TEACHING SCENARIOS FOR DIGITAL LEARNERS

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Abstract

From year 2015 to 2023, the Republic of Croatia implemented the e-Schools program, officially titled: "e-Schools: A Comprehensive Informatization of School Operations and Teaching Processes to Foster Digitally Mature Schools for the 21st Century". As part of this initiative, the project titled "Development of the System of Digitally Mature Schools" (widely known as e-Schools) was implemented. The program aimed to digitally transform schools by modernizing both their administrative systems and educational processes. Key priorities included providing schools with advanced technological infrastructure and enhancing the digital competencies of both teachers and students to support this transformation. A core component of the project involved integrating information and communication technology (ICT) into teaching and learning practices. To achieve this, teaching scenarios were developed as resources for educators, offering guidance on incorporating digital tools into lesson planning. These scenarios were tailored to meet the needs of digital-native learners, with the ultimate goal of fostering the achievement of learning outcomes. This paper highlights the findings of a survey conducted among computer science teachers (N=54) to explore their use of these teaching scenarios in primary and secondary school classrooms.

Keywords: Teachers, teaching scenario, digital competences, digital educational materials.

1. Introduction

The contemporary teaching process is facing significant challenges. Classrooms today are occupied by members of Generation Z (born between 1997 and 2012) and Generation Alpha (born after 2010) (Holubova, 2024). Generation Z is characterized by the use of modern information and communication technologies, which they enjoy using daily while practicing multitasking (e.g., simultaneously browsing the internet, doing homework, and chatting with friends). They retain information more effectively when it is presented visually (e.g., through graphs or diagrams) (Adamska, 2021), prefer learning through demonstrations and self-directed study, but tend to have shorter attention spans and struggle with developing critical thinking skills (Rončević & Vrcelj, 2020). Generation Alpha, on the other hand, is highly interested in technology and uses it for independent learning. They expect the use of visual, auditory, and kinesthetic elements in teaching. Their interpersonal intelligence is less developed, as they form social relationships in different ways. Nevertheless, they are entrepreneurial, curious, and open to new challenges (Ziatdinov & Cilliers, 2021).

It is evident that modern students learn differently, and a common trait shared by both Generation Z and Generation Alpha is their use of information and communication technologies. Consequently, the contemporary education system must adapt to the evolving nature of learning and teaching.

In the Republic of Croatia, the current framework is the National Curriculum (Ministry of Science and Education, 2017), which, through various curricular documents, prescribes the educational principles from preschool to secondary school levels. Accordingly, there has been a recognized need for implementing changes, driven in part by the digital era in which we live.

The program e-Schools: A Comprehensive Informatization of School Administrative and Teaching Processes with the Aim of Creating Digitally Mature Schools for the 21st Century was active from 2015 to 2023. Within this program, the project titled e-Schools: Establishing a System for the Development of Digitally Mature Schools—abbreviated as e-Schools—was implemented. The program was led by the Croatian Academic and Research Network (CARNET). Its goal was to digitally transform both administrative and teaching processes in educational institutions.

The first phase of the project, a pilot phase, lasted from 2015 to 2018 and involved 10% of Croatian schools. The second phase spanned from 2018 to 2023. This phase focused on the digital transformation of both administration and the educational process. A key emphasis was placed on infrastructure, ensuring

that schools and educational staff received the necessary equipment to participate in the project. This included the development of local networks and providing schools and staff with computers.

The digital transformation of the teaching process was based on the development and use of digital educational content created for all subjects from 5th grade of primary school to the final year of secondary school (12th grade). In addition to digital educational content, teaching scenarios were developed for school subjects and cross-curricular topics. Educators were provided support to develop their digital competencies through in-person meetings, practitioner-led sessions, and online workshops.

Teachers' digital competencies were defined by the European Framework for the Digital Competence of Educators and are intended for educators at all levels of education, from preschool to higher education. These competencies are divided into three main elements (professional competences, pedagogical competences, and student competences), encompassing six areas and a total of 22 digital competences (Croatian Academic and Research Network – CARNET, 2020).

Throughout the project, various services used by teachers were continuously improved, such as Moodle (an e-learning platform used in Croatian education), EMA (an application enabling teachers to register for professional development programs), and Edutorij (a repository of digital educational materials) (CARNET, 2019). Our research interest focused on the use of teaching scenarios, which can be described as digital lesson plans designed for teachers of specific subjects. We were particularly interested in the subject Computer science, which is a mandatory subject in the 5th and 6th grades of primary school in Croatia and is compulsory in the first grade of general secondary school (gymnasium).

At the time of conducting this study in May 2023, there were a total of 48 available teaching scenarios intended for students in the 5th and 6th grades of primary school and the first grade of gymnasium for the subject of computer science. These teaching scenarios were created based on previously developed digital educational content, which covered 60% of the learning outcomes from the computer science curriculum for the respective grades.

The development guidelines for teaching scenarios are grounded in the didactic principles of computer science education. Each scenario is based on learning outcomes derived from the official subject curriculum, which are then further operationalized in specific activities.

Each teaching scenario includes three activities based on operationalized learning outcomes, varying levels of ICT integration, and interdisciplinary connections with other subjects and cross-curricular themes. Each activity includes detailed lesson content structured by lesson stages, teaching forms and methods, and suggested use of ICT (basic, intermediate, and advanced levels). Furthermore, each activity includes adaptations for gifted students as well as those requiring additional support. One activity is also designed for online implementation. Since these teaching scenarios were developed within a national project, we were interested in examining the extent to which computer science teachers are familiar with and make use of these scenarios.

2. Methodology

The survey was conducted among primary and secondary school computer science teachers in the Republic of Croatia. The sample was created based on the available list of primary and secondary schools in Croatia, which is accessible on the official website of the Ministry of Education. A random (systematic) sampling method was used, and a total of 54 Computer Science teachers responded to the survey. These teachers taught computer science in the 5th and 6th grades of primary school and the 1st grade of secondary school. The survey consisted of four sections: general information, recognition of teaching scenarios, use of teaching scenarios, and digital tools.

3. Results and discussion

A total of 33 female teachers (61.1%) and 21 male teachers (38.9%) participated in the survey. In addition to general demographic information, the survey also included questions related to the participants' years of teaching experience and the type of school (primary or secondary) in which they are employed. The highest number of teachers (19 participants or 35.2%) have been employed at their school for between 11 and 20 years. A total of 20.4% (11 participants) have between 1 and 5 years of teaching experience. Both the 6 to 10 years and the 21 to 30 years categories each include 9 participants (16.7%). Four respondents (7.4%) have been working at their school for between 31 and 40 years. Of the total sample, one teacher has been employed for less than one year (1.9%), and one for more than 40 years (also 1.9%).

Regarding the type of school in which they are employed, more respondents work in primary schools (31 teachers or 57.4%) compared to those employed in secondary schools (23 teachers or 42.6%).

The second set of questions focused on the recognition of teaching scenarios. Majority of respondents (49 participants or 90.7%) are aware that the teaching scenarios were developed as part of the e-Schools project. The majority of respondents (34 or 63%) are aware that teaching scenarios have been developed for the subject of computer science.

More than half of the respondents (33 participants or 61.1%) have never created their own teaching scenario using the template provided within the e-Schools project. A total of 24.4% (13 participants) have considered creating their own e-Schools teaching scenario, while 14.8% (8 participants) have created one.

The third set of questions focused on the use of pre-existing e-Schools teaching scenarios.

Of the total number of respondents, 38.9% (21 participants) reported that they rarely use teaching scenarios, specifically 1 or 2 times per month. A large portion, specifically 29.6% (16 participants), indicated that they never use the teaching scenarios. Approximately once a week, 20.4% (11 participants) use the prepared teaching scenarios, 7.4% (4 participants) use them 2-3 times per week, while 3.7% (2 participants) stated that they use the scenarios almost every day.

We examined the relationship between the use of teaching scenarios and gender. Based on the Pearson Chi-Square test (3.05) with df (4) and a p-value of 0.549, it was found that there is no statistically significant difference. Therefore, both male and female respondents use the developed teaching scenarios equally.

We also examined the relationship between the use of teaching scenarios and the type of school in which the teachers are employed. Based on the Pearson Chi-Square test (5.25) with df (4) and a p-value of 0.263, it was determined that there is no statistically significant difference. Teachers employed in both primary and secondary schools use the developed teaching scenarios equally.

We were interested in the relationship between the use of teaching scenarios and years of service in the school. Based on the Pearson Chi-Square test (46.51) with df (24) and a p-value of 0.004, it was found that there is a statistically significant difference in the use of teaching scenarios based on years of service in the school. Teachers with more years of experience (11-20 years and 21-30 years) use the prepared teaching scenarios more frequently than those with fewer years of service (1-5 years and 6-10 years). Teachers with more experience have gained greater proficiency in lesson planning. Participation in various professional development programs has enabled them to recognize relevant teaching materials that they can use in their teaching process, and as a result, they will use the prepared teaching scenarios more frequently than their younger colleagues.

Respondents use the teaching scenarios in various domains of the computer science subject.

Table 1. Use of Teaching Scenarios in domains of the computer science Subject.

Domain	Number of respondents	%
Information and Digital Technology	12	27,3 %
Computational Thinking and Programming	11	25,0 %
Digital Literacy and Communication	11	25,0 %
e-Society	10	22,7 %

It is evident from Table 1 that teaching scenarios are used equally across all domains.

Since the teaching scenario is divided into several activities, the respondents were asked whether they use all the proposed activities.

Table 2. Use of All Activities in Teaching Scenarios.

Activities	Broj ispitanika N	%
Yes	4	8,16 %
No	20	40,81 %
Sometimes yes, sometimes no	25	51,02 %

Table 2 shows that respondents will not necessarily use all the proposed activities, which is understandable, as one teaching scenario is written for multiple teaching units. Given this, some activities will be more suitable for teachers, while others will be less suitable.

Teachers also answered statements related to the quality of teaching, which focused on whether using teaching scenarios contributes to greater student motivation to participate in lessons, and whether it allows for the modernization and improvement of the quality of teaching. Respondents were asked to rate their agreement with each statement on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Table 3. Use of Teaching Scenarios to Ensure Teaching Quality.

Statement	Value	Number of Respondents	%
Using prepared teaching scenarios can contribute to greater student motivation to participate in lessons	1	0	0,00
	2	2	4,08
	3	13	26,53

	4	29	59,18
	5	5	10,20
Using prepared teaching scenarios can modernize and improve the quality of teaching	1	0	0,00
	2	1	2,04
	3	20	40,81
	4	21	42,85
	5	7	14,28

It is evident from Table 3 that respondents mostly agree with the statement that teaching scenarios can influence student motivation as well as modernize and improve the teaching process. Teachers need to prepare their lessons. The prepared teaching scenarios provide them with new ideas that they can use in their lessons. Respondents were able to answer this question positively, negatively, or choose a neutral answer.

Table 4. Time Spent Preparing for Lessons Using Teaching Scenarios.

Statement	Answer	Number of Respondents	%
Prepared teaching scenarios can shorten the teacher's preparation time for lessons	Yes	34	68
	No	5	10
	Not sure	11	22

Table 4 shows that teachers believe that using teaching scenarios can shorten the time they spend preparing for lessons, which is understandable, as teaching scenarios provide ideas on how to organize the teaching process based on the learning outcomes that need to be achieved.

In this final part, two open-ended questions were asked with the aim of allowing teachers to express their views on the advantages and disadvantages of using teaching scenarios.

Table 5. Advantages and Disadvantages of Using Teaching Scenarios.

Advantages	Disadvantages
Modernization of teaching	Not always applicable to all students
Quality of teaching	Specificities of each school that are not covered
New ideas for teaching	May contain content that has not been covered earlier
Shortened preparation time	Decreased creativity of teachers
Interesting way of conducting lessons	Technical issues when implementing teaching scenarios
Helps the teacher deliver the lesson in a different way	

Table 5 shows that computer science teachers have recognized both the advantages and disadvantages of the provided teaching scenarios. They appreciate the possibility of receiving new ideas based on which they can deliver their lessons in a different way compared to their usual approach. On the other hand, the recognized disadvantages include the potential issue of the teaching scenario building on content that has not been covered earlier. In the Republic of Croatia, the curriculum-based approach is implemented, which means that the computer science subject curriculum prescribes the learning outcomes for each domain of a specific grade but does not specify the time when each outcome should be realized. As a result, different teaching content can be covered simultaneously in different counties of the Republic of Croatia. Furthermore, since the teaching scenarios suggest the use of various digital tools, technical problems may arise during lesson delivery. Ready-made teaching scenarios can also negatively affect the teacher's creativity if they decide to rely solely on the prepared materials.

The last group of questions referred to the digital tools proposed for use in the teaching scenarios.

Table 6. Digital Tools in Teaching Scenarios.

Mark and/or write the digital tools you use in teaching based on the suggested teaching scenarios.	Digital Educational Tools	Number of Respondents
	MS PowerPoint	45
	MS Word	45
	MS Teams	35
	Mentimeter	20

	Padlet	19
	Canva	26
	Other	Coggle, PosterMyWall, Prezi, Powtoon, OneNote, Forms, Sway, Wordwall, Bookwidgets, Kahoot, Excel, Access, Python, Gorms, Sway, HTML, Notepad, Paint 2D i 3D, Scratch.

Table 6 shows what tools computer science teachers use in teaching scenarios. Accordingly, the most frequently used tools are MS PowerPoint and MS Word. For videoconferencing, they use MS Teams. They also use Canva and Padlet, which offer the possibility to create multimedia posters, worksheets, leaflets, etc. Additionally, when self-reporting, it is evident that teachers/instructors use other tools, such as Prezi or MS Sway, which allow for the creation of more interactive presentations, Powtoon, which allows the creation of digital stories/comics, or Kahoot!, which allows the creation of digital quizzes.

4. Conclusions

Modern education adapts to contemporary students who are users of various digital educational tools. The subject of computer science in primary and secondary schools in the Republic of Croatia follows contemporary trends in the use of digital educational tools for educational purposes. As part of the E-Schools project, which was implemented between 2015 and 2023, teaching scenarios for the subject of computer science were created for the 5th and 6th grades of primary school and the 1st grade of secondary school. The survey aimed to examine the opinions of computer science teachers regarding teaching scenarios. A total of 54 participants responded to the survey. The survey results showed that more women (61.1%) completed the survey. The largest percentage of respondents (35.2%) had 11-20 years of experience, and the majority of respondents are employed in primary schools (57.4%). Although the respondents (63%) are aware that teaching scenarios have been created for the subject of computer science, most (38.9%) use them rarely (1-2 times per month) in their teaching. Teachers and instructors with longer teaching experience (11-20 years and 21-30 years) more frequently use the created teaching scenarios compared to teachers and instructors with less experience (1-5 years and 6-10 years). Encouragingly, teachers and instructors use teaching scenarios equally across all four domains, and only occasionally do most (51.1%) use all the proposed activities. The respondents believe that teaching scenarios influence students' motivation, can modernize and improve the quality of teaching, and shorten the time teachers spend preparing for classes. The respondents use the digital educational tools proposed in the teaching scenarios, which is understandable since the scenarios were developed by long-term employees of educational institutions, meaning the proposed tools are grounded in their practical use.

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