Continuing Professional Development in ICT for Primary School Teachers, Reflections and Issues

Irena Loudova[(✉)]

University of Hradec Kralove, Hradec Kralove, Czech Republic
`irena.loudova@uhk.cz`

Abstract. With regard to the main directions of the education policy of the Czech Republic 2030+ , it is clear that the development of information and communication technologies (ICT) in the society brings the necessity to detect the specifics of the teaching profession in the context of current conditions at school. In the future, education should be more integrated with the digital world and respond to technological developments. The upcoming changes will affect virtually all teachers. Computers should be used in the classroom of other subjects, and this may make teachers unwilling to change their practices. Another obstacle to the modernization of teaching is also the lack of school equipment. The Czech School Inspection Authority states that only 9.5% of big primary schools meet the standards for digital education. In small primary schools, it is less than five percent. The aim of our research is to detect, what the real situation is like in the area of professional preparedness in teaching ICT subjects at different types of school with special attention to the perception of the situation by professional teachers. The results of the research confirmed that although teachers have support at school, most of them lack Continuing Professional Development both in the methodology of teaching ICT subjects and in the field of professional ICT subjects. Teachers are rather dissatisfied with the current offer of Continuing Professional Development (CPD) and they would welcome corresponding support.

Keywords: Digital literacy · Continuing Professional Development (CPD) · Didactics of informatics · Competences of ICT teacher

1 Introduction

Continuing professional development programs are meant to provide teachers with opportunities to develop their professional abilities for teaching in particular domains. Current trends in research in CPD view teachers as professionals and CPD programs take the form of providing teachers with learning opportunities to enhance their in-class teaching abilities through processes that engage them in theory-driven pedagogical changes in their teaching practices.

Research in CPD over the past decade has revealed a number of principles that are important in supporting teacher learning during CPD programs and helping teachers

develop themselves through those programs. Generally speaking, CPD can address a variety of teacher needs, focusing on helping teachers refine their teaching approaches and pedagogy, understanding the need to change their everyday practices in particular areas and helping them implement changes in their daily teaching that will eventually help their students to learn more effectively [1]. Productive CPD programs need to provide teachers with opportunities to identify areas that need to be further developed by teachers themselves, however, the literature suggests that there are issues which are specific to ICT CPD. They are linked to wider approaches to the effective professional development of teachers. These affect the degree to which pedagogy is prioritised in the provision of CPD [2].

Issues which can be identified relating specifically to ICT are:

- An over-emphasis on skills training in itself at the expense of deep understanding and application of skills to developing learning and teaching. This is linked to a perceived need to address a skill 'deficit' in teachers, rather than to develop a focus on pedagogy.
- The challenge of developing an appropriate 'vision' for ICT among school leaders, which is focused on pedagogy and teacher development as a priority.
- 'Policy tensions' which deflect from coherent and consistent development of pedagogy using technologies, and create conflicts over how time and resources are used to embed technologies within schools.

A great deal of skills training has taken place in recent years, and yet there is a persistent lack of integration of technology into teachers' practice. The focus of CPD and the types of CPD activities have not led to the degree of change that was anticipated. This is in contradiction with the new educational policy in the Czech Republic, where with regard to the main directions of the education policy of the Czech Republic 2030+, ICT teachers are placed in a new role: to train teachers of other subjects to use ICT technologies in the instruction.

2   Theoretical Basis

At present, a number of subject didactics talk about the information-communication concept of their field, which underlines the increasing importance of informatics as a science, a teaching subject and a necessary base for efficient use of digital technologies at schools and in practical life [3].

Didactics of informatics is a very young field within the group of subject didactics. An important feature of contemporary informatics is i.e. the processing of text, visual (static and dynamic) and audio information in the form of hypertext. It is desirable for teachers to use a range of methodologies and forms, which they can implement depending on their personality characteristics and vocational focus. The quality teacher acquires several methodologies and teaching strategies and applies them appropriately according to the situation, the particular composition of the pupils in the classroom and other criteria [4].

In the study we focused on the situation in the area of professional preparedness in teaching ICT subjects at primary schools, the emphasis was placed on the perception of

the situation by professional teachers. We carried out the detection of didactic resources and overall preparedness of IT teachers for the planned introduction of informatics into non-ICT subjects.

Recently, the rapid development of ICT in education forced teachers to reconsider the lessons' design since ICT have to be incorporated in modern educational scenarios [5]. The integration of technology into curriculum documents in developed countries (most recently in Finland, for example) is through the definition of digital literacy, without which inclusion in educational programs is not possible.

2.1   Digital Literacy

Digital literacy is the ability to use information and communication technologies to find, validate, generate and transmit information that requires both cognitive and technical skills [6]. Digital literacy includes seven elements, see Fig. 1.
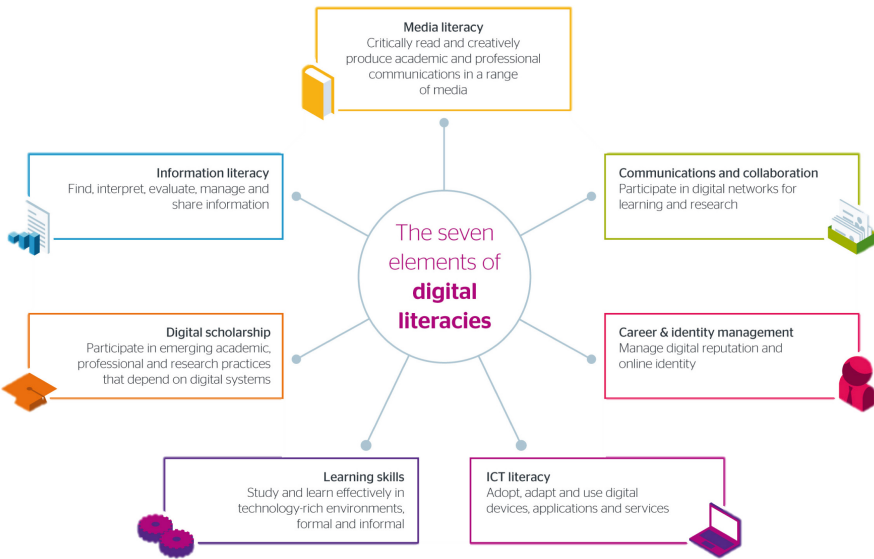

Fig. 1.   Seven basic components of digital literacy [6].

In order to develop the concept of information literacy development, it is necessary to know the definitions of concepts and objectives to which information literacy activities should contribute. These goals are often set as standards or as an information literate competence. From a systemic perspective, it is therefore necessary to decompose information literacy into individual skills, abilities and competences. Comparison of approaches used to ICT competences, which is applied in some countries (e.g. USA, UK) or recommended as a model through transnational educational institutions and clusters, seems to be a suitable tool.

2.2 ICT Competences

The European Framework for the Digital Competence of Educators (DigCompEdu) provides a framework describing what it means for educators to be digitally competent. It provides a general reference frame to support the development of educator-specific digital competences, and is directed towards educators at all levels of education, from early childhood to higher and adult education.

DigCompEdu details 22 competences organized in six areas. The focus is not on technical skills. Rather, the framework aims to detail how digital technologies can be used to enhance and innovate education and training [7], see Fig. 2.
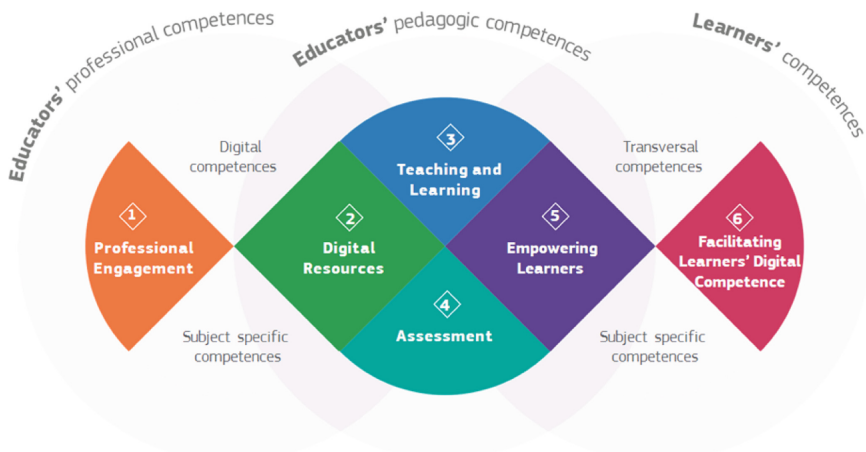

Fig. 2. Seven basic components of digital literacy [7].

Teachers have a large number of different roles in the modern information society, such as facilitators of the educational process, counselors and helpers of pupils and students, co-workers of their colleagues, employees, members of professional associations, professional experts, etc. From this point of view, it is important to realize that when defining teachers' competencies, it is necessary to apply a holistic approach that takes into account the whole spectrum of activities of the teacher.

It would be improper to concentrate on a mere exhaustive list of technological or pedagogical skills accentuated by curricular changes, ignoring the link between the general role of the teacher and the environment and conditions in which teachers operate [8].

The main purpose of ICT teacher training is to equip the graduate with the necessary knowledge, organizational and management skills, and didactic methods, so that the ICT teacher can be qualified in his/her school:

- methodically assist colleagues in integrating ICT into the teaching of most subjects;
- recommend and coordinate further ICT education of teaching staff;
- coordinate the use of ICT in education;

- coordinate software purchases and updates;
- prepare and implement an ICT plan in accordance with the school curriculum;
- coordinate the operation of the school's information system.

The study should fulfill the following **competences** in terms of its content and timing:

Competence for teaching

1. roles, advantages and limits of the use of ICT in the educational process, modern didactic methods;
2. computer use in the educational process;
3. organization of school pupils and student projects;
4. searching and evaluating teaching and information resources on the Internet;
5. using ICT-supported distance and combined learning methods.

Management competence

6. preparation and implementation of the school's ICT plan;
7. elaboration of school security policy (security rules, operating and SW rules);
8. organization of school involvement in regional (national) projects;
9. organization and methodological assistance in the operation of the school educational and organizational information system.

Competences to manage ICT at school

10. basic orientation in new trends in ICT development for education;
11. basic orientation in ICT related legislation;
12. knowledge of principles and possibilities of computer networks;
13. knowledge of principles and possibilities of modern presentation technologies;
14. implementation of new technologies - construction in 3D, 3D printers;
15. sharing materials and using modern communication tools (e-learning, cloud services).

Cheryl Whitfield [9] defines **ICT coordinator** (Technology Facilitator) as a person who should meet the following **characteristics**:

16. experienced teacher;
17. enthusiastic techno-optimist;
18. good lecturer;
19. active mentor;
20. perfect organizer.

We are aware that the list of competencies summarized above is not exhaustive, we intentionally selected only those that are relevant to our research.

3   Research Project

The main goal of the project was twofold, to find out how ICT teachers perceive the current offer of CPD programs focused on information technology, methodology and the subject didactics, and how practicing ICT teachers evaluate their ICT competencies. Based on the above mentioned issues the following research questions were formulated:

1. Does the school management support the ICT teachers' participation of in CPD programs?

2. Are ICT teachers satisfied with the current ICT CPD programs?

3. How do the ICT teachers evaluate the importance of ICT competences based on their teaching practice?

3.1   Methodology

Based on research goals and questions, quantitative research was chosen. An exploratory research method was used and a questionnaire was chosen as the basic research technique. The obtained data were processed by quantitative analysis procedures: tests to verify the psychometric properties of the questionnaire, descriptive statistics, nonparametric test for comparing two or more files - comparison of files to monitored variables: length of practice, overall evaluation of experience, etc. data). The questionnaire had two research parts, the first part was focused on exploration of CPD programs and questions in the form of open items were processed by qualitative analysis (categorical analysis). The second part of the questionnaire was aimed at ICT competencies and Likert scale with five-stage scale items was used. The scale was arranged so that a **value of 1** meant - **very important** and a **value of 5** meant - **unimportant**.

The applied pedagogical research was carried out at 165 primary schools (second level – 11 to 15 years old pupils) in Hradec Kralove Region, and the focus group consisted of 186 ICT teachers with at least 2 years' experience, see Table 1.

Table 1. Characteristics of focus group.

	ICT teachers in focus group
Total number of teachers	186
Male	28
Female	158
Age (AVG)	42.05
Standard deviation	2.4
Minimum	27
Maximum	58
Modus	46
Median	42

4 Research Results

Based on individual scores, we obtained a distribution of respondents in terms of their management support in CPD programs participation. 11% of ICT teachers receives full management support, unlike 42% of ICT teachers who get only limited support from school management to participate in CPD programs. Teachers from the focus group find the main reason in the content offer of provided CPT programs, which according to the school management does not correspond to the current needs in the field of methodology and didactics of ICT subject. see Fig. 3.
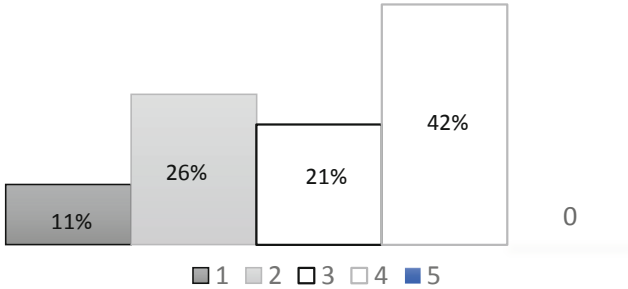

Fig. 3. Does the school management support the ICT teachers' participation of in CPD programs?

Our further objective was to find out if the ICT teachers in the focus group are satisfied with the current content offer of ICT CPD programs. The results of the questionnaire survey show that most ICT teachers (58%) are rather dissatisfied with the content of the CPD programs offer. They miss mainly programs focused on new and current trends (3D printer, robotics, HW…) and of course the methodology of teaching ICT subjects, see Fig. 4.
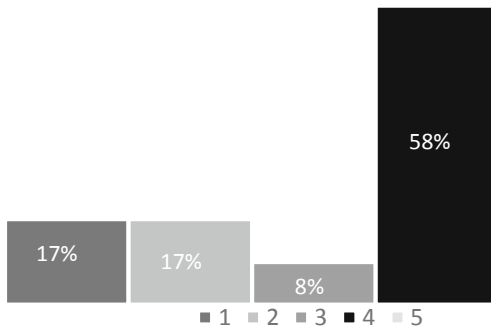

Fig. 4. Are ICT teachers satisfied with the current ICT CPD programs?

In the first part of the research, we found out that even though teachers have the support of school management and can participate in CPD programs, new ICT programs focusing on current trends are not available.

The second part of our research focused on the competences and importance that ICT teachers attach to them. We used the list of competences recorded and numbered in Sect. 2.2. Each number (1–20) represents one competence described in details in Sect. 2.2. The scale values in Table 2 were set as follows: 1- very important, 5 – unimportant, following the Likert scale with five-stage scale items.

Table 2. ICT teachers' evaluation of the importance of ICT competences.

Competence	Mean	SD	Median	Modus
1	1,63	0,07	1	1
2	2,28	1,00	2	2
3	2,03	1,16	2	1
4	3,93	1,22	4	5
5	2,29	1,22	2	1
6	1,98	1,07	2	1
7	2,44	1,11	2	2
8	2,37	1,08	2	2
9	1,37	0,68	1	1
10	1,38	0,63	1	1
11	2,13	1,14	5	5
12*	2,15	1,16	2	–
13	2,26	1,13	2	2
14	2,51	1,30	2	1
15	4.19	1,38	2	1
16	3,08	1,39	3	3
17	1.95	0.99	2	1
18	2,19	0,98	2	2
19	2,5	1,15	2	2
20	1,86	0,98	2	1

*Item 12 has the same frequency of two values, no number is given.

The reliability of the research tool was performed using the Cronbach alpha coefficient: $\alpha = 0.72$.

Descriptive analysis indicated that according to the arithmetic means of individual variables, respondents attach the highest importance in this part of the questionnaire to the following competences: active mentor, use and knowledge of modern didactic methods, knowledge of possibilities of computer network, and good lecturer.

The obtained data were subjected to further investigation; factor analysis was performed. The aim was to analyze the correlations of variables, we worked with the Quartimax rotation. Before the factor analysis itself was used, it was necessary to perform tests that allow its use. We expected that three factors could be used based on the rubble graph, but the extracted factors explained only 30% of the variance, so we used a method of determining the number of factors using the eigenvalue value. Based on eigenvalue >1, 5 factors were extracted for 20 variables, thus explaining 60% of the data variance, see Fig. 5.
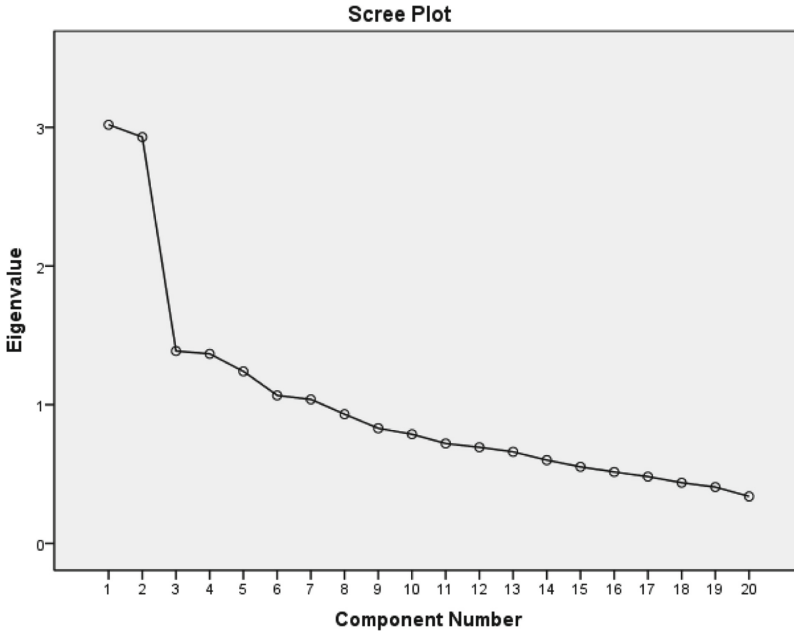

Fig. 5. Rubble chart

A factor is a construct that allows to determine how a group of variables merges into smaller groups (factors). Thus, at first sight, an invisible factor arises that characterizes the common features of the variables. Hendl [10] considers that factors are new variables from which conclusions can be drawn about the context of the original variables. Based on the amount of factor loads, we identified the following five factors (in our case competences):

F1: Competence no. 15 – sharing materials and using modern communication tool (e-learning, Teams, Cloud services);
F2: Competence no. 4 – searching and evaluating teaching and information resources on the Internet;
F3: Competence no. 16 – experienced teacher
F4: Competence 14 – implementation of new technologies – construction in 3D, 3D printers;

F5: Competence no. 7 – elaboration of school security policy (security rules, operating and SW rules).

We used cluster analysis to see if common profiles of respondents and typology of ICT teachers are reflected in the focus group. Numbers 1–5 in Fig. 6 indicate preferred competencies, colored numbers 1 (blue), 2 (red), 3 (green) indicate clusters that determine the types of teacher.
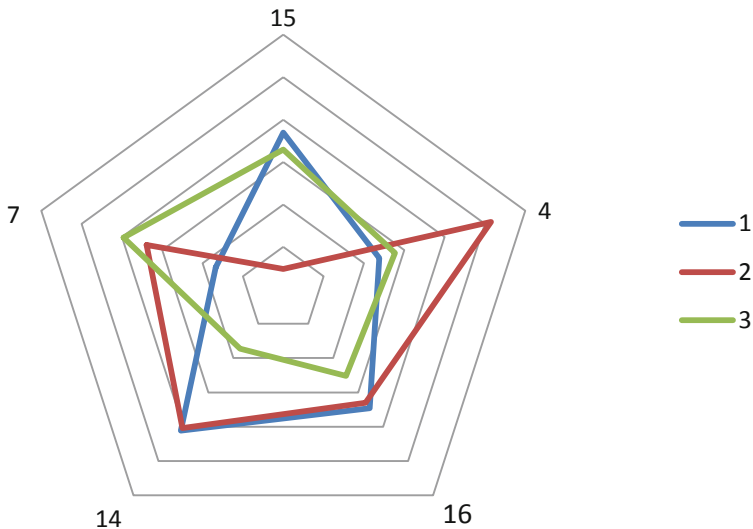

Fig. 6. Cluster analysis: typical respondent in terms of item preferences. (Color figure online)

Based on cluster analysis, the profiles of three types of ICT teachers, which are based on responding item preferences, were defined as follows:

Type 1: in terms of competences, the most important for this type of ICT teacher is to use modern communication tools (e-learning, cloud services) when sharing didactic materials, implements new technologies in the instruction (e.g. 3D printers), and relies on teaching experience;

Type 2: in terms of competences it is necessary for this teacher to evaluate teaching and information resources on the Internet, implement new technologies into the instruction, and elaborate school security policy (security and SW rules);

Type 3: in terms of competences, for this teacher the priorities are school security policy, teaching experience and evaluating teaching and information resources on the Internet.

5   Conclusion

The described research identified the school management support of ICT teachers to participate in CPD programs in Hradec Kralove region. We also investigated whether

ICT teachers are satisfied with the content and offer of CPD programs. The results of the survey showed that even though the teachers are encouraged to further develop and deepen their professional knowledge, there is a lack of courses focused on the implementation of new technologies in ICT instruction, not to mention modern methodological and didactic strategies.

The literature suggests that there are issues which are specific to ICT CPD, which are linked to wider approaches to the effective professional development of teachers. These affect the degree to which pedagogy is prioritised in the provision of CPD. Issues which can be identified relating specifically to ICT are:

- An over-emphasis on skills training in itself at the expense of deep understanding and application of skills to developing learning and teaching. This is linked to a perceived need to address skills 'deficit' in teachers, rather than to develop a focus on pedagogy.
- The challenge of developing an appropriate 'vision' for ICT among school management, which is focused on pedagogy and teacher development as a priority.
- 'Policy tensions' which deflect from coherent and consistent development of pedagogy using technologies, and create conflicts over how time and resources are used to embed technologies within schools [11].

The main feature of successful CPD is that it addresses teachers' individual needs as a priority. Meeting these individual needs takes very different forms, ranging from entirely school-based provision to external programmes. Currently, the National Pedagogical Institute in the Czech Republic is coming up with a number of innovations in CPD ICT programs, which take the form of webinars, workshops and seminars. These courses meet the needs and expectations of ICT subject teachers. In just six months in 2019, over 1,000 teachers participated in ICT webinars that are provided free within the project SYPO (System of the Professional Education Support for Pedagogical Staff and School Management), which is one of the National Pedagogical Institute projects, whose aim is to improve the quality of lifelong education.

Our research also dealt with the issue of ICT competencies and their importance in the teaching process. We found out that the main priorities for practicing ICT subject teachers are the implementation of modern technologies, the use of communication tools such as cloud services, cyber security and the guarantee of quality information obtained from Internet resources. Teaching experience is also very much appreciated.

We are aware that our research is subject to potential limitations, e.g. there is insufficient sample size for statistical measurement and thus we cannot generalize in any way. Despite the limits, we believe that information and communication technology is one of the fastest growing areas and teachers' attitudes to innovations in this area are important for the further development of education. In addition to all the above-mentioned factors that affect CPD programs lifelong education generates professional enthusiasm for teachers' practice of their perceptions, and a call for "hearts and minds" approach is needed [12]. Teachers' CPD participation results in knowledge which shapes teachers' 'minds' but only professional enthusiasm reframes thoughts and put them into action.

References

1. Fishman, J.J., Marx, R.W., Best, S., Tal, R.T.: Linking teacher and student learning to improve professional development in systemic reform. Teach. Teach. Educ. **19**, 643–658 (2003)
2. Boylan, M.: Enabling adaptive system leadership: teachers leading professional development. Educ. Manage. Adm. Leadersh. **46**(1), 86–106 (2018)
3. Kopecký, K., Szotkowski, R.: Moderní informační a komunikační technologie ve výuce (průvodce studiem) (2018)
4. Woods, P.: Creative Teachers in Primary Schools. Routledge, Abingdon (2019)
5. Clarke, B., Svanaes, S., Zimmermann, S.: One-to-one tablets in secondary schools: an evaluation study. Tablets for schools (2013)
6. Digital Literacy, Libraries, and Public Policy. (2013). [http://www.districtdispatch.org/wp-content/uploads…]. [cit. 2015-11-26]
7. DigCompEdu. https://ec.europa.eu/jrc/en/digcompedu
8. Cirus, L.: The influence of the teacher on the formation of digital literacy of primary school pupils. Hradec Kralove: Pedagogical faculty of Univerzity of Hradec Kralove, 2017, 195 p. dissertation work (2017)
9. Whitfield, Ch.: The Five Essentials of Technology Facilitators: Successful On-Site Help for Technology Integration. Techlearning (2005). Dostupné na Internetu Accessable from http://www.techlearning.com/story/showArticle.jhtml?articleID=159901663
10. Hendl, J.: Přehled statistických metod zpracování dat: analýza a metaanalýza dat. Portál, sro (2004)
11. Havigerova, J., Haviger, J., Janebova, R., Zikl, P.: Helping professions and normality. Int. J. Psychol. **43**(3–4) (2008)
12. Watson, M.B.: Career Maturity Assessment in an International Context. In: Athanasou, J.A., Perera, H.N. (eds.) International Handbook of Career Guidance, pp. 639–653. Springer, Cham (2019). https://doi.org/10.1007/978-3-030-25153-6_29