DE GRUYTER OPEN

ICTE Journal

2017, **6**(1): 35–43
DOI: 10.1515/ijicte-2017-0004

# PILOT TESTING OF IT SKILLS OF PRESCHOOL AND ELEMENTARY EDUCATION STUDENTS BY THE IT FITNESS TEST

Martina Adamkovičová[1], Jana Burgerová[2], Hedviga Kochová[3], Vladimír Piskura[4]

[1]*Department of Natural Sciences and Technological Disciplines, Faculty of Education, University of Prešov in Prešov, Slovak Republic {jana.burgerova@unipo.sk}*

[2]*Department of Natural Sciences and Technological Disciplines, Faculty of Education, University of Prešov in Prešov, Slovak Republic {martina.adamkovicova@unipo.sk}*

[3]*Department of Natural Sciences and Technological Disciplines, Faculty of Education, University of Prešov in Prešov, Slovak Republic {hedviga.kochova@unipo.sk}*

[4]*Department of Natural Sciences and Technological Disciplines, Faculty of Education, University of Prešov in Prešov, Slovak Republic {vladimir.piskura@smail.unipo.sk}*

**ABSTRACT**

The present paper reports on the testing of digital skills of students of the Faculty of Education, Univerity of Presov within their undergraduate training with the aim to estimate the level of digital skills in five defined domains. The IT Fitness test 2015 consisting of 25 items was used as the measure of the target skills. The sample comprised 532 students in bachelor and master study programs. The paper provides an interpretation of the selected research findings (mean total scores, mean scores for the given domains, discrimination power of items and domains). The results of digital skills testing point at the overall overestimation of Digital Natives Skills. With respect to the challenges brought by the educational practice itself by means of the implementation of digital technologies into pre-primary and primary education, it is necessary to modify the curricula of math- and IT-oriented subjects and include further activities allowing for the development of the lacking “Digital Skills”, since these are needed not only for students' own study but also due to increasing demands related to the use of digital technologies in primary and pre-primary education.

**KEYWORDS**

*digital natives, preschool and elementary education, digital skills, IT Fitness test.*

## 1 INTRODUCTION

The generation of young people studying at universities has been termed by several names, Millenial Generation – for those being born between 1982-2000, coined by Howe and Strauss (1991), Net Generation – which, according to Tapscot (1997) is a generation of grown-ups surrounded by digital media, or Digital Natives – the „native speakers“ of the digital language of computers and the Internet (Prensky, 2001). In the literature, one can also get across the term Y Generation – first appearing in the AdAge magazine in 1993 (Zhao and Liu, 2008), as a term to identify the generational cohort following Generation X, which just finished the university studies and gradually substituted by the Z Generation consisting of students born between the mid-1990s and 2010.

Regardless the given name, young people are generally considered to be fit working with digital technologies. However, there are also findings to the contrary. Gallardo et al (2015) claim that, following an analysis of literature and conducted studies, there is little support for the view "that digital natives are – by default – digitally competent and that these skills transfer to the academic environment. In fact, there is no evidence that they want to use these technologies for academic purposes. Despite their digital confidence and digital skills, their digital competence – the ability to assess and learn from resources – may be much lower than those of their teachers". Aberšek (2016) claims that the common opinion in digital natives' e-learning competence shows a very high opinion of their so called 'digital literacy'." His view is based on the results of a study on online learning competences, which were defined in following aspects: basic skills (computer basics, web searching basics, general navigation basics), the ability of locating information, finding a suitable website, locating the information on the website, critical evaluation of the information according to its reliability and its relevance for the science class assessment. The research involving three groups of students at age 14-18 years shows that although the Digital natives grew up in an online world and spent thousands of hours in online gaming, texting and socializing, they have limited skills in computer basics and even more limited skills in searching for the information on the Internet, navigating on web sites and evaluating the information they have found". A sociological study of Hargittai (2010) points at sociological differences in users' Web-use skills. The findings suggest that even when controlling for basic Internet access, among a group of young adults, socioeconomic status is an important predictor of how people are incorporating the Web into their everyday lives with those from more privileged backgrounds using it in more informed ways for a larger number of activities. In one of his papers, Buckingham (2006) states a rhetoric question: "Is there a digital generation?". In fact, the technological boom affects all of us, while there are differences in how distinct social and age groups use digital technologies.

Of course, there are distinctions in what adults do with technology and what young people do with it; however it is important to note that the meanings and uses of technology are so variable, that we need some quite fine distinctions in order to capture what is happening here. Based on a sample of 2096 Australian university students, Kennedy et al. (2010) identified four distinct types of technology users within the net generation age group: power users (14%), ordinary users (27%), irregular users (14%) and basic users (27%). Advanced technology users (power users) were in a minority, and the largest group of students were the basic users these students are characterized by extremely infrequent use of new and emerging technologies and less than weekly or monthly use of standard Web technologies. They are regular users of standard mobile features. The studies conducted by Jones and Hosein (2010a, 2010b) compared whether older Net Generation students (21-25 years) used technologies differently to the younger Net Generation students (≤ 20 years). The younger students used information and communication technologies (ICT) for social and leisure purposes more frequently than older students. The older students were more likely to use it for study. In relation to the present generation of students, there is a growing need for the use of the term "Digital learners" in the context of education since it offers a broader global vision of a 21st century student. The perception of this term varies among individuals as well as from the standpoint of societies, regions, countries and time (Morgan and Bullen, 2011).

Based on the above stated, it can be concluded that there is a wide array of different variables (like the age that is essential for the definition of the present generation) that need to be taken into account so that it is possible to understand students' use of digital technologies. Even though the present generation of students is since early age surrounded by technologies, it cannot be expected that young people intuitively know how to use technology and hence have no need for digital education or training.

## 2 PRESENT STUDY

Past experience with the undergraduate training of future teachers in primary and pre-primary education at the Faculty of Education, University of Presov indicates that the digital skills of the Digital Natives is usually being overestimated. The latest interim results of pretesting the students within the course "ICT in preschool and leisure time education" in February 2017 (students required to modify a document in a word processing software using basic tools) point at students' lacking skills. Moreover, direct experience of lecturers employing computers or tablets in at least part of their courses (allowing for direct observation of how students work) points at the absence of skill in working with word processing software, graphics editors, presentation tools, or cloud solutions. In a recent (last year) study, the aim was to examine the use of mobile devices by the students of the faculty. For study purposes, student mostly used notebooks and mobile phones, while accessing freely available study materials on the Internet most of the time. These devices were used to find study-related information on Google+, LinkedIn, scholarly-oriented discussion groups far less frequently (Adamkovičová and Burgerová, 2016).

Due to above stated reason, there was a need to monitor students' digital skills on a regular basis and to examine their propensity to employ digital technologies for study purposes. A further incentive to carry out the testing was the fact that the graduates will be confronted with digital technologies that get integrated into educational practice and they will have to manifest not only the user skills but also competent didactic skills.

For that matter, we set out to carry out a pilot testing of students in bachelor and master study programs in 2016, yielding the following results.

## 3 METHOD

### Participants

Testing was carried out on a total sample of 532 students with a modal age range of 19-22 years. The participants were sampled from the all the students studying at the Faculty of Education, University of Presov, by means of including all the study groups that had their math and IT courses. The final sample comprised 8 boys and 524 girls.

### Procedure

Prior to testing, students were instructed in person about the testing procedure. Place and time of testing was up to the students as the expected testing time took approximately 60-120 minutes. Students solved all the test items via LMS MOODLE for which they had a unique enrolment key. They could log in also on external devices. After completion, MOODLE immediately generated a report of the result for the student as well as all the data needed for subsequent analyses. Time to complete under 30 minutes was regarded impossible; the given subjects were removed from the analyses ($n = 28$).

### Measurement

The IT Fitness test 2015 was used to measure students' digital skills. In 2017, the test was made accessible for a public national testing following the registration on the official site eSkills.sk. The test contained 25 multiple choice items (4 to 16 possible answers) with only one answer being correct. The items of the IT Fitness test 2015 could be summed up to obtain a score of the following domains: Internet, Security and computer systems, Collaborative tools and social networks, Office tools, and Complex tasks. Each of the mentioned domains was reflected by five items. Following a consent from the IT Association Slovakia (IT AS, 2015a), we used the identical test for our testing, however, (1) it has been implemented in LMS MOODLE and (2) we used a fixed set of items so that every participant got the same questions instead of randomly sampling 25 question from a larger pool of items used for the national testing.

### Results

The mean achievement score in the 25-item IT Fitness test was at $M = 14.5$, representing a 58.0% success rate. At the same time, the scores of the current sample had rather large variability, $SD = 5.3$ in raw score units (21% in in percentage units). The full distribution of scores can be seen in Figure 1. The distribution shows a moderately positive skew, z-skew = 2.7, and it has a rather platykurtic character, z-kurtosis = 3.2.

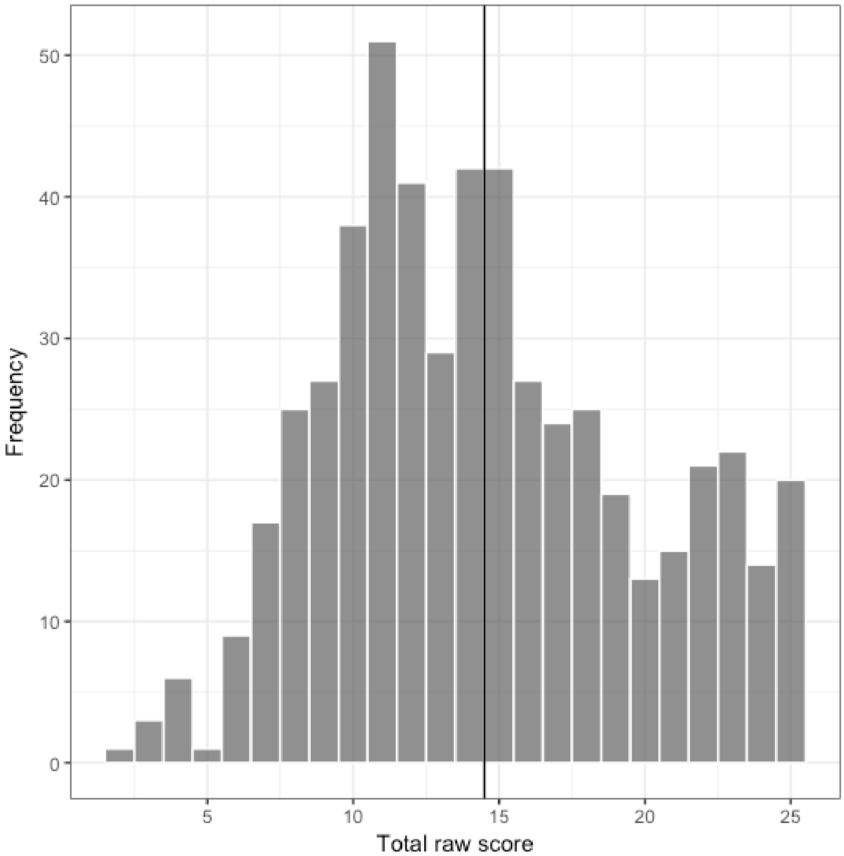


**Figure 1** The distribution of scores in the IT Fitness test. Vertical line represents the mean.

The mean success rate in the current sample was significantly higher than the estimated mean of 19-22 years-old female students in the Slovak population, as the reference group (IT AS, 2015b), at 43.98%, t(531) = 15.4, p < .001. The mean difference was approximately 14 percentage points, representing a standardized difference of 0.67 standard deviations, i.e., medium effect size.

**Table 1** Mean difference in overall success rates

| | Test | Statistic | *df* | *p* | Δ | ES | 95% CI LB-UB | |
|---|---|---|---|---|---|---|---|---|
| Success rate in % | t-test | 15.37 | 531 | < .001 | 14.02 | 0.67 | 56.21 | 59.79 |

*Note.* Δ = mean difference. *ES* = effect size in Cohen's *d* units. *CI* = confidence interval.

In comparison to the reference population of female students with mean age 19.8 years, the students of the Faculty of Education correctly solved 3.5 tasks more in average. students of the Faculty of Education correctly solved 3.5 tasks more in average. Should the estimate of the overall population mean be taken as the reference value (45.79%), the mean of the present sample is also significantly higher, given t(531) = 13.4, p < .001 for a mean difference of 12.2 percentage points and a corresponding medium effect size of d = 0.58.

In the national representative research, a substantial quantitative increase in overall success rate during the transition from 19th and 20th year of age was observed. In the present sample, we set out to test the relationship between the year of study and overall score. The scores increased proportionally with the year of study (from 1st to 3rd year, 56% – 62% – 65%, respectively), however the analysis of variance indicate the inability to reject the null hypothesis of equal means across the five years of study, with a negligible effect size of $\eta 2$ = .03. The data thus did not provide enough empirical evidence to back up the interpretation of proportional increase, probably due to small number of participants in 3rd to 5th year of study and rather high variability of scores across within each year of study. Despite apparent increase, without additional data, the mean scores for distinct years of study should be formally seen as equivalent.

The test items were divided into 5 thematic domains. Figure 2 displays mean success rate in the given domains. As evident, the domain “Internet” was the relatively easiest. On the other hand, domains “Security and computer systems” and “Complex tasks” proved to be the most difficult.

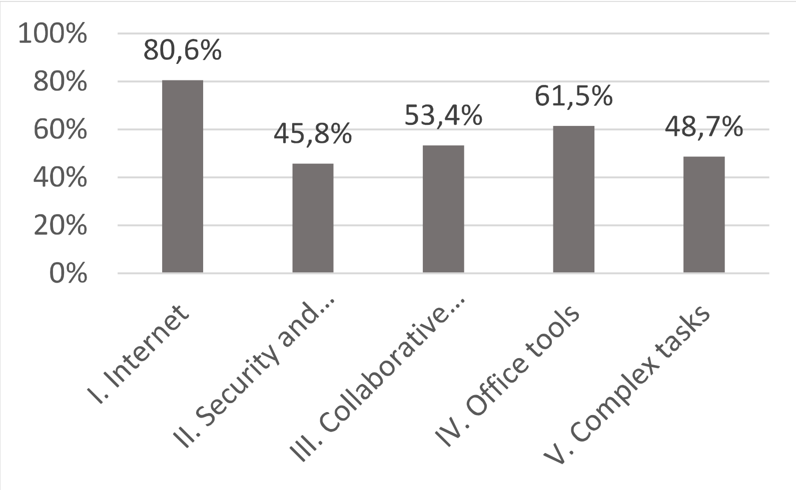


**Figure 2** Success rate in individual domains

To assess the measurement properties of the given test, it was more important to look at the sensitivity parameters, i.e., the discrimination power. Sensitivity reflects the ability of the individual test items any of the sum scores to discriminate between participants having good IT knowledge (participants above the 80th percentile) and participant with a rather poor level of knowledge (those below the 20th percentile of the overall distribution). Numerical estimate of sensitivity thus reflects mean percentage difference between those two groups of participants. As shown in Figure 3, sensitivity was inversely associated with the overall success rate, i.e., domains with the relatively lowest success rate showed the highest sensitivity. On the other hand, the domain “Internet” coined from less difficult items couldn’t sufficiently discriminate participants with good and those with poor knowledge of IT, since the individual items were answered correctly even by a substantial proportion of participants with poor knowledge.

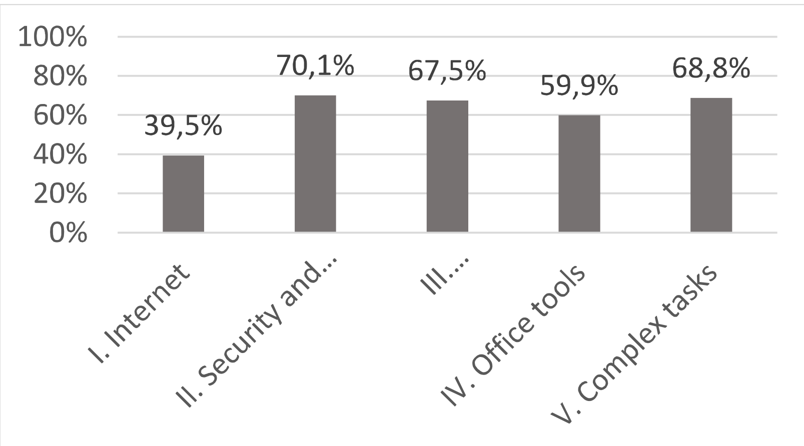


**Figure 3** Sensitivity in individual domains

The following two figures (Figure 4, Figure 5) show similar descriptive statistics for individual items. As can be seen, there is a large variability with respect to the difficulty of the items. While some items were answered correctly by the great majority of participants, the success rate in other items did not exceed chance level.

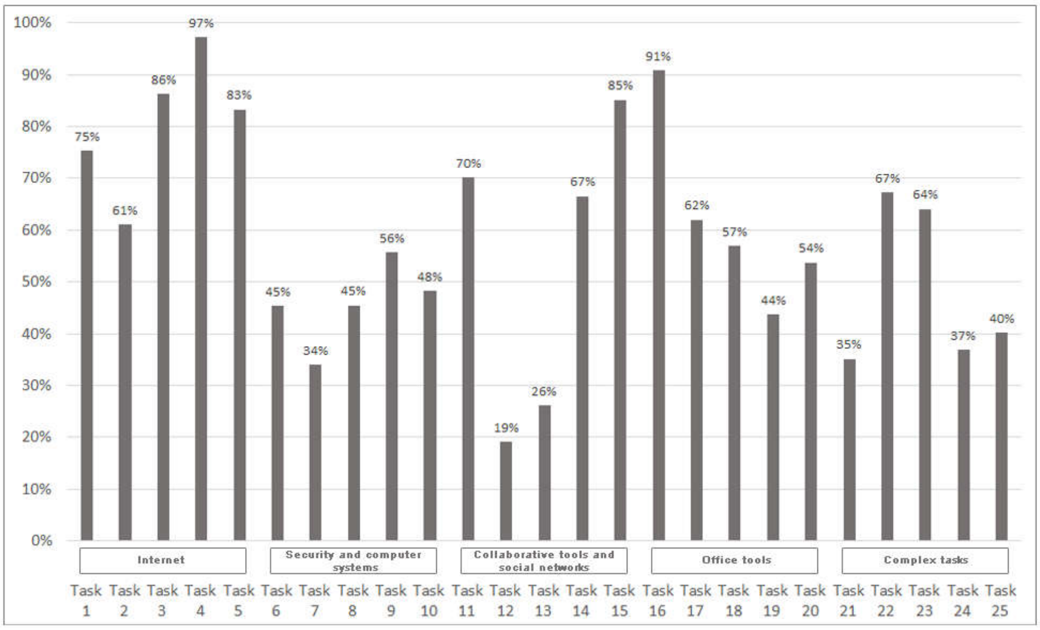


**Figure 4** Success rate in individual items

The interpretation of the sensitivity parameter is similar like with the analysis of thematic domains. Observed percentages reflect the difference in success rates for groups of participants with good and poor IT knowledge. In general, the highest sensitivity can be expected in items with approximately 50% success rate. In the present study, the best discrimination power was manifested by slightly more difficult items. Most of the items, however, showed sufficient level of sensitivity (> 30%). None of the items had negative sensitivity indicating its defective functioning (situation when the "poor" participants have a higher success rate than the "good" participants).

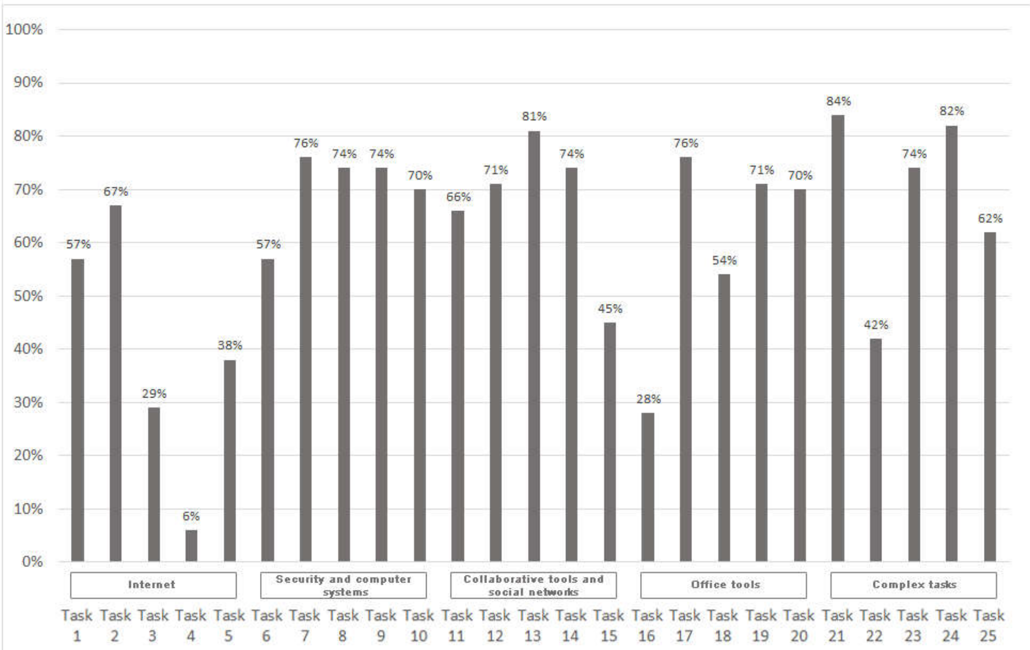


**Figure 5** Sensitivity in individual items

With respect to consensual psychometric criteria (Ebel & Frisbie, 1986), it can be concluded that the test showed satisfactory discrimination power. Mean value of biserial correlation between the individual item and overall sum score was at r = .46, while values above .40 are generally regarded as good. Regarding the reliability of the test scores, the overall sum score manifested a satisfactory internal consistency with Cronbach's α at .85. At the same time, the success rates in the given five domains generally inter-correlate positively, with polychoric correlations ranging from rpol = .38 to rpol = .57 (mean rpol = .49)

## CONCLUSION

The highest success rate was observed for the domain Internet, which can be due to the frequent use of internet by university students – according to the results of national testing, searching for study-related information via search engines is one of the favorite activities among university students (IT AS, 2015b). Activities related to IT that we devote more time to, are then expected to be mastered more easily. Another possible reason for the high scores in this domain is that it comprised less difficult items. Domain with the least success rate has been shown to be Security and computer systems. Given the university students sample, it was surprising that a task related to intellectual property law yielded the lowest success rate (only 34%, the third least overall). According to Ariu at al (2014), the results of a study on Italian university students also showed deficient skills in the domain of internet security (42% of the students are not adequately aware of the risks of a free Wi-Fi, 40% of them do not protect the access to their phones and 50% of students never or rarely check permissions that the application requires before installation).

The success rate in Collaborative tools and social networks at 53,4% can be considered relatively low, given the findings of another study (Burgerová, Adamkovičová 2016) where out of 473 participants, 381 had a Google+ account, all the students used group mail accounts, and all five tasks within this domain tackled Google+ and Google Drive. The research by Šimonová and Poulová (2015), Kostolányová at al (2015) examined the use of social networks by students of tertiary education in the Czech environment. Both studies confirmed the popularity of social networking among students. According to the authors, however, the question remains as to what challenges for formal education the social networks will bring in the future.

Office tools represented by spreadsheet software showed the second highest overall success rate, however, in e.g., item 19 requiring applying a more complex formula, the success rate dropped to only 44%. Moreover, item 16 from this domain had only 28% sensitivity what is beyond acceptable. Based on testing as well as in-class experience which provides for direct observation of students' work with word processing, spreadsheet and presentation software, we lean towards the conclusion that the students are more or less capable of using these tools but fail when faced with more elaborate demands. Similarly, a study carried out on a sample of 1000 participants who had left school in the past three years, 85 percent of university graduates learned to use PowerPoint software while in school but only 39 percent reported using it at work, 88 percent learned to use spreadsheet software, but only 65 percent use it as part of their job. According to the study, "many young adults are confident in their digital skills, survey finds, but businesses are not making the most of their tech savvy" (Lomas, 2008). The Chartered Institute for IT (2017) points out that the employers regard email, word processing and spreadsheet skills necessary for most roles in the work place.

The domain Complex tasks was a combination of search tasks and other knowledge where the participants were required to carry out a series of steps to resolve the tasks. This domain was marked with the second lowest success rate indicating a long-term issue which we face in education: tasks requiring higher-order cognitive functions are usually those in which the students fail.

Based on our findings, we concur that the digital skills of the digital generation tend to be generally overestimated as shown by numerous other studies. Apart from the above mentioned, the report by the ECDL Foundation (2014) shows that in Austria, only 7% of 15-29-year-olds has very good computer skills. A German study pointed out an alarming fact that the young people are capable of everyday tasks as bookmarking a webpage, whereas less than 20% of them can apply paragraph styles in text processing documents or change a chart type in spreadsheets. Moreover, a study by Kennedy (2010) concludes that only 15% of the student population are advanced users of ICTs and 45% students were rudimentary digital technology users.

What follows is the conclusion that favorite digital lifestyle skills of digital natives such text messaging, playing games, watching videos, listening to music are arguably not sufficient for study and work purposes of the future. Digital skills needed for study and preferred by employers can be quite specific and it is necessary to systematically and understand learn them. At the same time, it is important that the students develop skills needed for complex tasks where it is necessary to link pieces of knowledge within a broader context while making use of higher-order cognitive operations (analysis, assessment, creativity) (IT AS, 2015b). The combination of the development of digital skills and higher-order cognitive functions is offered by numerous applications. One of the most helpful tools is, e.g. iPedagogy Wheel (Padagogy.cz, 2017), which – based on Bloom's taxonomy – categorizes mobile applications according to the following criteria: remembering criteria, understanding criteria, applying criteria, analyzing criteria, evaluating criteria, creating criteria.

With respect to the studied sample of participants, it is important to mention that the educational practice continuously provides for new challenges by implementing digital technologies into pre-primary and primary education. That is why it is important to implement into courses with math and IT leaning activities allowing for the development of lacking study-related Digital Skills as well as activities leading to the improvement of teachers' competences to use digital technologies in primary and pre-primary education. Of importance is also the fact that much of the acquired competences to work with digital technologies is a subject to self-study. The role of institutional education is to complement the acquired skills with systematic approach and professional development. Present students are those who will soon face a responsible role to prepare the next generation for the future which we do not know much about yet. However, what we already know is, as Ken Robinson (2017), expert on education, creativity and innovation put it, that the best way how to tackle that challenge is to foster the children in a complex way, support their creative skills and imagination so that they will be able to face the future which we may not experience, but they will.

The paper was written with the support of the KEGA 013PU-4/2015 project called Application of Cooperation and Communication Tools in E-learning Courses for the Primary Education Teachers.

## REFERENCES

Ariu, D., Bosco, F., Ferraris, V., Perri, P., Spolti, G., Stirparo, P., … Zanero, S. (2014). *Security of the Digital Natives*. Tech And Law Center. Retrieved from https://ssrn.com/abstract=2442037

Buckingham, D., & Willett, R. (2006). *Digital generations : children, young people, and new media* (1st ed.). Mahwah, N.J. : Lawrence Erlbaum Associates, Publishers.

Bullen, M., & Morgan, T. (2011). Digital learners not digital natives. *La Cuestión Universitaria*, *7*, 60–68.

Burgerová, J., & Adamkovičová, M. (2016). Mobile Devices and Social Networks within Pre-Service Teacher Preparation. *International Journal of Information and Communication Technologies in Education*, *5*(2). http://doi.org/10.1515/ijicte-2016-0005

Carrington, A. (2017). Kolo iPadagogiky. Retrieved 2 March 2017, from http://www.padagogy.cz/?page_id=15

Ebel, R., & Frisbie, D. (1986). Essentials of Educational Measurement. *Journal of Educational Measurement*, *24*(2), 182–184. Retrieved from http://www.jstor.org/stable/1434697

ECDL Foundation. (2014). The Fallacy of the 'Digital Native': Why Young People Need to Develop their Digital Skills. Retrieved from http://ecdl.org/media/TheFallacyofthe'DigitalNative'PositionPaper1.pdf

Erdong, Z., & Liwei, L. (2008). China's Generation Y: Understanding the workforce. In *2008 4th IEEE International Conference on Management of Innovation and Technology* (pp. 612–616). IEEE. http://doi.org/10.1109/ICMIT.2008.4654435

Gallardo-Echenique, E. E., Marqués-Molías, L., Bullen, M., & Strijbos, J.-W. (2015). Let's talk about digital learners in the digital era. *The International Review of Research in Open and Distributed Learning*, *16*(3). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/2196/3337

Hargittai, E. (2010). Digital Na(t)ives? Variation in Internet Skills and Uses among Members of the 'Net Generation'. *Sociological Inquiry*, *80*(1), 92–113. http://doi.org/10.1111/j.1475-682x.2009.00317.x

Hosein, A., Ramanau, R., & Jones, C. (2010). Are all net generation students the same? The frequency of technology use at university. In *IADIS E-Learning Conference, 26-29 Jul 2010*. Freiberg, Germany. Retrieved from http://oro.open.ac.uk/id/eprint/24114

Hosein, A., Ramanau, R., & Jones, C. (2010). Learning and living technologies: a longitudinal study of first-year students' frequency and competence in the use of ICT. *Learning, Media and Technology*, *35*(4), 403–418. http://doi.org/10.1080/17439884.2010.529913

Howe, N., & Strauss, W. (1991). *Generations: The History of America's Future, 1584 to 2069*. New York: Quill.

Chmura, M., Malach, J., & Kostolányová, K. (2015). Social Media as a Means of University Study Support. In K. Kostolányová (Ed.), *Information and Communication Technology in Education* (pp. 51–53). Rožnov pod Radhoštěm: University of Ostrava. Retrieved from https://konference.osu.cz/icte/dokumenty/2015/proceedingsICTE2015.pdf

IT Asociácia Slovenska. (2015a). Fitness Test 2015. Retrieved 13 March 2017, from http://www.eskills.sk/sk/statistiky/grafy/prieskum/16eac8bc406aac0f4e2a45c07af8ba0eea128574/

IT Asociácia Slovenska. (2015b). *Správa o výsledkoch IT FITNESS Testovania 2015*. Retrieved from http://www.eskills.sk/media/redactor/ITAS_2016-fitnes_test_FINAL.pdf

Kennedy, G., Judd, T., Dalgarno, B., & Waycott, J. (2010). Beyond natives and immigrants: exploring types of net generation students. *Journal of Computer Assisted Learning*, *26*(5), 332–343. http://doi.org/10.1111/j.1365-2729.2010.00371.x

Kordiger, A. M. (2016). The Digital Natives Generation and their Prerequisites for Learning Online. In *Zborník Divai*.

Natasha, L. (2008). Survey: Generation Facebook's skills wasted at work - CNET. Retrieved 15 March 2017, from https://www.cnet.com/news/survey-generation-facebooks-skills-wasted-at-work /

Prensky, M. (2001). Digital Natives, Digital Immigrants Part 1. *On the Horizon*, *9*(5), 1–6. http://doi.org/10.1108/10748120110424816

R Development Core Team. (2011). *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from http://www.r-project.org/

Robinson, K. (2006). *Do schools kill creativity ?* Retrieved from https://www.ted.com/talks/ken_robinson_says_schools_kill_creativity

Šimonová, I., & Poulová, P. (2016). Mobilní elektronická zařízení a sociální sítě v terciárním vzdělávání na FIM UHK. *Media4u Magazine*, *12*(3), 60–67. Retrieved from http://www.media4u.cz/mm032015.pdf

Tapscott, D. (1998). *Growing Up Digital: The Rise of the Net Generation*. New York: McGraw-Hill Book.

The Chartered Institute for IT. (2014). Digital skills are key to employment according to BCS. Retrieved 3 March 2017, from http://www.bcs.org/content/conWebDoc/52627