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TEACHING METACOGNITIVE READING STRATEGIES TO PRIMARY SCHOOL STUDENTS THROUGH DIGITAL GAMES

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Abstract

Digital platforms have expanded technology-based instruction, providing teachers with a wide range of diverse applications. This study examines the impact of digital games and activities that aim to teach metacognitive reading strategies to primary school students on the attitudes towards reading, as well as on the metacognitive knowledge and skills. Teaching resources have been created in various digital programs such as Power point or Word wall. Digital games and activities aim to develop both metacognitive knowledge (before, during and after reading) and metacognitive skills through strategies such as visualization, self-monitoring and summarization. Tested during speech therapy classes on a number of 30 students with reading difficulties, the digital activities obtained high indicators of effectiveness, both in terms of the attractiveness of the items and the attitude toward reading (measured pre- and post-test with The Elementary Reading Attitude Survey), as well as in terms of metacognitive knowledge and skills during reading (measured pre- and post-test with the Metacomprehension Strategy Index.

Keywords: Digital games, instruction, metacognitive reading strategies, primary school, reading attitude, technology

1. Introduction

The school environment is constantly faced with various challenges, which determine the need for temporary or permanent adaptations of the education system. The period we have gone through in recent years, marked by the emergence of the COVID-19, has led to radical transformations in the educational process, forcing teachers and students alike to adapt to a new type of instruction, based on the online environment. The element of novelty was not the digitization itself, since it started more than two decades ago, but its exclusivity. Too much digitization resulted in the rejection of online learning by some users, while others kept the positive elements from the previous experience, such as education in a hybrid system or the continued use of valuable digital resources created during the pandemic.

The present study is the partisan of the preservation and use of digital resources as a method and means of instruction, and this because the online environment represents the present and the future (Iepure et al., 2020) and is molded with the quality of the digital native student. Student-centered learning calls for the inclusion of technology in all components of the educational system. In addition, through its highly energizing character, digital education makes a valuable contribution to the education of all children, regardless of individual characteristics. For the youngest students, play is the friendliest teaching method. By bringing non-formal elements from the child's world into a formal setting, didactic games acquire special affective values that favor the creation of a climate conducive to learning. The success of digital games was due to this very consideration, so the model was taken over and transposed in pedagogy, at the level of all school subjects. Catalano (2014, p. 81) describes e-games as "that category of games that, under the dome of entertainment and fun, induces certain types of learning that in turn involve the achievement of certain objectives specified in the school curriculum, with a higher degree or less general". Compared to traditional didactic games, e-games include technology-specific elements such as screen, mouse, graphics, animations, instructions, visual or auditory rewards (Albulescu & Crișan, 2019) and have a permanent character, in the sense that they can be played anytime if there is a device or internet access. They can be played individually, in which case they require digital skills, or together with the teacher, who plays the role of learning mediator, and the effective use of technology in the classroom depends on motivation, intention and skills, and behavior control (Rad et al., 2022).

E-games can be adapted to any age group or learning level. For students who have certain difficulties in acquiring or applying the curriculum content, e-games increase the degree of involvement and keep the attention focused for a longer period of time.

Digital education allows a metacognitive approach to learning, which corresponds to the educational ideal of the Romanian school to form an autonomous personality. Through metacognition, which is cognition about one's own cognition, students plan, monitor, evaluate, and regulate their learning, processes that lead to autonomous and effective learning. In this context, technology has an instrumental function, being a fast and accessible means of self-regulation. Digital educational programs help the student through the stages of learning by providing immediate feedback and thus the student can monitor and adjust his answers.

In schools, learning is largely based on reading skills, regardless of school subjects. Students who have low reading comprehension skills cannot achieve an optimal level of autonomy in learning. Comprehension of texts is related to a number of factors related to text, context and person (Pamfil,

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2016). However, a low level of one of the predictive variables of comprehension can be compensated by reading strategies from expert readers. Studies have shown that experienced readers, even of young school age, are more aware of a series of metacognitive reading strategies such as predicting, activating prior knowledge, clarifying, questioning, visualizing or monitoring when reading texts or solving tasks that involve reading texts (Anastasiou & Griva, 2009; Baker & Beall, 2014). Also, the participation of poor readers in metacognitive intervention programs increased the level of comprehension of the texts (Mirandola et al., 2018; Wing, 2017; Pecjak & Pirc, 2018), which highlights the fact that metacognitive strategies can be taught by teachers. "An effective pedagogy must be metacognitive" (Bocoș, 2013, p. 58), value self-reflection, self-control and self-direction in learning.

2.   Problem Statement

Improving students' reading skills is a priority of the educational system. A number of effective methods and strategies have been proposed over time to reduce reading difficulties. Interventions based on teaching metacognitive reading strategies are a promising field even for younger students with reading difficulties, but there are few studies that highlight the effectiveness of teaching these strategies in today's digital environment. On the other hand, several shortcomings have been pointed out by researchers regarding e-games. For example, Albulescu and Crișan (2019) point out that they are often used for their spectacularism, without taking into account the individual characteristics of the students or the operational objectives. Also, Catalano (2014) mentions among the limits of the use of digital games the difficulty of obtaining feed-back, both in terms of the emotions and opinions experienced by students and in terms of the fulfilment of the educational goal. Digital games should initially be mediated by a teacher, especially for students with low reading skills who require individualized instructional support. However, classroom teachers have limited time resources, so multidisciplinary teams made up of school counsellors, support teachers or speech therapists have been created in schools to offer personalized therapies to these children. Digital games are better monitored in individual therapies, as a specialist is present during the intervention and can observe emotional reactions as well as the learning progress. Furthermore, teaching metacognitive strategies involves thinking aloud, which provides immediate feedback to the teacher on the effectiveness of the electronic intervention.

3.   Research Questions

i.   Are digital games and activities an effective teaching-learning tool for students with reading difficulties?

ii.   Can speech therapy sessions meet the instructional needs of students with reading difficulties?

iii. Can digital games and activities increase the attitude towards reading in struggle readers?

iv.   Can digital games and activities improve knowledge related to metacognitive reading strategies in primary school students?

4. Purpose of the Study

The purpose of this study is to examine the impact of digital games and activities that aim to teach metacognitive reading strategies to primary school students on the attitudes towards reading, as well as on the metacognitive knowledge and skills.

5. Research Methods

5.1. Subjects

30 primary school students with reading difficulties participated in this study. The subjects come from five urban schools, 13 of them being boys and 17 being girls. A number of 12 of the students are in third grade and 18 students are in fourth grade. The students were selected by five speech therapists who work in the respective unit, the reading difficulties being evaluated through tests of decoding, fluency, and comprehension of the texts. The students do not present any other disorders or disabilities and do not hold a school or professional guidance certificate.

5.2. Instruments

Before the intervention and after the intervention, a questionnaire that measures the attitude towards reading and a questionnaire to evaluate the knowledge of metacognitive reading strategies were applied. In addition, an observation sheet of the students' behaviour during the activities was completed.

The Elementary Reading Attitude Survey -ERAS (McKenna & Kear, 1990) was translated and adapted by the authors of the paper. The instrument is divided into two sections: a. recreational reading (10 items) and b. academic reading (10 items). After reading each item, subjects circle the extent to which that statement corresponds to them by circling one emotion out of four possible: very happy, a little happy, a little angry, and very angry. Scores for each item range from 1 (very angry) to 4 (very happy), the overall score being obtained by adding up the answers. After adapting the instrument, good psychometric qualities were found, the alpha coefficients being: .91 for the recreational attitude, .84 for the academic attitude and .92 for the general attitude.

Metacomprehension Strategy Index - MSI, Schmitt (1990) was translated and adapted in a previous study by the authors of the paper. The MSI contains 25 multiple-choice items and investigates awareness of the use of metacognitive strategies for understanding narrative texts before (10 items), after (5 items) and during reading (10 items). Each statement is accompanied by four answer options (A, B, C, D). Subjects circle the activity that helps them the most when reading a story. Each correct answer is rated with 1 point. The metacognitive strategies evaluated by this questionnaire are: a) prediction and verification (7 items); b) preview (2 items); c) setting the goal (3 items); d) self-questioning (3 items); e) activating prior knowledge (6 items) and f) summarizing and applying remedial strategies (4 items).

The behavior observation sheet was completed by the speech therapists and contains information related to the emotional reactions of the students during the activities, the interest in the task - the manifestation of the desire to play or resume a game and the progress made, through the correctness of the answers.

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5.3. Intervention procedure

The intervention program is an exploratory one, the main purpose being to test the attractiveness and efficiency of digital materials in teaching-learning metacognitive reading strategies. The digital games and activities were created by the authors of the paper through Wordwall and PowerPoint software applications and aim to develop both metacognitive knowledge (before, during and after reading) and metacognitive skills such as visualization, self-monitoring, summarization and monitoring. All links to these activities were organized in a site made available to the experimenters in this study (https://sites.google.com/view/citire-metacognitiva). They are open educational resources and can be used by all specialists interested in teaching metacognitive reading strategies.

The duration of the intervention was four weeks, each subject participating in a number of 8 sessions of 20 minutes each. Different games and activities were selected for each student based on the feedback provided during the sessions. The common content sample was that related to teaching metacognitive knowledge.

The first part of the program focused on teaching metacognitive knowledge. The metacognitive knowledge about the strategies used before, during and after reading was taken and adapted from the Meta comprehension Strategy Index-MSI (Schmitt, 1990), so the evaluation of this component was a formative one. In the first phase, students were presented with a material about the thoughts in our mind and how to externalize them. With the help of a character (a puppy) presented in twenty poses, the character's thinking was modeled. First the teacher offered one or more thinking options out loud, then students imagined what was in the puppy's mind using the cues in the picture: the puppy's facial expressions, body position, and surrounding objects (e.g., a bone, a fence, a flower, a ball).

Once this phase was understood, we moved on to the activity "I see, I think, I ask" in which both images, written texts and worksheets from the curriculum were presented. By modeling out loud the students were encouraged to analyze the images in depth, identify the thoughts that come to mind and ask what the purpose of each material presented would be.

The next step was to present a PowerPoint material focused only on metacognition and the role of metacognition in reading. With the help of a 3D character representing a teacher sitting on clouds holding many books in her hands, students were introduced to the thoughts of an expert reader. The image was specially selected, to reinforce the idea represented by meta, meaning beyond or looking from above. On each slide, the character dialogues with the reader, revealing the secrets of effective reading.

Finally, three games were created through the Wordwall platform, representing the metacognitive strategies as described in the MSI: strategies before, during and after reading. Each game has three variations to play: Random cards, Open the box and Flash cards. We chose these variants because they involve different ways and processes of learning. The Random card game selects one strategy at a time, the Open box game keeps all strategies on the screen, while the Flash cards allow the player to confirm the use of that strategy. In addition, the Flash card template is accompanied by a soothing musical background, which activates the reflective component of thinking. During the game, the teacher modeled each statement by thinking aloud procedure. Students were always encouraged to externalize their thoughts by providing examples of their own thoughts based on the pictures that accompanied each statement.

The second part of the program was based on the school curriculum, as most of the texts and images were taken from the school textbooks and the reading bibliography of the primary school students. Although in achieving the didactic objectives the speech therapist has the freedom to select didactic materials that do not belong to the curriculum, we decided that they should be from the school curriculum, precisely to increase the attitude towards academic reading and improve the motivation for reading. The digital materials created focused in particular on prediction, visualization, summarization and monitoring.

The modeling of the metacognitive strategy of prediction was a curriculum-based one. A first category of games focused on acquiring an overview of the texts and authors from the Romanian language and literature school textbooks. All the titles, images and authors of the respective texts were taken from the digital textbooks on the website www.manuale.edu.ro, the students' task being to associate the title, author and image of each text. An image, an author and four title variants were displayed on the digital screen, the students' task being to associate or predict the title based on the image. Since there are alternative textbooks, games were created in Wordwall to include as many text titles as possible from most Romanian language and literature textbooks. In total, a number of 21 games were created, distributed as follows: 2nd class - two games, 3rd class - thirteen games and 4th class - six games. Through these games, the students were trained to carefully analyze the image to predict the title, but also to appreciate the appropriateness between the title of the text and the image proposed by the illustrators. The template of these games was Quiz or Win or lose quiz.

Other types of games focused on predicting the title based on the picture were Flash cards or Image quiz. The Flash cards contained a picture and three titles, with the correct answer on the back of the card. The Image quizzes are similar to a covered puzzle, which gradually reveals a piece of the picture, with the player tasked with guessing the title of the story as quickly as possible.

The metacognitive strategy of visualization was trained through PowerPoint activities. Each slide contains a text and images corresponding to the characters, objects or activities in the texts, the student's task being to assemble the parts into a meaningful whole. By thinking aloud, the teacher and student externalized their mental activity images when reading words and sentences.

To model the summarization, Wordwall activities such as Ranking, Labelled diagram and Win or lose quiz were created. In Ranking games, students are tasked with ordering the main ideas of the text, and in Labelled diagram games, the player reads the text on the screen and places the label (main idea) next to the corresponding fragment. Win or lose quiz activities present a piece of text and ask the student to identify the main idea. In addition, the player chooses a bet from four possible ones. The more the player bets, the more he wins. The game is on levels, so each correct answer attracts higher bets for the following texts.

Monitoring was modeled in all activities, but specific tasks were also designed in PowerPoint in which the student read a fragment, answered a question, being asked to indicate, whether the information was from the text or was a deduction based on the information from the text. These answer options were included in separate slides, precisely to highlight the importance of monitoring. This type of task proves its effectiveness especially in school assignments and assessments, where students must constantly check the correctness of their answers.

6. Findings

The descriptive analysis of the data indicates a low general level of awareness of metacognitive strategies in the pre-test (M=7.97 out of a possible maximum of 25) and medium in the post-test (M=16.16). The reading attitude is medium-low in the pre-test (M=46.8 out of a total of 80) and medium in the post-test (M=57.2). Inferential analysis indicated that these differences were statistically significant (Table 1).

Table 1. Mean values for awareness of metacognitive strategies and attitude towards reading before and after participating in the intervention program

Dependent variable	Before	After	T-test
Metacognitive reading strategies	M=7.97	M=16.16	-7.511(sig.<0.001)
Attitude toward reading	M=46.8	M=57.2	-5.075(sig<0.001)

Regarding the observations of the experimenters during the activities, the main finding is that the students show positive emotions such as joy, delight given and negative ones such as frustration, anger or sadness during the activities. Students have focused attention during the games and in the vast majority of cases completed the tasks. A preoccupation with computer feedback was also found, even when experimenters confirmed the correct answer beforehand. Among the activity templates proposed in Wordwall, the favorite was win or lose the test, whose goal is to earn as many points as possible.

7. Conclusions

The purpose of this study was to test the effectiveness of using digital games in the teaching-learning of metacognitive strategies for reading comprehension.

The results demonstrated that games and digital activities in Wordwall and PowerPoint increased the knowledge related to the use of metacognitive strategies from a low level to a medium level. The digital activities increased the knowledge related to the strategies, but we cannot say that these strategies were internalized, automated and applied in the reading of the texts, especially since the duration of the intervention was reduced. However, the awareness of metacognitive strategies is a first step in improving reading skills.

The data also revealed an increase in the level of attitude towards academic and recreational reading. Students with reading difficulties tend to avoid or abandon tasks that involve reading, as this is an area they cannot master. Digital games, through imaging and interactivity, keep attention focused on the task and increase student engagement. Reading becomes a game, being more pleasant and attractive. The musical background introduces the students to a state of relaxation, which reduces the possible effects related to lack of interest. Even those with low attitude are happy to complete the tasks.

Additionally, the feedback is objective and provided by a robot rather than a human, which reduces frustration in the event of a wrong answer. Even though they were told that the game maker was the author of the research, the students eagerly awaited the computer's feedback. This fact indicates a high trust in an external, objective device, compared to the human, subjective factor. An assessment made by a professor is often perceived as subjective, and accompanied by a judgment of personal value, which does

not apply to robot evaluators. With all these advantages, children should still be warned that there are people behind computers, and that information needs to be analysed and filtered.

From the observations gathered during the activities and from the conversations with the students participating in the study, it was found that among the favorite games were those with the template Win or lose the quiz. This type of game is one of betting on a number of points, and the more certain the player is on the correctness of the answer, the more points he can win. Although the motivation is external, the level of concentration of the student's attention is at the highest level, the items being processed in depth. For example, some children read the text more than three times in order to bet on as many points as possible. This type of activity is closest to the specifics of speech therapy, where the exercises are progressive and repetitive, until the new skill is mastered.

Future research should focus more on the effectiveness of digital games in improving reading comprehension and metacognition. The non-formal educational environment is concerned with the creation of virtual realities. As an example, a major social networking company has changed its name to Meta, promising to create a split reality where people will be able to participate in various activities imitating everyday life. Similarly, in the field of reading, the reader could be a holograph who will not only view himself as a reader, but also intervene by accessing the reflections of expert readers. Advanced technology could create a metacognitive reading metaverse, where one's own mind while reading is outsourced and thus used as a model for students with lower reading skills.

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