox of digitalization in the country is that the digital devices are available, but there is no one to operate them, as people do not have sufficient skills. Teachers often lag behind their students in digital competencies, because they leave pedagogical faculties without necessary knowledge and skills and are prepared to teach under the traditional pedagogy paradigm, without accepting and adopting modern approaches [12,13]. This results in a barrier between teachers and their students, and teachers quickly become afraid they will not catch up with the students, so they lose motivation to further educate themselves in ICTs. Teachers today can teach very creatively, using a variety of modern technologies; however, the real picture is often different, partially because of too full a curriculum or the low level of digital equipment of schools. According to the Czech School Inspectorate, the information in electronic form is used in only half of the teaching hours in Czech schools. The quality of work with ICTs was not examined and it would probably show even more deficiencies. Even the Covid-19 pandemic has shown that Czech teachers are not prepared to adequately teach their students in times
when face-to-face education is not possible [14]. As reference [15] suggest, it is important to open education to new methods and ways of learning through digital technology and improve students’ competencies in working with ICTs at all types and levels of schools. However, this goal is not possible without competent teachers.

The present study investigates barriers of Czech secondary school teachers in the use of ICTs in teaching and in further education in ICTs. Based on the research reference [16], even teachers who have sufficient technology skills are not well-prepared to integrate ICTs into teaching, as there is an obvious gap between being digitally competent in general and being digitally competent to meet the educational goals of students. As described before, the majority of Czech schools are equipped with computers, interactive whiteboards, tablets, and other technologies, and teachers working there have sufficient digital competencies. These two factors are unfortunately not enough to successfully face the challenges of digitalization of the education system. Teachers often lack the didactic skills necessary for a meaningful implementation of the ICTs into specific subjects. Hence, we expect that the missing link might be the absence of structured further education in ICTs that considers teachers’ individualities and adapts the further education to their specific taught subjects. It is thus important to analyze the barriers teachers encounter when it comes both to the actual use of ICTs in their teaching practice, but also the barriers that inhibit their further education in ICTs.

2. Theoretical Background

The use of ICTs in a critical yet creative manner is now one of the 21st Century Skills [17–19]. In recent years, the field of pedagogy and also, for example, andragogy, has been intensively dealing with the inadequate digital literacy of subjects in the educational process with the ambition to redefine the goals of education [20,21]. The aim is to transform education from today’s traditional form to the form of modern pedagogy, which is able to meet the growing demand for quality and relevant education, to which teacher education and further training must necessarily respond [22,23]. One of the main goals thus is to redesign the entire framework of the learning society [24].

The use of ICTs by a teacher can be considered an activity where the teacher actively uses ICTs directly to complete all or part of the educational activity, to communicate with students, to motivate them, and to further educate themselves, etc. [25,26]. Besides the use of ICTs for activities such as creating presentations with the use of audio and video materials, it should be also teaching activities that support problem-solving, critical thinking, creativity, cooperation, and community work that teachers integrate into their teaching practice [27,28]. The teacher should ideally be the author of a digital output that he/she uses in the classroom, but that is available for the students also outside the classroom setting to improve their knowledge and skills, and even for people outside the school. [29].

2.1. Further Education in ICTs

Further education in ICTs of pedagogical staff, but also other non-teaching school staff such as office workers, should be a stable part of their ICT competency development following the European framework of competencies DigCompEdu. Without sufficient knowledge and skills in ICTs, it is not possible to meet the goals of modernization of school infrastructure and school educational programs through the implementation of various modern technologies into schools as institutions and also into teaching as an educational process [30]. The framework of digital competencies of teachers highlights activities and skills that may be underestimated or not commonly considered in connection with teaching. It focuses mainly on pedagogical competencies and provides insight into how these competencies are affected by the possibility or necessity of using digital technologies in teaching, which may be difficult for teachers to understand, as they are trained in traditional pedagogical competencies [31]. Thus, schools should focus not only on material and technology background but also on further education of their teachers and other staff in ICTs [32] because one of the prevalent problems is that schools are well-equipped with new technologies, but do not have staff who know how to operate them. One possible reason for this paradox is that ICTs has always
been thought of as something only Computer Science teachers need to understand, but nowadays, ICTs can and should be a part of almost any subject—this idea is reflected in several countries, where the integration of ICTs into school life has been so successful, that a special subject such as Computer Science no longer makes sense [33]. School curricula need to be adjusted to implement the new approach to teaching, especially when it comes to subjects such as the social sciences, which reference [34] described as so-called “sleeping giants”, that only slowly adapt to the rapid development of ICTs and often encounter resistance from teachers to both acceptance of the importance of ICTs in teaching and understanding of its positive impact on the quality of students’ learning outcomes [35,36]. The necessary changes probably cannot be done at the individual institution level, and schools need to be open to community-based approaches and sharing information and best-practice examples with each other. This can lead to an improvement in the social and cultural capital of schools, their teachers and students, which further mediates the development of their 21st-century competencies and has a positive impact on their professional and educational achievements, creativity, and problem-solving skills both in school and real life [37–41].

Innovation in education learned through continuous further education in ICTs encourages teachers to move beyond the traditional learning models that emphasize the ‘how to answer, not to question’ models [42]. Therefore, teachers keenly lead their students to critically observe, research, analyze and experiment, use divergent thinking, curiosity, and creativity to test assumptions and challenge the status quo [43–45].

2.2. Further Education of Teachers in the Czech Republic

Continuous further education of pedagogical staff is the center of the professional development of in-service teachers for the entire duration of their professional careers. Therefore, it is not expected that teachers leave pedagogical faculties fully equipped with all necessary skills and competencies, but that they will improve their competencies in didactics, pedagogy, psychology, methodology, and specialized activities based on their needs and the needs of their students, but also the needs related to educational and social changes. The types and conditions of further education of pedagogical staff are described by the Ministry of Education, Youth, and Sports of the Czech Republic. In the Czech Republic, each pedagogical worker is legally entitled to 12 working days o ff for self-study. Further education takes place either at universities, in facilities for further education of pedagogical staff, or other facilities accredited by the Ministry of Education.

The Concept of the State Information Policy in Education [46] set the following two main goals for education in the Czech Republic: (1) to ensure the availability of ICTs to all persons participating in education and (2) to create a basic framework for the integration of ICTs into the educational curriculum at all levels of education. The fulfillment of both goals is not possible without teachers educated in ICTs and skilled in using ICTs in the teaching of their specific subjects. About 20 years after ‘The concept’ was introduced, we see that ICT schools are far from being available to all students or teachers for their homework, even though many schools may be well equipped with new technologies. ICTs are also still rather a supplement than a stable part of the teaching process and for many teachers, they present a source of anxiety, stress, or an inconvenience at least. Czech teachers are thus still below average in their ICT competencies and they lack systematic, continuous further education responding to their specific needs [47–49].

As seen from the previous text, further education of teachers is generally a problematic topic in the post-communist space, because it is gaining increasing attention, especially with international research showing the digital divide between these countries and more digitally developed ones, but also showing that providing an effective form of further education of teachers in countries that invest below average in education (in comparison to other EU countries) is a problem that needs to be solved not only on a micro-social but also a macro-social level. These circumstances, together with the low social and pay prestige of the teaching profession (based on teaching experience, teachers can expect a salary of $17,080 to $20,853 per year), are often in significant contrast to the progressive efforts of the EU for a
certain uniformization of competencies in education, reflected in PISA [50,51]. In the Czech Republic, which we focus on in the present study, we can see how the implementation of recommendations, tools, and innovations from various EU strategies, or other international organizations, encounters various historical, political, geographical, socio-demographic, and other barriers.

An important barrier stems from the neglect of teaching ICT competencies at pedagogical faculties, which fail to provide pre-service teachers with modern pedagogy approaches and creative, effective ways how to use ICTs in teaching. In-service teachers then often encounter other barriers such as the non-conceptuality of further education organized by the school principal based on teachers’ wishes, but not on the actual needs. A major problem is a demotivation, which concerns teachers with long teaching practice, and beginning teachers lack coping mechanisms to deal with the demands of the teaching profession, time-consuming preparations of classes and administrative tasks, problems with class management related to the declining authority of teachers, and possible demotivation of students to actively participate in education. Under these conditions, teaching itself is challenging enough, and teachers may focus on current problems instead of thinking in the bigger picture and participating in further education in ICTs, which may seem unnecessary at that time. Even though the obligation of further education for teachers is explicitly stipulated in the Act on Pedagogical Workers for pedagogical staff, teachers have the choice of the courses they want to attend. Without supporting the idea of ICTs being an important part of education at all levels and in all subjects, teachers may focus on competencies more in line with the traditional pedagogy and fail to incorporate modern approaches into their practice.

Further education in schools is organized by the school principal according to a plan that he/she determines after prior discussion with the relevant departments. This plan is based on the interests of teachers and the current needs of the school, yet programs for the development of ICT competencies are still at the fringes of interest, although the situation of current education shows that teachers are failing in these competencies. Despite the number of different courses, the development of teachers’ digital competencies is not carried out systematically. This issue is a problem in the Czech Republic, and as confirmed by several researchers [12,13], many teachers acquire digital competencies in their free time, regardless of the length of their practice. Related to this are the most important barriers in the development of ICT competencies, as a lack of time, lack of support from the school management and colleagues, or computer anxiety.

2.3. Barriers in the Use of ICTs in Teaching and in Further Education in ICTs

For the teaching profession, further education is a key element in the development of teachers’ competencies [52], but especially further education in areas other than teachers’ profile subjects may encounter many barriers that lead to either the absence of further education as such, low frequency of education or inability to get the most out of further education and failure in applying the acquired knowledge in practice. The problem may not be on the part of the teacher, but also in an inappropriately set up system of further education, in an inappropriately designed educational course, or in difficult to influence external conditions, which make it problematic to adapt the study to teachers’ rhythm of life [53].

Barriers to using ICTs in teaching can be divided into two broader categories. The so-called first-order (or extrinsic, institutional) barriers involve factors such as a lack of access to ICTs, lack of time to incorporate ICTs in teaching, and a lack of technical support in schools [54,55]. Second-order barriers (or intrinsic, personal) involve beliefs about using ICTs in teaching, commitment to maintaining established practices, and willingness to change the teaching approach [56–68]. Some authors suggest also using the term third-order barriers, which involve the use of ICTs to design classroom curricula [59]. Reference [60] divides the most common barriers that prevent teachers from using ICTs in teaching: time demands, the material background of the school, lack of support from school management and colleagues, lack of knowledge and skills, subjectively perceived unsuitability of using ICTs for the subject taught, distrust of new procedures and technologies, and lack of motivation. References [61,62] cite computer anxiety as a significant predictor of ICT integration into teaching. Interestingly, they have
found that teachers who frequently participate in further education in ICTs were better at dealing with computer anxiety, thus further education may help in reducing computer anxiety and in the integration of ICTs into teaching. According to references [63–66], the attitude towards the use of ICTs, perceived usefulness of ICTs in teaching, and perceived ease of use of ICTs are the most important predictors of teachers’ intentions to use ICTs in the classroom. However, the word ‘intentions’ is important, because, as stated by reference [67], teachers’ beliefs about using ICTs in education and their actual teaching practices may often differ, so even teachers who find ICTs beneficial for their subject may not be frequent users of technologies in teaching. The missing link might be the absence of social support, such as colleagues’ attitudes towards ICTs, their actual use of ICTs in teaching, their support of further education in ICTs, or being so-called “accountability buddies”. Social factors might be as important as knowledge and skills to use ICTs or material background of school (i.e., the technologies available at school) [68–71]. It can be assumed that similar barriers, which lead to difficulties in the implementation of ICTs in teaching, are also related to insufficient further education in ICTs. Here, too, we can assume that personality barriers are a common cause, such as doubts about one’s abilities and knowledge, fear, and anxiety about failure not being sufficient to understand the further education, but also attitudes towards ICTs as such and their role in teaching and education, specifically. The intensity of these barriers is influenced by unpredictable situational factors, such as a lack of time, work demands, health problems of teachers or their family members, etc. The motivation of the teacher to participate in further education plays an important role, which we can perceive as a possible personality barrier, but it is also significantly influenced by the institutional conditions, attitudes, and support of the school and colleagues, the technical and material background of the school, etc. [72–74]. In the conditions of the post-communist space, the ongoing financial underestimation of the teaching profession, the declining prestige of this profession and also the absence of longer-term educational concepts, or their problematic implementation into pedagogical practice, play an important role in motivating teachers in further education in general. It cannot be said that teachers have a lack of opportunities for further education in the Czech Republic and the countries of the former communist bloc; further education is generally accepted as essential for the professional and educational development of teachers, students, and the education system, but the quality of educational programs, although accredited by the Ministry of Education, Youth and Sports (in case of the Czech Republic), is not always sufficient or does not respect the specific needs of teachers as individuals.

3. Materials and Methods

A total of 1878 secondary school teachers of any subjects from vocational, technical, and upper secondary schools in the Czech Republic were asked to participate in the research. School psychologists and educational consultants from schools across the Republic helped sharing the information about research and link to an online survey with teachers from their schools. Respondents filled out the online survey which was divided into five sections: (1) demographic information, (2) questions about their perceived digital competencies, (3) questions about their actual use of ICT in teaching and possible barriers, (4) questions about further education in ICTs and possible barriers, (5) questions about computer anxiety.

The following research questions were addressed to identify the main barriers in the use of ICTs in teaching and further education in ICTs:

1. Which factors support and inhibit the use of ICTs in teaching?
2. Which factors support and inhibit further education in ICTs?
3. Is computer anxiety linked to the use of ICTs in teaching and further education in ICTs?

To address the perceived digital competencies of the teachers and their actual use of ICTs in teaching, we used an approach based on previous studies [75,76] on internet skills. A total score for perceived digital competencies (PDC) consisted of two components—a perceived level of experience in using ICTs evaluated on a scale from 1 (absolute beginner) to 4 (advanced user) and understanding
of items related to Web 2.0 and ICTs from five categories: digital communication (with following items: social media, WhatsApp, Skype, Blog, Tweet, networking, videoconference), digital education (with items: MOOC, BYOD, video couching, video mentoring, TED, Personal Learning Environment, podcast, webcasting, Machine Learning, gamification, virtual assistant, remote virtual laboratories, educaching, IoT, Virtual Reality, Augmented Reality, Artificial Intelligence, Industry 4.0), digital safety (with items: cybersecurity, open license, GDPR, digital trace, Spam, Hoax, Phishing, cyberbullying), software (with items: MS Office, Office 365, Google Docs, Cloud service, OneDrive, RSS feed, QR code, On-line presentation, Kahoot!, Google Classroom), and hardware (with items: Netbook, Ultrabook, Phablet, Padphone, Smartphone, eBeam, SmartTV, interactive table, visualizer). A total PDC score was computed for each respondent on a scale from 1 (absolute beginner) to 6 (expert).

A total score for the actual use of various ICTs in teaching (ICTuse) was computed based on the frequency of use of four subcategories of ICT means: social media (with items: Facebook, Twitter, Instagram, Yammer, Google+), digital services (with items: OneNote, Digital Learning Materials, cloud services, presentation software such as PowerPoint, Sway, Prezi, QR codes), digital devices (with items: desktop computer, laptop, smartphone, tablet, digital textbook, interactive whiteboard, eBeam, interactive desk, voting device, visualizer, virtual reality glasses), and digital learning forms (with items: electronic publications and electronic study aids, videos and audio recordings, webinars, open educational online courses, virtual and remote laboratories, teaching applications, tutored and untutored e-learning via LMS Moodle). The frequency was rated on a 4-point scale from 1 (never) to 4 (always). A total ICTuse score ranged from 1 (rare/non-user) to 5 (habitual user).

The barriers analyzed in the research covered both first- and second-order barriers as discussed in the theoretical section. They were divided into nine categories based on references [60,61]: lack of school support, lack of colleagues’ support, lack of motivation to use ICTs in teaching, lack of time, lack of sufficient technology in school, lack of ICT knowledge and skills, perceiving ICTs as not suitable for the taught subject, distrust in new approaches, and computer anxiety.

To measure computer anxiety, we used an adaptation of the scale by reference [77]. Teachers were asked to indicate their level of agreement with 11 statements on a scale of 1–5 (1 = Strongly Disagree; 5 = Strongly Agree). A total computer anxiety score was calculated for each participant, with higher scores indicating a higher level of computer anxiety.

Responses were processed via IBM® SPSS® v25, using descriptive statistics, correlations, independent samples t-test, ANOVA, Kruskal-Wallis nonparametric independent samples test, and regression analysis. Effect sizes for all the tests were computed.

Descriptive statistics were used to describe the sample characteristics. A total of 949 females (50.5% of the sample) and 929 males (49.5%) completed the survey, with age varying between 21–81 years (M = 48.44, SD = 11.07 for females, and M = 48.41, SD = 9.33 for males). The age was recoded into five categories with 87.9% of teachers being in the categories of 36 years and older (see Table 1). A total of 83.3% of the teachers had a master’s degree, and a total of 93.2% finished tertiary education. As seen in Table 2, 78.6% of teachers worked at secondary technical schools. The length of the teaching praxis varied between 1 and 54 years (M = 20.46, SD = 10.28).

Table 1. Age recoded in categories.

| Age (years) | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------------|-----------|---------|---------------|--------------------|
| 26 or younger | 44        | 2.3     | 2.4           | 2.4                |
| 27–35       | 180       | 9.6     | 9.7           | 12.1               |
| 36–45       | 512       | 27.3    | 27.6          | 39.7               |
| 46–55       | 583       | 31.0    | 31.4          | 71.1               |
| 56 and more | 535       | 28.5    | 28.9          | 100.0              |
| Total       | 1854      | 98.7    | 100.0         |                    |
| Missing     | System    | 24      | 1.3           |                    |
| Total       | 1878      | 100.0   |               |                    |
Table 2. In what type of school do you currently work?

| School                  | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------------------------|-----------|---------|---------------|--------------------|
| secondary vocational    | 247       | 13.2    | 13.2          | 13.2               |
| secondary technical     | 1477      | 78.6    | 78.6          | 91.8               |
| upper secondary         | 70        | 3.7     | 3.7           | 95.5               |
| other                   | 84        | 4.5     | 4.5           | 100.0              |
| Total                   | 1878      | 100.0   | 100.0         |                    |

4. Results

Respondents perceived themselves as having a rather intermediate level of perceived digital competencies \( (M = 3.11, SD = 1.109) \), with the total PDC score being significantly different between men \( (M = 3.41, SD = 1.033) \) and women \( (M = 2.81, SD = 1.103) \), \( t(1876) = 12.071, p < 0.000, d = 0.557 \), and between age groups, \( F(4, 1849) = 23.672, p < 0.000, f = 0.481 \), with highest scores for the age group 26 or younger \( (M = 3.39, SD = 1.211) \) and lowest for the age group 56 or older \( (M = 2.30, SD = 1.091) \).

Analysis of the use of various ICT means in teaching showed that teachers are occasional to average ICTs users \( (M = 1.71, SD = 0.586) \), with significant gender differences in the total ICTuse score, \( t(1876) = -2.478, p = 0.013, d = 0.114 \). Women reported using ICTs in teaching slightly less often than men \( (M = 1.74, SD = 0.606, M = 1.67, SD = 0.563, \) respectively). ANOVA showed significant age differences for the ICTuse score, \( F(4, 1849) = 2.708, p = 0.029, f = 0.066 \). The age group 56 and older reported the least frequent use of ICTs in teaching \( (M = 1.64, SD = 0.582) \), the age group 27–35 reported the most frequent use \( (M = 1.79, SD = 0.607) \). As seen, women scored lower than men in both PDC and ICTuse scores; respondents from the age group 56 or older scored lower than other age groups in both scores. The frequency tables for both PDC and ICTuse scores are shown below (see Tables 3 and 4).

Table 3. Total score of perceived digital competencies (PDC).

| PDC score       | Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------------|-----------|---------|---------------|--------------------|
| expert          | 93        | 5.0     | 5.0           | 5.0                |
| advanced        | 539       | 28.7    | 28.7          | 33.7               |
| intermediate    | 570       | 30.4    | 30.4          | 64.0               |
| beginner        | 428       | 22.8    | 22.8          | 86.8               |
| absolute beginner | 248      | 13.2    | 13.2          | 100.0              |
| Total           | 1878      | 100.0   | 100.0         |                    |

Table 4. Total score of use of ICTs in teaching (ICTuse).

| ICTuse score    | Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------------|-----------|---------|---------------|--------------------|
| occasional user | 675       | 35.9    | 35.9          | 35.9               |
| average user    | 1079      | 57.5    | 57.5          | 93.4               |
| habitual user   | 122       | 6.5     | 6.5           | 99.9               |
| frequent user   | 2         | 0.1     | 0.1           | 100.0              |
| Total           | 1878      | 100.0   | 100.0         |                    |

From the four categories of ICT means described in the Materials and Methods section, the most often used social media were Google+ (used by 32% of respondents at least occasionally), Facebook (24%), and WhatsApp (21%). Most used digital services were presentation software (89%), Digital Learning Materials (62%), and graphic editor (43%). Most used digital devices were desktop computer (87%), laptop (82%), and smartphone (51%). Interactive devices such as interactive whiteboard, eBeam, interactive desk, and voting device were used by less than 10% of the sample. In the digital learning forms category, respondents used videos and audio recordings (93%), electronic publications and electronic study aids (71%), and teaching applications (66%).
4.1. Which Factors Support and Inhibit the Use of ICTs in Teaching?

To investigate the factors that support and inhibit the use of ICTs in teaching, teachers were asked to evaluate the effect of eight factors on the integration of ICTs into their teaching practice. The barriers, as described in the Methodology section of the paper, were chosen based on the literature analysis. Descriptive statistics were used to analyze the frequencies of the barriers reported by the respondents. Table 5 shows the gender differences in frequencies of the barriers. The most prominent barriers were lack of school management support, lack of colleagues’ support, and lack of motivation for men, and lack of school management support, lack of colleagues’ support, and lack of sufficient technology in school for women. The least mentioned barriers for men and women were distrust in new technologies and approaches, insufficient knowledge, and skills in ICTs, and feeling ICTs are not suitable for the taught subject.

Table 5. Barriers to the use of ICTs in teaching.

|                                | Male               | Female              |
|--------------------------------|--------------------|---------------------|
|                                | Count | %     | Count | %     |
| lack of school management support | yes   | 843   | 90.7% | 874   | 92.1% |
|                                | no    | 86    | 9.3%  | 75    | 7.9%  |
| lack of colleagues’ support    | yes   | 840   | 90.4% | 793   | 83.6% |
|                                | no    | 89    | 9.6%  | 156   | 16.4% |
| lack of motivation             | yes   | 761   | 81.9% | 735   | 77.4% |
|                                | no    | 168   | 18.1% | 214   | 22.6% |
| lack of time                   | yes   | 653   | 70.3% | 753   | 79.3% |
|                                | no    | 276   | 29.7% | 196   | 20.7% |
| lack of sufficient technology in school | yes | 642   | 69.1% | 768   | 80.9% |
|                                | no    | 287   | 30.9% | 181   | 19.1% |
| insufficient knowledge and skills in ICTs | yes   | 376   | 40.5% | 594   | 62.6% |
|                                | no    | 553   | 59.5% | 355   | 37.4% |
| ICTs not suitable for the taught subject | yes | 415   | 44.7% | 634   | 66.8% |
|                                | no    | 514   | 55.3% | 315   | 33.2% |
| distrust in new technologies and approaches | yes   | 168   | 18.1% | 214   | 22.6% |
|                                | no    | 761   | 81.9% | 735   | 77.4% |

An independent-samples t-test was conducted to evaluate whether the barriers to using ICTs in teaching differed significantly between males and females. The results were significant for all barriers except the school management support in using ICTs, with women reporting the following five barriers more often: lack of time, t(1839) = 4.540, p < 0.000, d = 0.210, lack of sufficient technology in school, t(1815) = 5.964, p < 0.000, d = 0.275, perceived insufficient knowledge and skills to use ICTs in teaching, t(1873.6) = 9.827, p < 0.000, d = 0.454, thinking ICTs are not suitable for the taught subject, t(1869.1) = 9.897, p < 0.000, d = 0.457, and distrust in new technologies and approaches, t(1865.4) = 2.408, p = 0.016, d = 0.111.

A Kruskal–Wallis test was conducted to evaluate the differences among the five age groups on the barriers to the use of ICTs in teaching. No significant age difference for the lack of motivation and for the distrust in new technologies and approaches was found. The test was significant for the lack of school support, χ²(4, 1854) = 14.380, p = 0.006, η² = 0.006, lack of colleagues’ support, χ²(4, 1854) = 16.145, p = 0.003, η² = 0.007, lack of time, χ²(4, 1854) = 60.019, p < 0.000, η² = 0.03, lack of sufficient technology in school, χ²(4, 1854) = 56.712, p < 0.000, η² = 0.029, perceived lack of ICT knowledge and skills, χ²(4, 1854) = 39.844, p < 0.000, η² = 0.019, and perceiving ICTs as not suitable for the taught subject, χ²(4, 1854) = 22.383, p < 0.000, η² = 0.01. The analysis of means shown that for the age group 56 and older, the main barriers are the lack of time, lack of sufficient technology at school, perceived lack of ICT knowledge and skills, and perceiving ICTs as not suitable for the taught subject. The youngest age group of 26 or younger had the fewest barriers compared to other age groups, except for the lack of support from school management and colleagues.
The correlation matrix between the barriers and the total ICTuse score (see Table 6) shows significant correlations between the use of ICTs in teaching and all barriers except for the lack of school management support. All correlations are significant at $p < 0.000$, and except for the lack of colleagues’ support and distrust in new technologies and approaches, the barriers are linked to less frequent integration of ICTs in teaching.

### Table 6. Correlation matrix for the barriers to the use of ICTs and the ICTuse score.

| ICTuse Score | Lack of School Management Support | Lack of Colleagues’ Support | Lack of Motivation | Lack of Time | Lack of Sufficient Technology | Insufficient Knowledge and Skills in ICTs | ICTs not Suitable for the Taught Subject | Distrust in New Technologies and Approaches |
|--------------|----------------------------------|----------------------------|-------------------|-------------|-------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| Corr.        | 1                                | -0.003                     | 0.145 **          | -0.120 **   | -0.258 **                     | -0.297 **                                | -0.365 **                               | -0.323 **                               | 0.120 **                                |
| Sig. (2-tailed) | 0.895                          | 0.000                      | 0.000             | 0.000       | 0.000                         | 0.000                                    | 0.000                                   | 0.000                                   | 0.000                                   |
| N            | 1878                            | 1878                       | 1878              | 1878        | 1878                          | 1878                                     | 1878                                    | 1878                                    | 1878                                    |

4.2. Which Factors Support and Inhibit Further Education in ICTs?

In a similar way as in part 4.2, the factors that support and inhibit further education in ICTs were explored based on teachers’ evaluation of the effect of eight factors on the frequency of further education in ICTs. Descriptive statistics were used to analyze the frequencies of barriers reported by the respondents (see Table 7 for details). The most prominent barriers for men and women were lack of sufficient technology in school, insufficient knowledge and skills in ICTs, and lack of school management support. The least mentioned barriers for men and women were feeling ICTs are not suitable for the taught subject, distrust in new technologies and approaches, and lack of motivation.

### Table 7. Barriers to further education in ICTs.

|                          | Male          |            | Female       |            |
|--------------------------|---------------|------------|--------------|------------|
|                          | Count  | %         | Count      | %         |
| lack of school management support | yes     | 560 | 60.3% | 604 | 63.6% |
|                          | no      | 369 | 39.7% | 345 | 36.4% |
| lack of colleagues’ support | yes     | 440 | 47.4% | 591 | 62.3% |
|                          | no      | 489 | 52.6% | 358 | 37.7% |
| lack of motivation       | yes     | 369 | 39.7% | 345 | 36.4% |
|                          | no      | 560 | 60.3% | 604 | 63.6% |
| lack of time             | yes     | 489 | 52.6% | 358 | 37.7% |
|                          | no      | 440 | 47.4% | 591 | 62.3% |
| lack of sufficient technology in school | yes     | 840 | 90.4% | 793 | 83.6% |
|                          | no      | 89  | 9.6%  | 156 | 16.4% |
| insufficient knowledge and skills in ICTs | yes     | 761 | 81.9% | 735 | 77.4% |
|                          | no      | 168 | 18.1% | 214 | 22.6% |
| ICTs not suitable for the taught subject | yes     | 89  | 9.6%  | 156 | 16.4% |
|                          | no      | 840 | 90.4% | 793 | 83.6% |
| distrust in new technologies and approaches | yes     | 168 | 18.1% | 214 | 22.6% |
|                          | no      | 761 | 81.9% | 735 | 77.4% |

An independent-samples $t$-test was conducted to evaluate whether the barriers to further education in ICTs differed significantly between males and females. The results were significant for all barriers except the school management support in using ICTs, with men reporting more often the following three barriers: lack of time, $t(1871.1) = -6.562, p < 0.000, d = 0.303$, lack of sufficient technology in school, $t(1799.8) = -4.443, p < 0.000, d = 0.205$, and perceived insufficient knowledge and skills in ICTs, $t(1869.1) = -2.408, p = 016, d = 0.111$. 
A Kruskal–Wallis test was conducted to evaluate the differences among the five age groups in the barriers to further education in ICTs. The test was significant for the lack of colleagues’ support, $\chi^2(4, 1854) = 23.857, p < 0.000, \eta^2 = 0.01$, lack of motivation, $\chi^2(4, 1854) = 9.729, p = 0.045, \eta^2 = 0.003$, lack of time, $\chi^2(4, 1854) = 23.856, p < 0.000, \eta^2 = 0.011$, and perceiving ICTs as not suitable for the taught subject, $\chi^2(4, 1854) = 16.145, p = 0.003, \eta^2 = 0.007$. The lack of colleagues’ support and perceiving ICTs as not suitable for the taught subject was most frequently reported by the youngest age group (26 or younger), which also reported the time and motivation barriers least often. Lack of motivation was reported as a barrier to further education especially by the age group 27–35 and lack of time by the age group 56 or older. The oldest age group also reported the lack of school management support most often, though the difference was not significant.

The correlation matrix between the barriers and the frequency of further education in ICTs shows significant correlations for all barriers. The matrix suggests that respondents who reported lack of motivation, lack of time, lack of sufficient technology in school, and distrust in new technologies participated in further education less often. Those, who reported a lack of support from school management and colleagues, perceived insufficient knowledge and skills in ICTs and those who believed ICTs were not suitable for the subject they taught, participated in further education more often. The correlations and significance levels are described in Table 8 below.

Table 8. Correlation matrix for the barriers to the use of ICTs and the frequency of further education in ICTs.

| Frequency of Further Education | Lack of School Management Support | Lack of Colleagues’ Support | Lack of Motivation | Lack of Time | Lack of Sufficient Technology | Insufficient Knowledge and Skills in ICTs | ICTs are not Suitable for the Taught Subject | Distrust in New Technologies and Approaches |
|------------------------------|----------------------------------|-----------------------------|-------------------|-------------|-----------------------------|------------------------------------------|---------------------------------------------|---------------------------------------------|
| ****                         | **0.067**                        | **0.138**                   | **−0.067**        | **−0.138**  | **−0.159**                  | **0.066**                                | **0.159**                                  | **−0.066**                                  |

4.3. Is Computer Anxiety Linked to the Use of ICTs in Teaching and Further Education in ICTs?

The computer anxiety score for each respondent was computed based on their results from the reference [77] questionnaire (see Methodology section for details). The Table 9 below shows the frequencies of the five computer anxiety categories.

Table 9. Computer anxiety total score.

| Computer Anxiety          | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------------------------|-----------|---------|---------------|--------------------|
| not anxious at all        | 248       | 13.2    | 13.2          | 13.2               |
| not too anxious           | 428       | 22.8    | 22.8          | 36.0               |
| average anxiety           | 570       | 30.4    | 30.4          | 66.3               |
| quite anxious             | 539       | 28.7    | 28.7          | 95.0               |
| very anxious              | 93        | 5.0     | 5.0           | 100.0              |
| Total                     | 1878      | 100.0   | 100.0         |                    |

The correlation coefficient was used to investigate the relationship between computer anxiety and total ICT use score ($r = 0.414, p < 0.000$), and computer anxiety and frequency of further education in ICTs ($r = −0.268, p < 0.000$). Results suggest that higher computer anxiety is linked to lower use of ICTs in teaching and lower frequency of further education in ICTs.

An independent samples $t$-test was used to explore gender differences in computer anxiety levels, with significant results, $t(1876) = −12.071, p < 0.000, d = 0.555$. Women experience more anxiety.
(M = 3.19, SD = 1.103) than men (M = 2.59, SD = 1.033). A Kruskal–Wallis test was conducted to evaluate the differences among the five age groups in computer anxiety, with a significant result, χ²(4,1854) = 84.587, p < 0.000, η² = 0.044. The analysis of mean values shows that computer anxiety decreases with the increase of age, thus being the lowest in the 56 or older age group and highest in the 26 or younger age group. The differences among the five ICTuse levels and the computer anxiety were also significant, χ²(4,1854) = 324.902, p < 0.000, η² = 0.174, suggesting a large effect. Again, the mean values show a stable tendency, where the total score for the use of ICTs in teaching decreases as the computer anxiety score decreases. The data suggest that respondents with low computer anxiety use ICTs in teaching more often.

Regression analysis with the total ICTuse score as a dependent variable and the frequency of further education in ICTs and computer anxiety total score as independent variables was performed. The ANOVA model shows that both frequency of further training (Beta = −0.201, p = 0.000) and computer anxiety (Beta = 0.363, p = 0.000) reliably predict the dependent variable, F(1875,2) = 254.165, p < 0.000, with adjusted R Square = 21.3% of the variance in ICTuse scores being predicted from the independent variables. The coefficient table (see Table 10) shows that changes in both independent variables result in significant changes in the ICTuse score. Specifically, for every point increase in the frequency of the further education score, a −0.163 decrease in the ICTuse score can be predicted, i.e., a lower frequency of training results in lower use of ICTs in teaching. For every point increase in the computer anxiety score, a 0.192 increase in the ICTuse score can be expected. Thus, higher computer anxiety leads to lower use of ICTs in teaching.

Table 10. Regression analysis coefficients for the total ICTuse score.

| Model                      | Unstandardized Coefficients | Standardized Coefficients | t     | Sig. |
|----------------------------|-----------------------------|---------------------------|-------|------|
| (Constant)                 | 1731                        | 0.078                     | 22.182| 0.000|
| computer anxiety total score| 0.192                       | 0.011                     | 0.363 | 17.022| 0.000|
| frequency of further education| −0.163                      | 0.017                     | −0.201| −9432 | 0.000|

5. Discussion

Similar to references [78–80], who showed the impact of characteristics such as age, gender, subject area, teaching experience, class size, device ownership, technological knowledge, knowledge for integrating technology, ICT pedagogical practices, perceived effects of these practices on students, and professional teaching knowledge on technology integration our results suggest that age and gender are among the major factors influencing the use of ICTs among teachers. The results suggest that men have a better understanding of ICTs and they use them in teaching more often than women. Men would rate themselves as intermediate users, while women consider themselves beginners, which is consistent with references [81,82]. However, the results are based on self-evaluation, thus an object evaluation might be necessary since, for example, reference [83] indicates that women have the same or higher ICT competencies as men, but they do not have confidence in their abilities. As reference [84] suggest, confidence has a positive significant relationship with pedagogical uses of ICTs. As teachers gain confidence, they become more comfortable in using new, innovative methods. The repeated use of ICTs reduces clumsiness and helps gaining confidence in using ICTs in teaching.

The respondents in the age group 26 or younger had the best understanding of ICTs, while the group 27–35 years of age used ICTs in teaching most often. A longitudinal study might be needed to show whether this means that teachers leave pedagogical faculties with sufficient knowledge of ICTs, but only in the next years of their teaching practice, and they start using their knowledge actively in teaching, as suggested, for example, by reference [84]. The oldest group of respondents (56 years or older) reported the poorest understanding of ICTs and they used them in teaching least often. The age and gender differences are and will continue to be a major challenge for in-service teacher education.
It is necessary to consider the fact that the older generation of teachers mostly refuses to use ICTs and perceive the teaching of ICTs only as a separate subject of Computer Science. At the same time, the involvement of ICTs in other subjects (including, for example, history or geography) is the key to bringing the subject closer to the students. The transformation of this thinking should already take place at the pedagogical faculties, where the involvement of ICTs in teaching has so far received only minimal attention. Besides, it is an essential condition for improving teaching. The curricula of the Ministry of Education and other institutions should consider this fact and prepare special courses for the older age group of teachers. Similarly, in the pedagogical faculties, a greater emphasis must be placed on the teaching of ICTs. So far, unfortunately, the system is largely set up in such a way that the deans of these faculties secure considerable financial resources from the Ministry of Education, Youth, and Sports to support ICTs education, but the results are less than insufficient. However, it is the support of ICT education at the pedagogical faculties that is important for the subsequent use of these competencies in practice, i.e., in teaching. If the digitalization of education and other areas such as public administration are to be successful, investment in further education in ICTs needs to be a priority, as well-educated teachers are the ones who can not only educate their students in ICTs but also point out the possibilities and limits of their use in schools. Meta-analysis by reference [85] shows that teacher education courses for technology integration are having a significantly positive effect on practical and conceptual skills and knowledge needed for technology integration, but a single course is not enough, as it is critical to develop a sound understanding of the advantages technology offers in education for successful integration of ICTs into regular teaching practice.

Gender and especially age differences were also found in the analysis of barriers to using ICTs in teaching and to further education in ICTs. For men, the barriers to using ICTs are represented by the lack of school management support, the lack of colleagues’ support, and the lack of motivation. Women also reported social barriers, but also the lack of sufficient technology in school. Social influence does appear to be a predictor of technology usage [82]. The least mentioned barriers were distrust in new technologies and approaches, insufficient knowledge and skills, and feeling ICTs are not suitable for the taught subject, suggesting teachers would probably like to integrate new technologies in teaching more often. These results are further supported by the analysis of the barriers to in-service training—the most prominent were the lack of sufficient technology in school, insufficient knowledge and skills in ICTs, and lack of school management support. The least mentioned barriers were feeling ICTs are not suitable for the taught subject, distrust in new technologies and approaches, and lack of motivation. Therefore, we see that teachers are motivated to educate themselves and believe in the meaningful integration of technologies in teaching, but they lack the support from institutional leaders and colleagues, as shown by other studies [86,87]. Lack of time that is often seen as a significant barrier [88] was mentioned by 70.3% men and 79.3% women regarding the use of ICTs in teaching, but only by 52.6% men and 37.7% women regarding the further education. The reason might be that Czech teachers spend less time teaching in comparison to other OECD countries [89].

Interestingly, teachers do not consider the lack of skills as a barrier to using ICTs in teaching, but they do consider it a barrier to further education. Based on the age of the respondents, the oldest age group (56 and older) reported significantly more often the lack of time, the lack of sufficient technology at school, the perceived lack of ICTs knowledge and skills, and perceiving ICTs as not suitable for the taught subject as their main barriers to using ICTs in teaching, and the lack of time as the only barrier to further education with a significant age difference. The age group 26 or younger described the fewest barriers compared to the other age groups, except for the lack of support from school management and colleagues. The lack of colleagues’ support was also an important barrier to further education for this age group, showing that beginning teachers rely more on social factors, i.e., the support of colleagues or school management. An important factor, that affects the use of ICTs in teaching, is computer anxiety. Respondents indicated they experienced an average level of computer anxiety, with women and beginning teachers reporting higher anxiety, as shown by previous studies [90–92]. However, as reference [93] suggests, there are other factors that needs to be considered besides gender.
As the results show, higher computer anxiety is linked to lower use of ICTs in teaching, as reported also by reference [94] and to lower frequency of further education; thus, it is another psychological barrier that needs to be addressed in the further education, but also in the tertiary education of pre-service teachers and probably in the education in general. As reference [95] suggests, computer anxiety can be significantly reduced by systematic training and improves especially the perceived use of ICTs in teaching [96–98].

6. Conclusions

Based on the experiences during the Covid-19 crisis, the Ministry of Education, Youth, and Sports is aware of the need for further investments in ICTs in schools, and a subsidy program for ICTs purchases has already been prepared for this year. As digital technologies are ever-present, teacher educators’ need to help teachers acquire ICS competencies, but also to build on teachers’ existing skills and support sophisticated use of technology [99]. Therefore, this investment in hardware needs to be accompanied by educational programs for teachers so that teachers know how to operate the ICTs and are not be afraid to use them. Besides, research suggests that even teacher educators do not possess enough technological expertise, especially in latest technologies [100]. Thus, rigorous education in ICTs is crucial, not only for teachers, but also for their educators. Unfortunately, it often happens in Czech schools that, for example, they have interactive whiteboards and various software in their classrooms, but teachers do not use them. This mental barrier will also have to be overcome again, especially through educational programs and support for ICTs teaching by the schools themselves. Our results show that besides the school management support, the support of colleagues is of high importance. Peer influence has a positive impact on facilitating instructional changes initiated from outside of the school and the vertical and horizontal curriculum alignment [101]. This aspect should be emphasized in educational programs through collective learning and peer networks, but also in the schools, where more skilled teachers may serve as role models, mentors, or even ICT coordinators for others who lack ICT competencies but have the motivation and will to improve their knowledge and skills. Thus, the further education of teachers should have not only the form of structured professional development offered in special programs and workshops, but on-the-job learning opportunities such as instructional conversations and observations, advice, and information sharing should be also supported by the school management, as they are crucial for implementation of new practices. As reference [100] noted, an effective in-service education requires a combination of both forms; however, their effectiveness depends on supportive organizational conditions. The use of ICTs in schools and further teacher education are therefore still topics in which the Czech Republic is failing. There is a need for conceptual changes to structured in-service teacher education that considers the different socio-economic characteristics of teachers. As suggested by reference [84], awareness of relationships between teachers’ demographic characteristics and their ICT competencies may help teacher education leaders consider more effective ways to provide targeted or differentiated support.

It is crucial to understand that even in the modern pedagogy approaches using ICTs, the teacher remains central to the learning process, so the traditional teacher skills are still valuable and necessary for effective classroom leadership. However, teachers may benefit from using ICTs as a partner in teaching and create a more learner-centric environment. This change requires motivated teachers, but motivation may serve as an enabling factor only at the initial stages of ICT integration. The use of ICTs in teaching means spending more time planning and preparing the classes, exploring new methods of presenting and sharing information, communicating, and cooperating with students. Thus, it is not only about technical mastery of ICTs, but about constant learning how to incorporate them in pedagogical practices, which is not possible without further education and support from the school, Ministry, and state. As teacher training is the crucial key in changing the traditional approach to teaching, it cannot be done as a single event and without addressing issues such as computer anxiety, lack of understanding how to use ICTs in specific subjects, lack of support from the school, or lack of confidence in using ICTs. In-service development in ICTs needs to be a process consisting of various
development opportunities that help teachers create a positive attitude towards ICTs and find ways how to incorporate them into their regular teaching practice with growing ease.

There is a need to drastically improve the didactic skills needed for meaningful implementation of ICTs in teaching through a change in the approach to ICTs in schools but also through key documents of the state’s educational policy, for example, the currently prepared Digital Education Strategy 2030+. Given that learning technologies are widespread but underused within education; institutional leaders need to understand the process by which these technologies are adopted and which barriers may hinder their successful integration. Educational technologies at school must be directly linked to the pedagogical process, though the directors lack orientation in this issue, methodological guidance and also the financial and legislative support of the state, without which the situation cannot improve. Just as top companies need top ICT experts, so the same is needed in schools and during teacher training. We need quality educational programs for pre-service and in-service teachers, especially because they are educating new generations who will be more confronted with digitization than we are.

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