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Development of Metacognitive Skills through Digital Narratives in Higher Education

Desarrollo de habilidades metacognitivas a través de narrativas digitales en la educación superior

Desenvolvimento de habilidades metacognitivas através de narrativas digitais no ensino superior

Yuliana Lavrysh (1) https://orcid.org/0000-0001-7713-120X
Mariya Leshchenko (2) https://orcid.org/0000-0003-4121-565X
Larysa Tymchuk (3) https://orcid.org/0000-0003-4678-2362

(1) Igor Sikorsky Kyiv Polytechnic Institute, Ukraine
(2) Jan Kochanowski University, Poland
(3) Ivan Cherniakhovsky National Defence University, Ukraine
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Abstract

This paper focuses on metacognition facilitation through digital narratives. The objectives of the study were to explore how the creation of digital narratives strengthens the formation of metacognitive skills, and which teaching practices promote awareness of learning. The process of digital narrative creation connects literacy, language, technologies, and metacognitive planning, debugging, monitoring, and assessment strategies. A metacognitive awareness inventory questionnaire was used to assess the level of metacognitive skill formation, and content analysis and descriptive statistics were employed to analyze interviews and discussions. The study involved engineering and pedagogy students from three universities. Findings demonstrated improved metacognition subject to the implementation of appropriate teaching practices and the existence of an educational partnership between students and teachers. The most relevant practices were identified, and it was concluded that digital narratives may be an efficient strategy for the development of metacognitive skills including knowledge about cognition and regulation of cognition.

Keywords: cognitive processes, skills, digital narratives, self evaluation

Resumen

Este artículo se centra en la facilitación de la metacognición a través de narrativas digitales. El objetivo del estudio fue explorar cómo la creación de narrativas digitales potencia la formación de habilidades metacognitivas y qué prácticas docentes promueven la conciencia del aprendizaje. El proceso de creación de narrativas digitales une la alfabetización, el lenguaje, las tecnologías y las estrategias metacognitivas de planificación, depuración, seguimiento y evaluación. Se utilizó un cuestionario de inventario de conciencia metacognitiva para evaluar el nivel de formación de habilidades metacognitivas y se recurrió al análisis de contenido y a estadísticas descriptivas para analizar entrevistas y discusiones. Participaron en el estudio estudiantes de ingeniería y pedagogía de tres universidades. Los resultados demuestran la mejora de la

metacognición, siempre y cuando se apliquen prácticas docentes adecuadas y exista una colaboración educativa entre estudiantes y profesores. Se identificaron las prácticas más relevantes y se concluyó que las narrativas digitales pueden ser una estrategia eficiente para el desarrollo de habilidades metacognitivas, entre ellas el conocimiento sobre la cognición y la regulación de la cognición.

Palabras clave: cognición, habilidades, narrativas digitales, autoevaluación

Resumo

Este artigo enfoca a facilitação da metacognição através de narrativas digitais. O objetivo do estudo foi explorar como a criação de narrativas digitais potencializa a formação de habilidades metacognitivas e quais práticas docentes promovem a consciência da aprendizagem. O processo de criação de narrativas digitais une a alfabetização, a linguagem, as tecnologias e as estratégias metacognitivas de planejamento, depuração, seguimento e avaliação. Um questionário de inventário de consciência metacognitiva foi usado para avaliar o nível de formação de habilidades metacognitivas e se utilizou análise de conteúdo e estatística descritiva para analisar entrevistas e discussões. Participaram do estudo estudantes de engenharia e pedagogia de três universidades. Os resultados demonstram a melhoria da metacognição, desde que se apliquem as práticas docentes adequadas e exista uma colaboração educativa entre alunos e professores. Foram identificadas as práticas mais relevantes onde se concluiu que as narrativas digitais podem ser uma estratégia eficiente para o desenvolvimento de habilidades metacognitivas, incluindo o conhecimento sobre a cognição e a regulação da cognição.

Palavras-chave: cognição, habilidades, narrativas digitais, autoavaliação

I. Introduction

Mankind in the XXI century is undergoing critical transformational changes, globally and on multiple levels, due to the rapid evolution of digital technologies and the challenges of today's world. The use of modern technologies in education should play a key role in creating the necessary conditions for self-development, the activation of cognitive, metacognitive, and creative processes, and the formation and development of personalized e-learning skills. The global expansion of information and communication networks requires an upgrading of teaching content and quality, legitimizes the transformation of traditional educational models into integrative, dynamic, and technological approaches, and provides an outlet for the cognitive, metacognitive, and creative potential of students.

Studies in the international educational space demonstrate the spontaneous emergence and diffusion of digital narratives in social networks, the far-reaching expansion of biographical digital narratives in modern mass media, and the purposeful use of various types of narratives in the advertising industry. So far, there has been little discussion about the problem of improving the quality of teaching while implementing digital narratives, and their use in forming 21st-century competencies: the development of metacognitive, creative, communicative, and technological skills, and motivation for continuous self-development (van Aswegen et al., 2019; Mahdavi, 2014). Much uncertainty still surrounds the need to make the educational process personalized and attractive to students, and the insufficient use of digital biographical narratives as a means of increasing interest in learning and infusing learning with individual-oriented characteristics.

Philosophy interprets narrative as a way to achieve social goals and awareness of personal identity, as well as a means of self-identification (Currie, 1998). Narrative is a way of understanding the world through people's stories. We perceive the events and situations that take place around us as stories, and perceive ourselves and other people as participants of these stories. American scientist and founder of narrative theory Jerome Bruner (2004) claims, "The meaning of human behaviour is expressed in the story, not in logical formulas and laws. A person achieves self-understanding through narrative, focusing on important moments of life" (Bruner, 2004, p. 23). We support this idea and consider narratives a powerful tool for the development of metacognitive skills.

We are inclined to believe that the purpose of narrative practices is to create space for the development of alternative desired stories so that students feel able to influence their own lives or construct the trajectory of their professional self-realization. Therefore, it is necessary to take into account the social, cultural, and historical context in which knowledge is generated. Everyone's life is polyhistorical. With this in mind, the teacher may not know what is the "right" development for a given person; we do not know which "example" leads the student to self-realization. Hence, the focus is on the student's personality, values, knowledge, experience, and skills reflected through narratives. From this perspective, we contemplate the formation of metacognitive skills through narratives as a way to organize and interpret the educational content of a discipline, taking into account students' subjective positions, personal experience, professional needs, and life attitudes.

The study was designed to provide a tangible educational experience that will improve academic achievement and foster students' employability skills. Therefore, the goal of the paper is to introduce a practical experience of metacognition enhancement. The objectives of the study are to explore 1) how digital narrative creation strengthens the formation of metacognitive skills, and 2) which teaching practices promote metacognitive awareness of learning that is strongly correlated with professional training at university.

1.1 Theoretical background

In global educational practices, narrative learning strategies are quite common, as they are considered part of the personal-creative paradigm of self-development. A leading researcher in the introduction of narrative in educational processes, American scientist Bruner (2004), emphasizes that a person is set up to tell stories to organize disparate information into a single whole and share results with others. If students are allowed to develop and use this natural gift, they will gradually acquire the necessary communicative competencies, a sense of self-confidence, which in turn helps to develop divergent intellectual skills.

The method of "short reflective narratives" was introduced by Nygren and Blom (2001), who described it as an alternative method to find out how people experience events and reflect on them. The researchers claimed that narratives and follow-up interpretation help people to evaluate the impact of the event. When people reflect on their experience and feelings, they disclose the real meaning of the event.

Hokanson et al. (2018) define the objectives of combining narratives and modern educational technologies: the development of creative and critical thinking, the ability to analyze one's own experience, lifelong learning skills, and self-organization skills. These ideas are supported by research by Hiver et al. (2020). Authors consider narrative as a creative space for a constructive activity to reflect on and reevaluate one's own life. Research shows that when students are involved in the process of creating narratives, they must create an authentic product by synthesizing a variety of skills: research, writing, presentation, interviewing, and at the same time, interpersonal and technological skills.

In that respect, we view digital narratives as a strategy of constructivism theory because students are involved in knowledge construction while creating narratives. Constructivist learning implies self-reflection and an understanding of the learning and thinking processes. Thus, constructivism theory is closely connected with metacognition. To ensure a high level of metacognitive ability or "metacomprehension" (Griffin et al., 2008, p. 96), students should assess information, apply adequate information-processing strategies, and monitor personal cognition. These skills can be developed in the process of digital storytelling. Widespread metacognition teaching strategies suggested by researchers (Clandinin & Caine, 2013) include thinking journals, reflection essays, self-directed learning, exam wrappers, metacognitive talks, and reflexive thinking. Digital narratives are a less common strategy; however, they enhance the development of self-questioning through journals and exam wrappers, planning through essays, and monitoring comprehension or results through metacognitive talks. Therefore, we observe a meaningful correlation between digital narratives and metacognition development. Moreover, this strategy adds interactivity, multimodality, and creativity to the learning process.

The design of digital narratives in higher education institutions, according to Hung (2019), is associated with efforts to increase the efficiency of the educational process by activating channels of perception and creating

opportunities for transformation and personal presentation of educational content through digital narratives.

The use of digital narratives in pedagogical practices is substantiated by several positive factors:

- Digital narratives can be presented in compelling and emotional formats that are interactive in nature;
- Digital narratives can be posted on websites, blogs, and social networks for peer assessment;
- Digital stories are created using educational technologies;
- The process of creating and perceiving digital narratives deepens students' comprehension of educational material;
- Digital narratives allow students to express complex ideas and broad cultural discourses through the use of multiple media in a tightly compressed format;
- Digital narratives foster metacognitive skills like self-reflection, planning, and self-assessment.

There is an evident connection between narratives and metacognitive skills due to the personal nature of narratives, self-perception, and self-presentation. McTavish (2008) defines metacognition as complex, multilevel, autonomous and systemic mental formations aimed at the organization, regulation, and coordination of primary cognitive processes as crucial skills for professional self-realization. Thus, according to Hacker et al. (2009), metacognition is a universal function that controls and regulates all cognitive processes as well as educational activities. Researchers Terlecki and McMahon (2018) share the view that pedagogy, when focused on the development of metacognition, is aimed at achieving intellectual autonomy and socialization.

In modern research on metacognition, a significant place is occupied by the study of an individual's perception of possibilities and the limitations of his or her own knowledge, the choice of strategy, and what skills to apply to solve a problem. These aspects of metacognition are defined as the concept of "metacognitive awareness" (Rosnaeni et al., 2020) realized in the process of planning, monitoring, and evaluating solutions. We identify the concept of "metacognitive strategies" as a form of metacognitive process organization, a defined sequence of actions for control, planning of cognitive processes, and self-reflection on results.

Students usually use cognitive strategies to achieve a certain goal, whereas metacognitive strategies are implemented to transform the path toward the goal into a meaningful experience. Issues of metacognitive awareness are extremely relevant to the educational process. After all, transforming students into professionals to a large extent depends on awareness of the quality of personal knowledge, self-assessment, management of the learning process, and self-esteem, which in turn affects learning strategies and solutions.

A recent study by Howe (2019) reports that the development of basic cognitive processes, strategies, and metacognitions is maintained throughout human life. This idea substantiates the importance of metacognition for self-development and suggests that the use and accretion of metacognitive skills must be taught. Hence, the concept of conscious reflection is rather promising and shows great educational potential for the formation of metacognitive skills.

Key metacognitive strategies were suggested by Schraw and Dennison (1994) to develop a scale for measuring metacognitive skills: goal setting, decision making, planning, information management, debugging, monitoring, self-reflection, and self-assessment. However, by drawing on a more extensive range of sources, we could set out some more variable teaching strategies suggested for efficient metacognitive learning (Azevedo, 2009; Mitsea & Drigas, 2019):

1) A clear separation of known and unknown in problem situations;
2) Verbalization of the thinking process;
3) Keeping a thinking diary;
4) Self-regulation of cognitive processes;
5) Identifying difficulties and challenges;
6) Self-assessment of comprehension;
7) Cooperative learning;
8) Modeling;
9) Evaluating ways of thinking and acting;
10) Formulation of thinking strategies;
11) Keeping reflective journals;
12) Paraphrasing, elaborating, and reflecting ideas.

The results of the analysis of scientific studies suggest that the development of metacognitive skills does not occur spontaneously, but requires systemic actions focused on metacognitive learning, which provides mastery of metacognitive strategies. Therefore, the criterion for the quality of higher education should be the reorientation of educational content, as well as forms and methods of training aimed at developing metacognitive knowledge and skills. Since the digital narrative design process contains similar teaching strategies and approaches, we attempted to combine narratives and metacognitive learning to strengthen the metacognition process in students.

II. Methodology

Narratives have been recognized as a compelling tool to perceive people's experiences (Clandinin & Caine, 2013). Since the objective of the study was to verify the impact of narrative creation on metacognition, when supported with appropriate teaching strategies, we employed a multiphase case study with a mixed-methods research framework. Our qualitative approach was chosen to extend awareness of the phenomena and provide a thorough comprehension of complex experiences and contexts. The quantitative approach supports our hypothesis with statistical data. The case study is a powerful tool set within a qualitative framework that enables development and analysis of the subject of our study, namely metacognitive strategies, in a real-life context (Brown McLean & Williamson, 2019). Moreover, in the case study, we are able to investigate the dynamics of the process impacted by the participants' current and past experiences. The multiphase nature of the approach is explained by the stages of the study. In phase 1, we carried out a systematic review of the literature to construct a conceptual framework. Phase 2 involved the empirical study, in which the phenomena being researched were introduced. During phase 3 we analyzed the findings and offered an interpretation.

2.1 Data collection and analysis tools

Our case study includes such kinds of data collection methodologies as interviews, direct observation, and questionnaires (qualitative approach). As we were focused on measuring and tracking the level of formation and the dynamics of metacognitive skills, we applied the Metacognitive Awareness Inventory (MAI) questionnaire (quantitative approach) designed by Schraw and Dennison (1994). The questionnaire was developed to measure the following constructs: the level of formation of declarative and conditional

knowledge, self-monitoring and self-assessment skills, and planning, information management and debugging. Open-ended interviews were conducted among teachers on the teaching practices employed to provide metacognitive learning. To collect information about the metacognitive learning strategies used in the classroom, we created an observation rubric.

Table 1. Teaching strategy observation rubric

Strategy: The teacher…	Appropriate	Needs improvement	Not used
Activates prior knowledge about the topic.			
Uses instructions that reflect the specific lesson context.			
Embeds the "thinking language" into the narrative content.			
Introduces students to the goal of the lesson with strategies to plan how to achieve it.			
Suggests a model of cognitively active learning strategies for narrative analysis.			
Introduces students to monitoring strategies for their learning.			
Introduces supplementary learning material in the form of facts, concepts, and procedures.			
Explains information evaluation principles and strategies.			
Evaluates and traces retrospective changes in topic awareness (what students knew before and know now).			
Provides meaningful and reflective feedback.			
Acknowledges students' difficulties.			
Uses reflection questions.			
Employs mind mapping.			
Uses peer-review and self-assessment activities.			
Uses student response systems.			
Introduces a summary to reflect on topics and stimulates.			
Discussions on how students can apply what they have learned going forward.			
Uses grading rubrics that reflect students' expectations.			

The gathered data were analyzed applying interpretive and descriptive statistics. Content analysis was also employed to identify explicit and hidden structures in narratives and interviews. The answers and the data obtained from interviews were coded manually. We analyzed the frequency of the codes and their negative and positive connotations. The observation rubric was analyzed, as were the MAI results.

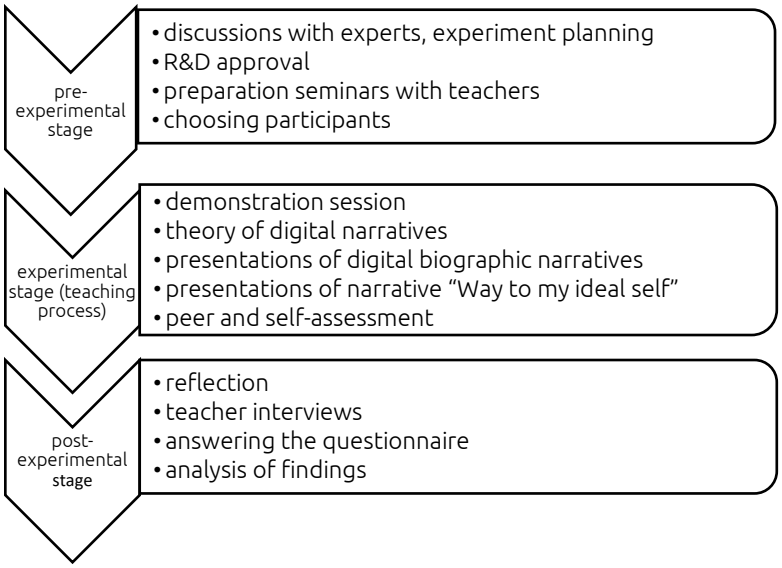
2.2 Study procedure

Our study consisted in several experimental stages. During the pre-experimental stage, we organized discussions of the experiment with members of the Research and Development Boards of the universities and received approval. Then we conducted seminars among teachers on the methodology of metacognitive learning strategies through digital narratives. We selected the following academic courses for the experiment: a foreign language course for students from the technical universities and a course on pedagogy for students from the pedagogical university. In total, teachers were required to give 13 classes for students' experimental learning. The focus of the first experimental stage was to familiarize students with the idea of our project "My way to success," demonstrating, for the analysis, biographic narratives about outstanding people (1 class). Secondly, teachers employed metacognitive learning strategies to conduct discussions about the content, structure, and design of narratives, their phases of development, and tools for information evaluation (2 classes). To develop metacognitive skills, students prepared and presented short digital narratives about themselves: "My present self" (4 classes). They were expected to set up a plan, agree on the structure, design and main focus of the narrative, choose and assess digital resources, present narratives for peer assessment during class, and reflect on their peers' opinions and on their own personal challenges and mistakes. The third stage was for students to produce their digital biographic narratives about the outstanding people whom they admire for achieving professional success. One of the requirements was to

focus on the most significant moment of a person's life or the skills that contributed to that accomplishment and drove their career or helped them forge a path to self-realization. This stage focused on the development of such metacognitive strategies as goal-setting, planning, information assessment, and monitoring. Then students presented their narratives and received feedback (4 classes). This stage targeted the development of peer and self-assessment skills. The fourth stage consisted in self-reflection and the presentation of a narrative, "Way to my ideal self."

Students had to express their ideas on what actions or events from the hero's life could serve as a personal guide for successful future professional self-realization, what ideas or actions inspired them toward achieving success and transforming their life goals (2 classes). Throughout the experiment, students participated in the discussions, performed reflection exercises, monitored their learning, and implemented other metacognitive skills. The last experimental stage included reflection, teacher interviews, answering the questionnaire, and an analysis of findings (Figure 1).

Figure 1. Study procedure structure

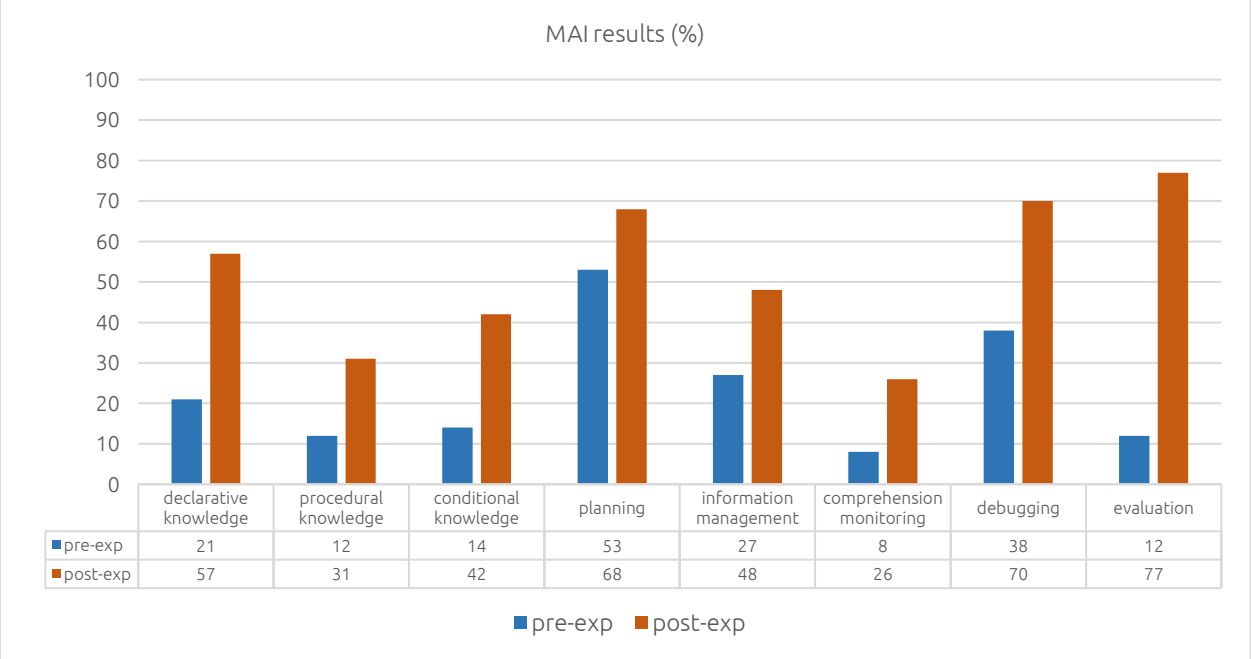


Participants. Sixty-nine students were invited to participate: 34 students from Igor Sikorsky Kyiv Polytechnic Institute, Ukraine; 21 students from Ivan Cherniakhovskyi National Defense University, Ukraine; and 14 students from Jan Kochanowski University in Kielce, Poland. Students were studying a bachelor's degree program, majoring in engineering and pedagogy. Students' ages ranged from 19 to 22 years old and they were all in their second year of study. We decided to invite students from the second year because they already had some familiarity with their future profession and were on the first step of their career, so these students needed metacognitive skills to develop their own personalized professional training trajectory. In total, eight teachers participated in the study and four teachers served as external experts. Student participation was voluntary and they were informed about the content of the study. Students would not face any academic consequences if they wished to discontinue their participation in the study.

III. Results

On the whole, the participants demonstrated positive dynamics and an increased level of metacognitive skills, as evidenced by MAI questionnaire statistical data. The questionnaire includes 52 statements for self-assessment and participants had to mark either true, for which they were assigned one point, or false, which was worth no points. The questionnaire is divided into two domains: knowledge about cognition and regulation of cognition. Each domain includes subcriteria. This tool was proposed to students at the pre- and post-experimental stages. The results are presented in Figure 2.

Figure 2. Metacognitive Awareness Inventory results



The chart demonstrates the average dynamics of transformations. In order to demonstrate inferential statistics to check for significance of results, we applied a paired t-test. Our null hypothesis H_0 was that there was no difference between indicators before and after the experiment. Our alternative hypothesis H_1 was that post-experimental results were greater than pre-experimental results. The t-value was calculated at $t = (M - \mu)/SM = (29.25 - 0)/5.73 = 5.11$. This means that the value of t is 5.11. The value of p is .00139. The result is significant at $p < .05$. Our t-score lies in the critical region, so we reject H_0 and accept H_1.

To conduct the content analysis, we identified themes, categories, and codes (Table 2). Content analysis was performed on interview responses and group discussions. Codes for the content are not exact but demonstrate the main ideas and trends presented in participants' responses. The categories and codes for content analysis are presented in Table 2.

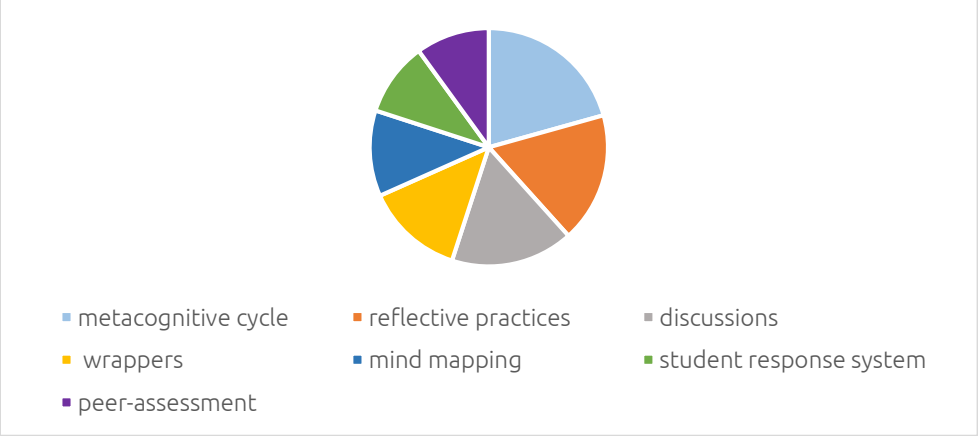
Table 2. Examples of content analysis codes

Theme	Category	Codes (key phrases)
Perception of metacognitive strategies and skills	Knowledge of personal strengths and weaknesses	Knowledge of self as a learner, phrases demonstrating the evaluation of personal abilities: to be good/bad at, find (something) difficult, learning needs
	Goal setting	Focus-oriented phrases: learning new content, improving skills, increasing awareness
	Academic course background assessment	Learning gaps, learning needs, misconceptions, knowledge from previous experiences
Knowledge about cognition	Declarative knowledge	Concept awareness, understanding of terminology, basic details of the discipline
	Procedural knowledge	Application of principles, resource implementation, discovery, evaluation or data collection methods, criteria and techniques, performance process
	Conceptual knowledge	Critical judgments, guidelines, research findings, construction of models and theories, deduction, prediction, critical thinking and problem solving

Theme	Category	Codes (key phrases)
Monitoring of cognition	Comprehension monitoring	Applying strategies and previously solved problems, explaining, comparing, interpreting, clarifying, appraising, evaluating the reliability of information, self-paced learning, acknowledging mistakes
	Debugging	Commenting on a task, problem, strategy or instructions, describing, communicating, summarizing or reporting, reorientation of learning, adapting strategies
	Peer and self-assessment	Evaluating or assessing ideas or perspectives, developing criteria, reaching or forming a decision or consensus, sharing, describing
Regulation of cognition	Progress planning	Self-directed learning strategies, learning schedule, searching for resources, seeking information or solutions
	Information management and resource assessment	Searching for information, asking questions to clarify instructions, making judgments about the validity of content and digital resources
	Self-reflection	Reflection-in-action, learning experience and learning expectations

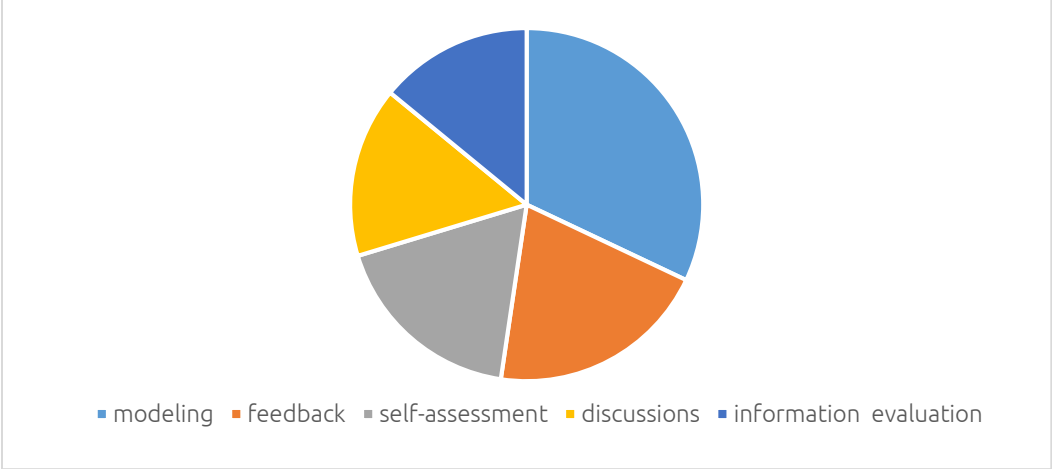
After interpreting the teacher interviews, analyzing observation rubrics, and conducting post-experimental discussions with students, we identified the most beneficial teaching practices from the point of view of both teachers and students (Figure 3).

Figure 3. Teachers' choice of strategies



Having analyzed teaching practices for metacognitive learning, we found that all teachers employed metacognitive learning strategies. But in practice, certain strategies were more prevalent. Among the most appropriate and widely-used strategies teachers mentioned were prior knowledge activation and reflective practices (n = 8), the metacognitive cycle (n = 8), discussions and debates (n = 8), wrappers (n = 7), mind mapping (n = 6), the student response system (n = 5), and peer assessment (n = 4). However, some strategies were more complicated and employed by teachers less frequently: tracing retrospective changes (n = 3) and self-assessment (n = 4). Students' views differed from those of teachers but not significantly. During the post-experiment discussions, students mentioned that modeling metacognitive learning strategies (68%) and questioning students' needs and challenges (47%) were most important, followed by self-assessment (42%), discussions (33%), and information assessment and management (30%) (Figure 4).

Figure 4. Students' choice of strategies



Strategies that students would like to expand include the principles of choosing reliable digital resources (43%) and selecting an appropriate learning strategy according to one's needs and learning style (57%).

Together, these results provide important insights into the correlation between digital narratives and the development of metacognitive skills. The next section, therefore, moves on to discuss the nature and consequences of this correlation.

IV. Discussion and conclusions

Narratives demonstrate the scope and relevance of students' cognitive development and academic skills. Moreover, we consider narratives a tool for persistent self-reflection for the improvement of students' learning. Digital narratives highlight creative thinking, reflection, purposeful information searching and technology selection, and the integration of planning and monitoring strategies. Therefore, narrative teaching provides crucial and lifelong educational experiences. The digitized approach to narrative development expands the range of disciplines across which narratives can be used.

The findings of this study are in line with research by Azevedo (2009) showing that metacognitive strategies are highly interdependent and require special attention from teachers. These study results also support the idea that digital narratives are an efficient educational tool for metacognition development, reflecting work by Skouge and Rao (2009) who also found that digital storytelling fosters the development of metacognitive ability due to the involvement of media and students' active participation. In a study investigating metacognition formation, Dewi et al. (2018) reported that metacognitive skills can be developed by utilizing "dramatic" questions which provoke critical thinking, information processing, and reflection. Exact awareness of the process of thinking and information identification comprises the first level of metacognition that can be developed by digital narratives (Dewi et al., 2018). It means that "dramatic" questions make up the basis for the digital story when students plan the content of narratives. We also suggested these questions to students and noticed that they were a "backbone" for stories.

There are well-known metacognitive strategies: planning, self-regulating, and evaluating. Researchers van Aswegen et al. (2019) outline an additional six strategies that foster metacomprehension: "… previewing; predicting and verifying; self-questioning; drawing on prior knowledge; purpose setting; summarizing and drawing on mental images; and applying fix-up strategies" (van Aswegen et al., 2019, p. 2). In our study, we observed that students applied these strategies for digital storytelling, which demonstrates the efficiency of digital narratives for fostering metacognitive abilities.

Today, adoption of digital educational resources has increased and become an important part of teaching and learning. Digital resources offer a lot of benefits over traditional tools: interactivity, multimodality,

accessibility, immediate feedback, etc. Digital storytelling online attracts more people, engaging them in discussion and enabling feedback on the ideas expressed. This option creates an environment of social cognition and contributes to the development of students' mediation and collaboration skills. In preparing digital narratives, students have to consider the audience they are appealing to. Another benefit of digital narratives is their multimodality, making it possible to express ideas through texts, videos, pictures, sounds, and colors. This makes the creation process more exciting for students and enhances their creativity.

The results of the MAI questionnaire show that before the experiment, students demonstrated some metacognitive skills and strategies, such as declarative knowledge to some extent ("I know my strengths and weaknesses," "I am good at remembering and understanding information"), planning skills ("I set goals," "I read instructions," "I can manage my time"), information management ("I define important information," "I create visuals for better understanding," "I break down information into pieces"), and debugging ("I ask for help," "I stop and reread," "I change strategies"). After the experimental study, we witnessed improvement in all criteria, but some changed significantly. For instance, obvious changes occurred in the domain of knowledge about cognition (Figure 2). Students received information on how to learn and what strategies are best depending on conditions, needs, and resources. This was achieved due to the implementation of discovery learning and simulations.

Additional improvement was observed in the areas of comprehension monitoring and evaluation, as these criteria are related and similar in meaning. Previously, students considered monitoring as a strategy to revise knowledge before an exam or test, and evaluation was simply the role of teachers. We wish to stress that these skills are about self-assessment and self-reflection, skills that teachers often underestimate because of a dominant teacher-centered approach. In order to teach students these skills, it is necessary to create a trustful learning environment, acknowledge students' needs and challenges, and be prepared to accept mistakes as not only a grading or leveraging tool but a powerful and engaging learning tool as well. Self-reflection and self-evaluation were highlighted during the discussions on narratives as strategies to achieve success.

During observations of classes, we found that one of students' key problems was an inability to choose a learning strategy or digital resource and correlate it with learning needs, because students could not objectively identify their needs and develop a personalized learning trajectory. For example, some of the students refused to create narratives as they did not know language rules or could not find appropriate information sources. But tests or individual consultations demonstrated the opposite. As a matter of fact, after self-reflection and peer assessment, students realized that the problem lay in the change of learning context; they could pass a test but could not apply knowledge to another context, such as narrative creation, or they became lost in a wide range of information sources they had not encountered before. When teachers assisted students with metacognitive regulation (needs assessment, goal setting, planning, and information management), students were able to cope with new learning contexts and improved their procedural and conditional knowledge. However, we agree with the ideas of Mohammadi et al. (2017) and have to admit that processes of metacognitive regulation are more often acquired from previous cognitive or metacognitive experience from school or personalized autonomous learning.

We must now offer a discussion of the teaching practices employed to enhance metacognitive learning. Our crucial strategy was to foster students' awareness of their learning style, strengths and weaknesses with the following selection of learning strategies. In creating digital narratives, students were required to engage a lot of skills and knowledge. Skills identified by students as weaknesses included a lack of knowledge about evaluating information and digital resources, differentiating primary and secondary information, presentation skills, time management, and autonomous independent learning without detailed instructions. In Table 2 we presented the most frequently used practices aimed at minimizing these weaknesses; however, not all of these practices are feasible or simple to implement. Practices dealing with the activation of prior knowledge and experience, the so-called anticipation stage, focus on stimulating curiosity and motivation. Moreover, students must identify their learning gap to transform it later into the learning goal. Also, it is important to inform students about the aim of the class and follow the plan to accomplish this aim, notifying students about the steps they are performing in making progress toward the objectives (metacognitive cycle). A lot of time was devoted to teaching reflective skills and peer assessment. In cooperation with

students, teachers created rubrics for assessment, successful digital narrative checklists, and models, and explained the criteria to fulfill teachers' and students' educational expectations (Lavrysh, 2016). Using the student response system and retrospective reflective practices, teachers demonstrated monitoring, assessment and mistake management strategies. The assessment wrapper was new to teachers (Gezer-Templeton et al., 2017), although some elements of the activity had been applied before. We used assessment wrappers as reflection and feedback worksheets that students completed before and after creating the narratives.

Strategies that were less popular, or not always appropriately used, included self-assessment strategies that help students identify themselves as learners. Teachers considered this practice unreliable but creating rubrics and a trustful learning environment improved the situation. Another problem was verbalizing the thinking process (thinking aloud). This problem was overcome through the content of narratives and success stories, as students explained how people behaved, how they studied, what metacognitive strategies were applied, and what steps they took to achieve their expectations. In doing so, they verbalized the process of thinking. Digital resources used to create and present narratives also contributed to the development of "thinking language." Students listened to people's interviews or watched videos, and using patterns from the Thinking Language Matrix (Hill & Miller, 2013), analyzed the experience of their "heroes." Stories told about a famous person in a narrative helped differentiate a person's attitude to his or her experience from the opinion of the author of the narrative.

Analyzing the students' evaluation of strategies allowed us to identify which strategies students appreciated most: modeling, when a teacher demonstrates how to approach complicated passages; making sense of specific terminology; managing information; and verbalizing the thinking process. Also, students found that activities that focused on identifying students' challenges, needs, and learning gaps were most helpful. This was determined through individual consultations, questionnaires, discussions or even through academic tests, with the key idea of managing mistakes rather than just controlling academic achievements.

With this in mind, we developed the following approach to design digital narratives and develop metacognitive skills and proposed it to students:

1) Search for the information source, pay attention to its validity and reliability, authorship, quality of illustrations, etc.;

2) Highlight main and secondary information;

3) Recall what you know about the historical events that occur in the context, think about what else you would like to know about these events;

4) Make an assumption about how the historical events influenced the life of the character from the narrative;

5) Differentiate the author's view and the character's position, which reflects his or her attitude to the content or problem;

6) Start working with the text, not with the translation of new words, but with an analysis of incomprehensible sentences (declarative knowledge);

7) Monitor the quality of content comprehension;

8) Determine when you better understand the basic information: when you read, listen to the text or watch a video;

9) Determine when you remember information better: when you read, listen to or write it;

10) Create a plan of action;

11) Review the narrative checklist and assessment criteria;

12) Talk with your peers or instructor in case of problems;

13) Learn and test a digital tool you mean to use;

14) Pre-write content;

15) Review a draft with wrappers;

16) Revise;

17) Present the narrative.

As a result, when choosing a strategy, a student organizes activities, which, in turn, help to create the educational conditions to develop cognitive and metacognitive independence.

During the creation of digital narratives, we paid most attention to the development of the desire for self-development and self-determination, productive reflection, tolerance of uncertainty, acceptance of mistakes as a tool for improvement, and the reframing of individual experience as self-realization. Our recommendations on efficient teaching of metacognitive skills are to ask students to reflect on their challenges and achievements during the process of creating narratives, foster self-questioning in relation to successfully completing a specific task, provide students with the opportunity for autonomous personalized learning to make the learning process relevant to their needs and objectives, allow students to choose and make mistakes without academic consequences and with a follow-up reflection on the causes of mistakes, and apply peer and self-assessment strategies.

Summarizing the above, we believe that metacognitive abilities are a systemic multilevel pattern that is subject to numerous meaningful transformations during life. However, the core components of metacognition are relatively stable integral personal attributes that can be developed or upgraded. Metacognitive strategies enhance students' awareness of how to become productive learners and strengthen their perception of knowledge. Our experience proves that metacognitive teaching practices can be incorporated into case studies, e-learning courses, narrative design, and informal learning. Statistical testing supports our hypothesis that digital narratives foster the development of metacognition due to their interactive and multimodal nature. The most significant results include positive changes in declarative knowledge, conditional knowledge, debugging, and evaluation. The development of metacognition promotes the development of a personalized learning style and prevents repetition of unproductive and irrational models of learning activities on the journey to personal self-realization and self-improvement.

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