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ONLINE READING IN DIGITAL LEARNING ENVIRONMENTS FOR PRIMARY SCHOOL STUDENTS

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Abstract

Learning environments and teaching methods have been constantly changing over the past decades. As the shift in the learning environment is primarily toward a physical to an online learning environment, this study examines how to enable younger students to select appropriate content for learning in digital learning environments that they can then successfully read and evaluate using appropriate strategies. The study is based on 54 in-depth case studies. Using the Internet reciprocal teaching method (IRT), 54 implementers trained 54 primary school students from first to fifth grade in basic computer skills, Internet information searching, and website navigation, as well as analysing data obtained using the TICA Phase 1, 2, and 3 Checklists, the implementers' report, and the children notes in a text editor. Triangulation of the data in combination with selected statistical methods shows that there are differences in the use of the method between students according to age. While the latter can use an unadopted form of the method, younger students need some adjustments, which are suggested in the light of previous research.
Keywords: *digital literacy, e-reading, primary school, internet reciprocal teaching, online learning*

Introduction

We live in a time of constant and rapid changes that are significantly shaping most areas of human activity, environment, and development. Many try to anticipate trends and tendencies, including educational trends, which can be predicted to some extent by describing models, planning research on future processes, and taking preventive measures (Chan, 2022). One of the current trends is digital literacy in education, which has recently been recognized as one of the basic skills of the 21st century (Siddiq et al., 2017). It refers to all types of digital devices and digital environments (Jin et al., 2020), and is defined in the UNESCO document *A global framework of reference on digital literacy skills for indicator 4.4.2* as: "the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technology for employment, decent jobs and entrepreneurship. It includes competences that are variously referred to as computer literacy, ICT literacy, information literacy and media literacy" (Law et al., 2018, p. 6). With all new technologies, the classroom literacy learning is also changing (Leu et al., 2015), including digital literacy (Leu et al., 2013).

Children must navigate in an environment that even adults sometimes cannot navigate well. Zhang and Duke's (2008) study has shown that reading online requires different reading strategies than reading printed texts. The study of strategies for reading online with different purposes in online reading by adults has identified more than 50 reading strategies that readers use depending on the purpose of reading. The online environment offers unimaginable amount of information that anyone can send out into the world (Zhang & Ghorbani, 2020). When reader reads online, he reads from multiple web pages that often present multiple texts, pictures, videos, and other interactive content. The reader is constantly moving between texts

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and pages (Spiro at al., 2015), dealing with a large amount of information from many different type of sources (hypertext, image, video) (Salmerón et al., 2019) and different types of text (websites, travel reports, stories, magazines and the like) (Forzani et al., 2020) and multiple sources require the reader to constantly deal with increasing amount of information, different formats of the information presented, and different quality of the information received, a big part of information online is not fact-checked and published by a reliable source. In online reading, the reader quickly gets lost in hyper-space with the multitude of web pages and links, the integration of more information also means more text formats, and all the information the reader receives must be critically evaluated (Salmerón et al., 2019). There is also a process of connecting, combining, and organizing information that originates from prior knowledge, self-selected online texts, and discussions during searching for information online (Kiili & Leu, 2019). For the reader to be able to successfully select the correct and relevant information from all the information he receives while reading, he must have advanced reading skills beyond those needed to read analog (i.e., printed) texts. Less proficient readers quickly find themselves unable to overcome the aforementioned challenges due to fatigue, decreased reading speed and comprehension, and decreased reading motivation (Cobb, 2017), which many studies have cited as one of the key elements for successful reading in online environments (Forzani et al., 2020; Leu et al., 2017; Goodwin et al., 2019).

The children of the Generation Alpha (also known as the iGeneration) born after year 2010 are considered the most technologically driven demographic, as they are born and grow up with computers, phones, tablets, and apps and do not know life without these devices (McCrindle & Fell, 2020). They are also characterized by access to information anywhere, anytime (Nagy & Kölcsey, 2017; Tootel et al., 2014). Therefore, one would expect them to successfully use the devices and the opportunities they provide. However, this is not the case. The Stavanger Declaration on the Future of Reading (COST E-READ, 2019) has pointed out that one of the most important aspects of digital technologies that affect children in particular is online reading, because information is processed differently when reading on paper than when reading information on a screen. In addition to the need for more in-depth study of reading in a screen environment, participants in the Stavanger discussion have noted that, contrary to expectations, digital natives have difficulties comprehending longer texts when they read on screen. They have therefore recommended that students must be taught strategies that will enable them to read more deeply even when they are on screen and emphasize that teachers and other educational decision makers need to know that the introduction of digital technologies into schools needs to be considered, as it can have a negative impact on children's reading comprehension and critical thinking development. Other research studies have also shown and confirmed that Generation Alpha students do not have sufficiently developed digital literacy skills to successfully participate in digital learning environments (Delgado et al., 2018; Legvart et al., 2021), which presents us with a particular challenge because the literacy skills children will need tomorrow include skills we do not know today (Leu et al., 2013). As a result of the lack of online reading skills, there are also difficulties in reading for learning (Mullis & Martin, 2020; OECD, 2011), which is what online reading usually is (Lin & Ko, 2019).

Research Problem

So how can we help young readers learn in online reading environments? Brun-Mercer (2019) has said the problem should be addressed strategically, otherwise training and practice should be planned for students to help them overcome the challenges and obstacles they encounter in online reading and move toward digital literacy, which the author defines as being "*able to read with sufficient accuracy, fluency, and ease*" (p. 4). Reading literacy has changed and is no longer what it was before the emergence of digital learning environments

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because, as Leu et al. (2015) have noted, not only are paper-based reading skills required, but also skills associated with searching, evaluating, and integrating online information to come to new knowledge required for new competencies. A method that could provide knowledge to individuals who read and learn online and promotes digital literacy in primary school students, is the Internet reciprocal teaching method (IRT), which was developed with the goal of enabling teachers to prepare their students for 21st century learning and communication (Leu et al., 2008), and which views online reading as a process that involves both traditional and additional skills (Leu et al., 2019). It is based on the already known, tested, and established method of reciprocal learning, which has been shown to be the most effective learning method when students read an offline text. Students work in groups, and the main goal of the method is for students to learn four skills that improve their metacognitive reading comprehension skills: content prediction, asking questions, clarifying the content, and summarizing the content (Palincsar & Brown, 1984). In their meta-analysis study, Rosenshine and Meister (1994) have found a high effect of using this method on students' reading comprehension (effect size coefficient .74). A high effect has occurred regardless of the age, and the effect has been higher when the teacher directly explained and demonstrated the steps of the strategy to the students than when the strategy was used alone.

The main goal of IRT, which was developed for adolescents, is to develop structural elements of student's ability to search for knowledge online and to understand what they read online. The prior knowledge a student needs are basic computer skills, the ability to search the internet and internet navigation skills, while the structural elements of IRT are to ask important questions, locate information, critically evaluate information, synthesize information, and communicate about new knowledge. The student learns this in three steps. In the first step the teacher presents basic computer skills and rules for using the computer in class. In the second step the teacher and the students begin to take responsibility for presenting new strategies and demonstrating, and the third step is about acquiring the ability to independently search for information/knowledge online (Leu et al., 2008).

Research Focus

The aim of the study was to explore whether IRT is an appropriate didactic way to develop competencies for online learning already in primary school. Based on one-to-one teaching directly between an individual single student and one implementer (teacher), which Grasha (2010) has also defined as suitable to develop the ability of learners to work independently, a deeper insight into student digital literacy skills was provided. The research focus was on the following fundamental questions:

1. Which digital competences predominate among younger students?
2. How digital competence develops when implementing the IRT method as an experimental program?
3. What are the peculiarities of implementing the IRT method in primary school, depending on the grade level and gender?

Research Methodology

General Background

In the academic year 2021/2022, from October 2021 to November 2021, the third generation of students of the fourth year of the academic undergraduate program Elementary Education, future teachers from first to fifth or sixth grade in primary school (hereafter implementers), was trained in the use of the IRT method in a 6-hour course. Karakuş and Kılıç

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(2022) report that pre-service teachers have a high level of digital awareness, competence, and fluency, therefore, the choice of students from the point of view of prior knowledge was not arguable. Gradually, from November 2021 to January 2022, they applied their knowledge with elementary school students for the first time (the first two generations of students trained in this field did not have the opportunity due to the actions of COVID). The study was designed as a multiple-case study (Eisenhardt, 1989) and is quasi-experimental in design (Cooper, 2009; Kulikowich, 2008). The effects of a program based on the IRT method on student's digital literacy were examined. Qualitative and quantitative research approaches were used to measure the dependent variables. With the help of the collected data, the phenomenon was comprehensively and thoroughly explained and interpreted in the context of the concrete circumstances.

Ethical Procedures

The implementers sought out the students with whom they conducted the IRT program. All participants volunteered to take part in the study. After an introductory presentation of the goals and purpose of the study, the parents of the participants signed consent for the student's participation. Each student was assigned a code that was used in all steps of the study to ensure the anonymity of all participants.

Sample

The opportunity non-random sample consists of children, students of Slovenian primary schools from first to fifth grade, who were available for teaching due to proximity and acquaintance. Data were obtained from 64 case studies, and valid results were obtained from 54 implementers. The students who participated in the study were students from first (6-year-olds) to fifth (10- year- olds) grade: 34 students from first triennium (10 students from first grade (18.2 %), 14 students from second grade (25.5 %), 10 students from third grade (18.2 %)), and 20 students from second triennium (9 students from fourth grade (16.4 %), and 11 students (20.0 %) from fifth grade).

The data was also collected on the gender of the participating students to answer the question whether there were gender differences in the acquisition of computer skills. Most participants were male students – 30 (55.6 %), one tenth more than female students – 24 (44.4 %).

Instrument and Procedures

Students from first to fifth grade were taught one-on-one how to use information and knowledge in the digital environment. Student progress was monitored in a multiple case study and reinforced through triangulation.

First, the implementers were trained in the actual use and implementation of the IRT method. The training was systematic and was conducted in three 2-hours sets (Table 1).

Table 1
Training

Steps	Context	Content
First step (2 hours)	Theoretical background	Reciprocal teaching IRT
Second step (2 hours)	Practical implementation	Reciprocal teaching First phase of IRT with checklist
Third step 2 hours	Practical implementation	Second and third phase of IRT with checklists

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The implementers conducted a pre-test (student prior knowledge using TICA Phase 1, 2 and 3 Checklist), which they used to check the prior knowledge of the child they will be working with. TICA checklists are a part of TICA project (Teaching Internet Comprehension Skills to Adolescents) (Leu et al., 2008). For this study, not all data obtained using the TICA checklist were used and interpreted, but only those relevant to the objectives of this research. Using a 3-point scale (1 – do not know yet (0 points), 2 – if someone helps him (1 point), 3 – knows (2 points), the implementers checked the student's prior knowledge within context of three checklists. The first checklist tested the computer basics (14 skills), web searching basics (4 skills), and general navigation basics (3 skills) (all together 42 points). Another checklist tested the student's ability to use at least one search engine (1 skill), use some of the basic search strategies (3 skills), use some of the more demanding search strategies (3 skills), read and understand and critically evaluate search engine results (7 skills), and mark and save a web page to return to when needed (1 skill) (all together 30 points). The third checklist tested knowledge of website navigation (7 skills) and website evaluation (11 skills) (all together 36 points). The reliability of the questionnaire was checked with Cronbach's Alpha coefficient, which is .776 and shows good internal consistency.

Based on the results, the implementers decided which IRT phase to start with and when to move to the next step according to the IRT method. The IRT is designed so that the instructor should move to the next step with all the students in the class when most of the students in their class have mastered the skills within that step. During the one-on-on work, the implementers were instructed to track the student's individual progress and skills, and then decide when the student has sufficient knowledge within the current checklist, such that without that knowledge, the student will be able to successfully acquire the knowledge of the next step while acquiring the skills not yet mastered in the current step. The same checklists were used for ongoing monitoring of student's progress.

Six activities were developed for each step phase of IRT. In carrying out the activity, the implementers considered the student's prior knowledge. During the last training, all the activities designed for the research were also presented to the students. All activities were based on the curriculum objectives for educational period or grade that the selected student was attending (Table 2). When searching for appropriate topics it was also made sure that there was enough content in Slovenian language, and the advantage of individual work was also used when the implementers helped the student translate the content into and from a foreign language (which would not be possible when working in a class with several groups of students).

Table 2
Content

	Phase 1	**Phase 2**	**Phase 3**
Activity 1	A personally important question	Reading news in the online newspaper Časoris, which is intended for children, and looking for additional information on the most interesting topic	The student develops his or her own research questions or problems to solve.
Activity 2	Finding answers to student questions about animals	Healthy eating/healthy living	
Activity 3	What would I like to be when I grow up	Miki Muster	
Activity 4	Favourite TV-series	Our planet, our future	
Activity 5	Favourite book	Learning to learn	
Activity 6	My hobby	Holidays at home and in the world	

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After each activity, the implementers completed the report – to obtain quantitative data, they completed the checklist according to the current IRT phase, qualitative data were obtained in two ways. The implementers inserted the student's notes, and at the same time the note in the comments, the steps they and the student took, current problems, dilemmas, the student's questions, his answers, observations, etc. With this data collection method, the triangulation of the data was ensured, as it was used both qualitatively and quantitatively (Denzin, 1978, pp. 219–305). The data collected as part of the checklist were initially verified by qualitative data. Later, the Kruskal-Wallis test was used to check whether there were statistically significant differences between groups of independent variables, the Mann-Whitney test was used when two groups were compared. The data obtained in this way were checked again with the help of implementer's notes. The information obtained from the implementers was transcribed, signified, frequencies were determined, rank types were created, and the results were subsequently interpreted.

Data Analysis

Data collection was designed so that all implementers followed the same program, and reporting was done using the same measurement tools (checklists, students' notes, implementers' report), thus ensuring reliability. In the first phase, the data collected by the implementers were checked, some deficiencies were detected, due to which we excluded incomplete reports from further consideration. The second phase followed, in which the data were processed according to the type of questions. Several procedures were used to analyse the results. Basic descriptive statistics were calculated to define the sample. The results of the pre-test were discussed for each checklist, and in the case of the analysis under the aspect of class influence, they were checked with the Kruskal-Wallis test, and in the case of the gender of the participants, with the Mann-Whitney test. In this way, information was obtained on whether there were differences in acquired computer skills as a function of the observed variable. Further analysis was conducted with respect to student progress in digital literacy. Thus, progress was not monitored as progress on an individual checklist, but as the total sum of all digital literacy skills acquired, since the same number of meetings were not held in all classes, with the implementers following the procedure described in the previous chapter. To examine the dependence between dependent and independent variables, a multivariate MANOVA method was used to determine differences between groups. Data on whether there were statistically significant differences in digital literacy acquisition were examined using Wilk's Λ. To determine how dependent variables differed for the independent variable, the Test of Between-Subjects Effects was observed, and the means were compared by Turkey's HSD test.

Results of Research

Pre-test

To obtain data on the digital literacy of students in grades 1 to 5, a pre-test was conducted, based on three checklists that were analysed in terms of grade level and gender.

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Table 3
Pre-test Results – Grade

Grade	*N*	*M* (Checklist 1)	*M* (Checklist 2)	*M* (Checklist 3)
1	10	17.7	2.4	2.7
2	14	28.0	7.9	9.1
3	10	29.1	8.6	8.4
4	9	33.1	12.8	15.1
5	11	36.5	15.3	20.2

The results of the Kruskal-Wallis test showed that there were statistically significant differences between students' prior knowledge based on the grade attended for all three checklists: Checklist 1: $H(4) = 24.177$, $p = .001$ Checklist 2: $H(4)$: 18.192, $p = .001$; Checklist 3: $H(4) = 19.246$, $p = .001$. The largest differences occurred in basic computer skills, with the greatest variation occurring among the first-grade students that acquired the least knowledge compared to students in the other grades (Table 3) and had significantly lower competencies in using the Internet than the students of higher grades. The results also deviated from the results of the students of the remaining two classes of the first triennium, whose results were at a similar level. The same applied to fourth and fifth grade students. Greater differences between first and other grade students also emerged in testing the ability to find the correct web page, as well as skills related to navigating the web page and assessment, again in terms of skills acquired, with second and third grade students and fourth and fifth grade students differing in their ability to navigate the web page. The older the students, the more skills they had, and more progress was achieved. Very good computer skills (using a computer) were demonstrated by only one student in first triennium, a third-grade student, because of his prior knowledge, gained in computer course (basic computer skills) in school. Because of his prior knowledge, this student progressed significantly faster than his peers. In all grades basic computer skills predominated other researched skills, proportionately supplemented by the skills in finding the right website and navigating the web, and assessments, depending on the age of the students.

It was also checked whether there were gender differences in digital literacy. The mean rank of each checklist for each gender is shown in Table 4.

Table 4
Pre-test Results – Gender

Gender	*N*	*M* (Checklist 1)	*M* (Checklist 2)	*M* (Checklist 3)
Male	30	28.65	29.17	28.28
Female	24	26.06	25.42	26.52

The results of the Mann-Whitney test showed that there were no statistically significant differences between the genders for any of the checklists: Checklist 1: $U = 325.500$, $p = .547$; Checklist 2: $U = 210.000$, $p = .383$; Checklist 3: $U = 336.500$, $p = .680$, so no further analysis was performed.

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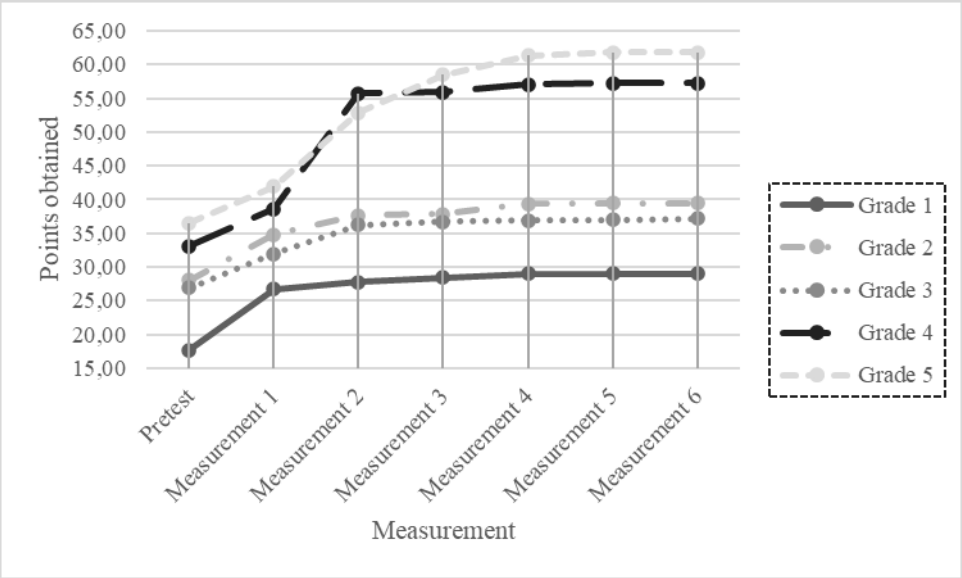
The results presented in Figure 1 show that digital literacy can be successfully developed in students from first to fifth grade, as students made successful progress at all grade levels, as indicated by the mean scores obtained on each measurement (grade 1: $\mu_{pre\text{-}test} = 17.70$, $\mu_{meas.1} = 26.70$, $\mu_{meas.2} = 27.80$, $\mu_{meas.3} = 28.40$, $\mu_{meas.4} = 29.00$, $\mu_{meas.5} = 29.00$, $\mu_{meas.6} = 29.00$; grade 2: $\mu_{pre\text{-}test} = 28.00$, $\mu_{meas.1} = 34.79$, $\mu_{meas.2} = 37.64$, $\mu_{meas.3} = 37.86$, $\mu_{meas.4} = 39.36$, $\mu_{meas.5} = 39.43$, $\mu_{meas.6} = 39.43$; grade 3: $\mu_{pre\text{-}test} = 29.10$, $\mu_{meas.1} = 31.90$, $\mu_{meas.2} = 36.20$, $\mu_{meas.3} = 36.70$, $\mu_{meas.4} = 36.90$, $\mu_{meas.5} = 37.00$, $\mu_{meas.6} = 37.20$; grade 4: $\mu_{pre\text{-}test} = 33.11$, $\mu_{meas.1} = 38.56$, $\mu_{meas.2} = 55.67$, $\mu_{meas.3} = 55.89$, $\mu_{meas.4} = 57.00$, $\mu_{meas.5} = 57.22$, $\mu_{meas.6} = 57.22$; grade 5: $\mu_{pre\text{-}test} = 36.55$, $\mu_{meas.1} = 41.91$, $\mu_{meas.2} = 52.82$, $\mu_{meas.3} = 58.48$, $\mu_{meas.4} = 61.36$, $\mu_{meas.5} = 61.81$, $\mu_{meas.6} = 61.81$). However, progress varied by student age or grade level, with fifth and fourth grade students making the most progress, followed by fourth grade students, and third grade students showing the least progress (Figure 1).

Figure 1

The Average of Points Obtained in Each Measurement According to Grade



The results of the repeated measures analysis of variance showed statistically significant difference in digital literacy acquisition as a function of student grade, F (28, 156) = 2.161, p = .002, Wilk's Λ = .308, partial $\eta 2$ = .255. To determine how the dependent variable differs from the independent variable, the results of Tests of Between-Subjects Effects were considered. The data showed that grade level had a statistically significant effect on scores on all measurements: pre-test: F (4, 49) = 8.373, p = .001; partial $\eta 2$ = .41; first measurement: F (4, 49) = 6.107, p = .001; partial $\eta 2$ = .33; second measurement: F (4, 49) = 7.327, p = .001; partial $\eta 2$ = .37; third measurement: F (4, 49) = 7.449, p = .001; partial $\eta 2$ = .38; fourth measurement: F (4, 49) = 8.688, p = .001; partial $\eta 2$ = .42; fifth measurement: F (4, 49) = 8.901, p = .001; partial $\eta 2$ = .42; sixth measurement: F (4, 49) = 8.869, p = .001; partial $\eta 2$ = .42.

The results and data presented in Figure 1 show that first, second, and third grade students, i.e., first triennium students, made less or slower progress than fourth fifth grade students, i.e., second triennium students. Mean scores were significantly different in: pre-test between grade 1 and 2 (p = .023), grade 1 and 4 (p = .001), grade 1 and 5 (p = .001); first measurement between

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grade 1 and 4 (p = .012), grade 1 and 5 (p = .001), grade 3 and 5 (p = .033); second measurement between grade 1 and 4 (p = .001), grade 1 and 5 (p = .001), grade 2 and 4 (p = .028), grade 3 and 4 (p = .027); third measurement between grade 1 and 4 (p = .003), grade 1 and 5 (p = .001), grade 2 and 5 (p = .014), grade 3 and 5 (p = .003); fourth measurement between grade 1 and 4 (p = .002), grade 1 and 5 (p = .001), grade 2 and 4 (p = .006), grade 3 and 4 (p = .042), grade 3 and 5 (p = .005); fifth measurement between grade 1 and 4 (p = .002), grade 1 and 5 (p = .0001), grade 2 and 5 (p = .005), grade 3 and 4 (p = .040), grade 3 and 5 (p = .005); sixth measurement between grade 1 and 4 (p = .002), grade 1 and 5 (p = .001), grade 2 and 5 (p = .005), grade 3 and 4 (p = .043), grade 3 and 5 (p = .004).

The interpretation in the context of the question of the specifics of the implementation of the IRT method in relation to class proved necessary. The first-grade students had the most problems with the acquisition of digital competences. It was most difficult for implementers to motivate them to participate, as they were mainly interested in playing with their peers (physical play, not digital). For the second and third grade students, the biggest obstacle was the use of the computer, which they themselves see primarily as a means to have fun. The method of working, which was planned for younger and older students alike, proved to be a problem.

One of the main reasons for the differences between younger and older students was the proportion of students who terminated the program earlier. Therefore, the reasons for terminating the program were checked, and the responses were examined from the point of view of the grade level of the students. The Pearson Chi-Square results indicated that the class the student was attending was a factor influencing the reason for termination $\chi 2$ (16, 54) = 31.862, p = .010.

Table 5

Reasons for the Termination of the Implementation of the Program

Grade	Highest level reached	Corona	Too demanding	No reason given	Other	Total
1	0	1	9	0	0	10
2	0	0	12	0	2	14
3	0	0	7	1	2	10
4	1	2	3	3	0	9
5	2	4	2	2	1	11
Total	3	7	33	6	5	54

The data presented in Table 5 show that the program was completed only in the case of second triennium students due to highest level reached – the acquisition of all digital competencies checked in checklists 1, 2, and 3. This is also the case with Corona as a reason for early termination, where the answers were placed that the students were oversaturated with computer work due class quarantines and the quarantine of both the implementers and the students, which did not allow the program to be fully implemented in time. The majority of implementers stopped the program because using the computer proved to be too challenging for students, with responses classified as not continuing the program because the student was not showing progress, the steps needed to take computer actions (for example saving the website and the like), are too demanding (not understandable for younger students), younger students rather wanted to play outside looking for unicorns, playing football, or playing a board game. Most of these responses were at the first triennium level (85 %). A few implementers did not

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give any reasons, and there were also responses that were included in the category "Other". In one case parents did not allow the continuation of the program because they were afraid that their child would be spoiled by using the computer too often and would want to use it too often, one student had an old computer and a bad internet connection, which meant that she had no motivation to work at all because sometimes she had to wait a few minutes for the website to load. Among the responses was also the answer that the student only wants and know how to use computer to play computer games.

Discussion

The starting point of the research was a qualitative study that evaluated the implementation of IRT for primary school students, finding that it is most appropriate for second triennium students, but that some adaptations are needed for younger first triennium students. The research participants pointed out that the IRT method is particularly valuable for the teacher, as it provides him/her with an opportunity and a tool for working in the classroom (Kordigel Aberšek & Kerneža, 2022) and the results of the presented quasi-experimental study confirmed the findings of the initial study. Teaching with the IRT is suitable for fourth and fifth grade students, and seems to be suitable for first to third grade students as well, but adaptations are needed for implementation at a lower school level (from first to third grade), as learning according to the IRT method is too demanding for them (implementers received the same instructions for implementation, regardless of the age of the students, based on the basic steps of the method.)

As part of research question 1, it was explored which digital competences predominate among younger students. The results of the study showed that younger students have significantly lower competencies in using the Internet than the students of higher grades, which is related to both basic computer skills and the skills children need for successful online learning, which is consistent with previous research, for example, by researchers Delgado et al. (2018), Legvart et al. (2021) and Legvart et al. (2022). Forzani and Leu (2012, p. 6) said that students need to start learning new literacy skills early if they are to adopt them by adulthood, which is not only necessary for them, but will also determine their future. Computer literacy emerged as the biggest problem based on the research results. Although the implementers were instructed that they could run the given program on any device (computer, mobile phone, tablet, etc., they all chose to use a computer, which was not a barrier for older students who were acquiring basic computer shills through the emergency distance learning. In future research, it would be interesting to introduce a tablet or mobile phone in half of monitored cases as a variable, since children are more accustomed to use this kind of devices (devices on touch) instead of a computer. Gorghiu et al. (2021, p. 716) even referred to mobile education as one of the most important achievements at the beginning of the 21st century. Mobile devices offer many opportunities for work, such as adding ideas and bookmarks, reading e-books, sharing information, assessing, and making photos etc., but they must be used properly and effectively, and children must also be involved in the learning process (Lamanauskas et al., 2020, p. 150).

The answer to the question on how digital literacy develops when the IRT method is implemented as an experimental program, was also addressed. IRT method was found to be suitable for developing digital literacy even in students from first to fifth grade, and a difference in the level of progress was found – older students made greater progress than younger ones. Leu et al. (2015) recommended a short research project with a partner for the younger students, which should be conducted on a single website, and the students should write their notes in a kind of Internet research journal. The fact that work on the Internet can quickly become too extensive and that students can get lost in their search for information was also confirmed, and it would be worthwhile to try out the option of shorter research. More time should be devoted

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to the basic acquisition of computer skills in the form of computer course or club for younger students. The second triennium students had the most problems not due to the lack of skills or motivation, but due to the oversaturation with computer work (the study was conducted during the Corona quarantine for people with risky contact, which means that the children were still often learning from home (some implementers reported about several consecutive isolations), which for the fourth and fifth grade students usually meant working many hours on and with the computers. It is important to point out that students in the higher grades also progressed successfully using the standard method of IRT, which means that major adaptations for older students are not necessary, but of course one must assume possible specific situations in the classroom. An element that could have affected the results of students of all ages, are the characteristics of pairs. Collaborative learning and research with peers are of great importance in the IRT method (Palincsar & Brown, 1984), and the program was designed so that the teacher implementers worked with the students one-to-one, i.e., they were his learning partners. In future research, the work should be planned so that the implementer leads the work of two participating children (working in pairs is also recommended by Leu et al. (2015)). In this way, the real purpose of the reciprocal teaching method would be achieved, and the possible influence of the implementer would be limited.

The third research question, related to the peculiarities of implementation of the IRT method in first five grades of primary school, depending on the grade level and gender, can also be answered. Gender was found to have no effect on the success of acquiring digital literacy skills. In examining other research that also addressed reading and learning in digital learning, conflicting reports were found. Yukselturk and Bulut (2009) examined gender differences in an online self-regulated learning environment and reported that there were no statistically significant mean differences among motivational beliefs, self-regulated learning variables and achievement in programming with respect to gender. Wu (2014), using data from the PISA database, found that girls performed better on knowledge of metacognitive strategies, navigation skills and printed reading assessment, but not in case of electronic reading assessment. Maximova (2020) also observed no differences in reading comprehension between male and female readers when reading online in the context of foreign language instruction. Other researchers reported that they have encountered significant differences between genders in their studies. Liu and Huang (2008) reported that female readers had a stronger preference for paper as a reading medium than male readers, whereas male readers exhibited a greater degree of satisfaction with online reading and concluded that genders differ on the dimensions of selective reading and sustained attention. Gender differences had also been reported by Cai and Du (2017), who said that men have more positive attitudes toward technology use than females, and that women have a lower attitude toward technology use than males. Contrasting research findings suggest that online reading and learning is a multidimensional construct that should be examined as such in future research.

Conclusions

Are we failing in integrating new literacies into primary grades? It is difficult to set a limit to what constitutes failure in this case, since there are not yet guidelines in this area (for example, in the form of a curriculum). But considering the future that is emerging not only in the school environment but in Society 5.0 (Industry 4.0) in general, an education is the foundation for this, the right answer could be: Yes. Children meet the digital world at the earliest, most tender age. Usually by getting their hands on a device whose functionality, purpose, etc. is not introduced to them by anyone, but through their research they discover the possibilities that the device offers them, while operating the device in a way that they discovered themselves and that is not necessarily optimal/appropriate. How to do it? With older students with using

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the IRT method, and with younger students with using an adaptation of the method, which still needs to be developed and researched for use with the youngest. Based on the results, working according to a specific program for the first grade is recommended. According to the data obtained for the other grades, the students could work according to the same program, i.e., the same program for the students of the second and third grade and the same program for the students of the fourth and fifth grade.

What also proved to be extremely important in the present research is that despite the fact that the critical use of the online environment is discussed, we are talking about children whose greatest need is still to look for shiny unicorns, play football, and enjoy themselves in their free time in contact with their peers.

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Declaration of Interest

The authors declare no competing interest.

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