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Pedagogical and Technological Aspects of a Teacher Training Experience on the Educational Tool Vidya Network

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ABSTRACT

This article presents the pedagogical and technological aspects observed in a teacher training experience conducted for teachers of the final years of elementary education in a municipal school network. The goal was to train them in the use of the educational tool Vidya Network, which was developed based on the concept of Semantic Networks of Concept Maps. The in-person training took place over three meetings, during which participants, through lecture-dialogue classes, dynamic activities, and practical exercises, used desktop computers and mobile phones to experience the tool. The proposal aimed to enable participants to develop the ability to evaluate the pedagogical techniques employed in the tool concerning their capacity to support the cognitive development of their students. The training results were gathered from three main sources: 1) an online questionnaire for teachers during the second meeting; 2) individual qualitative interviews with teachers during the third meeting; and 3) a questionnaire answered by the municipality's Pedagogical Coordination after the activity concluded. Based on the feedback received from both the teachers and the Pedagogical Coordination, it is concluded that Vidya Network holds the desired potential for enhancing students' cognitive development. However, for its effective use in the municipal network, improvements in the school laboratories are necessary to allow students to interact with the educational tool continuously and institutionally.

KEYWORDS: Teacher training. Semantic networks of concept maps. Vidya Network.

1 INTRODUCTION

As part of a set of continuing education initiatives, the Municipal Department of Education (SMED) in a city in the state of Rio Grande do Sul sought to provide training in Educational Informatics aimed at motivating middle school teachers in its Municipal Education Network (RME) to use cognitive development techniques with their students. The chosen approach was to offer training on Vidya Network[1], an educational tool based on the concept of Semantic Networks of Concept Maps (RSMC), an expansion in size and dimensionality of Novak's concept maps. The increase in size refers to the number of concepts and their interconnections. Regarding dimensionality, Fisher (1990) compares the two-dimensional view of a traditional concept map with the multidimensionality of a semantic network. Vidya Network was selected as the educational tool for this training due to its ability to support learners' cognitive development by employing collaborative and cooperative techniques to create and evolve concept maps, essay texts, and lexical semantic relationships between concepts. It is a free and open tool available to schools seeking to use it for this purpose.

An RSMC, detailed further in this text, can be understood as a knowledge network composed of learners and teachers, organized into study groups and classes interacting collaboratively or cooperatively. These groups develop concept maps, essay texts, and lexical relationships, aiming for cognitive development in mediated topics. The desired development from using these combined cognitive techniques originates from Ausubel's theory of meaningful learning, which posits that knowledge is assimilated in a reasoned, non-arbitrary, and non-literal manner (NOVAK; MUSONDA, 1991; AUSUBEL, 2003).

The training occurred across three meetings from May to August 2023, totaling 12 instructional hours. The teaching methodology included lecture-dialogue classes, dynamic activities, and practical exercises using the participating teachers' laptops and mobile phones. The results of the training, described in this study, were primarily obtained from questionnaires and interviews and, additionally, through oral feedback during the meetings. Feedback from teachers and pedagogical coordinators sought to answer the following question: “Does Vidya Network have the necessary features to foster cognitive development in students from the final years of elementary education in the municipal education network? If so, what infrastructure and costs are required for its use?” Therefore, this study combines a training initiative with a diagnosis of the infrastructure needs for implementation in the network's schools.

Regarding structure, the study is organized as follows: Section 2, Theoretical Framework, delves into the concept of RSMC, as well as techniques and theories related to its construction—semantic networks, concept maps, meaningful learning, lexical semantic relationships, and socio-interactionist learning. Section 3, Materials and Methods, lists the materials and methodology used to conduct teacher training and obtain results. Section 4, Implementation and Results, summarizes the training activities and presents the findings from the evaluations received. Section 5, Final Considerations, concludes the research question based on the assessments provided by the trained teachers and SMED's Pedagogical Coordination.

2 THEORETICAL FRAMEWORK

This section details the project, licensing, and pedagogical theories that supported the development of the Vidya Network tool, which was created within the scope of the Post Graduate Program in Informatics in Education[2] (PPGIE) at the Federal University of Rio Grande do Sul (UFRGS).

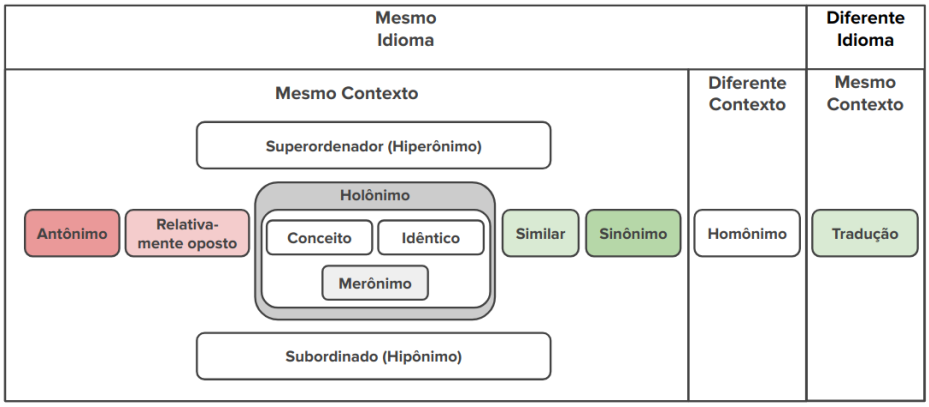
As introduced in the opening section, Vidya Network is an educational tool based on the concept of RSMC (Semantic Networks of Concept Maps). Grounded in graph theory—a branch of mathematics that studies the representation and analysis of relationships between objects by modeling them as graphs composed of vertices (or nodes) and edges (or connections)—an RSMC is defined as a specific type of semantic network. In this network, a set of concept maps forms an Interdisciplinary Knowledge Network, where the nodes represent concepts within the concept maps, and the edges represent associations between concepts within the same concept map (internal associations) or between different concept maps (external associations). When multi-tenant, concept map creators invited to share their maps form an Interdisciplinary and Collaborative Knowledge Network (GRANDI, 2024; JOHNSON & JOHNSON, 1999; VYGOTSKY, 2014). Adding structures of information about educational institutions, departments, classes, and study groups allows concept maps to belong to students, teachers, or these collective structures (GRANDI, 2024).

This specific type of multi-tenant RSMC is termed an Institutional RSMC, which was implemented in Vidya Network. It forms a socio-interactionist learning network, enabling each user, study group, and class to build and evolve their own collection of concept maps organized as a unique RSMC. Concept maps belonging to individuals—teachers and students—can be configured as public (visible to all) or private (visible only to their owners), allowing private development if desired by the authors. Visible concept maps from study groups and classes linked to a user form a Multi-user RSMC, enabling the search, visualization, copying, and specialization of each other's concept maps. To create a relevant knowledge network, the meaning of each concept map is properly contextualized, with its context defined as either generic, expressing a denotative meaning, or specific, associated with a particular knowledge domain (GRANDI, 2024).

Study groups and classes are also offered the opportunity to use the Debate of Theses, a feature based on a pedagogical architecture designed to facilitate structured argumentation and counter argumentation on the themes of concept maps. This feature fosters cooperative development of interpretation skills and deeper thematic understanding (NEVADO; MENEZES; JÚNIOR, 2011).

To enhance conceptual cognitive development capabilities, Vidya Network allows not only the development of concept maps but also argumentative texts—aiming to strengthen writing skills and vocabulary expansion—and the identification of the following lexical semantic relationships. These relationships reinforce context comprehension and the meanings associated with the developed theme: identity (same term and context), homography (same term, different context), semantic proximity (synonymy and similarity), semantic distancing (antonymy and gradual opposition), hierarchy and classification (hypernymy and hyponymy), part-whole relationships (meronymy and holonymy), and translations (CRUSE, 1986; 2006; ALEGRIA, 2019). Figure 1 presents a diagram of the various lexical semantic relationships addressed in Vidya Network.

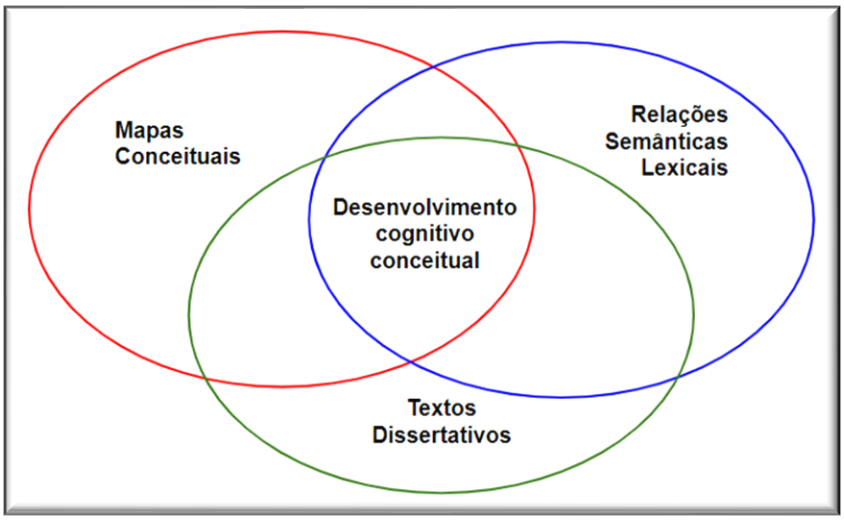
Figure 1 – Lexical semantic relationships addressed in Vidya Network.



Source: Grandi (2024).

The unified use of these cognitive techniques—concept maps, argumentative texts, and lexical-semantic relationships—as represented in Figure 2, aims to enhance meaningful learning: a type of learning in which knowledge is assimilated in a non-random, reasoned manner, and therefore is neither arbitrary nor literal (NOVAK; MUSONDA, 1991; AUSUBEL, 2003), becoming integrated into cognition. For this to occur, new knowledge must anchor itself in relevant pre-existing ideas within the learner's cognitive structure, referred to as subsumes (AUSUBEL, 1968, p. 217). Following Ausubel's theoretical framework, during the process of knowledge acquisition, a concept becomes subordinal when the learner's cognitive structure contains stable elements capable of establishing relationships with that concept, thereby enabling the attribution of meaning.

Figure 2 – Conceptual cognitive development in Vidya Network



Source: Grandi (2024).

Given that concept map design is facilitated on larger screens, its preferred use is on laptops or desktop computers. However, due to its responsive interface, most operations can also be performed on mobile phones, including registration, queries, and even map design through textual inputs followed by an auto-layout organization feature. The tool was also designed to provide comfort and enhanced understanding for individuals with autism by incorporating soft colors, denotative text to guide operations, and universally recognized button icons (NAIR *et al.,*

2022). Additional features were implemented to assist visually impaired users as well as individuals with fine motor coordination difficulties (MACEDO *et al.,* 2023). Accessibility tests conducted using the Lighthouse[3] plugin for the Chrome browser and experiments carried out in pilot projects confirmed the tool's assistive capabilities (FRAZÃO; DUARTE, 2020). From a legal perspective, which is important for educational administrators, the tool is free to use and distributed under an open license GPL[4].

3 MATERIALS AND METHODS

This section presents the materials and methods used in the research. It was a field study with a dual purpose: (1) to pedagogically validate the potential of the Vidya Network in supporting cognitive development within a socio-interactionist approach among elementary school teachers, and (2) to leverage feedback from the participating teachers to improve the educational tool.

During the planning phase of the study, socioeconomic and organizational data about the municipality and its municipal education network were collected (REATEGUI, 2020). The exploratory research employed both quantitative data—collected through online forms designed in line with Malhotra's recommendations (2001)—and qualitative data, gathered through individual interviews, analyzed for content, and direct observation of participant reactions (RAJABALEE and SANTALLY, 2021).

The qualitative data was complemented by an evaluation of the pedagogical potential of the Vidya Network, conducted by the municipality's Pedagogical Coordination. This evaluation involved a qualitative analysis of responses to a questionnaire featuring open-ended questions, also designed following Malhotra's guidelines (2001). The questionnaires submitted to volunteer teachers during the first and second meetings can be found in Appendices 4 and 5 of Grandi (2024), respectively. The interview script for the individual interviews conducted in the third and final meeting is included in Appendix 6 of Grandi (ibid.). The categorization of interview responses is detailed in Table 28 of the same document, while the questions and feedback received from the Pedagogical Coordination are presented in their entirety in Table 29.

The field study was formalized through a training program held in three in-person morning meetings, from May to August 2023, totaling 12 instructional hours. Each meeting had a specific objective, with data collected according to that objective. The meeting 1 focused on presenting the theoretical foundation underlying the development of the educational tool and creating initial concept maps. The meeting 2 introduced how to work with argumentative texts and lexical relationships between concepts. The meeting 3 showcased assistive technologies implemented in the tool and advanced features such as the Thesis Debate functionality. The overall perception of the tool's support for socio-interactionist cognitive development activities was consolidated through feedback from the Pedagogical Coordination.

The training program's teaching methodology included interactive lectures, group dynamics, and practical exercises using laptops and mobile phones provided by the participating teachers. The study's results, as described, were mainly derived from questionnaires and interviews, supplemented by oral feedback

during the meetings. In meeting 2, an online questionnaire was administered to evaluate the effectiveness of the tool's tutorials, which were utilized during training, and to gather initial impressions of its pedagogical capabilities. The tutorial evaluation was critical as it ensured that teachers understood both the tool and the applied pedagogical techniques, enabling effective learning outcomes. Tutorials also play a fundamental role in distance learning. In meeting 3, priority was given to individual qualitative interviews to delve deeper into perceptions of the tool's pedagogical potential. After completing the training, the municipality's Pedagogical Coordination was asked to provide a formal assessment of the tool's pedagogical support potential for the municipal education network (RME). All questionnaires were pre-approved by the Research Ethics Committee (CEP) of UFRGS under Opinion No. 5.711.613 dated October 20th, 2022.

To host the three training meetings, a hall was provided, equipped with ten round tables seating up to five people each for the trainee teachers, and three-square tables for the Pedagogical Coordination team. For the instructor, a whiteboard on an easel and two tables were made available, one of which featured a projector for displaying content from a computer. Post-its were also used during a group activity in the first meeting. Teachers were encouraged to bring personal laptops to practice using the Vidya Network educational tool. For this purpose, the Municipal Workers' Union provided access to their Wi-Fi network.

4 TRAINING IMPLEMENTATION AND EVALUATION

This training program for teachers in RSMC was designed with a pedagogical architecture aimed at supporting meaningful learning of content. This learning process was mediated through unified cognitive development involving three steps: writing a dissertation-style text, followed by creating a concept map, and, for deeper engagement, identifying lexical-semantic relationships between the concepts in the concept map and those available in the semantic network (Grandi, 2024). The participants were teachers invited by the Municipal Department of Education (SMED), working in various subject areas in the final years of elementary education within the municipality's Municipal Education Network (RME). Seventeen teachers voluntarily registered with the Vidya Network. The average age of the participating teachers was 40.8 years. Of the participants, five were male, and twelve were female. One was currently pursuing postgraduate studies, thirteen had completed postgraduate degrees, one was pursuing a master's degree, one had completed a master's degree, and one was pursuing a doctoral degree.

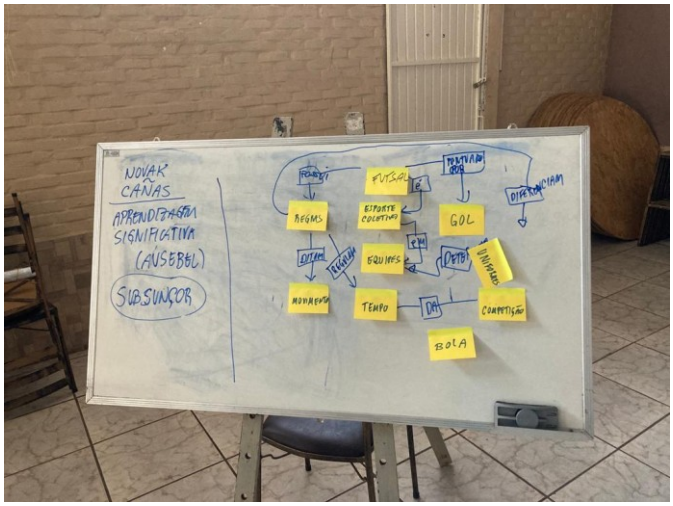
The goal of the first meeting was to provide theoretical alignment with the teachers and offer initial experiences in constructing concept maps using the tool. In the second meeting, practices were deepened, including the identification of lexical-semantic relationships between different concept maps. The third and final meeting served as a concluding meeting, focusing on presenting the improvements requested by the teachers and collecting feedback on the tool and the training program. The details of the three training meetings are presented below.

4.1 Meeting 1 – Foundations and Practice I

Held on May 10th, 2023, the first meeting was attended by 5 teachers from SMED and 37 teachers from the RME. The objective was to present the theoretical and methodological foundations of concept maps, mind maps, meaningful learning, semantic relationships, collaborative learning, and thesis debates. The practical portion focused on how to register in the Vidya Network, create classes, form study groups, and perform basic operations such as creating concept maps and lexical-semantic relationships. The registration activities, along with the main pedagogical exercises, were based on the Operational Tutorial[5] of the Vidya Network.

To deepen understanding of concept maps—a technique that requires comprehension and practice to achieve the best results—the next activity involved working through the Good Concept Maps Tutorial[6], which includes the definition of concept maps, the differentiation between concept maps and mind maps, the process of creating and evolving concept maps, and common difficulties encountered during their development. After introducing the topic, an interactive exercise was conducted based on the recommendations of Novak and Cañas (2010). This exercise used post-it notes and a whiteboard to construct an initial version of a concept map. The participants selected the question, "*What is futsal?",* as the focus for the map. The initial version of this concept map, containing 10 concepts (with the concept "ball" remaining unlinked), is shown in Figure 3.

Figure 3 – Initial version of the concept map "Futsal" created with post-its.



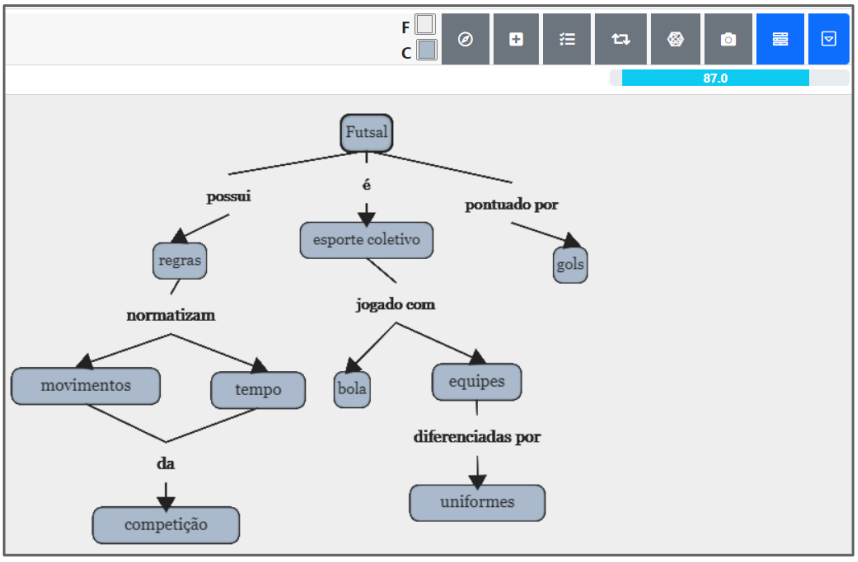
Source: Grandi (2024).

Once this stage was completed, a brief demonstration was provided on how to: a) register on the platform; b) create classes; c) form study groups; and d) associate teachers and students with classes or study groups. Some teachers registered using their personal computers, while others used their mobile phones, as the Vidya Network's responsive interface automatically adapts to various screen sizes.

After the registration exercise, the post-it version of the concept map on Futsal was transferred to the Vidya Network. This process provided an opportunity for collective reanalysis of the concept collection and their connections. Following

this second round of analysis, the computerized version (Figure 4) no longer featured isolated concepts, and some linking phrases were revised.

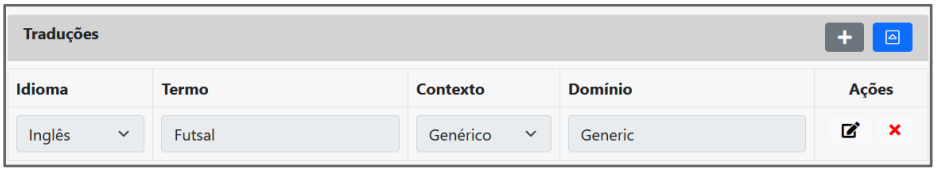
Figure 4 – Evolved version of the Futsal concept map on the Vidya Network.



Source: Grandi (2024).

To conclude the meeting, brief explanations were provided regarding the semantic-lexical relationships available in the Vidya Network. Additionally, a translation of the term "Futsal" into English was added, where the word retains the same spelling (Figure 5).

Figure 5 – Translation of "Futsal" from Portuguese to English (same spelling).



Source: Grandi (2024).

At the end of the first meeting, possible pedagogical exercises related to RSMCs were also presented, along with the agenda for the next meeting, which included a deeper exploration of semantic relationships and simulations of pedagogical practices using the tool during the second meeting.

4.2 Meeting 2 – Semantic Relationships and Practice II

Following the outlined plan, the second meeting began with a theoretical deep dive, complemented by pedagogical examples of semantic-lexical relationships. These exercises were based on the Semantic Relationships Tutorial of the Vidya Network. The meeting included the participation of the Municipal Secretary of Education, six teachers from SMED, and 30 teachers from the municipal school network.

Relationships such as identity, homography, and inclusion (concepts included in a conceptual map, expressing meronymy) are automatically detected by the tool

across various conceptual maps within Vidya Network's multi-user RSMC. However, relationships like synonymy, similarity, antonymy, gradual opposition, superordination, subordination, and translation need to be manually declared by the learner (see Figure 1).

The following exercises simulated different pedagogical practices that combine conceptual maps and essays:

1. Requesting the joint creation of a conceptual map and an essay.
2. Providing an essay and requesting the creation of a conceptual map based on it.
3. Providing a conceptual map and requesting the creation of an essay derived from it.

Next, the chat and discussion forum tools were introduced, particularly useful for distance learning activities. Following that, the Thesis Debate tool was presented.

Once this stage of presenting the features, functionalities, and pedagogical potentials of Vidya Network was concluded, volunteers were asked to share their initial impressions of the tool through an online questionnaire. Additionally, those who wished could express their opinions and suggestions for improvements verbally. One of the orally expressed suggestions was to allow greater flexibility in the colors used for map designs, which were set by default to a palette of soft colors to avoid discomfort for students and teachers diagnosed with Autism Spectrum Disorder (ASD).

The online questionnaire aimed to evaluate whether the tutorials provided by the tool—Operational Tutorial, Good Concept Maps Tutorial, and Semantic Relationships Tutorial—met participants' expectations, as their reading was recommended before the second meeting. Another goal was to gather, through an open-text field, general perceptions of the tool. This questionnaire was developed using Google Forms technology and was completed by ten volunteer teachers.

The average age of respondents was 37.9 years, with seven identifying as male and three as female. The subjects taught by these teachers included mathematics, biology, Portuguese language, science, history, geography, and physical education. When asked to evaluate:

1. *The Operational Tutorial of Vidya Network*: One respondent stated they had not read it yet. The others replied that they had read the tutorial and that it helped them understand how to operate Vidya Network.
2. *The Good Concept Maps Tutorial of Vidya Network*: Three respondents indicated they had not read it yet, while the others stated that they had read it and that the tutorial helped them create good concept maps.
3. *The Semantic Relationships Tutorial:* Five respondents said they had not read it yet, while the remaining respondents noted that the tutorial helped them create semantic relationships, including synonymy, similarity, antonymy, gradual opposition, superordination, subordination, and translation.

Based on the responses, it was observed that there was greater initial interest in understanding how the system works, followed by how to create good concept maps, and finally, how to establish lexical semantic relationships. In the free-text

comments of the last question, which voluntarily invited additional feedback, all participants contributed, with the following observations:

- Five participants praised the tool, with remarks such as: *"Excellent," "Wonderful activity," "I found it very interesting," "Great tool, a very interesting support,"* and *"I liked the tool."*
- One participant praised the conceptual maps: *"The didactics used in the conceptual maps are very valuable and can, with proper infrastructure, be interactively used in classrooms."*
- One participant noted the tool's challenging nature*: "It's a very challenging tool because it requires mastering the sequencing of similar and opposite ideas. At the same time, creating a social network of conceptual maps contributes to knowledge sharing and the organization of linguistic structures on various topics. Congratulations on the research."*
- One participant highlighted the tool's intercultural potential: *"I see intercultural potential in the Vidya Network, enabling greater understanding of concepts perceived differently across cultures and contexts."*
- One participant commented on their learning process: *"I'm still in the process of understanding the Vidya Network, but I found the training very good, didactic, and clarifying, with time for questions during the meetings, which I consider crucial for better assimilation."*
- Finally, one participant expressed their struggle with technology but appreciated the tutorials: *"I'm not very skilled with technology, but I try hard and need a logical sequence to follow. The tutorials are very explanatory, with a perfect sequence for guidance."*

Analyzing the content of the respondents' comments, it was noted that they identified potential pedagogical benefits in using the tool, including assistance in constructing concept maps, organizing ideas based on lexical knowledge, socializing knowledge, and establishing intercultural relationships. However, these benefits are contingent on schools having the necessary computational infrastructure to enable the implementation of the pedagogical practices perceived as potentially useful by the teachers.

4.3 Meeting 3 – Improvements, Accessibility, and Training Conclusion

In the third and final meeting, improvements requested by participants during the previous meeting were presented, along with others derived from additional pedagogical analyses. The meeting was attended by the Municipal Secretary of Education, five teachers from SMED, and 27 teachers from the municipal school network. The implemented improvements (see Table 1) were part of the ongoing evolutionary process of the tool, where feedback from teachers and students undergoes a decision-making process by the Vidya Network research and development team. Once approved, these improvements are implemented. The new features were demonstrated using the simultaneous editing mode of a conceptual map, with operations performed on an Apple mobile device. Each operation made on the phone was reflected in real time on a Datashow projection from a Google Chrome browser.

Table 1 – Vidya Network Improvements Presented During the Third Meeting

Category	Improvement
Documentation	The Pedagogical Tutorial[6] was created to assist teachers in organizing their activities with the support of Vidya Network.
Map Design	Moving concepts and linking phrases with the mouse is now smoother and more precise. Color customization for maps was added, while the default palette remains soft for comfort, especially for autistic users. Backgrounds and concept colors can now be customized. Isolated concepts are highlighted with dotted borders to alert students to either connect or discard them. Arrowheads now appear only on linking phrases pointing to destination concepts, making visuals cleaner.
Guided Mode	A new mode allows conceptual map creators to follow steps recommended by Novak and Cañas more rigorously: 1. Adding parked concepts. 2. Ordering concepts from the most general to the most specific. 3. Linking concepts to form the desired conceptual map.
Topological Quality Metric	A new metric, ranging from 0 to 100, allows teachers to set a minimum topological quality requirement (e.g., 70 or higher) for conceptual maps. The metric is calculated based on four variables: 1) Number of distinct concepts: ideally between 15 and 25, as per Novak and Cañas (2010). 2) Number of isolated concepts: ideally zero. 3) Number of unnamed concepts: ideally zero. 4) Number of unnamed linking phrases: ideally zero.

Source: The Authors (2024).

4.3.1 Accessibility Features of Vidya Network

A summary of the accessibility features of Vidya Network, which were planned from the project's inception, was then presented. For individuals with autism, as previously mentioned, the default color palette is soft. Additionally, text and icons were carefully selected to convey clear, denotative meanings, avoiding ambiguity as much as possible. To assist individuals with fine motor coordination issues, the map design includes various keyboard and mouse options, with no actions requiring the right mouse button. Concepts and linking phrases can be added via text boxes, followed by auto-layout. These elements can also be moved by selecting them and using the arrow keys on the keyboard.

Both the Vidya Network system and its documentation were designed to accommodate screen readers (such as Windows Narrator) as assistive technology for visually impaired users. Evaluations and corrections of the main pages were conducted using the Lighthouse plugin for Google Chrome until an accessibility score of 100% was achieved. With the help of screen readers, visually impaired users can navigate the Vidya Network, adding concepts through a text field or inserting logical propositions (origin concept + linking phrase + destination concept) via a set of text fields. Both operations are followed by auto-layout to

update the map visuals. In other words, visually impaired users can create conceptual maps within the Vidya Network.

Another feature designed to support visually impaired and low-vision users, but also useful for sighted individuals, is the ability to download an Excel spreadsheet summarizing the map, listing the existing logical propositions. Lastly, the Vidya Network was developed using responsive interface libraries that automatically resize both text and map visuals, enabling individuals with low visual acuity to navigate the tool, create maps, and view text according to their needs.

At the conclusion of this presentation, the attending teachers expressed appreciation for the attention to accessibility that had been incorporated into Vidya Network from its design phase.

4.3.2 Individual Closing Interviews

After presenting the corrections, improvements, and accessibility features, six individual interviews were conducted after a break. Participation was voluntary, and the contents were analyzed qualitatively (SOUSA, 2020). The interviews were recorded using a mobile phone, with the interviewees' consent. Transcriptions were created in a Word document using the "Dictate" function. The semi-structured interview guide is outlined in Table 2.

Table 2 – Semi-Structured Interview Guide for the End of Training

The purpose of this interview is to include your understanding, as a teacher, of the potential of Vidya Network as an educational tool in your field of work. Do you agree to participate in the interview with your responses being recorded, while ensuring your confidentiality will be respected? Yes | No.
Q1. Could you please identify yourself by stating your full name?
Q2. In which field do you work as a teacher?
Q3. Do you perceive a potential for cognitive reinforcement through the use of concept maps in your pedagogical activities?
Q4. Do you perceive a potential for linguistic reinforcement by working with lexical semantic relationships in your pedagogical activities?
Q5. Do you perceive Vidya Network as a supportive tool for your pedagogical activities?
1. Could you elaborate a bit on the reasons for your response?
2. What improvements does Vidya Network need to better support your pedagogical activities?

Source: Grandi (2024).

All six teachers interviewed voluntarily agreed to participate in the interviews and to have their responses recorded, provided the condition of confidentiality was respected. Five content categories were analyzed, as detailed below: 1) Field of work; 2) Perception of the potential for cognitive reinforcement through concept maps; 3) Perception of the potential for linguistic reinforcement when working with lexical semantic relationships; 4) Perception of the potential support provided by Vidya Network for pedagogical activities; 5) Necessary improvements to Vidya Network to better support pedagogical activities.

As a confidentiality measure, the genders of the teachers have been omitted from the analyses that follow.

P1. Field of Expertise

The interviewed teachers work in the final years of elementary education, in the fields of languages (Portuguese language), history, geography, mathematics, science, and physical education.

P2. Perception of Cognitive Reinforcement Potential of Conceptual Maps

Of the six interviewees, five perceived potential cognitive reinforcement from concept maps directly in their fields of work. One stated that understanding the content is much easier than relying solely on texts. Additionally, they mentioned that classes become less tiring and less dense.

A history teacher noted using both concept maps and mind maps on the classroom board to create links between historical terms, understanding that these techniques aid both comprehension and student focus. This teacher was asked whether the Good Concept Maps Tutorial helped clarify the structural and functional differences between concept maps and mind maps. The response was positive, with the teacher stating that it was very helpful.

A mathematics and science teacher believes that concept maps are particularly beneficial in the sciences. For example, they have worked with students on the concepts of underdevelopment and the greenhouse effect using concept maps.

The physical education teacher sees good potential for concept maps in other subjects. However, in their daily teaching practices, concept maps are somewhat distant. Nonetheless, they acknowledged that concept maps could be explored in other contexts, such as alternative activities on rainy days, to work on sports theory or other complementary activities.

P3. Perception of Linguistic Reinforcement Potential Through Lexical Semantic Relations

When asked about the potential for linguistic reinforcement through lexical semantic relations, five of the six teachers provided positive feedback. A history teacher noted that it is very beneficial because "sometimes there's a very specific historical term, and by bringing it into everyday life and making associations with their experiences, it becomes much easier and highly enriching." The physical education teacher offered a similar response to their perspective on conceptual maps, describing lexical semantic relations as a complementary activity.

P4. Perception of Vidya Network's Potential Support for Pedagogical Activities

For this question, interviewees were asked to elaborate on their responses. A Portuguese language teacher believes that with Vidya Network, students can create more refined syntheses of content.

A history and geography teacher also recognized the tool's potential support. However, they noted that for more effective use, schools would need to allow the pedagogical use of mobile phones in classrooms. When asked if the demonstration of using a mobile phone to work with Vidya Network during the last meeting showed that such devices are a viable alternative for accessing the tool, the response was again positive, provided the school grants permission for their use.

The mathematics and science teacher also responded positively, particularly regarding conceptual areas and listing words, synonyms, and antonyms. They also noted that the tool is highly beneficial in the field of special education and inclusion. When inclusion was mentioned, the teacher was asked if Vidya Network's accessibility features seemed appealing. The response was positive, particularly concerning the use of less vibrant colors for students on the autism spectrum, while providing alternatives for other children to use different colors if they wish.

The physical education teacher maintained their previous responses, considering it as an option for complementary activities.

P5. Necessary Improvements to Vidya Network to Support Pedagogical Activities

The final category analyzed was the improvements suggested by teachers to enhance Vidya Network's support for pedagogical activities. Four teachers, including the physical education teacher, stated that the improvements presented during the last meeting—color customization, topological quality, guided mode, etc.—were excellent or sufficient. History and geography teachers suggested adding images to work on geographic topologies and historical contexts.

3.4.3 Feedback from the Municipality's Pedagogical Coordination

In addition to the teachers working in schools, four questions were posed to the Municipal Pedagogical Coordination regarding their perception of the potential cognitive reinforcement provided by concept maps, lexical semantic relationships, pedagogical support, and suggested improvements to Vidya Network.

Table 3 – Feedback from the Municipality's Pedagogical Coordination

Question	Answer
1. Does the Pedagogical Coordination perceive cognitive reinforcement potential in conceptual maps for pedagogical activities within the RME?	Yes. Conceptual maps make learning more meaningful for students by helping them organize and visually summarize concepts and content covered in the classroom.
2. Does the Pedagogical Coordination perceive linguistic reinforcement	Yes. Curriculum components often establish semantic relationships between the learning objectives developed in the classrooms,

Question	Answer
potential in working with lexical semantic relationships between concepts—such as synonymy, antonymy, similarities, gradual oppositions, overlaps, subordinations, and translations in the currently supported languages (Portuguese, English, and Spanish)—for pedagogical activities within the RME?	facilitating the understanding of the various languages they encompass, as well as their meanings.
3. Does the Pedagogical Coordination perceive Vidya Network's potential support for pedagogical activities within the RME? Could you elaborate on the reasons for your answer?	Yes. Vidya, in addition to being a modern technological resource, makes learning more engaging for students by fostering the socialization of knowledge through semantic networks of conceptual maps.
4. What improvements does the Pedagogical Coordination suggest for Vidya Network to better support pedagogical activities within the RME?	After consulting with some teachers, the idea was deemed highly favorable. However, the same group expressed some difficulties in using the platform with their students, either due to a lack of proficiency (practice) with the tool or issues with internet access (the most frequently noted concern). We acknowledge that we are progressing toward a more technological world and believe that tools like Vidya Network will significantly contribute to education.

Source: The Authors (2024).

From the responses provided by the Pedagogical Coordination, it is evident that Vidya Network has potential for adoption as a cognitive development tool for students in the later years of municipal schools. However, it is crucial to provide technological resources in these schools—specifically computers and internet infrastructure—to ensure its effective implementation.

5. FINAL CONSIDERATIONS

Based on the feedback from teachers regarding the studied topics—conceptual maps, lexical semantic relationships, and Vidya Network—it is evident that Vidya Network has the potential to support the Municipal Education Network (RME), particularly in subjects where activities are primarily conducted in classrooms. Physical Education, which predominantly takes place in open spaces with a strong emphasis on practical lessons, shows less potential. However, the tool could still be used to develop the theoretical aspects related to concepts and fundamentals of the sports studied, enabling a logical and associative relationship between these fundamentals.

The feedback provided by the teachers who participated in the training was instrumental in improving the tool. Additionally, an opportunity for further enhancement was identified: the incorporation of images to enrich conceptual

maps, a suggestion particularly emphasized by teachers in the fields of history and geography.

While it is possible to operate Vidya Network on mobile phones—devices that students, especially those in the later grades, have greater access to—there remains a need for improvements in computer labs. Such improvements would enable students to create conceptual maps and establish semantic relationships on computers with larger screens, operated via mouse or touchpad. With advancements in school infrastructure, there is a promising opportunity for cognitive development through the conceptual reinforcement provided by the semantic network of multiuser conceptual maps, managed and organized by the educational tool Vidya Network.

Aspectos Pedagógicos e Tecnológicos de uma Experiência de Formação Docente sobre a Ferramenta Educacional Vidya Network

RESUMO

Este artigo apresenta aspectos pedagógicos e tecnológicos observados em uma experiência de formação docente realizada para professores dos anos finais do ensino fundamental de uma rede municipal de ensino. Teve como objetivo formá-los para o uso da ferramenta educacional Vidya Network, a qual foi desenvolvida a partir do conceito de Redes Semânticas de Mapas Conceituais. A formação, presencial, foi realizada ao longo de três encontros em que, por meio de aulas expositivo-dialogadas, dinâmicas e exercícios práticos, os participantes, utilizando computadores de mesa e telefones celulares, puderam experienciar a ferramenta. A proposta teve como objetivo permitir aos participantes desenvolver a aptidão de avaliar as técnicas pedagógicas utilizadas na ferramenta em relação à capacidade de apoio ao desenvolvimento cognitivo de seus alunos. Os resultados da formação foram obtidos de três fontes principais: 1) um questionário online para os professores, no segundo encontro; 2) entrevistas qualitativas individuais para os professores no terceiro encontro e 3) um questionário respondido pela Coordenação Pedagógica do município após o encerramento da atividade. Com base nos resultados dos retornos obtidos tanto dos professores como da Coordenação Pedagógica, conclui-se que a Vidya Network tem o potencial almejado de desenvolvimento cognitivo dos alunos, mas que, para seu uso efetivo na rede municipal, é necessário realizar melhorias nos laboratórios das escolas pesquisadas para que os alunos possam interagir com a ferramenta educacional de modo contínuo e institucional.

PALAVRAS-CHAVE: Formação docente. Redes semânticas de mapas conceituais. Vidya Network.

NOTES

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