Ability of the Information Science teachers to teach programing in the lower grades of primary school

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Abstract - In anticipation of the introduction of the elective subject of Information Sciences for the lower grades of primary school, a question of the professional teaching competences of students - future teachers and current teachers of Information Sciences (with an emphasis on programing), comes into the focus. This article discusses their ability from professional (knowledge of programing) and pedagogical aspects. We present the results of a research conducted among students of the Faculty of Education Sciences with a module in Information Sciences and Informatics Teachers in the Class Teaching study group. Respondents, through self-evaluation of their knowledge and competencies in the field of programing, gave answers from which it can be concluded whether they are ready to teach programing. The article also presents a case study in which students of the final year of the Faculty of Education Sciences with a module of Information Sciences, made a video clip of processing new contents for a programing class, as a methodical exercise. The programing languages used were Scratch, Python and the micro:bit simulator. Project assignments were correlated with the subjects of Croatian language, Physical and Health Culture, Music Culture, Mathematics and Information Sciences. The results of the research indicate that the respondents are generally ready, but they would need additional education in programing domain.

Keywords: programing, Scratch, classroom teaching, computer thinking and programing

I. INTRODUCTION

The decision to adopt the curriculum for the subject of Information Sciences for primary and secondary schools in the Republic of Croatia was published in the Narodne novine on March 6, 2018 [1]. This decision has already been in effect for the school year 2018/2019 and has been applied to the students from the 5th grade of primary schools through the 4th grade of secondary schools. For the students of the lower grades of primary schools, the curriculum will be applied in the school year 2020/2021. However, the introduction of the initial curricula for the subject of Information Sciences as an elective subject in the lower grades of primary schools raises a question of the professional competences of our teachers of Information Sciences, students of the final year of the Teacher education - Faculty of Education Sciences with the module of Information Sciences and students of Information Sciences – Class Teaching study group.

Today’s children are often called the digital natives. They have no fear of new technologies or getting information from online sources, and they like to learn "harder, happier and more serious things" [2]. Previously, teachers of Information Sciences mostly taught in the upper grades of primary schools or in secondary schools, and only few of them have some experience in working with younger students. In this paper, we were interested in the opinion of teachers of Information Sciences about their own pedagogical and professional competencies that they have acquired so far. Do they have sufficient competencies, or do they need additional education?

Information Technology should have a positive effect on the quality of life and not have a purpose of exclusively teaching specific skills. [3] The Curriculum sets teaching and learning outcomes of the subject of Information Sciences as development of critical thinking, creativity and innovation through the use of information and communication technology, and development of computational thinking, problem-solving skills, and programing skills [1]. At the same time, programing is seen in a broader context than the creation of computer programs, i.e. as a way of solving problems that are practiced with the help of computers, and can be transferred to areas outside the boundaries of computing. Therefore, children should have the opportunity to learn programing, not necessarily to become programmers, but to practice problem-solving. [4]

The activities and contents used should correspond to the cognitive stage of the child's development. The younger the students, the more appropriate it is to approach them with concrete examples and tangible contents, such as computer games without the use of computers, the so-called unplugged activities. In the next phase of learning, it is appropriate to move on to managing images of objects. It is appropriate to use visual programing languages in which commands are used to manage events in the micro-world. Coding in abstract programing languages such as Python, C++ and others is considered the final stage of learning programing.

We distinguish two types of visual programing languages in which images of objects are managed in the micro-world. Some are visual-textual, like Logo, and others are visual block-based, like Scratch, Alice, Game Maker, Blockly and the likes. The basic advantage of block-based programing languages is the significantly reduced possibility of syntax errors, which in text languages often result in frustration and reduced motivation to learn programing. The focus has shifted from the syntax of a particular language to logical programing.
thinking. Such languages are visually appealing, commands are displayed in blocks that are arranged like a jigsaw puzzle, and the result of running the program is immediately visible on the screen.

In addition, a feature of block-based programming languages is to shift the programming context from solving mathematical problems to programming games, animations, stories, and similar contents. Programming context is thus moved away from activities that are not attractive to digital natives, and placed in an environment that allows not only the development of mathematical abilities, but encourages creativity in other fields, thus taking into account other types of intelligence, and not exclusively mathematical-logical type of intelligence. [4]

Scratch has recently become one of the most popular block-based programming languages. It is a free program developed at the famous American university, the Massachusetts Institute of Technology (MIT), in a group called Lifelong Kindergarten. The idea is to encourage children to explore, come up with, and realize their ideas, which they can then show to others over the Internet, while adopting the basics of programming, math, visual and interactive design. Programming in Scratch is completely visual. Children write programs by stacking ready-made blocks into larger constructions. By using Scratch, a child can effortlessly learn to create simple computer games and programs on their own, and in the same way they can turn their creativity into interactive stories and multimedia animations. [5]

As stated before, the aim of this paper is to determine whether current or future teachers of Information Sciences in primary school education, possess professional competencies to teach Information Science in the domain of Computational Thinking and Programming. The authors also wanted to find out what the situation in other countries was. They made a brief overview of the existing literature; unfortunately, this topic has not been adequately researched. It seems that there is a notion that teachers are competent enough, or that conditions differ from those in Croatia.

Sáez-López and Miyata [6] state that in Spain, where they work, there is no ICT in primary schools and that on the Scratch Day, teachers had to make great efforts in preparation for working with students, and that results of the students were not satisfactory.

López-Escribano and Sánchez [7] state that their experience with teachers is that they generally do not want to learn programming languages, including Scratch. They state that mastering programming languages, including Scratch, requires a high level of abstraction and the complexity of the concepts they have to learn, and that this is a serious problem for teachers. Although Scratch has tried to overcome these obstacles, many teachers do not feel comfortable using programming languages.

A study conducted by Jimogiannis and Komis [8] focuses on teachers’ attitudes towards ICT. Students primarily emphasized feelings such as: 1. Anxiety and stress, 2. Self-efficacy, 3. Desire and pleasure, 4. Perceptions about ICT value and usefulness etc and the study concluded that Effective teachers’ training is considered among the most important factors for the formulation of positive attitude towards ICT, as in the previous research conducted by Yildirim [9].

Fesakis and Serafeim [10] reached the similar conclusion as López-Escribano and Sánchez [7]. They conducted research with prospective students at the University of the Aegean in Greece. The research focused on students’ opinions on the effect of a one-semester introduction to the Scratch environment for computer programming in primary education. Students had basic ICT skills, but no computer programming skills. Nevertheless, students - future teachers find Scratch useful and getting acquainted with it has significantly reduced the stress and anxiety associated with the ability to use ICT in educational practice.

II. CASE STUDY

In this case study we present the Information Sciences (IS) projects assigned to the students of the fifth and final year of the Teacher education - Faculty of Education Sciences with the module of Information Sciences.

Students are adequately trained for in-person teaching of the IS subjects in primary schools (1st to 6th grade). As a part of the curriculum, each student usually gives one or two IS presentations to the primary school students. In the context of the COVID 19 pandemic, classes could not be conducted in classrooms, and students had to prepare and present one teaching unit in the form of a video lesson that will be used for online teaching. Preparation of the video lesson was to be the final assignment for the subject "Informatics teaching methodology III", and students had to show that they have acquired sufficient professional and pedagogical competencies to work with primary school students.

Professional competencies imply an average knowledge of programming (Computational Thinking and Programming - which is quite demanding for most students of the Teacher education - Faculty of Education Sciences). Pedagogical competencies imply that students have learned to transfer knowledge and skills, i.e. to teach primary school students from the pedagogical-didactic-psychological-methodological aspect.

Nine students were given assignments with a very broad framework on how to prepare their presentation. Each student could choose a method of presentation. They were supposed to record the preparation of the process by using ActivePresenter 8 (All-in-One Screen Recorder, Video Editor & eLearning Authoring Software [11]) or similar application for audio and visual recording of the lecturer. They were supposed to make a video lesson (teaching material) from which the students will be able to learn independently. Video lesson should have lasted from 10 to a maximum of 45 minutes. All assignments were to be done in one of the programming languages, and the following were used: a) Scratch - programing language and development environment for creating games (block-based programing language); b) Standard structural / object-oriented Python programing language, which is often defined as a language for teaching an algorithmic approach to problem solving [12] and c) The MakeCode
platform for programming micro:bits (block-based programming language).

Goal of selected tasks was to achieve the learning outcomes in the subject Informatics domain of Computational Thinking and Programming. They correlated with other subjects: Croatian language, Music culture, Mathematics, Physical and health culture, and with the interdisciplinary topic Health.

Students were not particularly enthusiastic about the assignments because they had to prepare lessons in a way they were not used to. They had knowledge of programming in the Python programing language, but not in the Scratch. They encountered screen and monitor recording programs, and video editing programs, but not the ActivePresenter. Therefore, students had to use online versions of textbooks by Croatian publishers (primarily [13]), as well as the instructions for using ActivePresenter [11]. The eighth student was also supposed to use the MakeCode platform for programming micro:bits [14] with accompanying educational materials [15].

The first student had to prepare an IT lesson for the subject of Music Culture, for the 3rd grade of the primary school. The assignment was: "We play in Scratch - Creating a quiz to recognize a definite number of songs." The video lesson was made in Scratch and it can be viewed at https://youtu.be/h5clpKyygL0.

The second student had to prepare an IT lesson for the subject of Music Culture for the 3rd grade of the primary school. The assignment was We play in Scratch - programming a song. The student chose the song And so ticks the little clock. The video lesson was made in Scratch, and it can be viewed at https://youtu.be/7ZPzGtt5m0s.

The third student had to prepare an IT lesson for the subject of Music Culture for the 3rd grade of the primary school. The assignment was We play in Scratch - Music quiz to recognize several musical instruments. The video lesson was made in Scratch and it can be viewed at https://youtu.be/BrJZQIUJYJs.

The fourth student had to prepare an IT lesson for the subject of Mathematics for the 4th grade of the primary school. The assignment was Mathematical quiz in Scratch - Guessing numbers from 1 to 64 - introduction of variables. The video lesson was made in Scratch and it can be viewed at https://youtu.be/vUCYzpFNLwM.

The fifth student had to prepare an IT lesson for the subject of Mathematics for the 4th grade of the primary school. The assignment was Final project in Scratch - Creating a math quiz: multiplication with numbers from -12 to 12. The video lesson was made in Scratch and it can be viewed at https://youtu.be/GOvMuqknbdg.

The sixth student had to prepare an IT lesson for the subject of Croatian Language for the 3rd grade of the primary school. The assignment was We create stories by programing - a story: 'Little Red Riding Hood'. The video lesson was made in Scratch and it can be viewed at https://youtu.be/Enqq9tQOwsDk.

The seventh student had to prepare an IT lesson for the subject Physical and Health Culture for the 4th grade of the primary school. The assignment was Programing the presentation of several physical exercises in Scratch. The video lesson was made in Scratch and it can be viewed at https://youtu.be/2mS5q0eWUWq4.

The eighth student had to prepare an IT lesson for the interdisciplinary subject Health for the 4th grade of the primary school. The assignment was Making a pedometer with additional options on the micro:bit. The video lesson was made in the MakeCode platform for micro:bit programing, and it can be viewed at (https://youtu.be/xI2N7mNNlqg).

The ninth student had to prepare an IT lesson for the 7th grade of the primary school. The assignment was Processing loops and functions through turtle graphics. The video lesson was made in the Python programing language, and it can be viewed at (https://youtu.be/THEJ7vE7v2w).

Learning outcomes from the subject Informatics domain Computational Thinking and Programming (B.3.1., B.3.2., B.4.1., B.4.2., B.7.1. and B.7.3) were to be met through “the Curriculum of the subject Information Science for primary and secondary schools” [1]. All Scratch programing solutions were supposed to have a ‘Scene’ and all the programs were supposed to be interactive. Mentor wanted to know how much time students needed to complete the assignments. Students reported that it took them between 15 and 25 hours because they needed to master Scratch, record applications, prepare auxiliary materials (music, sketches, drawings, pictures) for the process of recording teaching content, multiple recording of individual parts due to errors observed by students, multiple recording individual parts due to finishing indicated by other students (peer assessment), multiple recording of individual parts due to finishing pointed out by the teacher and post-productions, text insertion, insertion of introductory and checkout tips, image acceleration etc.

Students evaluated each other's papers and marked with a grade of 5 (on a scale of 1 to 5), and the teacher-mentor also gave them excellent grades (from 87 to 98% of possible points) and expressed satisfaction with the work done by students. Students were also very satisfied with the final work and the level of acquired knowledge and experience.

Video (lessons) materials were also presented to the members of the Association - Society of Informatics Teachers Pula that consists mostly of the primary school teachers of Information Sciences in Pula and the surrounding area. Members of this society (16 members) have been very active since its inception, some 15 years ago and they were quite satisfied with the video materials.

The conclusion of the case study is that when teachers make an effort and use the resources available to them, it is possible to create excellent online teaching materials that can facilitate online lecturing. Since it takes a long time to make such material, it is recommended that teachers share the recorded lessons with each other.
III. RESEARCH

The goal of this study is to determine whether current teachers of Information Science, current fifth year students Teacher education - Faculty of Education Sciences with the module of Information Sciences and students of Information Sciences – Class Teaching study group, have professional competencies for teaching Information Sciences in the classroom, with the domain on the Computational Thinking and Programing.

For this purpose, we compiled a questionnaire with approximately 20 questions. The questionnaire was filled out by the Information Sciences teachers who work as teachers in primary and secondary schools, as well as fifth-year students of the Faculty of Education Sciences with the module Information Sciences and students of Information Sciences – Class Teaching study group. The survey was anonymous, filled out via a Google Form, and the completion time was, on average, 4 minutes. Respondents did not receive any benefits for completing the survey, other than being able to obtain survey results a week after its completion.

The survey group consisted of 58 respondents. 46 respondents of the survey group were female (79%) and 12 male (21%).

17 respondents were under the age of 30, 28 were between the ages of 31 and 45, and 13 were over the age of 45.

Two thirds of the respondents, 39 of them (67%) came from the County of Istria, and 1-3 respondents came from 13 other counties (mostly evenly represented throughout Croatia - from the Vukovar-Srijemska County to Split-Dalmatia County).

In terms of the respondents’ teaching experience in primary and secondary schools, 28 of them (48.3%) had over 10 years of experience, 12 (20.7%) had 5-10 years of work experience, 8 (13.8%) had 0-2 years of teaching experience, 6 of them (10.3%) were students and had no work experience, and 4 (6.9%) had from 2 to 5 years of work experience.

Majority of the respondents, 41 of them (70.7%) had no experience in teaching the lower grades in primary schools, 16 of them (27.6%) taught the lower grades in primary schools for up to 5 years, and 3 of them (5.2%) taught the lower grades in primary schools from 5-10 and over 10 years.

When asked if they taught Information Sciences in primary and secondary schools, 27 (46.6%) respondents taught IS for over 10 years, 7 (12.1%) of them from 5 to 10 years, 5 of them (8.6%) from 2 to 5 years, 6 of them (10.3%) up to 2 years, 6 of them were students (10.3%), and 7 (12.1%) were primary school teachers studying the module Information Sciences had no experience as teachers of Information Sciences.

The next question was How long have you worked as an Information Sciences teacher in the lower grades of primary school? As the teaching of Information Sciences in lower grades was discontinued a few years ago (at least in the County of Istria), we assumed there would be no teachers of Information Sciences with working experience in lower grades of primary schools. Our assumption proved correct. As many as 41 of them (70.7%) had no experience, 10 of them (17.2%) had up to 2 years, 3 (5.2%) from 2 to 5 years and from 5 to 10 years, and only one (1.7%) respondent had more than 10 years of work experience with teaching Information Sciences in the lower grades of primary schools.

Conducting IT workshops in clubs or similar in or out of school premises can be of great help in acquiring both pedagogical and professional competencies. Twenty nine (50%) respondents stated that they did not hold any IT workshop, 13 (22.4%) respondents stated that they held one or two, while 8 (13.8%) respondents held from 3 to 5 or more than 5 workshops.

Pedagogical competencies were acquired by Information Sciences teachers mainly, 40 (70.0% of them) during their regular faculty education. Fifteen of them (24.8%) acquired it by enrolling in Pedagogical Competences class after completing studies that did not have pedagogical competencies in its program (technical or economic studies), and 3 of them (5.2%) are currently in the process of acquiring competencies.

The next question was How many times have you participated in programing training workshops, lasting at least 10 hours? Nineteen respondents answered “never”, 11 respondents participated in 1-2 workshops, 9 in 3 or 4 of them, and 19 respondents participated in 5 or more.

How many times have you held an Information Sciences workshop at a professional conference? Forty six of them replied “never”, 6 of them held 1 or 2 workshops, 4 of them held 3 or 4 workshops, and two respondents held 5 or more workshops.

Although we expected better results in response to the question How many times have you held an Information Sciences workshop at the County Expert Council?, the improvement was insignificant: 35 (60.3%) respondents never held a workshop, 11 (19.0%) held 1 or 2 workshops, 3 (5.2%) held 3 or 4 workshops, and 9 (15.5%) respondents held 5 or more workshops.

The most interesting part of this research contains the following five questions in which respondents were asked to assess their knowledge of the Scratch programing language. Questions were associated with a measuring scale from 5 to 1, where 5 indicates excellent knowledge and 1 indicates insufficient knowledge. Each question was scored with an estimated value that the respondent has chosen. The minimum number of points for 5 questions is 5, and the highest is 25. The higher the value, the more competent the respondent is. However, the first step in the analysis of the initial set of statements was to assess the reliability of the analyzed measurement scales. This was achieved by Cronbach’s alpha coefficients for each statement. The Cronbach’s alpha coefficient is a measure of the internal consistency of a set of statements, and can assume a value between 0 and 1; the closer to the value of 1, the more reliable the measurement scale. The values of the Cronbach’s alpha coefficient for all items are given in Table 1.
Sciences teachers who have recently completed their studies but are not currently working as Information Sciences teachers.

Information Sciences teachers with up to 5 years of teaching experience scored the worst results in the Average section (on the border of sufficient and good). There is no statistically significant difference between the obtained mean values at the significance level of $p < 0.05$. In determining whether there is a difference between students and unemployed IT teachers on one hand and employed IT teachers, in the section I need additional professional training for Scratch shows the number of respondents who think that they need or do not need additional professional training in Scratch.

Based on the results shown in the previous table, and the reference values stated in the literature, it can be concluded that the developed measurement scales have an excellent level of reliability.

Table 2 shows the results of the self-assessment of knowing Scratch and it compares the obtained values in different groups of respondents. The results (column Average) are graded and interpreted as follows: for the respondents with up to 7 points have insufficient knowledge; respondents with 8-12 points have acceptable knowledge; respondents with 13-17 exceeds the acceptable knowledge respondents with 18-22 points have very good knowledge, and respondents with 23-25 points have excellent knowledge. Standard deviation and Median refer to the individual number of respondents in each group item. In the column I have professional competencies, the scale of points goes from 5 to 1, where the mark 5 indicates that respondents have excellent professional competencies, 4 - that respondents generally have professional competencies, 3 – that the respondents have average competencies; 2 - that respondents generally don’t have sufficient professional competence, and mark 1 - that respondents don’t have the necessary professional competence. The column I need additional professional training for Scratch shows the number of respondents who think that they need or do not need additional professional training in Scratch.

Kline [16] states the reliability criteria of the measurement scales: if the reliability coefficient takes a value of about 0.9, the reliability can be considered excellent, for a value of about 0.8, the reliability can be considered very good, for values around 0.7, the reliability can be considered acceptable. A reliability coefficient of less than 0.5 indicates that more than half of the observed variance could be due to an error.

Table 1. Items with Cronbach's Alpha Coefficient

<table>
<thead>
<tr>
<th>Item</th>
<th>Cronbach alpha coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 [To what extent do you know and can explain to the students] how to create an interactive quiz</td>
<td>0.9322</td>
</tr>
<tr>
<td>Q2 [To what extent do you know and can explain to the students] how to program a song by following musical notes</td>
<td>0.9370</td>
</tr>
<tr>
<td>Q3 [To what extent do you know and can explain to the students] how to make an animation of an object</td>
<td>0.9206</td>
</tr>
<tr>
<td>Q4 [To what extent do you know and can explain to the students] how to create a menu</td>
<td>0.9259</td>
</tr>
<tr>
<td>Q5 [To what extent do you know and can explain to the students] how to set a Scene</td>
<td>0.9316</td>
</tr>
</tbody>
</table>

Table II. Comparison of obtained values by self-assessment of respondents

<table>
<thead>
<tr>
<th>Group</th>
<th>Respondents</th>
<th>No of Respondents</th>
<th>Average</th>
<th>Stdev</th>
<th>Median</th>
<th>I have professional competencies</th>
<th>I need additional professional training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average</td>
<td>Stdev</td>
</tr>
<tr>
<td>I.</td>
<td>Students</td>
<td>6</td>
<td>18,5</td>
<td>5,24</td>
<td>20,5</td>
<td>4,17</td>
<td>0,983</td>
</tr>
<tr>
<td></td>
<td>Informatics teachers working up to 5 years</td>
<td>11</td>
<td>13,5</td>
<td>8,41</td>
<td>15</td>
<td>4,18</td>
<td>0,874</td>
</tr>
<tr>
<td></td>
<td>Informatics teachers working over 5 years</td>
<td>34</td>
<td>15,6</td>
<td>6,16</td>
<td>16</td>
<td>4,10</td>
<td>0,923</td>
</tr>
<tr>
<td></td>
<td>Informatics teachers who do not teach Informatics</td>
<td>7</td>
<td>17,9</td>
<td>8,00</td>
<td>19</td>
<td>3,90</td>
<td>0,831</td>
</tr>
<tr>
<td>II.</td>
<td>Respondents who taught Informatics in lower grades of primary school</td>
<td>17</td>
<td>15,8</td>
<td>6,65</td>
<td>17</td>
<td>4,18</td>
<td>0,809</td>
</tr>
<tr>
<td></td>
<td>Respondents who did not teach Informatics in lower grades of primary school</td>
<td>41</td>
<td>15,8</td>
<td>6,90</td>
<td>17</td>
<td>4,05</td>
<td>0,921</td>
</tr>
<tr>
<td>III.</td>
<td>Respondents who held programing workshops</td>
<td>29</td>
<td>17,6</td>
<td>6,50</td>
<td>19</td>
<td>4,45</td>
<td>0,736</td>
</tr>
<tr>
<td></td>
<td>Respondents who did not hold programing workshops</td>
<td>29</td>
<td>14,0</td>
<td>6,65</td>
<td>14</td>
<td>3,72</td>
<td>0,882</td>
</tr>
</tbody>
</table>

The obtained values are classified into 3 groups: Group I. – Comparison between students and working teachers of Information Science based on the length of employment; Group II. – Comparison between the respondents with teaching experience of Information Science in lower grades of primary school with those without it; Group III. – Comparison between respondents with experience in holding workshops in programing in extracurricular and / or out of school activities. The same respondents participated in all three groups.

The results obtained from Group I indicate that final year students are introduced to Scratch in course of their studying and can respond with professional competencies to the requirements of teaching computational thinking and programing in the lower grades of primary schools. Slightly worse results are achieved by Information Sciences teachers who have recently completed their studies but are not currently working as Information Sciences teachers.
Scratch while studying, and have not had an opportunity to work with Scratch in schools, because Scratch was commonly used in teaching the lower grades of primary schools, while Logo or Python programming languages are used in the higher grades.

Results obtained for Group II. indicate there is no statistically significant difference between the average values between the respondents who taught Information Sciences in lower grades and those who did not. In the answers to the question I need additional professional training in Scratch between the respondents who taught Information Sciences and those who did not, there is also no statistically significant difference in the level of significance of p <0.05. Such results were expected.

Results for the Group III show that the achieved average values, between respondents who held programming workshops outside of regular classes and those who did not, are statistically different (for two-sided t-test, t = 2.117 N1 = N2 = 29 with p <0.05) and we can conclude that respondents who held programming workshops have better average results than those who did not. Furthermore, there is a statistically significant difference among those who conducted programming workshops as extracurricular activity in the section “I have professional competencies” at the level of significance p <0.05 (two-sided t-test, t=3.394, N1=N2=29), but there is no statistical significant difference between the answers given by the respondents regarding the question I need additional education at the level of significance p <0.05 (χ² = 1.6207, and the limit value is 3.843 for df = 1). Such results were expected. Those who held programming workshops have many more hours of programming work with students than those who taught Information Sciences in schools. Programming is performed in only one of the four domains and the number of programming hours is relatively small. With a larger number of hours of programming lessons, teachers gain more self-confidence, and it is possible that they have encountered another block-based programming language in their work.

In general, a conclusion can be drawn that is valid for all three groups. Although most of respondents believe that they have very good professional competencies, they also need additional professional training in Scratch.

IV. CONCLUSION

Teachers and students who are the future teachers of Information Sciences feel adequately professionally competent to conduct the teaching of Computational Thinking and Programming (one of the domains of the subject of Information Sciences) in the lower grades of primary school. Almost everyone thinks that they would need additional training in the block-based programming language Scratch. The article also presents a case study that shows how, through a practical project, students of the Teacher education - Faculty of Education Sciences at the Juraj Dobrla University of Pula, in the course of Methodology of Teaching Information Sciences are professionally trained for the most demanding part of teaching the Information Sciences.

REFERENCES


