Croatian Journal of Education
Vol.26; No.2/2024, pages: 445-484
Original research paper
Paper submitted: 4th January 2023
Paper accepted: 27th March 2024
https://doi.org/10.15516/cje.v26i2.5158

Informatics Teachers' Attitudes Towards the Primary Education Curriculum of the Given Subject in the Republic of Croatia and the Czech Republic

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Abstract

The current paper aims to analyse the attitudes of primary education teachers who teach Informatics in the Republic of Croatia and the Czech Republic; these refer to the given subject curricula that have been used in their countries. The sample consisted of 368 teachers, 187 from the Republic of Croatia and 181 from the Czech Republic. The research was conducted simultaneously in the Republic of Croatia and the Czech Republic, using an online questionnaire. The obtained results show that there is no statistically significant difference in the respondents' satisfaction with the given curriculum content, just as there is no statistically significant difference in the respondents' desire for additional primary teacher education with regards to their country. However, the respondents from the Republic of Croatia (Mdn=4, M=4.19, SD=1.01) can be considered more competent for teaching Informatics when compared to the respondents from the Czech Republic (Mdn=4, M=3.74, SD=1.10), (Z=-4.49, p=0.000), that is, there is a significant statistical difference between them in this aspect. The qualitative part if the research indicates many curriculum advantages and disadvantages being considered important by the teachers from both countries; consequently, these should be taken into account at designing a new curricula.

Key words: *curriculum, Informatics, Republic of Croatia, the Czech Republic.*

Introduction

The 2018 curriculum reform of the education system, initiated by the Ministry of Science and Education of the Republic of Croatia, introduced the new subject curricula

for primary and secondary education in the Republic of Croatia (Ministry of Science and Education of the Republic of Croatia, 2018b). In the Czech Republic, the Ministry of Education, Youth and Sports adopted a revised Framework Educational Programme for Primary Education (in Czech: Rámcový vzdělávací program pro základní vzdělávání (RVP ZV)) (National Institute for Education, 2021).

Information and communication technologies (ICT) belong to one of the most dynamic development areas. New hardware and software technologies are developed daily, improving and facilitating human work as well as affecting how people work and learn. Computers are present in almost any area of human activity, so working and learning can hardly be imagined without them. The significant ICT impact is yet to be felt in the near future due to the increasingly rapid development of automation, artificial intelligence and robotics. This will significantly affect the required knowledge and skills of future workers, as a significant part of human work will be replaced by the work of artificial intelligence and robots.

"Driven by innovation and technological evolution, the digital transformation is reshaping society, the labour market and the future of work. Employers face difficulties in recruiting highly skilled workers across a number of economic sectors, including the digital sector." (European Commission, 2020, p. 2). There are two interrelated aspects of digital education: the deployment of a vast and growing array of digital technologies, and the need to equip all learners with digital competence. Such an orientation implies policies and actions on many levels, such as: infrastructure, strategy and leadership, teacher skills, learner skills, content, curricula, assessment and national legal frameworks (European Commission, 2020).

This is one of the major reasons why it has already become important to prepare children – future participants in the labour market – for jobs/occupations that may not even exist today. There is an increasing need for experts in STEM (Science, Technology, Engineering, Mathematics), which also includes Informatics, since computers and software are an indispensable part of this field. The Informatics subject curriculum for primary education should follow the above-mentioned rapid and significant development of new ICT, also to be improved and updated, so that it does not lag behind the current situation in the world of ICT.

"Informatics should be seen as important as mathematics, the sciences, and the various languages. It should be recognized by all as a truly foundational discipline that plays a significant role in education for the 21st century" (Caspersen et al., 2019, p. 58).

Literature review

Informatics in school education has recently undergone important reforms. Its curriculum in 2020/2021 in some countries, such as Croatia, France, Montenegro, Norway, Poland and Sweden, resulted from the reforms that had previously been implemented. In other countries, the curriculum reforms in 2020/2021 were not fully implemented or are still under development. Some countries have included them in

the recovery and resilience plans (RRPs) developed in response to the COVID-19 pandemic, which are financially supported by the Recovery and Resilience Facility (European Commission, 2022).

A total of seventeen education systems participated in the process of the given curricular reform implementation. The following countries are currently implementing curricular reforms in the education of Informatics: Belgium (German-speaking community and Flemish community), Bulgaria, The Czech Republic, some of the German federal states, Estonia, Ireland, Spain, Latvia, Lithuania, Hungary, Malta, Austria, Bosnia and Herzegovina (the Serbian entity of Republika Srpska), Switzerland (French-speaking cantons), North Macedonia, and Serbia. In the rest of eleven systems, the educational authorities are planning to develop such curricular reforms in Informatics: Belgium (French community), Denmark, Greece, Luxembourg, Italy, Cyprus, Slovenia, Slovakia, The Netherlands, Romania, and Iceland (European Commission, 2022).

The documents that can contribute to the development of the Informatics curricula and facilitate this include the *Digital Competence Framework for Citizens – DigComp* (Vuorikari et al., 2022) and the *Informatics education at school in Europe: Eurydice report* (European Commission, 2022). The first document contains the competence areas like: Information and Data Literacy, Communication and Collaboration, Digital Content Creation, Safety, and Problem Solving, with a total of twenty-one competences within. The second document covers the following main areas of Informatics education in terms of its learning outcomes: Data and Information, Algorithms, Programming, Computing Systems, Networks, People-System Interface, Design and Development, Modelling and Simulation, Awareness and Empowerment, also Safety and Security. This list is contributed by the areas of education in Informatics as stated in Caspersen et al. (2022).

Teachers surely need their educator-specific digital competence. It is specified in the European Framework for the Digital Competence of Educators – DigCompEdu (Punie & Redecker, 2017). The DigCompEdu Framework consolidates the initiatives at both national and regional levels in order to define the digital competence tailored for educators. Its goal is to serve as a comprehensive guide for those in charge of developing the models of digital competence, such as member states, regional governments, relevant national and regional agencies, educational institutions, and public or private professional training providers. The framework has been designed for educators across educational levels, ranging from early childhood to higher and adult education, as well as encompassing general and vocational training, special needs education, and non-formal learning environments (Punie & Redecker, 2017). This document has six areas of educators' competence: Professional Engagement, Digital Resources, Teaching and Learning, Assessment, Empowering Learners, and Facilitating Learners' Digital Competence. Within them there are twenty-two competences (Punie & Redecker, 2017).

When discussing teachers' challenges of computing in the curriculum, Sentance and Csizmadia (2017) in their own qualitative research have stated that in England there is

a notable emphasis on enhancing teachers' confidence in their subject knowledge skills. Although teachers attend numerous training courses to bolster their expertise, they often find themselves lacking enough confidence to effectively address the problems which students encounter. The authors of this particular paper highlight various challenges closely related to resources, including the need for adequate hardware and software, sufficient funding, correct installation, configuration, and maintenance of software resources to align with the school platform. Teachers express frustration at what they perceive as a lack of support and understanding from their managers. Additionally, some teachers are concerned about the technical staff's reluctance to maintain and troubleshoot installed software.

In their study, Northrup and associates (2022) discuss qualitative research findings by highlighting challenges in the new computer science curriculum. These challenges include teachers' belief in the pivotal role of computer science in the future and the necessity for a pedagogical shift, given that the traditional teaching methods involve the teacher as the subject expert. In the realm of computer science, students may possess more knowledge than their teachers, requiring the latter to acknowledge and accept the expertise possessed by the former. Another identified challenge lies in the perceived difficulty of coding.

The study of Stringer et al. (2022) explores teachers' experiences with the digital technology curricula to understand how teachers can be supported to raise their implementation efforts. Teachers' digital technology self-efficacy, digital technology self-esteem, and digital technology confidence were seen to greatly influence implementation. The pedagogical approach development, required for teaching digital technologies effectively, has also seen as a challenge by some teachers in typically traditional teaching methods (Geldreich & Hubwieser, 2020), and there are just a few initial teacher education programmes that explicitly cover these pedagogical practices (Cai & Gut, 2020). Professional learning and development were suggested as a solution to boost teachers' confidence and help them overcome common implementation barriers (Stringer et al., 2022).

Fluck et al. (2016) discuss the difficulties faced by schools when reintroducing computer science. They highlight a need for fresh pedagogical content knowledge and essential teaching resources, including programming development environments and textbooks or their equivalents. The focal point of their findings refers to the notable tension, arising from the swift pace at which innovations are reshaping the comprehension of computer science.

In their paper, Webb et al. (2017) claim that there exists a widespread agreement on the crucial role of teachers' professional development in computer science education to facilitate curriculum changes, posing a significant challenge in numerous countries. They identify the key emerging themes in the evolution of computer science curriculum, encompassing the aspects like: starting age, sequence and structure, curriculum content and balance, and imperative for teacher professional development.

Primary education curriculum for the subject of Informatics in the Republic of Croatia

In the Republic of Croatia, primary education is regulated by the Education in Primary and Secondary Schools Act (Zakon HR, 2020).

The National Framework Curriculum in the Republic of Croatia represents the basic component of preschool, general compulsory and secondary education, including the education of children with special educational needs. The fundamental document in the state-level education system is the national curriculum, which includes the following components: values, goals, principles, contents and general goals of education areas, evaluation of student achievements, evaluation and self-evaluation of the national curriculum achievement. Namely, the National Framework Curriculum serves as the basis for creating the subject curriculum and other curriculum documents (handbook for teachers, handbook for parents, guidelines for the curriculum application, standards for designing textbooks and other curricula, etc.) (Ministry of Science, Education and Sports of the Republic of Croatia, 2011, p. 16).

Informatics-related competence is necessary for solving various challenges in any science and field of human activity. Therefore, Informatics should be studied as another field in addition to traditional scientific disciplines, such as chemistry, physics, or mathematics. During the educational process which targets the subject of Informatics, the emphasis should be on programming and problem solving, which consequently encourages the development of computational thinking that enables analysing, understanding and problem-solving by choosing appropriate strategies of programming solutions and algorithms. In short, computational thinking should be transferred to other fields of science, as well as to everyday life (Ministry of Science and Education of the Republic of Croatia, 2018b).

Informatics-related competence, along with self-confidence, independence, responsibility and reliability, should be developed through an adequate pedagogical practice that places the student at the very centre of the process with a constructivist approach to learning. Learning is based on the assumption that students learn best through active participation. A strong motivation for learning refers to cooperation and teamwork. Students learn actively in the best possible way when they are creative. During the entire schooling, the contents of Informatics should be learnt through using the principle of the spiral model in which the knowledge acquired at a lower level of education is expanded and deepened at a higher level. Acquired knowledge, attitudes and skills in Informatics support the teaching of any subject and cross-curricular topic (Ministry of Science and Education of the Republic of Croatia, 2018a, p. 6).

Educational goals of learning and teaching the subject of Informatics

In the relevant curriculum, the following learning and teaching objectives of Informatics are listed, with the help of which students will:

"– become IT literate in order to be able to use digital technologies independently, responsibly, efficiently, purposefully and appropriately, and to prepare for learning, living and working in a society that is changing very quickly due to the development of digital technologies

– develop digital wisdom as the ability to select and apply the most appropriate technology depending on the task, area or problem being solved

– develop critical thinking, creativity and innovation using information and communication technology

– develop computational thinking, problem solving and programming skills

– communicate and collaborate effectively and responsibly in a digital environment

– understand and responsibly apply safety recommendations and respect legal guidelines when using digital technology in everyday life" (Ministry of Science and Education of the Republic of Croatia, 2018a, p. 7).

The educational goals of the given subject are achieved on the basis of the curriculum by using four domains, such as: e-Society, Digital Literacy and Communication, Computational Thinking and Programming, and Information and Digital Technology (Ministry of Science and Education of the Republic of Croatia, 2018a).

According to the new primary education curriculum, Informatics is an optional subject from grades 1 to 4, also in grades 7 and 8, while it is a compulsory subject in grades 5 and 6 (Ministry of Science and Education of the Republic of Croatia, 2018a).

Framework primary education programme in the Czech Republic

Primary education in the Czech Republic is regulated by the School Act (In Czech: Školský zákon) (The Ministry of Education, Youth and Sports, 2022).

In 2021, the Ministry of Education, Youth and Sports of the Czech Republic adopted a revised Framework Educational Programme for Primary Education (National Institute for Education, 2021). The purpose of the revision was to adjust the educational content to the needs and dynamics of the 21st century. Namely, the new programme introduces the field of Informatics and the development of digital literacy as a basis for some of students' key competences. Since September 1, 2021, schools have been able to start classes according to the school educational programme. All classes at the 1st level of primary education will begin by September 1, 2023, at the latest, and classes at the 2nd level by September 1, 2024, at the latest.

The key competences that students should acquire till the end of primary education are listed in the RVP ZV. It defines the teaching content and the expected outcomes. As a compulsory part of primary education, the RVP ZV includes cross-curricular topics with an emphasis on teaching tasks. It supports a comprehensive approach to realising educational content, enables the application and choice of different educational procedures, different forms and methods of teaching, and the use of all supportive measures according to individual students' needs. The RVP ZV was designed to enable students with special educational needs, gifted students and exceptionally gifted students to be educated according to it. Namely, the RVP ZV is an open document that will

be refined at certain times, following the needs of the community, the experiences of teachers with school educational programme and according to the needs and interests of students. The task of teachers is to cooperate in the preparation of school educational programme and to jointly link the appropriate topics within the educational field (National Institute for Education, 2021).

The educational field of Informatics in the RVP ZV

The field of Informatics in the RVP ZV is oriented towards the development of computational thinking and the understanding of digital technologies. Computational thinking should be developed in students by using various games, experiments, discussions, etc. Therefore, the goal of Informatics is to develop and shape students' competences, leading them towards:

"– a systematic approach to the analysis of situations and phenomena of the world that surrounds them

– finding different solutions and choosing the most appropriate one for a particular situation

– the experience that teamwork enhanced by technology can lead to better results than individual work

– understanding of different approaches to encoding information and different ways of their organization

– making decisions based on relevant data and their correct interpretation using factual arguments

– communication and using formal languages that machines can understand

– standardization and work procedures in situations where it facilitates work

– assessment and technical solutions from the perspective of other people and their evaluation in a personal, ethical, security, legal, social, economic, ecological and cultural context

– resilience in solving difficult problems, coping with ambiguities and uncertainties, and dealing with open-ended problems

– openness to new ways, tools, and efforts to gradually improve" (National Institute for Education, 2021, p. 38.).

The educational contents of Informatics as an educational field are divided into 4 thematic areas: Data, Information and Modelling, Algorithmisation and Programming, Information Systems, and Digital Technology. Each subject area contains expected learning outcomes and contents that students should acquire during primary education.

In the Czech Republic, the educational field of Informatics and its related subject are compulsory for all students from the 4th to the 9th grade. Schools are currently being in an adaptation phase, and the changes are taking place gradually. Schools that wish to do so have been able to start classes according to the revised Framework Education Programme for Primary Education for the subject of Informatics since September 1, 2021. No later than September 1, 2024, the change must include all students across primary schools.

Comparing some features of the primary education systems of the Republic of Croatia and the Czech Republic

In Table 1 there are some of the general features of the primary education systems of the Republic of Croatia and the Czech Republic. Primary education in the Republic of Croatia lasts eight years (grades 1-8) and in the Czech Republic nine years (grades 1-9). School marks in the Republic of Croatia are from 1 - insufficient to 5 - excellent, while in the Czech Republic from 1 - excellent to 5 - insufficient. There are four curriculum domains in both countries, just as both countries have cross-curricular topics (the Republic of Croatia has seven topics, the Czech Republic has six topics). In the Republic of Croatia, the subject of Informatics is compulsory only in the fifth and the sixth grade but optional in grades 1-4 and 7-8 (2018a). In the Czech Republic, the same subject is compulsory in grades 4-9, without being even optional in grades 1-3 (2021).

Table 1
Some of the general features of the primary education systems of the Republic of Croatia and the Czech Republic

Education system features	The Republic of Croatia	The Czech Republic
Duration and division of primary education classes	8 years Class (core subjects) teaching - from 1st to 4th grade Subject teaching - from 5th to 8th grade	9 years 1st stage from 1st to 5th grade 2nd stage from 6th to 9th grade
School marks and school behaviour	(5) excellent (4) very good (3) good (2) sufficient (1) insufficient Conduct: exemplary, good, bad	(1) excellent (2) commendable (3) good (4) sufficient (5) insufficient Conduct: very good, satisfactory, unsatisfactory
Curriculum domains of the subject of Informatics	1. Information and Digital Technology 2. Computational Thinking and Programming 3. Digital Literacy and Communication 4. e-Society	1. Data, Information, and Modelling 2. Algorithmisation and Programming 3. Information Systems 4. Digital Technology
Cross-curricular topics	1. Health 2. Citizenship education 3. Entrepreneurship 4. Sustainable development 5. Personal and social development 6. Learning how to learn 7. Use of ICT	1. Personal and social education 2. Education of democratic citizens 3. Education for thinking in the European and global context 4. Multicultural education 5. Ecological education 6. Media education

Education system features	The Republic of Croatia	The Czech Republic
Representation of the subject of Informatics by grade and its optionality	First grade - optional Second grade - optional Third grade - optional Fourth grade - optional Fifth grade - compulsory Sixth grade - compulsory Seventh grade - optional Eighth grade - optional	First grade Second grade Third grade Fourth grade - compulsory Fifth grade - compulsory Sixth grade - compulsory Seventh grade - compulsory Eighth grade - compulsory Ninth grade - compulsory

Methodology

The aim of the research

This research had an aim to examine potential differences in the opinions and attitudes of the Croatian and Czech teachers of Informatics in relation to the curricula of the given subject in their primary education systems. The teachers of Informatics were asked about their opinions and attitudes concerning the questions like these: how they got used to the transition to the new curriculum designed for this subject, how much effort they invested in class preparations, whether their professional development helped them to do better in the given curriculum, whether they consider themselves competent enough to teach according to the given curriculum, whether they would like to receive additional education about this curriculum, whether they are satisfied with the support of their primary school principal when implementing this curriculum, whether they are satisfied with its content in the Republic of Croatia and the Framework Educational Programme for Primary Education for Informatics in the Czech Republic, what advantages and disadvantages of these curricula they observe, and what should be changed in them.

Hypotheses

Based on the research objectives, the following hypotheses were set:

First hypotheses: There is no statistically significant difference in the respondents' satisfaction with the content of the given primary education curriculum with regards to their country. The respondents from the Republic of Croatia are expected to have similar assessments of their satisfaction when compared to the respondents from the Czech Republic.

Second hypotheses: There is no statistically significant difference in the respondents' desire for additional education about the curriculum of Informatics with regards to their country. The respondents from the Republic of Croatia are expected to have similar attitudes towards the desire for additional education about the curriculum of Informatics in comparison to the respondents from the Czech Republic.

Third hypotheses: There is no statistically significant difference in the respondents' attitudes regarding whether they consider themselves competent enough to teach

Informatics based on its curriculum, with regards to their country. It is expected that the respondents from the Republic of Croatia will have similar attitudes considering whether they are competent enough to teach this particular subject compared to the attitudes reported by the respondents from the Czech Republic.

Sample

The research sample consisted of 368 primary education teachers of Informatics in the Republic of Croatia and the Czech Republic. It included 187 (50.8%) respondents from the Republic of Croatia, and 181 (49.2%) respondents from the Czech Republic (Table 2).

The methods

The current authors used both quantitative and qualitative methods. The former ones included descriptive (measures of central tendency and variability) and inferential statistical methods (Mann-Whitney U test). Conclusions about the differences between the data were made at the 95% significance level.

In the qualitative part of the research, they analysed the respondents' answers to the open-ended questions about the advantages and disadvantages of the curricula as well as about what they would like to change in them.

The instruments

An online survey questionnaire, constructed by the authors of this paper, was used. Its first part refers to the general respondents' data (gender, country, age, and length of service), whereas its second part covers the examination of the respondents' attitudes towards the Informatics curriculum in the Republic of Croatia and that in the Czech Republic. The statements in the questionnaire use a 5-point Likert-type scale, where value 1 means "I do not agree at all", value 2 "I do not agree", value 3 "I neither disagree nor agree", value 4 "I agree", and value 5 "I completely agree". The evaluation items of the questionnaire use a scale with values 1 – insufficient, 2 – fair, 3 – good, 4 – very good, and 5 – excellent.

The last few open-ended questions are included in the qualitative part of the research to let the respondents state the advantages and disadvantages of their respective curriculum, and what they would like to change in it.

Statistical data processing and analysis were performed by using the programme for statistical data analysis GNU PSPP 1.6.2 (https://www.gnu.org/software/pspp/).

The procedure

Contact information and e-mail addresses of primary schools and their principals were found on the official websites of the ministries of education of the Republic of Croatia (http://mzos.hr/dbApp/pregled.aspx?appName=OS#) and the Czech Republic (https://www.seznamskol.cz/zakladni-skoly/). The current authors asked the administrative staff in schools to forward the survey questionnaire to their teachers of Informatics.

Data was simultaneously collected from April to May 2022 in the Republic of Croatia and the Czech Republic. The respondents filled out an online questionnaire, which had been created by using Google Forms. Before filling out the questionnaire, they could read the instructions briefly and learn about the research purpose; they were also informed about the anonymity of data collection and their optional refusal to participate in the given research. It took them about 5 minutes to fill out the questionnaire.

Results

Table 2 shows the included socio-demographic data. There were 187 (50.80%) participants from the Republic of Croatia, and 181 (49.20%) from the Czech Republic. The largest number referred to female participants – 221 (60.10%). The most represented age group included the respondents from 30 to 39 (113 respondents, 30.70%), followed by those from 40 to 49 (100 respondents, 27.20%) and those up to 29 (76 respondents, 20.70%). According to the length of service, the largest number of the respondents taught for less than 5 years (155 respondents, 42.10%), followed by those who taught between 11 and 20 years (98 respondents, 26.60%), and between 5 and 10 years (63 respondents, 17.10%).

Table 2

Frequencies and percentages of the respondents by the socio-demographic items (N=368)

Item		Number of respondents	% of respondents
Gender	Male	147	39.90
	Female	221	60.10
	Total	368	100.00
Country	Czech Republic	181	49.20
	Republic of Croatia	187	50.80
	Total	368	100.00
Age group	Up to 29 years	76	20.70
	30 – 39 years	113	30.70
	40 – 49 years	100	27.20
	50 – 59 years	62	16.80
	60 years and more	17	4.60
	Total	368	100.00
Length of service	Less than 5 years	155	42.10
	5 – 10 years	63	17.10
	11 – 20 years	98	26.60
	21 – 30 years	48	13.00
	More than 30 years	4	1.10
	Total	368	100.00

The second part of the survey questionnaire consisted of six statements and one evaluation (Table 3). The respondents had to assess the degree to which they agreed with

the given statements, on a 5-point Likert-type scale. They evaluated their satisfaction with the content of the Informatics curriculum for primary education on a scale from 1 – insufficient to 5 – excellent. Table 3 shows the results of the Mann-Whitney U test for the independent large samples with regards to the country of the respondents.

Table 3
Results of the Mann Whitney U test for two large independent samples

Items	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
1. I had a hard time adapting to the transition to the new curriculum of the subject of Informatics	11852.50	29430.50	-5.17	.000
2. I put a lot of effort into preparing for the classes	14268.50	31846.50	-2.70	.007
3. Professional training helped me to better navigate the curriculum for the subject of Informatics	14307.00	31885.00	-2.67	.008
4. I believe that I am competent enough to teach informatics according to the curriculum for the subject of Informatics	12602.50	29073.50	-4.49	.000
5. I would like to further educate myself about the curriculum of the subject of Informatics	15447.00	31918.00	-1.50	.135
6. I am satisfied with the principal's support during the implementation of the curriculum related to the subject of Informatics	16101.50	33679.50	-.85	.394
7. Respondents' satisfaction with the content of the curriculum of the subject of Informatics in primary education	16501.00	32972.00	-.45	.655

Respondents from the two countries significantly differ in terms of statistics according to whether they had difficulties getting used to the new curriculum ($Z = -5.17$; $p = 0.000$), whether they put a lot of efforts in preparing classes ($Z = -2.70$; $p = 0.007$), whether professional training helped them navigate the given curriculum better ($Z = -2.67$, $p = 0.008$), and whether they consider themselves competent enough to teach following the new curriculum ($Z = -4.49$; $p = 0.000$) (Table 3).

Respondents from the given countries do not significantly differ when it comes to statistics in terms of whether they would like further education about the curriculum of Informatics ($Z = -1.50$; $p = 0.135$), whether they are satisfied with the principal's support ($Z = -0.85$; $p = 0.394$), and in terms of their satisfaction (rating) with the new curriculum of Informatics ($Z = -0.45$; $p = 0.655$).

The median values in Table 4 do not show quite precisely the difference between the respondents from the two countries, so that additional descriptive statistics (mean and standard deviation) is used to show this difference.

Table 4
Descriptive data on the teachers' attitudes towards the curricula of Informatics

Item	Country	N	Mdn	M	SD
1. I had a hard time adapting to the transition to the new curriculum of the subject of Informatics	Republic of Croatia	187	2	1.95	1.07
	Czech Republic	181	2	2.51	1.08
Total		368			
2. I put a lot of effort into preparing for the classes	Republic of Croatia	187	4	3.26	1.27
	Czech Republic	181	4	3.65	1.04
Total		368			
3. Professional training helped me to better navigate the curriculum for the subject of Informatics	Republic of Croatia	187	3	3.18	1.15
	Czech Republic	181	4	3.48	1.05
Total		368			
4. I believe that I am competent enough to teach Informatics according to the curriculum for the subject of informatics	Republic of Croatia	187	4	4.19	1.01
	Czech Republic	181	4	3.74	1.10
Total		368			
5. I would like to further educate myself about the curriculum of the subject of Informatics	Republic of Croatia	187	4	3.60	1.23
	Czech Republic	181	4	3.46	1.14
Total		368			
6. I am satisfied with the principal's support during the implementation of the curriculum for the subject of Informatics	Republic of Croatia	187	4	3.91	1.18
	Czech Republic	181	4	4.02	1.15
Total		368			
7. Respondents' satisfaction with the content of the curriculum of the subject of Informatics in primary education	Republic of Croatia	187	3	3.43	0.77
	Czech Republic	181	3	3.35	0.89
Total		368			

Legend: N – number of respondents, Mdn – median, *M* – mean, *SD* – standard deviation

The results of the Mann Whitney U test in Table 3 and those of descriptive statistics in Table 4 for the two large independent samples with regards to the respondents' country show the following:

- the respondents mostly disagree (Mdn = 2, M = 2.23, SD = 1.11) with the statement that it was difficult for them to adapt to the transition to the new curriculum designed for the subject of Informatics. There is a statistically significant difference between the respondents from the Republic of Croatia (Mdn = 2, M = 1.95, SD = 1.07) and the Czech Republic (Mdn = 2, M = 2.51, SD = 1.08)

(Z = -5.17, p = 0.000). The respondents from the Republic of Croatia got used to the new curriculum more easily than the respondents from the Czech Republic,

– the respondents slightly agree (Mdn = 4, M = 3.45, SD = 1.18) with the statement that they put a lot of efforts in preparing their classes of Informatics to be based on the new curricula. A statistically significant difference can be seen between the respondents from the Republic of Croatia (Mdn = 4, M = 3.26, SD = 1.27) and the Czech Republic (Mdn = 4, M = 3.65, SD=1.04) (Z = -2.70; p = 0.007). The respondents from the Republic of Croatia invested less effort than the respondents from the Czech Republic,

– the respondents slightly agree (Mdn = 3, M = 3.33, SD = 1.11) with the statement that professional training helped them cope better with the new curriculum. There is a statistically significant difference between the respondents from the Republic of Croatia (Mdn = 3, M = 3.18, SD = 1.15) and the Czech Republic (Mdn = 4, M = 3.48, SD = 1.05) (Z = -2.67; p = 0.008). The respondents from the Czech Republic were aided by professional training designed for their curriculum more than the respondents from the Republic of Croatia were for their curriculum,

– the respondents mostly agree (Mdn = 4, M = 3.97, SD = 1.07) with the statement that they are competent enough to teach Informatics according to their new curricula. A statistically significant difference can be seen between the respondents from the Republic of Croatia (Mdn = 4, M = 4.19, SD = 1.01) and the Czech Republic (Mdn = 4, M = 3.74, SD = 1.10) (Z = -4.49; p = 0.000). The respondents from the Republic of Croatia are considered more competent than the respondents from the Czech Republic,

– the respondents slightly agree (Mdn = 4, M = 3.53, SD = 1.19) with the statement that they would like to further learn about the curriculum of Informatics. There is no statistically significant difference between the opinions of respondents from the Republic of Croatia (Mdn = 4, M = 3.60, SD = 1.23) and those from the Czech Republic (Mdn = 4, M = 3.46, SD = 1.14) (Z = -1.50; p = 0.135),

– the respondents mostly agree (Mdn = 4, M = 3.96, SD = 1.17) with the statement that they are satisfied with the principal's support during the implementation of the given curriculum. There is no statistically significant difference between the opinions of those from the Republic of Croatia (Mdn = 4, M = 3.91, SD = 1.18) and their colleagues from the Czech Republic (Mdn = 4, M = 4.02, SD = 1.15) (Z = -0.85; p = 0.394),

– the respondents evaluate their satisfaction with the content of the given curriculum as good (Mdn = 3, M = 3.39, SD = 0.83). There is no statistically significant difference between the respondents' evaluations from the Republic of Croatia (Mdn = 3, M = 3.43, SD = 0.77) and those from the Czech Republic (Mdn = 3, M = 3.35, SD = 0.89) (Z = -0.45; p = 0.655).

In the questionnaire, the respondents were given an opportunity to list the advantages and disadvantages of the curriculum designed for the subject of Informatics in their country.

Respondents from the Republic of Croatia cited the following advantages: content-related adaptability to student capabilities, teacher autonomy, choice of applications,

good division of domains, goals and outcomes by age groups, evaluation elements that can be standardised, flexibility in achieving educational outcomes, correlation of cross-curricular topics and other subjects, use of multiple sources of knowledge (not only the textbook), creativity, modernisation of content, multimedia content, enriched with good quality content, excellent introduction to programming for students of all ages from Scratch to Python, basics of programming, adaptability, adaptability of lesson plans, applicability of outcomes to different contents, early student learning about the digital age, independence in creating lessons and choosing content, improving and acquiring knowledge, self-evaluation, freedom in choosing tools that will be used to ensure the given outcomes, freedom in choosing methods, students' logical thinking and reasoning are being developed, the introduction of Informatics in the lower school grades, the knowledge acquired at the lower levels of education is expanded and deepened at the higher ones.

Respondents from the Republic of Croatia cited the following disadvantages: too little work performed on the computer, repetition of the same content, a large difference in knowledge and prior knowledge between the best and the poorest students, 7th and 8th grade - optional subject, unclear and imprecise results, students with difficulties, partially covered topics, the curriculum from 1st to 8th grade does not include proper writing and sending of e-mail messages, large differences in textbooks with regard to the publisher, too much theory, too little practice, the curriculum design assumes that all students start learning Informatics in the 1st grade, Informatics is not a compulsory subject in all classes, everything cannot be covered, poorly designed learning elements, outdated school computer equipment, lack of robots and Informatics infrastructure, coverage of unnecessary topics in classroom teaching, too many terms and content, insufficient dedication to certain topics, evaluation by elements is neither explained in detail nor it is shown by examples, computer-assisted writing is taught in the 1st grade but students have not yet learned all the letters, insufficient number of school hours allocated for teaching the intended content, terse and sketchy, no planned hours that would be spent on practice and revision, the new curriculum forces primary school students to do research although they are not ready yet, the amount of programming, teacher education that did not give answers to the fundamental questions and problems of the curriculum.

One of the most prevalent advantages is teacher autonomy. In case of shortcomings, various reasons are mentioned, for example, the lack of necessary teaching hours (in three cases), unnecessary topics, partially covered topics, vagueness, and others.

The things that teachers in the Republic of Croatia would like to change in the given curriculum are stated as answers in the questionnaire like this:

"– Better definitions of domains and outcomes to be included.

– I would add more robotics and things related to robots.

– Separate programming in a specific subject.

– I would introduce Informatics as a compulsory subject at least in all upper grades, from the fifth to the eighth ones.

– I would reduce the amount of materials. Programming in grades 1 - 4 is too much difficult for students, while in grades 5 - 8 students find difficulties when need to process the complete material according to the curriculum.

– More creative activities, making videos, pictures, video games, 3d modelling, and sound processing.

– I would reduce the number of hours for the 1st and 2nd primary school grade from 2 hours to 1 hour per week.

– I believe that Informatics should be a compulsory subject from the 1st to the 8th grade".

Respondents from the Czech Republic cited the following advantages: current needs, flexibility, development of computational thinking, relations in terms of cross-curricular topics, focus on student practical skills, longer hours, open opportunities, greater student creativity, student independence, development of necessary competence, development of logical thinking, possibility of adapting the content to the needs of teaching all subjects, clear idea of what to teach, material in which students are interested, emphasis on algorithms and information technologies, creativity, focus on robotics, opportunity for gifted students to improve, children learn more.

Respondents from the Czech Republic cited the following disadvantages: incomplete teaching materials for students, strong focus on programming, insufficient education of Informatics teachers, lack of equipment, lack of school preparation, heavy administrative burden, only partial focus on Informatics, omission of certain topics, insufficiently educated teachers of Informatics, removal of work in office applications, difficulty in mastering certain topics in 45 minutes, removal of graphics, emphasis on programming in Scratch, a few hours, weekly hours from the 6th grade onwards should be increased to two hours, negligence of weaker students and students with special needs, concretisation, insufficient correlation with other subjects, ambiguity of expected outcomes, quite demanding for the first stage students.

Informatics teachers in the Czech Republic most often cite the openness and flexibility of the given curriculum, also the opportunities for showing student creativity, as being advantageous. The disadvantages, however, include a small number of scheduled teaching hours, emphasis on programming, insufficient education of Informatics teachers, lack of such teachers, lack of equipment and others.

The things that the teachers in the Czech Republic would like to change in the given curriculum were stated as the answers in the survey questionnaire like this:

"– I would probably focus on Informatics as such from the first grade – you can play with robots and do various exercises without technology; the sooner students start practising all about digital literacy, the better for them.

– It would be nice to ensure greater correlation with other subjects.

– Even more weekly hours at the second degree.

– I would cut algorithms and programming in half, leaving more time for mastering office programmes and computer skills.

– Programming as an optional activity – big differences between students, it is a specific skill that some students do not understand and will never understand, it is not necessary to teach this to everyone.

– First, I would teach students to use a computer for the needs of education, personal life, social inclusion and employment.

– I would certainly recommend teacher training.

– Making Informatics compulsive up to the third grade. Greater emphasis on working with graphical office applications.

– First, the school would be fully equipped with aids, and then the RVP ZV would be applied."

Testing the first hypothesis

First hypothesis: There is no statistically significant difference in the respondents' satisfaction with the given curriculum content with regards to the country. The respondents from the Republic of Croatia are expected to have similar assessments of their satisfaction when compared to the respondents from the Czech Republic.

Using a scale from 1 – insufficient to 5 – excellent, all the respondents had to evaluate how satisfied they were with the given curriculum content, and on this part the overall Mdn = 3, M = 3.39 and SD = 0.83 was obtained, which indicates the fact that the respondents are satisfied with the curriculum content, and this satisfaction can be graded as good (3.39).

The results of the Mann-Whitney U test for the large independent samples (Table 3) show that there is no statistically significant difference in the satisfaction of the respondents with the given curriculum content with regard to the country of the respondents (Z = -0.45; p = 0.655). This confirms the first hypothesis.

Testing the second hypothesis

Second hypothesis: There is no statistically significant difference in the respondents' desire for additional education about the curriculum of Informatics with regard to their country. The respondents from the Republic of Croatia are expected to have similar attitudes towards the desire for additional education about the given curriculum in comparison to the respondents from the Czech Republic

The respondents were asked to assess how much they agreed with the statement *I would like to be further educated about the curriculum of the subject of Informatics* by using a 5-point Likert-type scale, where 1 means "I do not agree at all", 2 "I do not agree", 3 "I neither disagree nor agree", 4 "I agree", and 5 "I completely agree".

The results of the Mann-Whitney U test for the large independent samples show that there is no statistically significant difference in the respondents' desire for additional education on the given curriculum with regard to their country (Z = -1.50; p = 0.135). The respondents from both countries slightly agree with the statement that they want to learn more about the curriculum designed for the subject of Informatics (Mdn = 4, M = 3.53). This confirms the second hypothesis.

Testing the third hypothesis

Third hypothesis: There is no statistically significant difference in the respondents' attitudes regarding whether they consider themselves competent enough to teach Informatics as based on the given curriculum, with regards to their country. It is expected that the respondents from the Republic of Croatia will have a similar attitude about whether they are competent enough to teach this particular subject compared to the attitude reported by the respondents from the Czech Republic.

The respondents were asked to assess how much they agreed with the statement *I consider myself competent enough to teach Informatics according to the curriculum for the subject of Informatics* by using a 5-point Likert-type scale, where 1 indicated "I do not agree at all", 2 "I do not agree", 3 "I neither agree nor agree", 4 "I agree", and 5 "I completely agree".

The Mann-Whitney U test for the large independent samples shows a statistically significant difference in the respondents' attitudes in relation to their country ($Z = -4.49$; $p = 0.000$). The respondents from the Czech Republic agree less when it comes to the statement about their sufficient competence (Mdn = 4, M = 3.74, SD = 1.10) compared to the respondents from the Republic of Croatia who agree with the statement showing that they are sufficiently competent (Mdn = 4, M = 4.19, SD = 1.01). It can be claimed that the respondents from the Republic of Croatia are considered more competent to teach Informatics following the relevant curriculum than those from the Czech Republic. The third hypothesis is not confirmed.

Discussion

Considering a possible reason for the differences on the Mann-Whitney U tests (items related to adaptation, efforts, professional development, and competence), it can be said that in the Czech Republic the new curriculum designed for teaching Informatics was adopted in 2021, the teachers used it for a shorter time, they had less time to get used and may not be fully familiar with it. In the Republic of Croatia, the Informatics curriculum was adopted in 2018, and the Informatics teachers already had time to familiarise themselves with its content and requirements.

Similar research and results can be found in the paper by Dagiene et al. (2019), which included 1342 primary school teachers as the participants. The main research question was raised like this "How much are the Lithuanian teachers prepared for the introduction of the new Informatics curriculum on the national level?" The evaluation scale with points from 1 to 5 was used: 1 – not prepared, 2 – weak, 3 – moderate, 4 – good, 5 – very good.

The results are presented as two mean values of the teachers who had courses for enhancing their digital competence during the last three years and of those who did not. The results show that the teachers feel most prepared to teach Data and Information (mean values 4 and 3), as well as Virtual Communication Skills (4 and 3). They have moderate preparation to teach Problem Solving (3 and 3) and Safety and Copyright Skills (3 and 3). They are less prepared to teach Digital Content (3 and 2). They are

hardly prepared to teach Algorithms and Programming (2 and 1). There are differences between the self-evaluation of those who had digital competence training during the last three years and those who did not.

The results presented by Dagiene et al. (2019) and the results presented in this paper indicate a similar readiness of teachers to teach Informatics according to the curriculum in their countries. The mean values in Lithuania (after the digital competence enhancement courses) are mostly 4 and 3, which is comparable to M = 3.74 for the Czech and M = 4.19 for the Croatian teachers of Informatics. The Lithuanian results show that the digital competence courses are useful and have a positive influence on the digital competence when it comes to the teachers of Informatics.

Similar results are observed in the paper by Hildebrandt and Diethelm (2015), dealing with the programmes designed for the teachers of Informatics at different types of secondary schools which support them to put the new core curriculum into practice. The teachers were asked to assess their subjective competences in various fields of Informatics before and after their in-service training. The Likert scale consisted of ten grades, ranging from 1 = "none at all" to 10 = "specialist". The mean values by the subject fields before and after the three-day education programme are like this:

– algorithmic problem solving: 4.37 and 6.04 (+1.67)
– functioning of the Internet: 6.27 and 6.92 (+0.65)
– networks: 4.76 and 6.08 (+1.32)
– automated processes: 4.31 and 6.10 (+1.79).

The comparative quantitative research results show that the given teachers do not feel fully competent to teach Informatics. There is room for the improvement of their competence in teaching as based on the new curricula content, also some additional digital competence education should be offered to them.

It can be concluded that the authors of the above-compared research papers report that their respondents do not feel confident about teaching Informatics due to a lack of the subject knowledge and that of the required hardware, software, infrastructure, and support. Almost every analysed paper reports a lack of pedagogical content knowledge.

These are the challenges that should seriously be taken into account when updating the existing curriculum of Informatics or creating the new one.

Conclusion

The teachers of Informatics in the Czech Republic have only had a new curriculum designed for the given subject in primary education since 2021, and the research in this paper shows that they got used to this new curriculum with more difficulties than their Croatian colleagues, they put more efforts into transition to the new curriculum compared to their Croatian colleagues, professional training helped them more than their Croatian colleagues and they are considered less competent to teach Informatics according to the new curriculum when compared to their Croatian colleagues.

The teachers of Informatics in the Republic of Croatia have had a new curriculum for this particular subject since 2018 and thus had more time to familiarise themselves with its content and get used to the new curriculum requirements.

Informatics as a subject plays an important role in the entire education system. The viewpoints of primary education teachers on its curriculum in the Republic of Croatia and in the Czech Republic were compared, their opinions about advantages and disadvantages collected, with regards to what they would like to change in the given curriculum. The research resulted in a significant number of responses from the participants who wanted to share their opinions and views on the curriculum designed for the subject of Informatics.

The teachers of Informatics from both countries are moderately satisfied with the content of their curriculum. One of the possible solutions is to include them more actively in the process of creating the content.

The quantitative results compared from similar research papers show that they do not feel fully competent to teach Informatics. There is room for the improvement of their competence in teaching Informatics according to the new curricula content, also some additional digital competence education should be offered to them. The authors of the similar research papers report that their respondents do not feel confident to teach Informatics due to a lack of the subject knowledge, as well as that they have problems with the required hardware, software, infrastructure, and support. Almost all analysed papers report a lack of pedagogical content knowledge.

During the research result analysis, possible questions for the further research or discussion appeared, for example, whether programming should be taught as a separate subject. These and other questions can be raised in some further research, which could contribute to the improvement of the given curriculum content.

Information and communication technologies are one of the fastest developing areas of human activity, and every day new types of services and more advanced computers and computer-based devices are designed, which has a positive impact on the overall development of society. For this reason, the curriculum designed for teaching Informatics in primary education should constantly improve and change in order to follow this rapid development of information and communication technologies.

Limitations of the research

The limited analysis of the qualitative data is presented in this paper. More complex analysis is, therefore, required in the future work, e.g., coding, labelling and organising qualitative data for the purpose of identifying different themes and relations between them.

Acknowledgment

The authors do not report any conflict of interest.

The results of the research presented in this paper have not been published yet. The research was a part of an unpublished master's thesis.

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Stavovi učiteljica i učitelja informatike o kurikulima predmeta Informatika u osnovnom obrazovanju Republike Hrvatske i Češke Republike

Sažetak

Cilj jeistraživanja prikazanoga u ovom radu analizirati stavove učiteljica i učitelja informatike u osnovnom obrazovanju Republike Hrvatske i Češke Republike prema kurikulima predmeta Informatika koji se koriste u njihovim zemljama. Uzorak istraživanja čini ukupno 368 učiteljica i učitelja: 187 iz Republike Hrvatske i 181 iz Češke Republike. Istraživanje je provedeno istovremeno u Republici Hrvatskoj i Češkoj Republici putem online upitnika. Rezultati istraživanja pokazuju da ne postoji statistički značajna razlika u zadovoljstvu ispitanika sadržajem kurikula predmeta Informatika i da ne postoji statistički značajna razlika u želji ispitanika za dodatnim obrazovanjem s obzirom na zemlju ispitanika. Međutim, ispitanici iz Republike Hrvatske (Mdn = 4, M = 4,19, SD = 1,01) mogu se smatrati kompetentnijima za izvođenje nastave uspoređujući ih s ispitanicima iz Češke Republike (Mdn = 4, M = 3,74, SD = 1,10) (Z = -4,49, p = 0,000). U kvalitativnom dijelu istraživanja navedene su mnoge prednosti i nedostatci kurikula koje učitelji iz obje zemlje smatraju važnima te bi ih trebalo uzeti u obzir pri izradi sljedećega izdanja kurikula.

Ključne riječi*: Češka Republika, informatika, kurikul, Republika Hrvatska.*

Uvod

Kurikulnom reformom sustava obrazovanja 2018. godine doneseni su novi predmetni kurikuli za osnovne i srednje škole u Republici Hrvatskoj (Ministarstvo znanosti i obrazovanja Republike Hrvatske, 2018b). U Češkoj Republici Ministarstvo školstva, mladeži i sporta donijelo je 2021. godine revidirani Okvirni obrazovni program za osnovno obrazovanje (češki: Rámcový vzdělávací program pro základní vzdělávání (RVP ZV)) (Národní ústav pro vzdělávání, 2021).

Područje informacijskih i komunikacijskih tehnologija (IKT) jedno je od najdinamičnijih razvojnih područja te se svakodnevno razvijaju nove hardverske i softverske tehnologije

koje unaprjeđuju i olakšavaju ljudski rad te utječu na to kako ljudi rade i uče. Računala su prisutna na gotovo svim područjima ljudskoga djelovanja te se rad i učenje gotovo ne može zamisliti bez njih. Velik utjecaj IKT-a tek se treba osjetiti u bliskoj budućnosti zbog sve bržega razvoja automatizacije, umjetne inteligencije i robotike. To će imati veliki utjecaj na potrebna znanja i vještine budućih radnika jer će značajan dio ljudskoga rada biti zamijenjen radom umjetne inteligencije i robota.

„Potaknuta inovacijama i tehnološkom evolucijom, digitalna transformacija preoblikuje društvo, tržište rada i budućnost rada. Poslodavci se suočavaju s poteškoćama u zapošljavanju visokokvalificiranih radnika u nizu gospodarskih sektora, uključujući digitalni sektor." (European Commission, 2020, str. 2) Dva su međusobno povezana aspekta digitalnoga obrazovanja: primjena golemoga i rastućega niza digitalnih tehnologija i potreba da svi učenici steknu digitalne kompetencije. Ti aspekti zahtijevaju politike i radnje na mnogim područjima kao što su infrastruktura, strategija i vodstvo, nastavničke vještine, učeničke vještine, sadržaj, kurikuli, ocjenjivanje i nacionalni pravni okviri (European Commission, 2020).

Zato je već danas važno pripremati djecu - buduće sudionike na tržištu rada - za zanimanja koja danas možda još ni ne postoje. Sve je više potreba za stručnjacima iz područja STEM-a (Science, Technology, Engineering, Mathematics) u koje spada i informatika jer računala i softver su njihov nezaobilazan dio. Kurikul predmeta Informatike za osnovno obrazovanje treba biti u skladu s takvim brzim i značajnim razvojem novih IKT-a te ga je potrebno poboljšavati i aktualizirati kako ne bi zaostajao u odnosu na aktualno stanje u svijetu IKT-a.

„Informatiku treba smatrati jednako važnom kao i matematiku, znanosti i razne jezike. Trebalo bi je priznati kao istinski temeljnu disciplinu koja igra značajnu ulogu u obrazovanju za 21. stoljeće" (Caspersen i sur., 2019, str. 58)

Pregled literature

Informatika je u školskom obrazovanju europskih zemalja posljednjih godina doživjela važne reforme. Kurikul Informatike je u 2020./2021. u nekim zemljama, poput Hrvatske, Francuske, Crne Gore, Norveške, Poljske i Švedske, bio rezultat reformi koje su nedavno provedene. U nekim zemljama kurikulne reforme u 2020./2021. godini nisu još u potpunosti provedene ili su još u razvoju. Neke su ih zemlje uključile u planove oporavka i otpornosti (RRP) kao odgovor na pandemiju COVID-19, koje financijski podržava Instrument za oporavak i otpornost. (European Union, 2022)

Ukupno je sedamnaest obrazovnih sustava bilo u procesu provedbe kurikulnih reformi informatičkoga obrazovanja. Zemlje koje trenutačno provode kurikulne reforme informatičkoga obrazovanja su: Belgija (Njemačka govorna zajednica i Flamanska zajednica), Bugarska, Češka Republika, neke od njemačkih saveznih država, Estonija, Irska, Španjolska, Latvija, Litva, Mađarska, Malta, Austrija, Bosna i Hercegovina (Republika Srpska), Švicarska (kantoni u kojima se govori francuski jezik), Sjeverna Makedonija i Srbija. U jedanaest drugih obrazovnih sustava obrazovne vlasti planiraju

razvoj kurikulnih reformi informatičkoga obrazovanja: Belgija (Francuska zajednica), Danska, Grčka, Luksemburg, Italija, Cipar, Slovenija, Slovačka, Nizozemska, Rumunjska i Island (European Commission, 2022).

Dokumenti koji mogu značajno doprinijeti i olakšati razvoj kurikula za predmet Informatika su *Okvir digitalnih kompetencija za građane* (Vuorikari i sur., 2022) i *Informatičko obrazovanje u školama u Europi* (Europska komisija, 2022). Prvi sadrži sljedeća područja kompetencija: informacijska i podatkovna pismenost, komunikacija i suradnja, stvaranje digitalnoga sadržaja, sigurnost i rješavanje problema, s ukupno 21 kompetencijom unutar tih područja kompetencija. Drugi navodi sljedeća glavna područja informatičkoga obrazovanja u smislu ishoda učenja: podatci i informacije, algoritmi, programiranje, računalni sustavi, mreže, sučelje ljudi-sustav, oblikovanje i razvoj, modeliranje i simulacija, svijest i osnaživanje te sigurnost i zaštita. Ovome popisu doprinio je i popis područja informatičkoga obrazovanja naveden u Caspersen i sur. (2022).

Učitelji trebaju svoju digitalnu kompetenciju koja je specifična za njih kao edukatore. Ta je kompetencija navedena u *Europskom okviru za digitalnu kompetenciju edukatora – DigCompEdu* (Punie i Redecker, 2017). DigCompEdu sintetizira nacionalne i regionalne napore za prikupljanje digitalnih kompetencija specifičnih za nastavnike. Cilj mu je pružiti opći referentni okvir za one koji oblikuju modele digitalne kompetencije, tj. države članice, regionalne vlade, relevantne nacionalne i regionalne agencije, same obrazovne organizacije te javne ili privatne pružatelje stručnoga osposobljavanja. Usmjeren je na edukatore na svim razinama obrazovanja, od ranoga djetinjstva do visokoga obrazovanja i obrazovanja odraslih, uključujući opće i strukovno osposobljavanje, obrazovanje s posebnim potrebama i kontekste neformalnoga učenja (Punie i Redecker, 2017). Ovaj dokument ima šest područja kompetencija nastavnika: Profesionalni angažman, Digitalni resursi, Poučavanje i učenje, Ocjenjivanje, Osnaživanje učenika, Omogućavanje digitalne kompetencije učenika. Navedene su ukupno 22 kompetencije (Punie & Redecker, 2017).

Raspravljajući o izazovima učitelja u vezi s informatikom u kurikulu, Sentance i Csizmadia (2017) pokazali su rezultate kvalitativnoga istraživanja u svojim radovima koji upućuju na to da je u Engleskoj značajan naglasak na jačanju povjerenja učitelja u njihove vještine predmetnoga znanja. Unatoč pohađanju brojnih tečajeva za unaprjeđenje svoje stručnosti, učiteljima često nedostaje uvjerenje da učinkovito rješavaju probleme s kojima se učenici susreću. Autori toga rada ističu različite izazove vezane uz resurse, uključujući potrebu za odgovarajućim hardverom i softverom, dostatnim financiranjem te ispravnom instalacijom, konfiguracijom i održavanjem softverskih resursa kako bi se uskladili sa školskom platformom. Učitelji izražavaju frustraciju zbog onoga što doživljavaju kao nedostatak podrške i razumijevanja svojih upravitelja. Osim toga, neki učitelji izražavaju zabrinutost zbog nevoljkosti tehničkoga osoblja da održava i rješava probleme instaliranoga softvera.

U svojem radu Northrup i sur. (2022) raspravljaju o kvalitativnim nalazima istraživanja ističući izazove u novom kurikulu Informatike. Ti izazovi uključuju vjerovanje

učitelja u središnju ulogu informatike u budućnosti i nužnost pedagoškoga pomaka, s obzirom da tradicionalne metode poučavanja uključuju učitelja kao predmetnoga stručnjaka. U području informatike učenici mogu imati više znanja od učitelja, što od učitelja zahtijeva da priznaju i prihvate stručnost učenika. Drugi učitelji vide izazov u percipiranoj složenosti kodiranja.

U radu Stringera i sur.(2022) istražuju se iskustva učitelja s kurikulima digitalnih tehnologija kako bi se saznalo kako se može podržati učitelje da povećaju svoje napore u primjeni kurikula. Samoučinkovitost učitelja u digitalnoj tehnologiji, samopoštovanje vlastitih znanja o digitalnoj tehnologiji i samopouzdanje u primjeni digitalne tehnologije uvelike utječu na uspješnu primjenu digitalne tehnologije od strane učitelja u nastavi. Razvijanje pedagoškoga pristupa potrebnoga za učinkovito poučavanje digitalnih tehnologija također se smatra izazovom za neke učitelje koji su naučeni koristiti tipične tradicionalne metode poučavanja (Geldreich i Hubwieser, 2020), a vrlo je malo početnih programa obrazovanja učitelja koji eksplicitno poučavaju te pedagoške prakse (Cai i Gut, 2020). Profesionalno učenje i razvoj istaknuti su kao rješenje za jačanje povjerenja učitelja i prevladavanje uobičajenih prepreka u provedbi (Stringer i sur., 2022).

Fluck i sur. (2016) raspravljaju o poteškoćama s kojima se susreću škole pri ponovnom uvođenju informatike. Ističu potrebu za svježim znanjem o pedagoškom sadržaju i osnovnim nastavnim resursima, uključujući okružja za razvoj programiranja i udžbenike ili njihove ekvivalente. Središnja točka njihovih rezultata istraživanja je primjetna napetost koja proizlazi iz brzoga tempa kojim inovacije preoblikuju shvaćanje informatike.

U svom radu Webb i sur. (2017) tvrde da postoji široko rasprostranjeno slaganje u vezi s ključnom ulogom stručnoga usavršavanja učitelja u poučavanju informatike kako bi se olakšale promjene kurikula, što predstavlja značajan izazov u brojnim zemljama. Identificiraju ključne novonastale teme u razvoju kurikula Informatike, obuhvaćajući aspekte kao što su početna dob, redoslijed i struktura, sadržaj i ravnoteža kurikula i naglašena potreba za profesionalnim razvojem učitelja.

Kurikul za nastavni predmet Informatika za osnovne škole u Republici Hrvatskoj

U Republici Hrvatskoj osnovno obrazovanje regulirano je Zakonom o odgoju i obrazovanju u osnovnoj i srednjoj školi (Zakon HR, 2020).

Nacionalni okvirni kurikul Republike Hrvatske predstavlja temeljne sastavnice predškolskoga, općega obveznog i srednjega obrazovanja, uključujući obrazovanje djece s posebnim odgojnim i obrazovnim potrebama. Temeljni dokument odgojno-obrazovnoga sustava na razini države je nacionalni kurikul koji predstavlja sljedeće sastavnice: vrijednosti, ciljeve, načela, sadržaje i opće ciljeve odgojno-obrazovnih područja, vrednovanje učeničkih postignuća, vrednovanje i samovrednovanje ostvarenosti nacionalnoga kurikula. Naime, nacionalni okvirni kurikul temelj je za

izradu predmetnoga kurikulu i ostalih kurikulskih dokumenata (priručnik za nastavnike, priručnik za roditelje, smjernice za primjenu kurikula, standardi za izradu udžbenika i ostalih kurikula i dr.) (Ministarstvo znanosti, obrazovanja i športa RH, 2011, str. 16.).

Informatičke su kompetencije nužne u rješavanju različitih izazova u svim područjima znanosti te u područjima ljudskoga djelovanja. Prema tome, informatiku je potrebno izučavati kao dodatno područje uz tradicionalne znanstvene discipline kao što su kemija, fizika ili matematika. Tijekom obrazovnoga procesa u predmetu Informatika, naglasak treba biti usmjeren na programiranje i rješavanje problema čime se potiče razvijanje računalnoga načina razmišljanja koje omogućuje analizu, razumijevanje i rješavanje problema odabirom odgovarajućih strategija programskih rješenja i algoritama. Ukratko, računalno se razmišljanje treba prenositi i u druga područja znanosti, ali i u svakodnevni život (Ministarstvo znanosti i obrazovanja Republike Hrvatske, 2018b).

Informatičke se kompetencije uz samopouzdanje, samostalnost, odgovornost i pouzdanost trebaju razvijati primjerenom pedagoškom praksom koja stavlja učenika u središte procesa uz konstruktivistički pristup učenju. Učenje se temelji na pretpostavci kako učenici najbolje uče aktivnim sudjelovanjem. Snažna motivacija za učenje su suradnja i timski rad. Učenici svojom kreativnošću najbolje uče aktivno. Tijekom cijeloga školovanja trebaju se usvajati sadržaji iz predmeta Informatike koristeći načelo spiralnoga modela u kojem se stečeno znanje na nižem stupnju obrazovanja proširuje i produbljuje na višem. Usvojena znanja, stavovi i vještine u Informatici potpora su svim nastavnim predmetima i međupredmetnim temama (Ministarstvo znanosti i obrazovanja Republike Hrvatske, 2018a, p. 6).

Odgojni i obrazovni ciljevi učenja i poučavanja nastavnoga predmeta Informatika

U kurikulu za nastavni predmet Informatika navedeni su sljedeći ciljevi učenja i poučavanja pomoću kojih će učenici:

„– postati informatički pismeni kako bi se mogli samostalno, odgovorno, učinkovito, svrhovito i primjereno koristiti digitalnim tehnologijama te se pripremiti za učenje, život i rad u društvu koje se razvojem digitalnih tehnologija vrlo brzo mijenja

– razvijati digitalnu mudrost kao sposobnost odabira i primjene najprikladnije tehnologije ovisno o zadatku, području ili problemu koji se rješava

– razvijati kritičko mišljenje, kreativnost i inovativnost uporabom informacijske i komunikacijske tehnologije

– razvijati računalno razmišljanje, sposobnost rješavanja problema i vještinu programiranja

– učinkovito i odgovorno komunicirati i surađivati u digitalnome okruženju

– razumjeti i odgovorno primjenjivati sigurnosne preporuke te poštivati pravne odrednice pri korištenju digitalnom tehnologijom u svakodnevnome životu" (Ministarstvo znanosti i obrazovanja Republike Hrvatske, 2018a, p. 7).

Odgojno-obrazovni ciljevi predmeta Informatike realiziraju se prema kurikulu pomoću četiri domene: e-Društvo, Digitalna pismenost i komunikacija, Računalno razmišljanje i programiranje te Informacije i digitalna tehnologija (Ministarstvo znanosti i obrazovanja Republike Hrvatske, 2018a).

Prema novom kurikulu Informatika je izborni predmet od 1. do 4. razreda te u 7. i 8. razredu osnovne škole dok je obavezan u 5. i 6. razredu (Ministarstvo znanosti i obrazovanja Republike Hrvatske, 2018a).

Okvirni obrazovni program za osnovno obrazovanje Češke Republike

Osnovno obrazovanje u Češkoj Republici regulirano je Zakonom o školi (češki Školský zákon) (Ministerstvo školství, mládeže a tělovýchovy, 2022).

Ministarstvo školstva, mladeži i sporta Češke Republike donijelo je 2021. godine revidirani Okvirni obrazovni program za osnovno obrazovanje (Národní ústav pro vzdělávání, 2021). Svrha je revizije prilagoditi obrazovne sadržaje prema potrebama i dinamici 21. stoljeća. Naime, novi program uvodi područje informatike i razvoj digitalne pismenosti kao temelj za neke od ključnih kompetencija učenika. Od 1. rujna 2021. godine škole mogu započeti nastavu prema školskom obrazovnom programu. Sva nastava na 1. stupnju osnovnoga obrazovanja počet će najkasnije do 1. rujna 2023. godine, a nastava na 2. stupnju najkasnije do 1. rujna 2024. godine.

Ključne kompetencije koje bi učenici trebali ostvariti do kraja osnovnoga obrazovanja navedene su u RVP ZV. U njemu se definiraju nastavni sadržaji i očekivani ishodi. Kao obvezni dio osnovnoga obrazovanja RVP ZV uključuje međupredmetne teme s naglašenim nastavnim zadaćama. Podržava cjelovit pristup realizaciji obrazovnih sadržaja, omogućuje primjenu i izbor različitih odgojnih i obrazovnih postupaka, različitih oblika i metoda poučavanja te korištenje svih mjera potpore prema individualnim potrebama učenika. RVP ZV oblikovan je tako da se prema njemu mogu obrazovati učenici s posebnim obrazovnim potrebama, daroviti učenici i iznimno daroviti. Naime, RVP ZV je otvoreni dokument koji će se u određenim trenutcima dorađivati u skladu s potrebama zajednice, iskustvima učitelja sa školskim obrazovnim programom te prema potrebama i interesima učenika. Zadaća je učitelja da međusobno surađuju u izradi školskoga obrazovnog programa te da zajednički povezuju odgovarajuće teme obrazovnoga područja (Národní ústav pro vzdělávání, 2021).

Obrazovno područje Informatika u RVP ZV

Područje Informatike u RVP ZV orijentirano je na razvoj računalnoga razmišljanja i razumijevanje digitalnih tehnologija. Računalno razmišljanje treba razvijati kod učenika pomoću raznih igara, eksperimenata, rasprava i sl. Prema tome, cilj je obrazovnoga područja Informatike razvijati i oblikovati kompetencije učenika vodeći ih prema:

„– sistemskom pristupu analizi situacija i pojava svijeta koji ga okružuje

– pronalaženju različitih rješenja i odabiru najprikladnijega za određenu situaciju

– iskustvu da timski rad unaprijeđen tehnologijom može dovesti do boljih rezultata nego individualni rad

– razumijevanju različitih pristupa kodiranja informacija i različitih načina njihove organizacije

– donošenju odluka na temelju relevantnih podataka i njihova točna interpretacija pomoću činjeničnih argumenata

– komunikaciji pomoću formalnih jezika koje strojevi mogu razumjeti

– standardizaciji radnih postupaka u situacijama kada to olakšava rad

– procjeni tehničkih rješenja iz perspektive drugih ljudi i njihova evaluacija u osobnom, etičkom, sigurnosnom, pravnom, društvenom, gospodarskom, ekološkom i kulturnom kontekstu

– otpornosti u rješavanju teških problema, snalaženje nejasnoća i nesigurnosti te suočavanje s problemima otvorenoga tipa

– otvorenosti prema novim putevima, alatima, nastojanja da se postupno poboljšaju" (Národní ústav pro vzdělávání, 2021, str. 38.).

Obrazovni sadržaji obrazovnoga područja Informatika podijeljeni su u 4 tematska područja: Podatci, informacije i modeliranje, Algoritmizacija i programiranje, Informacijski sustavi te Digitalna tehnologija. Svako tematsko područje sadrži očekivane ishode učenja i sadržaj koje bi učenici trebali usvojiti tijekom osnovnoga obrazovanja.

U Češkoj Republici obrazovno područje Informatika i pripadajući predmet obvezni su za sve učenike od 4. do 9. razreda. Škole trenutačno imaju fazu prilagodbe te se promjene odvijaju postupno. Škole koje to žele mogu od 1. 9. 2021. početi nastavu prema revidiranom Okvirnom obrazovnom programu za osnovno obrazovanje za predmet Informatika. Najkasnije do 1. 9. 2024. godine promjena mora uključivati sve učenike u svim osnovnim školama.

Usporedba nekih obilježja sustava osnovnoškolskoga obrazovanja Republike Hrvatske i Češke Republike

U Tablici 1 izdvojena su neka od općenitih obilježja osnovnoškolskih obrazovnih sustava Republike Hrvatske i Češke Republike. Osnovno obrazovanje u Republici Hrvatskoj sastoji se od osam razreda, a u Češkoj Republici od devet razreda. Školske ocjene u Republici Hrvatskoj kreću se od 1 - nedovoljan do 5 - odličan, a u Češkoj od 1 - odličan do 5 - nedovoljan. U obje zemlje postoje četiri kurikulske domene u predmetu Informatika i obje zemlje imaju međupredmetne teme (Republika Hrvatska ima sedam tema, a Češka Republika šest tema). U Republici Hrvatskoj predmet Informatika je obvezan samo u petom i šestom razredu, a izborni od 1. do 4. i u 7. i 8. razredu 8 (Ministarstvo znanosti i obrazovanja Republike Hrvatske, 2018a). U Češkoj Republici predmet Informatika obvezan je od 4. do 9. razreda, a nije ni izborni predmet od 1. do 3. razreda (Národní ústav pro vzdělávání, 2021).

Tablica 1

Metodologija

Cilj istraživanja

Cilj je ovoga istraživanja ispitati postoje li razlike u mišljenjima i stavovima hrvatskih i čeških učiteljica i učitelja Informatike o kurikulima nastavnoga predmeta Informatika u osnovnim školama njihovih zemalja.

Namjera je ispitati kakvi su stavovi učiteljica i učitelja informatike o predmetu Informatika u hrvatskim i češkim osnovnim školama. Učiteljice i učitelji informatike trebali su navesti svoja razmišljanja i stavove o sljedećim pitanjima: kako su se prilagodili prijelazu na novi kurikul nastavnoga predmeta Informatika, koliko su napora i truda uložili u pripremu za nastavu, jesu li im stručna usavršavanja pomogla da se bolje snalaze u kurikulu za nastavni predmet Informatika, smatraju li se dovoljno kompetentni za provođenje nastave informatike prema kurikulu za nastavni predmet Informatika, bi li se htjeli dodatno educirati o kurikulu nastavnoga predmeta Informatika, jesu li zadovoljni podrškom ravnatelja/ravnateljice osnovne škole tijekom provedbe kurikula za nastavni predmet Informatika te jesu li zadovoljni sadržajem kurikula za nastavni predmet Informatika u Republici Hrvatskoj i okvirnim obrazovnim programom za osnovno obrazovanje za predmet Informatika u Češkoj Republici, koje su prednosti i nedostatci kurikula te što bi se u njima trebalo mijenjati.

Hipoteze

Na temelju ciljeva istraživanja postavljene su sljedeće hipoteze:

Prva hipoteza: Ne postoji statistički značajna razlika u zadovoljstvu sadržajem kurikula nastavnoga predmeta Informatika u osnovnom obrazovanju s obzirom na zemlju ispitanika. Očekuje se da će ispitanici iz Republike Hrvatske slično procijeniti zadovoljstv sadržajem njihovoga kurikula nastavnoga predmeta Informatika u osnovnom obrazovanju u odnosu na ispitanike iz Češke Republike i njihova kurikula predmeta Informatika.

Druga hipoteza: Ne postoji statistički značajna razlika u želji ispitanika za dodatnom edukacijom o kurikulu nastavnoga predmeta Informatika iz Republike Hrvatske i Češke Republike. Očekuje se da će ispitanici Republike Hrvatske imati slične stavove u vezi sa željom za dodatnom edukacijom o kurikulu nastavnoga predmeta Informatika u odnosu na ispitanike iz Češke Republike.

Treća hipoteza: Ne postoji statistički značajna razlika u stavu ispitanika o tome smatraju li se dovoljno kompetentni za provođenje nastave informatike prema kurikulu za nastavni predmet Informatika s obzirom na zemlju ispitanika. Očekuje se da će ispitanici iz Republike Hrvatske imati sličan stav o tome jesu li dovoljno kompetentni za poučavanje predmeta Informatika u odnosu na stav ispitanika iz Češke Republike.

Uzorak ispitanika

Istraživački uzorak čini 368 učiteljica i učitelja predmeta Informatika u osnovnom obrazovanju u Republici Hrvatskoj i Češkoj Republici. U uzorak je uključeno 187 (50,8 %) ispitanika iz Republike Hrvatske i 181 (49,2 %) ispitanika iz Češke Republike (Tablica 2).

Metode

Autori su koristili kvantitativne i kvalitativne metode. Kvantitativne metode koje su se koristile uključuju deskriptivne (mjere centralne tendencije i varijabilnosti) i inferencijalne statističke metode (Mann-Whitney U test). Zaključci u vezi s razlikama između podataka doneseni su na razini značajnosti od 95 %.

U kvalitativnom dijelu istraživanja autori su analizirali odgovore ispitanika na otvorena pitanja u vezi s prednostima i nedostatcima kurikula te što bi oni u njima htjeli promijeniti.

Instrumenti

Koristila se metoda ankete te je korišten *online* anketni upitnik koji su konstruirali autori ovoga rada. Prvi dio anketnoga upitnika odnosi se na opće podatke o ispitanicima (spol, država, dob i duljina radnoga staža), dok se drugi dio odnosi na ispitivanje stavova u vezi s kurikulom nastavnoga predmeta Informatika u Republici Hrvatskoj i Češkoj Republici. Stavke tvrdnji u upitniku koriste se skalom Likertova tipa od 5 stupnjeva, pri čemu vrijednost 1 znači „uopće se ne slažem", vrijednost 2 „ne slažem se", vrijednost 3 „niti se ne slažem niti se slažem", vrijednost 4 „slažem se", a vrijednost 5 „u potpunosti se slažem". Za stavke vrednovanja u upitniku koristi se ljestvica s vrijednostima 1 – nedovoljno, 2 – dovoljno, 3 – dobro, 4 – vrlo dobro i 5 – izvrsno.

Zadnjih nekoliko otvorenih pitanja bavi se kvalitativnim dijelom istraživanja. Ovdje su ispitanici mogli navesti prednosti i nedostatke kurikula u svojim zemljama te što bi željeli promijeniti u kurikulu.

Statistička obrada i analiza podataka napravljena je pomoću programa za statističku analizu podataka GNU PSPP 1.6.2 (https://www.gnu.org/software/pspp/).

Postupak

Na službenim stranicama ministarstva obrazovanja Republike Hrvatske (http://mzos.hr/dbApp/pregled.aspx?appName=OS#) i Češke Republike (https://www.seznamskol.cz/zakladni-skoly/) pronađeni su kontaktni podatci i e-mail adrese osnovnih škola i njihovih ravnateljica i ravnatelja na koje su se slale molbe da se anketni upitnik proslijedi njihovim učiteljicama i učiteljima informatike.

Prikupljanje podataka provedeno je od travnja do svibnja 2022. godine i obavljalo se istovremeno u Republici Hrvatskoj i Češkoj Republici. Ispitanici su ispunjavali *online* anketni upitnik koji je bio izrađen pomoću Google obrazaca. Prije ispunjavanja anketnoga upitnika, ispitanici su ukratko mogli pročitati upute i svrhu istraživanja te su bili upoznati o anonimnosti prikupljanja podataka i mogućnosti odustajanja od sudjelovanja u istraživanju. Za ispunjavanje anketnoga upitnika bilo je potrebno oko 5 minuta.

Rezultati

U Tablici 2 prikazani su sociodemografski podatci ispitanika koji su sudjelovali u istraživanju. Broj ispitanika iz Hrvatske bio je 187 (50,80 %), a iz Češke Republike 181

(49,20 %). Najveći broj ispitanika bio je ženskoga spola (60,10 %). Najzastupljenija dobna skupina bili su ispitanici u starosti od 30 do 39 godina (113 ispitanika, 30,70 %), zatim od 40 do 49 godina (100 ispitanika, 27,20 %) te do 29 godina (76 ispitanika, 20,70 %). Prema duljini radnoga staža u ispunjavanju anketnoga upitnika sudjelovalo je najviše ispitanika s duljinom radnoga staža manje od 5 godina (155 ispitanika, 42,10 %), zatim od 11 do 20 godina (98 ispitanika, 26,60 %) te 5 do 10 godina (63 ispitanika, 17,10 %).

Tablica 2

Drugi dio anketnoga upitnika sastojao se od šest čestica s tvrdnjama i jednoga vrednovanja (Tablica 3). Zadatak ispitanika bio je procijeniti u kojem stupnju se slažu s navedenim česticama, na skali Likertova tipa od 5 stupnjeva. Trebali su i vrednovati svoje zadovoljstvo sa sadržajem kurikula predmeta Informatika u osnovnom obrazovanju koristeći se skalom s vrijednostima od 1 – nedovoljan do 5 – izvrstan. U Tablici 3 nalazi se prikaz rezultata Mann-Whitney U testa za nezavisne velike uzorke s obzirom na zemlju ispitanika.

Tablica 3

Ispitanici iz dviju zemalja statistički se značajno razlikuju prema tome jesu li imali poteškoća u prilagodbi novom kurikulu (Z = -5,17; p = 0,000), ulažu li puno truda u pripremu za nastavu (Z = -2,70; p = 0,007), je li im stručno usavršavanje pomoglo da se bolje snađu u kurikulu za predmet Informatika (Z = -2,67, p = 0,008) te smatraju li se dovoljno kompetentnima za poučavanje po novom nastavnom planu i programu (Z = -4,49; p = 0,000) (Tablica 3).

Ispitanici iz obiju zemalja ne razlikuju se statistički značajno u pogledu toga žele li se dodatno obrazovati o kurikulu predmeta Informatika (Z = -1,50; p = 0,135), jesu li zadovoljni potporom ravnatelja (Z = -0,85; p = 0,394), te u pogledu zadovoljstva (ocjene) novim kurikulom predmeta Informatika (Z = -0,45; p = 0,655).

Vrijednosti medijana u Tablici 4 ne pokazuju s dovoljnom preciznošću razliku između ispitanika iz dviju zemalja te se za prikaz te razlike koristi dodatna deskriptivna statistika (srednja vrijednost i standardna devijacija).

Tablica 4

Rezultati Mann Whitney U testa u Tablici 3 i rezultati deskriptivne statistike u Tablici 4 za dva velika neovisna uzorka s obzirom na zemlju ispitanika pokazuju sljedeće:

– ispitanici se uglavnom ne slažu (Mdn = 2, M = 2,23, SD = 1,11) s tvrdnjom da im je bilo teško prilagoditi se na novi kurikul predmeta Informatika. Postoji statistički značajna razlika među ispitanicima iz Republike Hrvatske (Mdn = 2, M = 1,95, SD = 1,07) i Češke Republike (Mdn = 2, M = 2,51, SD = 1,08) (Z = -5,17, p = 0,000). Ispitanici iz Republike Hrvatske lakše su se prilagodili novom kurikulu predmeta Informatika nego ispitanici iz Češke svojem kurikulu predmeta Informatika

– ispitanici se donekle slažu (Mdn = 4, M = 3,45, SD = 1,18) s tvrdnjom da su uložili puno truda u pripremu nastave iz predmeta Informatika prema novom kurikulu.

Statistički značajna razlika vidljiva je između ispitanika iz Republike Hrvatske (Mdn = 4, M = 3,26, SD = 1,27) i Češke (Mdn = 4, M = 3,65, SD=1,04) (Z = -2,70; p = 0,007). Ispitanici iz Republike Hrvatske uložili su manje truda od ispitanika iz Češke Republike

– ispitanici se donekle slažu (Mdn = 3, M = 3,33, SD = 1,11) s tvrdnjom da im je stručno usavršavanje pomoglo da se bolje snađu u novom kurikulu. Postoji statistički značajna razlika između ispitanika iz Republike Hrvatske (Mdn = 3, M = 3,18, SD = 1,15) i Češke Republike (Mdn = 4, M = 3,48, SD = 1,05) (Z = -2,67; p = 0,008). Ispitanicima iz Češke više je pomoglo stručno osposobljavanje za njihov kurikul nego ispitanicima iz Republike Hrvatske za njihov kurikul

– ispitanici se uglavnom slažu (Mdn = 4, M = 3,97, SD = 1,07) s tvrdnjom da su dovoljno kompetentni za poučavanje informatike po novom kurikulu. Statistički značajna razlika vidljiva je između ispitanika iz Republike Hrvatske (Mdn = 4, M = 4,19, SD = 1,01) i Češke Republike (Mdn = 4, M = 3,74, SD = 1,10) (Z = -4,49; p = 0,000). Ispitanici iz Republike Hrvatske smatraju se kompetentnijim od ispitanika iz Češke Republike

– ispitanici se donekle slažu (Mdn = 4, M = 3,53, SD = 1,19) s tvrdnjom da bi se željeli dodatno educirati o kurikulu predmeta Informatika. Ne postoji statistički značajna razlika između mišljenja ispitanika iz Republike Hrvatske (Mdn = 4, M = 3,60, SD = 1,23) i Češke Republike (Mdn = 4, M = 3,46, SD = 1,14) (Z = - 1,50; p = 0,135),

– ispitanici se uglavnom slažu (Mdn = 4, M = 3,96, SD = 1,17) s tvrdnjom da su zadovoljni potporom ravnatelja tijekom realizacije kurikula za predmet Informatika. Ne postoji statistički značajna razlika između mišljenja ispitanika iz Republike Hrvatske (Mdn = 4, M = 3,91, SD = 1,18) i Češke Republike (Mdn = 4, M = 4,02, SD = 1,15) (Z = - 0,85; p = 0,394),

– ispitanici ocjenjuju svoje zadovoljstvo sadržajem kurikula predmeta Informatika u osnovnom obrazovanju ocjenom 3 (dobar) (Mdn = 3, M = 3,39, SD = 0,83). Ne postoji statistički značajna razlika između ocjena ispitanika iz Republike Hrvatske (Mdn = 3, M = 3,43, SD = 0,77) i Češke Republike (Mdn = 3, M = 3,35, SD = 0,89) (Z = - 0,45; p = 0,655).

Ispitanici su u anketnom upitniku imali priliku navesti prednosti i nedostatke kurikula u svojim zemljama.

Kao prednosti u kurikulu predmeta Informatika ispitanici iz Republike Hrvatske naveli su sljedeće: prilagodljivost sadržaja mogućnostima učenika, autonomija učitelja, biranje aplikacija, dobra podjela domena, ciljeva i ishoda po dobnim skupinama, elementi vrednovanja koji se mogu standardizirati, fleksibilnost u ostvarivanju odgojno-obrazovnih ishoda, korelacija međupredmetnih tema i ostalih predmeta, korištenje više izvora znanja (ne samo udžbenik), kreativnost, modernizacija sadržaja, multimedijski sadržaji, obogaćen je kvalitetnim sadržajima, odličan uvod u programiranje za učenike svih uzrasta od Scratcha do Pythona, osnove programiranja, prilagodljivost, prilagodljivost satnice, primjenjivost ishoda na različite sadržaje, rano učenje učenika o digitalnom dobu, samostalnost u kreiranju nastave i odabiru sadržaja, usavršavanje

i stjecanje znanja, samovrednovanje, sloboda u odabiru alata koji će se obrađivati kako bi se postigli zadani ishodi, sloboda u odabiru metoda, učenici razvijaju logičko razmišljanje i zaključivanje, uvođenje informatike u nižim razredima, znanje stečeno na nižim stupnjevima obrazovanja se proširuje i produbljuje na višim.

Kao nedostatke u kurikulu predmeta Informatika ispitanici iz Republike Hrvatske naveli su sljedeće: premalo rada na računalu, ponavljanje istoga gradiva, velika razlika u znanju i predznanju između najboljih i najlošijih učenika, 7. i 8. razred - izborni predmet, nejasni i neprecizni ishodi, učenici s teškoćama, djelomično obrađene teme, u kurikulu od 1. do 8. razreda nije obuhvaćeno pravilno pisanje i slanje poruka elektroničke pošte, velike razlike u udžbenicima od izdavača do izdavača, previše teorijskoga dijela, premalo praktičnoga, kurikul je napisan tako da se pretpostavlja da svi učenici idu na informatiku od 1. razreda, informatika nije redovan predmet u svim razredima, ne stigne se sve obraditi, loše osmišljeni elementi učenja, zastarjela računalna oprema škola, nedostatak robota i informatičke strukture, obrađivanje nepotrebnih tema u razrednoj nastavi, previše pojmova i gradiva, nedovoljno posvećenosti određenim temama, ocjenjivanje po elementima nije detaljno objašnjeno niti pokazano na primjerima, u 1. razredu uči se pisanje na računalu, a učenici nisu naučili sva slova, premalo sati za obradu nastavnoga sadržaja, štur i nedorečen, nema planiranih sati vježbanja i ponavljanja, forsiranje istraživačkoga rada kod učenika osnovne škole, čemu nisu dorasli, količina programiranja, edukacije koje nisu dale odgovore na temeljna pitanja i probleme kurikula.

Jedna od najzastupljenijih prednosti je autonomija učitelja. Kod nedostataka se spominju različiti navodi, primjerice nedostatak potrebnih sati nastave (u tri slučaja), nepotrebne teme, djelomično obrađene teme, šturost i nedorečenost te drugo.

Ono što bi učiteljice i učitelji u Republici Hrvatskoj htjeli promijeniti u kurikulu za nastavni predmet Informatika navedeno je kao odgovori u anketnom upitniku kao što slijedi:

„ – Bolje definiranje domena i ishoda.
– Dodao bih više robotike i stvari vezane za robote.
– Izdvojio programiranje kao zaseban predmet.
– Ja bih uvela nastavu informatike kao obavezan predmet barem u svim višim razredima od petog do osmog.
– Smanjio bih količinu gradiva. Programiranje u nižim razredima učenicima je preteško, a u višim razredima je teško obraditi čitavo gradivo po planu i programu.
– Više kreativnih aktivnosti, izrada videa, slika, videoigrice, 3d modeliranje, obrada zvuka.
– Smanjila bih broj sati za 1. i 2. razred OŠ s 2 sata na 1 sat tjedno.
– Smatram da informatika treba biti obvezan predmet od 1. do 8. razreda".

Kao prednosti u kurikulu predmeta Informatika ispitanici iz Češke Republike naveli su sljedeće: aktualne potrebe, fleksibilnost, razvoj računalnoga razmišljanja, odnos

međupredmetnih tema, usmjerenost na praktičke vještine učenika, veća satnica, otvorene mogućnosti, veća kreativnost učenika, samostalnost učenika, razvoj potrebnih kompetencija, razvoj logičkoga mišljenja, mogućnost prilagodbe sadržaja potrebama nastave iz svih predmeta, jasan koncept što poučavati, gradivo učenike zanima, naglasak na algoritmima i informacijskim tehnologijama, kreativnost, fokus na robotiku, prilika za darovite učenike da se usavršavaju, djeca više nauče.

Kao nedostatke u kurikulu predmeta Informatika ispitanici iz Češke Republike naveli su sljedeće: nepotpunost nastavnoga materijala za učenike, velika usmjerenost na programiranje, nedovoljna edukacija nastavnika informatike, nedostatak opreme, nepripremljenost škola, veliko administrativno opterećenje, fokusiran samo na dio informatike, izostavljanje određenih tema, nedovoljno obrazovanih učitelja informatike, uklanjanje rada u uredskim aplikacijama, teško je savladati pojedine teme u 45 minuta, uklanjanje grafike, naglasak na programiranju u Scratchu, malo sati, treba povećati satnicu od 6. razreda na 2 sata tjedno, zanemarivanje slabijih učenika i učenika s posebnim potrebama, konkretizacija, nedovoljna povezanost s drugim predmetima, dvosmislenost očekivanih ishoda, dosta zahtjevan za učenika 1. stupnja.

Učiteljice i učitelji informatike u Češkoj Republici kao prednosti njihovoga nastavnog plana i programa za predmet Informatika najčešće navode njegovu otvorenost i fleksibilnost te mogućnosti za pokazivanje učeničke kreativnosti. Kao nedostatci spominju se mali broj predviđenih nastavnih sati, naglasak na programiranje, nedovoljna edukacija učitelja informatike, nedovoljan broj učitelja informatike, nedostatak opreme i drugo.

Ono što bi učiteljice i učitelji u Češkoj Republici htjeli promijeniti u kurikulu za nastavni predmet Informatika navedeno je kao odgovori u anketnom upitniku kao što slijedi: „- Vjerojatno bih se od prvog razreda fokusirao na informatiku kao takvu – možete se igrati s robotima, raditi razne vježbe bez tehnologije, što prije učenici počnu prakticirati sve o digitalnoj pismenosti ,to bolje.

– Bilo bi lijepo osigurati veću usklađenost s drugim predmetima.

– Još veća satnica na 2. stupnju.

– Prepolovio bih algoritme i programiranje, ostavio bih više vremena za svladavanje uredskih programa i računalnih vještina.

– Programiranje kao izborna aktivnost - velike razlike među učenicima, to je specifična vještina koju neki učenici ne razumiju i nikada neće razumjeti, nije potrebno učiti svakoga.

– Prvo bih naučio učenike koristiti računalo za potrebe obrazovanja, osobnog života, socijalnu uključenost i zapošljavanja.

– Svakako bih preporučila obuku učitelja.

– Proširivanje obvezne informatike do 3. razreda. Veći naglasak na radu s grafičkim uredskim aplikacijama.

– Prvo bi škola trebala biti kompletno opremljena pomagalima, a zatim bih primijenila RVP ZV."

Testiranje prve hipoteze

Prva hipoteza: Ne postoji statistički značajna razlika u zadovoljstvu ispitanika sadržajem kurikula nastavnog predmeta Informatika u osnovnom obrazovanju s obzirom na zemlju ispitanika. Očekuje se da će ispitanici iz Republike Hrvatske imati slične procjene u vezi sa zadovoljstvom sadržajem njihovoga kurikula nastavnoga predmeta Informatika u osnovnom obrazovanju u odnosu na ispitanike iz Češke Republike i njihov kurikul predmeta Informatika.

Svi ispitanici trebali su na ljestvici od 1 - nedovoljno do 5 - izvrsno ocijeniti koliko su zadovoljni sadržajem kurikula predmeta Informatika u osnovnom obrazovanju. U tom dijelu dobiveni su rezultati Mdn = 3, M = 3,39 i SD = 0,83, što ukazuje na činjenicu da su ispitanici zadovoljni sadržajem kurikula i to se zadovoljstvo može izraziti ocjenom dobar (3,39).

Rezultati Mann-Whitney U testa za velike nezavisne uzorke (Tablica 3) pokazuju da ne postoji statistički značajna razlika u zadovoljstvu ispitanika sadržajem kurikula iz predmeta Informatika u osnovnom obrazovanju s obzirom na zemlju ispitanika (Z = -0,45; p = 0,655). Ovime se potvrđuje prva hipoteza.

Testiranje druge hipoteze

Druga hipoteza: Ne postoji statistički značajna razlika u želji ispitanika za dodatnom edukacijom o kurikulu nastavnoga predmeta Informatika iz Republike Hrvatske i Češke Republike. Očekuje se kako će ispitanici Republike Hrvatske imati slične stavove u vezi sa željom za dodatnom edukacijom o kurikulu nastavnoga predmeta Informatika u odnosu na ispitanike iz Češke Republike.

Zadatak ispitanika bio je procijeniti u kojem se stupnju slažu s tvrdnjom *Volio/voljela bih se dodatno educirati o kurikulu nastavnoga predmeta Informatika* na skali Likertova tipa od 5 stupnjeva, pri čemu je vrijednost 1 označavalo „uopće se ne slažem", vrijednost 2 "ne slažem se", vrijednost 3 "niti se ne slažem niti se slažem", vrijednost 4 "slažem se", a vrijednost 5 „u potpunosti se slažem".

Rezultati Mann-Whitney U testa za velike neovisne uzorke pokazuju da ne postoji statistički značajna razlika u želji za dodatnim obrazovanjem o kurikulu predmeta Informatika s obzirom na zemlju ispitanika (Z = -1,50; p = 0,135). Ispitanici iz obje zemlje donekle se slažu s tvrdnjom da žele naučiti više o kurikulu predmeta Informatika (Mdn = 4, M = 3,53, SD = 1,19). Tako se potvrđuje druga hipoteza.

Testiranje treće hipoteze

Treća hipoteza: Ne postoji statistički značajna razlika u stavu ispitanika o tome smatraju li se dovoljno kompetentni za provođenje nastave informatike prema kurikulu za nastavni predmet Informatika s obzirom na zemlju ispitanika. Očekuje se da će ispitanici iz Republike Hrvatske imati sličan stav o tome jesu li dovoljno kompetentni za poučavanje predmeta Informatika u odnosu na stav ispitanika iz Češke Republike.

Zadatak ispitanika bio je procijeniti u kojem se stupnju slažu s tvrdnjom *Smatram da sam dovoljno kompetentan/na za provođenje nastave informatike prema kurikulu za nastavni predmet Informatika* na skali Likertova tipa od 5 stupnjeva, pri čemu je vrijednost 1 označavalo „uopće se ne slažem", vrijednost 2 „ne slažem se", vrijednost 3 „niti se ne slažem niti se slažem", vrijednost 4 „slažem se", a vrijednost 5 „u potpunosti se slažem".

Mann-Whitney U test za velike neovisne uzorke pokazuje statistički značajnu razliku između stavova ispitanika s obzirom zemlju ispitanika ($Z = -4,49$; $p = 0,000$). Ispitanici iz Češke Republike manje se slažu s tvrdnjom da su dovoljno kompetentni ($Mdn = 4$, $M = 3,74$, $SD = 1,10$) u odnosu na ispitanike iz Republike Hrvatske koji se slažu s tvrdnjom da su dovoljno kompetentni ($Mdn = 4$, $M = 4,19$, $SD = 1,01$). Može se zaključiti da se ispitanici iz Republike Hrvatske smatraju kompetentnijima u nastavi informatike prema kurikulu za predmet Informatika od ispitanika iz Češke Republike. S obzirom na navedeno treća hipoteza nije potvrđena.

Rasprava

Kao mogući razlog ovakvih razlika koje pokazuju Mann-Whitney U testovi (čestice koje se odnose na prilagodbu, trud, profesionalni razvoj i kompetencije) može se navesti da je u Češkoj Republici novi kurikul za predmet Informatika donesen 2021. godine, učitelji su ga koristili kraće vrijeme, imali su manje vremena za prilagodbu i možda nisu u potpunosti upoznati s njim. U Republici Hrvatskoj kurikul Informatike donesen je 2018. godine i učitelji informatike već su se imali vremena upoznati s njegovim sadržajem i zahtjevima.

Slično istraživanje i njegovi rezultati mogu se vidjeti u radu Dagiene i sur. (2019) u kojem su sudjelovala 1342 učitelja u osnovnim školama. Glavno istraživačko pitanje ove studije bilo je „Kako su litvanski učitelji pripremljeni za uvođenje novoga kurikula informatike na nacionalnoj razini?" Korištena je ljestvica ocjenjivanja s bodovima od 1 do 5: 1 - nisam pripremljen, 2 – slabo, 3 – umjereno, 4 – dobro, 5 – vrlo dobro.

Rezultati toga istraživanja prikazani su kao dvije srednje vrijednosti učitelja koji su prošli tečajeve digitalnih kompetencija tijekom posljednje tri godine i onih koji nisu. Rezultati pokazuju da se učitelji osjećaju najspremnijima poučavati teme Podatci i informacije (srednje vrijednosti 4 i 3) kao i Virtualne komunikacijske vještine (4 i 3). Umjereno su spremni za poučavanje Rješavanja problema (3 i 3) i Vještina sigurnosti i autorskih prava (3 i 3). Učitelji su manje pripremljeni za poučavanje Digitalnih sadržaja (3 i 2). Gotovo da nisu pripremljeni poučavati Algoritme i programiranje (2 i 1). Postoje razlike između samovrednovanja onih učitelja koji su prošli obrazovanje o digitalnim kompetencijama tijekom posljednje 3 godine i onih koji nisu.

Rezultati koje su predstavili Dagiene i sur. (2019) i rezultati istraživanja prikazani u ovom radu pokazuju da postoji slična spremnost nastavnika informatike za poučavanje informatike prema kurikulu u njihovim zemljama. Srednje vrijednosti u Litvi (nakon tečajeva za poboljšanje digitalnih kompetencija) uglavnom su 4 i 3, što je usporedivo s $M = 3,74$ za Češku Republiku i $M = 4,19$ za učitelje informatike iz Republike Hrvatske.

Rezultati iz Litve pokazuju da su tečajevi digitalne kompetencije korisni i imaju pozitivan utjecaj na digitalnu kompetenciju učitelja informatike.

Slični rezultati kompetencija učitelja informatike vidljivi su u radu Hildebrandta i Diethelma (2015), u kojem se autori bave programima osmišljenim za nastavnike informatike u različitim vrstama srednjih škola koji su poduprli nastavnike u primjeni novoga temeljnog kurikula u praksi. Od nastavnika se tražilo da procijene svoju subjektivnu kompetenciju u različitim područjima informatike prije i nakon stručnoga usavršavanja. Odgovori su bili ponuđeni na skali Likertova tipa od deset stupnjeva, u rasponu od 1 = „nikakva" do 10 = „specijalist". Srednje vrijednosti po predmetnim područjima prije i nakon trodnevnoga programa edukacije su sljedeće:

– algoritamsko rješavanje problema: 4,37 i 6,04 (+1,67)
– rad interneta: 6,27 i 6,92 (+0,65)
– mreže: 4.76 i 6.08 (+1.32)
– automatizirani procesi: 4,31 i 6,10 (+1,79).

Uspoređeni rezultati kvantitativnih istraživanja pokazuju da se učitelji informatike ne osjećaju potpuno kompetentnima za poučavanje informatike. Postoji prostor za unaprjeđenje kompetentnosti učitelja informatike u nastavi prema sadržaju novih informatičkih kurikula te im treba ponuditi dodatno obrazovanje iz područja digitalne kompetencije.

Može se zaključiti da autori iz uspoređivanih sličnih istraživačkih radova navode da se njihovi ispitanici ne osjećaju sigurnima u poučavanju informatike zbog nedostatka znanja o predmetu te da imaju problema s potrebnim hardverom, softverom, infrastrukturom i podrškom. Gotovo svi analizirani radovi govore o nedostatku znanja o pedagoškim sadržajima.

To su izazovi o kojima treba voditi računa pri osvježavanju ili izradi novoga informatičkog kurikula.

Zaključak

Učiteljice i učitelji informatike u Češkoj Republici tek od 2021. godine imaju novi kurikul za predmet Informatika u osnovnim školama te je istraživanje u ovom radu pokazalo da su se teže od svojih hrvatskih kolega prilagodili novom kurikulu, da su uložili više napora za prijelaz na novi kurikul u odnosu na hrvatske kolege, da su im stručna usavršavanja više pomogla u odnosu na hrvatske kolege te da se smatraju manje kompetentnima za izvođenje nastave prema novom kurikulu u odnosu na svoje hrvatske kolege.

Učiteljice i učitelji informatike u Republici Hrvatskoj novi kurikul za predmet Informatika imaju od 2018. godine te su imali više vremena za upoznavanje njegovoga sadržaja te prilagodbu zahtjevima novoga kurikula.

Informatika ima važnu ulogu u cjelokupnom sustavu obrazovanju. Uspoređeni su stavovi učiteljica i učitelja informatike u osnovnim školama o kurikulima iz njihovih

zemalja te su kod učiteljica i učitelja utvrđene koje su, po njihovim mišljenjima, prednosti, a koji mogući nedostatci te što bi oni htjeli promijeniti u obrazovnom području predmeta informatike u osnovnom obrazovanju. Istraživanjem je prikupljen značajan broj odgovora ispitanika koji su htjeli podijeliti vlastita mišljenja i viđenja nastavnih kurikula predmeta Informatika.

Učitelji informatike iz obiju zemalja samo su osrednje zadovoljni sadržajem svojega informatičkoga kurikula. Jedno od mogućih rješenja toga problema jest da se oni aktivnije uključe u kreiranje njegovoga sadržaja.

Usporedba rezultata kvantitativnih istraživanja iz sličnih istraživačkih radova pokazuje da se učitelji informatike ne osjećaju potpuno kompetentnima za poučavanje informatike. Postoji prostor za unaprjeđenje kompetentnosti učitelja informatike u nastavi prema sadržajima novih informatičkih kurikula te im treba ponuditi dodatno obrazovanje iz područja digitalnih kompetencija. Autori uspoređivanih sličnih istraživačkih radova navode da se njihovi ispitanici ne osjećaju sigurni u poučavanju informatike zbog nedostatka predmetnih znanja te da imaju problema s potrebnim hardverom, softverom, infrastrukturom i podrškom. Gotovo svi analizirani radovi govore o nedostatku znanja o pedagoškim sadržajima.

Analizirajući rezultate istraživanja pojavila su se moguća pitanja za daljnja istraživanja ili rasprave, primjerice treba li programiranje poučavati u posebnom predmetu. To i druga pitanja mogu biti predmet daljnjega istraživanja, što bi moglo doprinijeti poboljšanju sadržaja kurikula predmeta Informatike.

Informacijske i komunikacijske tehnologije jedno su od najbrže razvijajućih područja ljudskoga djelovanja te se svaki dan osmišljavaju nove vrste usluga te nova naprednija računala i na računalima temeljeni uređaji te to ima pozitivan utjecaj na cjelokupni razvoj društva. Zbog toga je i kurikul predmeta Informatika za osnovno obrazovanje podložan stalnim unaprjeđenjima i promjenama kako bi bio u skladu s brzim razvojem informacijskih i komunikacijskih tehnologija.

Ograničenja istraživanja

U ovom radu prikazana je samo ograničena analiza kvalitativnoga istraživačkog dijela podataka. U budućem radu potrebna je složenija analiza, kao što je korištenje kodiranja za označavanje i organiziranje kvalitativnih podataka za prepoznavanje različitih tema i odnosa među njima.

Napomena

Autori ne prijavljuju sukob interesa.

Rezultati istraživanja prikazani u ovom radu dosad nisu bili javno objavljeni.

Istraživanje predstavlja dio neobjavljenoga magistarskog rada.