

Publication status: Preprint has been published in a journal as an article
DOI of the published article: <https://doi.org/10.1590/0102-469849142t>

METHODOLOGY FOR USING DIGITAL INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE STUDENTS' SOCIO- EMOTIONAL SKILLS DEVELOPMENT

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<https://doi.org/10.1590/SciELOPreprints.7379>

Submitted on: 2023-12-06

Posted on: 2023-12-08 (version 1)

(YYYY-MM-DD)

ARTIGO

METHODOLOGY FOR USING DIGITAL INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE STUDENTS' SOCIO-EMOTIONAL SKILLS DEVELOPMENT

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ABSTRACT: The COVID-19 pandemic led to the closure of Brazilian educational institutions in March 2020, resulting in a shift to virtual classes for almost all students. This abrupt transition disrupted social interaction and cooperation among students. In response, a research study focused on improving virtual classes using Digital Information and Communication Technologies (DICT). The study proposed a four-step methodology: analyzing the impact of DICT on socio-emotional skills, designing and developing digital tasks to enhance social interaction, evaluating the effectiveness of these tasks through a questionnaire, and validating the methodology through qualitative analysis. The results showed that using DICT, combined with tailored pedagogical activities based on students' access to technology, aided in developing socio-emotional skills. Virtual classes positively affect students' organizational skills, empathy, and collaboration in group dynamics and individual activities.

Keywords: Virtual Classes, Elementary School, Socio-Emotional Abilities, Digital Information and Communication Technologies (DICTs), Mind Maps.

METODOLOGIA PARA USAR TECNOLOGIAS DIGITAIS, INFORMAÇÃO E COMUNICAÇÃO NO DESENVOLVIMENTO DE HABILIDADES SOCIOEMOCIONAIS DE ALUNOS

RESUMO: Para mitigar os impactos da pandemia da COVID-19, as instituições de ensino brasileiras foram fechadas e encerraram as atividades presenciais em março de 2020, o que afetou quase 100% da população estudantil brasileira, acelerando a adoção de aulas virtuais no ensino fundamental. Tal medida forçou os alunos a mudarem de aulas presenciais para virtuais, resultando numa interrupção abrupta da interação social e do sentido de cooperação entre os alunos. Devido ao cenário exposto, esta pesquisa investigou um método viável para melhorar aulas virtuais utilizando Tecnologias Digitais de Informação e Comunicação (TDIC). Na sequência, procurou-se conceber e desenvolver novas dinâmicas e tarefas pedagógicas, em formato digital, que potencializassem a interação social para melhorar o foco dos alunos na execução das atividades escolares. O método foi implantado e validado por meio dos resultados que demonstraram que o uso das TDIC em conjunto com atividades pedagógicas desenvolvidas conforme a realidade de acesso dos alunos à tecnologia auxilia no desenvolvimento de competências socioemocionais porque, durante as aulas virtuais, foram reconhecidos impactos positivos no sentido de organização tanto nas dinâmicas de grupo em que os alunos demonstraram empatia e colaboração com colegas que tinham dificuldades na utilização das TDIC, quanto nas atividades individuais.

Palavras-chave: Aulas Virtuais, Ensino Fundamental, Sócio Emocional, Tecnologias Digitais de Informação e Comunicação, Mapas mentais.

METODOLOGÍA DE USO DE TECNOLOGÍAS DE INFORMACIÓN Y COMUNICACIÓN DIGITALES EN EL DESARROLLO DE HABILIDADES SOCIOEMOCIONALES DE LOS ESTUDIANTES

RESUMEN: Para mitigar los impactos de la pandemia de COVID-19, las instituciones educativas brasileñas cerraron y finalizaron las actividades presenciales en marzo de 2020, lo que afectó a casi el 100% de la población estudiantil brasileña y aceleró la adopción de clases virtuales en la educación primaria. Esta medida obligó a los estudiantes a pasar de clases presenciales a clases virtuales, lo que resultó en una interrupción abrupta de la interacción social y un sentido de cooperación entre los estudiantes. Debido al escenario expuesto, esta investigación investigó un método viable para mejorar las clases virtuales utilizando Tecnologías de la Información y la Comunicación Digital (TICD). En primer lugar, se realizó un análisis de cómo impacta el uso de las TICD en el desarrollo de habilidades socioemocionales. A continuación, buscamos diseñar y desarrollar nuevas dinámicas y tareas pedagógicas, en formato digital, que potenciaran la interacción social para mejorar la concentración de los estudiantes en la realización de las actividades escolares. El método fue implementado y validado a través de resultados que demostraron que el uso de las TIC en conjunto con actividades pedagógicas desarrolladas de acuerdo a la realidad del acceso de los estudiantes a la tecnología ayuda en el desarrollo de habilidades socioemocionales porque, durante las clases virtuales, se reconocieron impactos positivos sobre el sentido de organización tanto en dinámicas de grupo en las que los estudiantes demostraron empatía y colaboración con compañeros que tenían dificultades para utilizar las TICD como en actividades individuales.

Palabras clave: Clases Virtuales, Educación Primaria, Habilidades Socioemocionales, Tecnologías de la Información y la Comunicación Digital (TICD), Mapas Mentales..

INTRODUCTION

The rapid expansion of the COVID-19 pandemic initiated in Wuhan (China) in December 2019 brought up a no-way-back experience to online and digital media education. The Ministry of Education of Brazil, on March 17th, 2020, published the Normative n°343, which regulated the substitution of in-person classes for digital media classes for 30 days or, on an exceptional basis, it would be extended as long as the COVID-19 pandemic lasts (du Brésil, 2020).

The exceptionality character of this normative came into force with the consensus of most municipal and state officials, resulting in the Emergency Remote Teaching and the approval of strategies to prevent the spread of COVID-19 and thus decrease the rise of the contagion curve (Bezerra, 2020).

The Secretary of Education of the State of São Paulo (SEDUC) announced the plan of optional returning to staggered in-person classes, scheduled for November 03rd, 2020. This decision was not official in all schools in the state, as the mayors of each municipality had autonomy over municipal and private schools to return the classes. In addition, all of them had to meet the health safety protocols and attend to the risk groups and the numbers and cases of COVID-19 in each city (SEDUC-SP, 2022). Therefore, the COVID-19 pandemic enabled Digital Information and Communication Technologies (DICTs) on a large scale. As cited in (Behar, 2020), the main plan was to emphasize the technological transformation in education that could happen in a decade and take only three months to be in service properly (Pereira, 2019).

It must be mentioned that during the social isolation, students remained physically distant from school and, within their homes and flats, they had the opportunity to study virtually, making use of DICTs in moments of synchronous classes (real-time video classes) and asynchronous (recorded classes) an effective technology applied to education. However, such exposure and the constant use of these technological tools exposed positive and negative impacts that online classes caused on the development of socio-emotional skills in primary school students during the COVID-19 pandemic. Thereby, owing to the scenery mentioned earlier, it instigates the following question: How can pedagogical practices and activities be developed using DICTs to improve social interaction and student engagement in virtual environments?

To answer the above question, this article analyzes how the use of DICTs impacts the development of socio-emotional skills of primary school students during the remote emergency teaching

period. Moreover, it seeks to investigate, design, and develop new dynamics and pedagogical tasks in digital formats that enhance such social interaction and improve students' focus on the execution of school activities in virtual environments and validate them through the application in the virtual classrooms.

To reach the proposed goal, primary school teachers from public and private schools in São Paulo State participated in the exploratory-qualitative research composed of a questionnaire in Google Forms to understand the impacts of online classrooms. Afterward, a brainstorming session was run to develop new tasks in the format of mind maps. In sequence, assuming that the educators applied the new proposed activities, professors answered a questionnaire with open questions for collecting a narrative inquiry to understand their impact. Finally, an analysis was conducted by evaluating them, and the literature was studied through a qualitative approach to validate the results.

A premise assumed in the research was that the preference for primary school teachers was due to their permanent contact with students between 6 and 11 years old. When entering school, students in this age group manifest their emotional aspects to teachers and classmates and their assessment performance more clearly (Squassoni, 2014). Moreover, the paper also introduced the NCCB (National Common Curricular Base), a document approved in December 2017 by the Brazilian Education Ministry, and the relationship between the DICTs deployed during the pandemic period and socio-emotional skills defined in the core curriculum model (Brasil, 1997).

RELATED WORK AND THE USE OF DICTs ACCORDING TO NCCB

Thereby, a short description and concepts of the leading education theorists adopted as the principal references in the current research and their use in the sphere of social interaction, emotional intelligence, emotions and psychomotricity, and deterritorialization architecture are presented as follows: 1) Vygotsky's concept of mediation (Bessa, 2008); 2) Emotional intelligence concept and its importance in childhood (Gardner, 2011); 3) Cyberspace (Lévy, 1998); 4) The learning process and the relation between the environment, the individual, and kinetics (Wallon, 1975); 5) DICT and education (Valente, 2005); and 6) (Collaborative for Academic Social and Emotional Learning) (Schonert-Reichl, 2017). Considering the aforementioned theoretical references, many researchers combining theoretical references with DICTs have proposed and developed innovative tools and instruments to improve education quality at all educational system levels. The influence of emotional intelligence has also been explored and studied to understand human behavior and improve the use of DICTs in education. A study presented (Chinyere, 2022) investigated the emotional intelligence influence on students' ability level, and the findings of the study revealed that academic motivation has a positive and significant relationship with the attitude of students to study in university regarding the use of DICTs in the courses of engineering fields.

Other remarkable research approaches to emotional intelligence and the use of technologies can be found in (Morais, 2023), (Rezvani, 2019), and (Vershitskaya, 2020). The technologies for promoting learning at all levels of education have been explored in cyberspace, as proposed in (Ozcan-Deniz, 2022), where the authors proposed and analyzed the cyberspace application in the learning related to the technical skills for construction, among other uses, such as in (Marshall, 2019), where the authors investigated the cyberspace for proposing a new approach for teaching and learning in child and youth care education. The learning process and the relation between the environment have been studied (Toutain, 2017), where the environmental impacts on the learning process were investigated and analyzed. Therefore, the DICTs are being incorporated into teaching practices to promote more expressive learning, support teachers in the insertion of active teaching methodologies, adjust the teaching and learning process to the student's reality, and awaken student interest and engagement in stages of Basic Education.

In this sense, the NCCB seeks to develop skills and abilities focused on critically and responsibly using digital technologies across all knowledge areas. The NCCB mentions that incorporating digital technologies in education should not be used only as a means of learning support or to encourage students' interest. Instead, students should use the DICTs to learn how and for what purpose these digital tools can be deployed. With this, it has prepared and made available, openly and free of charge, the

Reference Curriculum in Technology and Computing, which presents axes, concepts, and skills aligned with the NCCB for developing skills, including general competence of Digital Culture. Such axes subdivision proposes that each concept works on one or more skills, for which pedagogical practices, assessments, and reference materials are suggested. The Reference Curriculum can guide managers and teachers in implementing the technologies in the school context, not only as an environment in which students are inserted but also as an object of knowledge, preparing students in the professional and personal spheres using DICT. The NCCB emphasizes that in recent years, it has been discussed that digital technology in education needs to be inserted responsibly and always with a critical reflection. Despite digital inclusion being placed transversally, reaching all disciplines and curricular components, the Portuguese Language component of the NCCB dialogues with documents and curricular guidelines, seeking to adapt to the transformations of language practices that occurred, mainly due to the development of DICT. In the context of digital culture, DICTs have promoted significant social changes in contemporary societies.

METHODOLOGY

The Research Design

The first phase of the research is exploratory and qualitative through data collection, the objective of which is to analyze how the use of digital information and communication technologies impacts the development of socio-emotional skills of elementary school students. Thus, a questionnaire was created and sent to public and private school teachers to identify the positive and negative impacts and the emotional challenges that using DICTs caused in the students' socio-emotional skills during the pandemic period.

Based on the results and analysis of the answers collected with the questionnaire and its respective statistical description, a brainstorming dynamic was created that sought to discover new dynamics and pedagogical tasks in digital formats that improve social interaction, cooperation, and social focus among elementary school students during the execution of school activities in virtual environments. For this stage, the deliverable is the production of two mind maps.

From the results obtained (the mind maps), another questionnaire was created in open questions format so that teachers could narrate their experiences with the implementation in the virtual environment of the ideas presented in the created mind maps.

Finally, the qualitative data analysis has been formulated, and it involved discovering and understanding the new scenario by applying the new teaching strategies proposed in stage 2 of the proposed methodology. It was conducted using individual information, such as the NCCB, the theoretical framework discussed in Section Related Works, and the responses from open interviews in step 3 of the proposed methodology. A summary of the methodology with the sequential steps is shown as follows:

Stage I – questionnaire I and statistical description;

Stage II – analysis of the questionnaire I answered, which aimed to bring up understanding and comprehension of the scenario and then formulate the guiding topics used in the design thinking dynamics proposed;

Stage III – questionnaire for evaluating the developed mind maps;

Stage IV - Qualitative analysis of mind maps and their respective application.

Stage I – Questionnaire I and the Descriptive Statistics

The questionnaire of this stage was developed in closed format and sent virtually by Google Forms tool to teachers from two schools in the state of São Paulo, one public school (A) and a private school (B), with a total of 32 participants, 5 participants from the public school, named as (A), and 27 participants from the private school, named as (B).

The questionnaire comprises two sections: 1) 5 multiple-choice questions to identify gender, age, level of education, year of elementary school taught, and working hours; 2) 12 questions in a closed format with multiple-choice answers on a Likert scale.

Such questions seek to identify the impacts of DICT on the students' socio-emotional skills. For this, the questions comprised statements that accommodate socio-emotional skills and the use of

DICTs in virtual classes. Furthermore, to facilitate the understanding of DICTs' impacts (positive or negative) on the development of socio-emotional skills in the school environment, the questions were divided into three pillars: 1) General Skills Socio-Emotional Teaching– Learning Expectation; 2) Architecture; and 3) Technical-operational. In the first section, five multiple-choice questions have been formulated to identify gender, age, level of education, year of elementary school taught, and working hours, as shown in Chart 1.

Chart 1- The Questionnaire I - Part 1. Multiple-choice questions to identify features.

Question	Answers Available
Gender	1. Male
	2. Female
	3. Other
Age	1. between 20 and 30 years old
	2. between 30 and 40 years old
	3. between 40 and 50 years old
	4. between 50 and 60 years old
	5. between 60 and 70 years old
Education Level	1. Bachelor's or equivalent level
	2. Incompleted Specialization in Education or equivalent
	3. Completed Specialization in Education or equivalent
	4. Incompleted Master's degree or equivalent
	5. Completed Master's degree or equivalent
	6. Incompleted Doctoral degree or equivalent
	7. Completed Doctoral degree or equivalent
School year working on currently	1. Elementary I - first and second years
	2. Elementary I - from 3 rd to 5 th year
	3. Elementary II - from 6 th to 9 th year
Current working hours	1. Morning
	2. Afternoon
	3. Night
	4. Full

Source: Prepared by the authors

For the second section, a set of twelve questions was elaborated in a closed multiple-choice format, and the response options were given on the Likert scale as follows: I agree (100%); Partially agree (50% to 70%); Disagree (100%); Partially disagree (50 to 70\%); Neither agree nor disagree (0%). They have been equally distributed in each pillar, as shown in Chart 2.

Chart 2 - Questionnaire I - Part 2—questions for socio-emotional skills' identification with the use of DICTs.

Pillar	Questions
General Skills Socio-emotional Teaching-Learning Expectations	1. Can you recognize your students' leadership posture and assertiveness in group activities during virtual classes?
	2. Does the excess of information found online during school research frustrate students due to the difficulty in defining fact or fake?
	3. In virtual classes, Do students tend to be more cooperative and participatory in group activities that require collaboration?

	4. Do virtual classes provide a greater appreciation for cultural diversity?
Architecture	5. The virtual classes show only one part of the body. Do you realize that students feel more anxious due to the contact with cameras and screens?
	6. Does the sitting position looking at the computer screen leave students more focused on the material learned?
	7. Using slides and digital teaching materials in virtual classes is necessary. Do you see an improvement in the students' focus with this classroom format?
	8. Do the calendars and agendas found in digital technologies give students a better sense of organization?
Technical-Operational Pillar	9. Do you notice more students withdrawing from learning when the internet is down, or there are failures because the signal is Inadequate?
	10. Do you understand the students' more significant curiosity in learning the new functionalities and updates of the operating systems and software during the virtual classes?
	11. Does the screen freezing generate a feeling of insecurity in students who prefer to keep the camera off during class?
	12. Do you observe a feeling of cooperation and empathy from the students when the internet is slow or the class is interrupted due to internet failures?

Source: Prepared by the authors

The first four questions sought to identify the socio-emotional skills, such as leadership, assertiveness, frustration, collaboration, and cultural diversity, mentioned in the general skills of the NCCB. Questions 5 to 8 aimed to analyze how the architecture of virtual classes through DICTs interferes with socio-emotional skills such as anxiety, focus, organization, and creativity. Questions 8 to 12, which are in the technical/operational pillar, desired to analyze the effects of using DICT on socio-emotional skills and abilities: giving up, curiosity, shyness, and empathy. Finally, All the results of Questionnaire 1 were compiled using descriptive statistics tools to provide basic information about variables in a dataset and highlight potential relationships between variables to be used in the next stage of the proposed methodology.

Stage II - Design Thinking Dynamics for Mind Maps' Development

According to (Meinel, 2011), design thinking is a humanistic procedure of innovation, creativity, collaborative work, and multidisciplinary vision focused on principles of engineering, design, arts, social sciences, and corporate discoveries.

The design thinking selection is justified because it is a non-linear protocol that allows participants to use their creativity more expansively. (Serrat, 2017) explains that non-linearity enables the participant to see, model, and build inspiring perceptions instead of just presenting problems and procedural issues. With this, the participant can point out new ideas and alternative solutions.

In addition to encouraging creativity, (Nash, 2011) points out that the Design Thinking deployment in education is necessary because going beyond the problem and understanding the emotions intrinsic to the situation allows school managers to preserve empathy. In this way, the design thinking process uses the empathy of its participants to solve problems. According to (Giacomin, 2014) , design thinking is composed of three procedural steps, which are:

- Listening – is the exploration stage that seeks to understand people's expectations, desires, and needs;

- Create – this is the most abstract stage of the process that demands from those involved an ability to synthesize and interpret the information collected, emphasizing the insights or ideas that have emerged from the previous stage;
- Implement – based on the ideas made up by the participants, the idealization and creation step enable mobilization, producing quick prototypes that should preferably be tested on their own.

For this research, the item listening was explored through sampling I, which used a questionnaire distributed to public school (A) and private school (B) teachers to collect data to understand the impacts of the use of DICT on socio-emotional skills of students from the perspective of teachers from both schools.

Subsequently, the create step applies the ideation process, including the brainstorming dynamics explained below. The procedural Create step of Design Thinking interprets previously collected information. In this research, the information originates in the responses to the questionnaire distributed to the teachers of public schools (A) and private schools (B). (Giacomin, 2014) explains that during the Create step, it is possible to observe ideas that arise from collecting acquired information. The most used dynamic in the Create step is brainstorming, which allows the participating group to create from other participants' ideas (Meinel, 2011), and (Gerbaudo, 2021). In the HCD toolkit (Giacomin, 2014), the procedural steps of brainstorming consist of:

1. Distribute Post-it notes to all participants and have a large piece of paper on the wall or a whiteboard;
2. Review the rules of brainstorming dynamics before starting;
3. Introduce the question that needs to be answered by the group, or write it at the top of the piece of paper or on the whiteboard;
4. As each participant has an idea, they should expose it to the group, write it on the post-it note, and stick it on a piece of paper or the whiteboard;
5. Generate and expose as many ideas as possible.

However, due to the COVID-19 pandemic, the above operational steps were carried out virtually with individual video meetings and the MindMeister application. This allowed the construction of mind maps based on the discussion or topic (MindMeister, 2020). With the application, participants in brainstorming mode could creatively collaborate with ideas from a specific guiding topic. Dynamic brainstorming uses Post-it notes to record the ideas and possible insights of the participants. The HCD Toolkit (IDEO, 2009) explains that having insights brings to light meanings that have not been previously observed.

In this way, the dynamics took place with the participation of 6 teachers from the private school (B) based on two guiding topics, as follows:

1. Ideas to keep the student focused on the class without being dispersed by search engines, applications, or other sites that are irrelevant to the virtual class taught;
2. Ideas for dynamics and pedagogical tasks in digital formats that improve students' social interaction and cooperation, alleviating insecurity during technical failures in digital media.

The two topics above were sent and answered by the participants via email. An individual call was made with each participant to clarify and resolve doubts.

Brainstorming allowed the discovery of new dynamics and pedagogical tasks in digital formats that improve social interaction, cooperation, and focus, emphasizing questions 3, 6, 7, and 11 of the questionnaire – Part Two.

Stage III – Questionnaire II for Evaluating the Developed Mind Maps

For this phase, first, the teachers received the two developed mind maps and applied the ideas and digital activities suggested in these two documents. It must be noticed that each mind map has been used by a group of six teachers in real virtual classrooms.

Afterward, the questionnaire of this phase was created in an open configuration and sent virtually through the Google FORMS tool to teachers from two private schools in São Paulo state, with 12 participants (six for each mind map proposed).

The first mind map deals with the aspects of the visual and objective language of the classes, the digital technology resources, and the use of breaks during the classes. Thereby, the questionnaire is composed of six questions, and the goal is to collect a narrative investigation to understand the impacts of the ideas and proposals and whether they resulted in improvements in the classes being taught digitally by applying Digital Information and Communication Technologies during a long period of COVID-19 restrictions. The questions are shown in Chart 3.

Chart 3 - Questionnaire II - Questions to understand the impacts of the Mind Map 1 application.

Idea	Answers
Visual and Objective Language and Digital Technological Resources	1. During the remote classes, what technological resources did you use to keep the student focused on the class? Tell us about your experience.
	2. Relate a situation where you noticed the students dispersed and lost focus during the remote class.
	3. Comparing the remote classes with face-to-face classes, in which type did you observe better retention of students' focus and attention when using technological resources such as visual and objective language? Describe your observation.
Taking some breaks	1. Did you take any class breaks in a 45-minute remote class duration? Tell us your experience and how it took the course.
	2. Did you notice focus improvement in the students due to class breaks during remote classes? Describe a situation in which you noticed focus improvement after a class break.
	3. Comparing remote classes to face-to-face classes, which class format was the breaks more productive?

Source: Prepared by the authors

Likewise in the first, the second mind map deals with using technological tools like Kahoot and Padlet and developing online mind maps in the MindMeister tool. Thereby, the questionnaire comprises six questions, whose purpose is to compile a narrative investigation to comprehend the impacts of the use of technological tools and how to develop them on the class and analyze whether their use resulted in improvements in the classes being taught digitally by applying Digital Information and Communication Technologies over a long period of COVID-19 restrictions. The questions are shown in Chart 4.

Chart 4 - Questionnaire II - Questions to understand the impacts of the Mind Map 2 application.

Idea	Answers
	1. During the remote classes, did you use one of the learning technologies: Kahoot, Padlet, or Mindmeister? Tell us about your experience.

Idea	Answers
Use of technological tools like Kahoot and Padlet	2. When using Kahoot, Padlet, or MindMeister technologies, was there any technological failure in the digital media such as screen freeze, internet crash, or some bug in the application? If yes, did you notice an insecure feeling coming from the students? What was done to improve social interaction during technological failures?
	3. Comparing the use of technologies such as Kahoot, Padlet, and MindMeister in remote classes to face-to-face classes using paper, notebook, and pencil, in which of the two formats have you noticed a feeling of insecurity in moments of social interaction? Can you narrate a situation that you recall?
Flipped Class	1. did you use the flipped classroom strategy during the remote classes? Tell us about your experience.
	2. Were there technological failures (screen freezing, internet crash) in the remote classes when the students brought up the previously studied topics? Did you observe insecurity in the student's behavior?
	3. How would you rate the social interaction of students in remote classes when compared to face-to-face classes?

Source: Prepared by the authors

Stage IV - Qualitative Data Analysis

For this phase, a qualitative and descriptive study should be carried out based on the experience of the teachers with the application of the ideas and methodologies defined in the two mind maps developed. The option for this type of analysis was mainly justified by delving into the understanding of pedagogical practices and the teacher's experience to understand how the generated mind maps impacted the remote classes during the COVID-19 pandemic.

Thus, it sought to verify the pedagogical practices aligned with the two proposed mind maps. In this context, a search was made for representative teacher profiles, adopting the selection criteria as follows: a) the use of DICTs should be a deliberate and planned strategy for classes; b) in addition to the use of DICTs, the teacher must adopt the practices and methodologies suggested in the two suggested mind maps, and c) have taught at least their classes entirely remotely during the period of the COVID-19 pandemic.

For data collection, analyses of documents and interviews were carried out. The documents cited in the Literature Review, shown in Section RElated Works, were consulted. The most important are: 1) Vygotsky's concept of mediation; 2) the Emotional intelligence concept; 3) Cyberspace; 4) The learning process and the relation between the environment; 5) DICTs and education; 6) socio-emotional skills in the school environment; and 7) The National Common Curricular Base.

Then, a semi-structured interview guide was prepared based on the theoretical framework and proposed mind maps. Tables~\ref{tab:mindmap1} and~\ref{tab:mindmap2} illustrate such a proposed guide. Furthermore, the interviews were conducted with scientific rigor based on the study's criteria.

The interviews were carried out with 12 teachers, six for each mind map, who met the established criteria, and the people indicated are teachers who actively use the proposed technologies and methodologies. Finally, the number of respondents proved to be sufficient for data collection and to preserve the identity of respondents, and they were randomly named Interviewee 1 (E1), Interviewee 2 (E2), and so on.

All the collected data were analyzed using qualitative content analysis. This technique represents the categorization of central elements based on the previously raised theoretical framework. Categorization effectively organizes and reduces data by grouping information into limited categories (Bardin, 1977).

Considering the proposed qualitative model, this procedure was performed using the MAXQDA® software for data structuring. Thus, the processes of reading and interpreting the data and encoding text segments, analysis, graphics, and tables were generated from it (Gizzi, 2021). The details and results of such methodology are demonstrated in Section Results and Discussion.

RESULTS AND DISCUSSION

Answers and Statistical Description to the Questionnaire I

As described in Section Stage I – Questionnaire I and the Descriptive Statistics, the responses to Questionnaire I generated two main guiding topics for the dynamics of design thinking, the next stage of the proposed methodology. In addition, although it reported 32 responses, one of them was submitted with blank responses. Therefore, only 31 responses were considered for analysis.

For the first section of the questionnaire, the percentage of the answers to the question is shown as follows:

1. From the answers to question 1, it should be noted that 90.3% of respondents are female, which predicts that the primary school environment of the two participating schools has female primarily individuals. This result aligns with the MEC's Basic Education School Census, indicating a female predominance of early childhood and elementary education professionals.

2. Regarding question 2, 38.7% are between 40 and 50 years old, 29% are between 50 and 60, and 25.8% are between 30 and 40. It is also observed that 67.7% of the responding teachers are 40 or older, with a small minority, 6.5%, between 20 and 30 years old.

3. Among the 31 respondents to question 3, it should be noted that 64.5% have completed a Specialization in Education or equivalent degree, while 19.4% have only completed higher education.

4. Regarding working hours, question 4, the respondents teach in the following school years: 45% fundamental I – from 3rd to 5th year; 38.7% Elementary I – first and second years; and 12.9% Elementary II – from 6th to 9th year. The remaining 3.2% are substitute teachers in Elementary I and II education.

5. Finally, the answers to question 5 show that 51.6%, just over half of the respondents, work full-time at school. Now, 32.3% work in the afternoon and 9.7% in the morning. Only 6.4% teach at night.

In a nutshell, taking into account the responses to the first five questions, it can be stated that 90.3% of the respondents are female, 67.7% are 40 years old or older, 64.5% have a postgraduate degree, 45% teach in fundamental I between the 3rd and 5th year and that 51.6% work in full-time scheme.

For the second section of the questionnaire, composed of twelve questions shown in Chart 2, the summarized results are briefly highlighted as follows:

1. In question 1, the total number of responses between agreeing and partially agreeing is 74.2%, highlighting the recognition of leadership and assertiveness in group activities during virtual classes.

2. In question 2, 45.2% of respondents agree with the question. In contrast, 35.5% partially agree that the excess of information on the internet generates a feeling of frustration in students who have difficulty defining whether a given information is true or false (fake).

3. In question 3, there is a balance in the answers, as 16.1% agree and 35.5% partially agree, while 16.1% somewhat disagree and 32.3% disagree with the statement proposed. Mathematically, however, respondents indicated that students tend to be more cooperative in group activities.

4. In question 4, 45.2% partially agree, and 12.9% agree with the information. Thus, 58.1% agree with the statement about virtual classes and respect for cultural diversity.

5. In question 5, 61.3% agree, and 12.9% partially agree that using cameras and screens generates a feeling of anxiety in students during virtual classes.

6. In question 6, most respondents, 64.5%, disagree that the sitting position and looking at the screen make students more focused.

7. In question 7, 61.3% partially agree with, and 29% agree. The results found emphasized the importance of creating classes with appropriate teaching materials.

8. In question 8, calendars and diaries found in digital technologies are favorable for students' sense of organization, according to the percentage of 41.9% of respondents who agree and 29% partially agree.

9. In question 9, most respondents (77.4%) agree that there is a dropout in learning when the internet goes down or there are signal failures.

10. In question 10, 54.8% agree, and 29% partially agree that virtual classes instigate students' curiosity to understand the functionalities and updates of operating systems and software.

11. In question 11, a total of 77.5%, with 45.2% agreeing and 32.3% partially agreeing, that the screen freeze generates a feeling of insecurity in students in virtual classes.

12. Finally, in question 12, 38.7% of respondents agree, and 35.5% partially agree that students demonstrate cooperation and empathy as class is interrupted due to slowness and internet failures.

Answers and Statistical Description to the Questionnaire I

Mind Map 1 consists of ideas to keep the student focused on the class without dispersing with the search engine, applications, games, or other sites irrelevant to the virtual class.

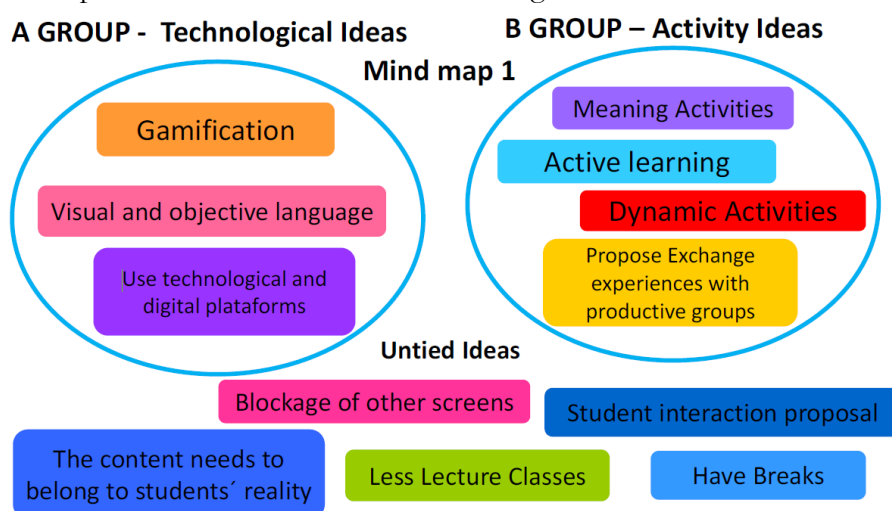
The choice for this topic is due to the results of questions 6 and 7, in which question 6 indicated that 64.5% of the participants disagreed that sitting down and looking at the computer screen keeps students focused. In question 7, 61.3% partially agree, and 29% agree that using slides and teaching materials for virtual classes improves students' focus.

Mind Map 2 consists of ideas for dynamics and pedagogical tasks in digital formats, which improve social interaction and student cooperation, alleviating insecurity in times of technical failures of digital media. It was prepared based on questions 3 and 11 of the questionnaire.

In question 3, 35.5% partially agree, and 32.3% disagree that in virtual classes, students tend to be more cooperative and participatory in group activities. Question 11 points out that 45.2% agree and 32.3% partially agree that technical failures such as screen freezing can generate a feeling of insecurity in students who prefer to keep the camera off.

From the sets of ideas and proposals inserted by the teachers in mind Map 1, Ideas to keep the student focused in class without getting dispersed by search engines, applications, games, or other sites, then two groups were created: A) Technological Ideas; and B) Activity Ideas. Fig. 1 illustrates the generated ideas.

Figure 1- Group of Ideas raised in the brainstorming session to elaborate on Mind Map 1.



Source: Prepared by the authors

Afterward, the ideas of groups A and B were enumerated, and the ideas of the A group were listed, as shown in Chart 5.

Chart 5-Group A - Tecnological Ideas.

Group	Idea
Group A - Technological Ideas	1. Visual and objective language
	2. Use technological resources and digital platforms
	3. Gamification

Source: Prepared by the authors

In virtual classes, the visual and objective language deployed with technological resources is necessary for learning. As explained (Otterborn, 2019), texts read on computer screens must be formatted in small blocks, being short and organized, as reading on screens may not be comfortable or healthy, especially for long hours.

There is also the Gamification methodology that uses game elements at times when games are not used. According to (Deterding, 2012), the use of game elements seeks to create changes in the behavior of people or groups, also introducing a solution for these circumstances. Group B ideas were listed, as shown in Chart 6.

Chart 6 - Group B - Activity Ideas.

Group	Idea
Group B - Activity Ideas	1. Significant activities
	2. Dynamic activities
	3. Active learning
	4. Propose the exchange of experience with constructive groups
	5. Foster family participation/interaction

Source: Prepared by the authors

In this group of ideas, the participants propose Active learning (item 3), which is part of the active methodologies and uses different modalities. According to (Mattar, 2017), active methodologies are composed of learning methods that make spaces more flexible and allow the execution of activities, giving students autonomy to carry out their projects or group activities. Therefore, active methodologies tend to connect with the use of DICTs since they make spaces that can be both face-to-face and virtually more flexible.

Idea 5, fostering family participation, connects students to their reality and family routine, making students use only the search engines and applications needed for the class without being dispersed with random digital materials. However, According to the emphasis given by (Moran, 2021), parents need to be prepared for active methodologies and understand this philosophy, supporting their children in flipped learning, consisting of projects, and participating dynamically in transforming the school.

The untied ideas of mind Map 1 are shown in Chart 7. As these are different ideas from each other, not having any correlation between them, no group was formed.

Chart 7- Untied Ideas.

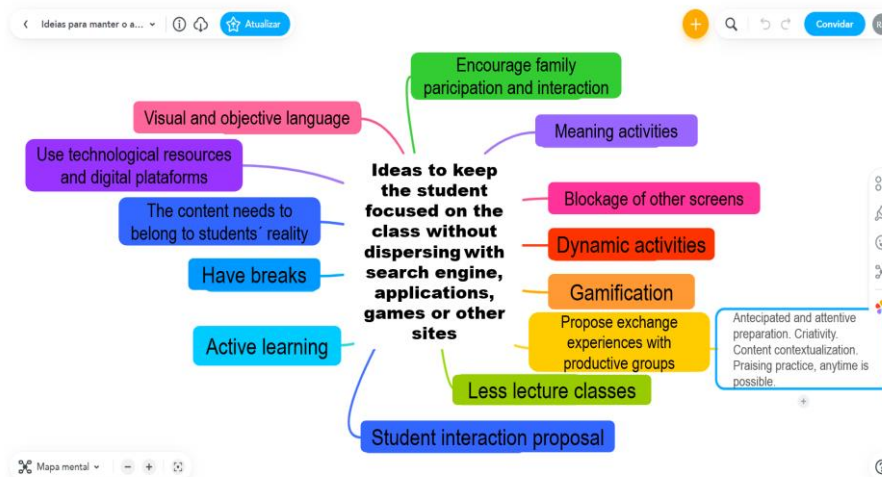
Group	Idea
Untied Ideas	1. Take some breaks
	2. Blocking other screens
	3. The content must be from his reality
	4. Fewer classes

Source: Prepared by the authors

A solution to prevent the student from being dispersed by irrelevant material to the class, such as search engines, applications, and online games, is pointed out in idea 2 (Blocking other screens can be a viable solution). Nevertheless, this idea needs to be intertwined with idea 3 - the content must be something from his reality because when the material taught has no connection with the student's

reality, he will find another form of dispersion that may not be inside a computer but rather inside the student's mind. In the case of idea 4, fewer classes (Valente, 2005) state that students tend to learn from online tutorials or videos on YouTube, and this type of student will have difficulty watching a class for more than 30 minutes. Therefore, to avoid a long period of classes, the alternation of search engines, online applications, and games focused on the material taught can be productive. Still considering idea 4, fewer classes, some authors argue that uniting technology with the classroom and using the teacher's mediation in the knowledge construction process can change the traditional model. For the authors, both the computer and the cell phone can enhance some educational processes such as thinking, analyzing, creating, interpreting, building knowledge, making it more flexible, and adapting the rhythm of each student (de Lima Terçariol, 2021). Finally, the ideas of Mind Map One, raised by the Design Thinking application, are shown in Fig. 2.

Figure 2- Mind Map 1 developed from the brainstorming section.



Source: Prepared by the authors

Likewise, in Mind Map 1, Mind Map 2 also generated a guiding topic idea (Ideas of dynamics and pedagogical tasks in digital media) that improve students' social interaction and cooperation, relieving insecurity at times of technical failure was also divided into groups as follows: A, B, and intersection AB. Fig. 3 illustrates the ideas that compose Mind Map 2.

Figure 3- Group of Ideas raised in the brainstorming session to elaborate on Mind Map 2.



Source: Prepared by the authors

The idea found by group A about games was listed, as shown in Chart 8.

Chart 8 - Group A – Game Ideas.

Group	Idea
Group A – Game Ideas	1. Interactive games

Source: Prepared by the authors

The educational theorist Piaget argues that the activities that include games and applying symbols and rules show the transition in how the individual interacts individually or socially when performing such activities. The goal of executing a game activity is to regulate and integrate the individual into the social group. This integration can be recognized in interactive games. Games activities collaborate with communication and language, enabling children to learn social conventions and social skills (Kishimoto, 1994). The ideas of Group B are shown in Chart 9.

Chart 9 - Group B - Ideas for Group Activities.

Group	Idea
Group B - Ideas for Group Activities	1. The division into small sub-groups for group activities
	2. Promote autonomous activities with productive groups
	3. Stimulate self-evaluations and group feedback

Source: Prepared by the authors

According to (Moran, 2021), group activities consist of projects, problems, challenges, debates, team learning, peer instruction, games, and narratives during face-to-face and online moments that can help teachers' moments of tutorial and mentoring. Therefore, group activities in general, whether face-to-face or online, can stimulate cooperation and alleviate student insecurity, as it is capable of nurturing and encouraging students who are not feeling comfortable with the proposed new challenges, allowing participation with support from other students who feel more self-confident, encouraging and helping those who feel insecure during technical failures.

Finally, the list of ideas found at the intersection of the AB Group is shown in Chart 10.

Chart 10 - The intersection between groups A and B.

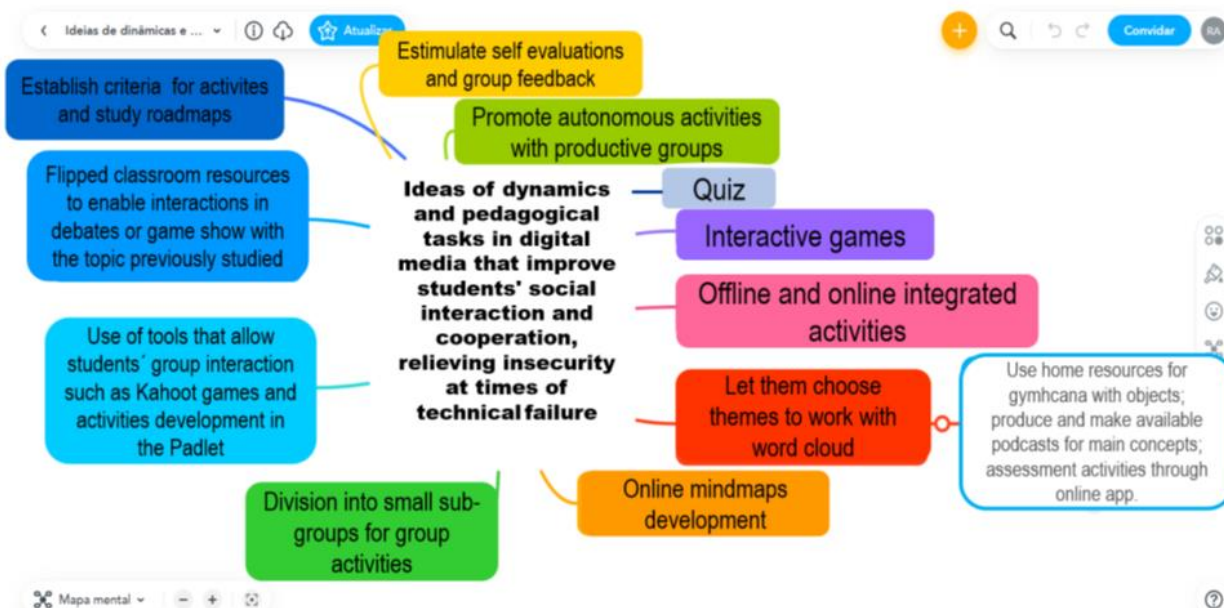
Group	Idea
The intersection between groups A and B	1. Flipped class resources to enable interactions
	2. se of tools that allow students to interact in groups, such as games in Kahoot and the development of activities in the padlet

Source: Prepared by the authors

At the AB Group intersection, there is a combination of activities with different types of games. The participants mentioned these techniques, and although these ideas and proposals contribute to the student's social interaction and cooperation, it must be highlighted that for this specific game, Kahoot, the dynamics only work in online mode. There cannot be an internet outage; otherwise, the game will be interrupted. In this way, the participant of Mind Map 2, responsible for this idea found at the intersection of the AB Group, cannot predict the feeling of insecurity in moments of technical failure, but the social interaction and cooperation between students during virtual classes in online mode.

The flipped class idea belongs to active learning methodologies, and it is interpreted (Valente, 2005) as a modality where the student has previously studied the class content before the face-to-face class, allowing the student to practice the studied content in the classroom. These pre-class activities, with project and laboratory practices, enable students to practice debates and group activities, thus fostering social interaction. In this way, other authors complement that teachers and school institutions must first analyze the changes that new learning theories bring to the school environment, foreseeing that, nowadays, students arrive at school with prior knowledge of the world (de Lima Terçariol, 2021). Finally, the ideas raised in Mind Map Two are shown in Fig. 4.

Figure 4 - Mind Map 2 developed from the brainstorming section.



Source: Prepared by the authors

The answers to Questionnaire II and the Qualitative Data Analysis

This section presents the results obtained in response to Questionnaire II and the proposed qualitative analysis. Initially, the characterization of the sample, composed of 12 participants, 6 for each mind map evaluated, is shown. Chart 11 depicts the profile of such a sample.

Chart 11- Profile summary of the questionnaire's II respondents.

Respondent	Mind Map Used	Gender	Education Level	School year working on currently
E1	1	Male	Bachelor's	Elementary I - from 3 rd to 5 th year
E2	1	Male	Completed Master's degree	Elementary I - from 3 rd to 5 th year
E3	1	Male	Bachelor's	Elementary I - 1 st and 2 nd years
E4	1	Male	Bachelor's	Elementary I - from 3 rd to 5 th year
E5	1	Male	Completed Specialization in Education	Elementary I - 1 st and 2 nd years
E6	1	Male	Completed Specialization in Education	Elementary I - from 3 rd to 5 th year
E7	2	Male	Completed Specialization in Education	Elementary I - 1 st and 2 nd years
E8	2	Male	Bachelor's	Elementary I - from 3 rd to 5 th year
E9	2	Male	Completed Master's degree	Elementary I - from 3 rd to 5 th year
E10	2	Male	Completed Specialization in Education	Elementary I - from 3 rd to 5 th year
E11	2	Male	Bachelor's	Elementary I - 1 st and 2 nd years
E12	2	Male	Bachelor's	Elementary I - from 3 rd to 5 th year

Source: Prepared by the authors

Chart 11 shows that, of the 12 professionals interviewed and who follow the profile previously established in Section Stage IV - Qualitative Data Analysis, all teachers are women, often with a complete Specialization in Education, teaching for Elementary I - from 3rd to 5th year.

Data was collected as mentioned in Section Related Works and all collected documents. In addition, the interviews were conducted and transcribed into files separated by the mind map and teacher in such a way as to facilitate the categorization and identification of the passages that will be highlighted in the qualitative analysis. Regarding segment coding, the main terms and their respective variations presented in the mind maps were adopted as codes. Thus, the processing was carried out with the MAXQDA® to analyze the relationship between the terms found in the documents and interviews observed and whether they are significant for the qualitative analysis.

Its respective ideas were evaluated for the interviews and documents focusing on Mind Map 1, and 3616 segments were processed and analyzed. The three codes used in more segments of texts extracted from the transcripts were Student Interaction Proposal (1868), Active Learning (989), and Content Needs to be in Students' Reality (393). Table 1 shows the list of codes after data processing.

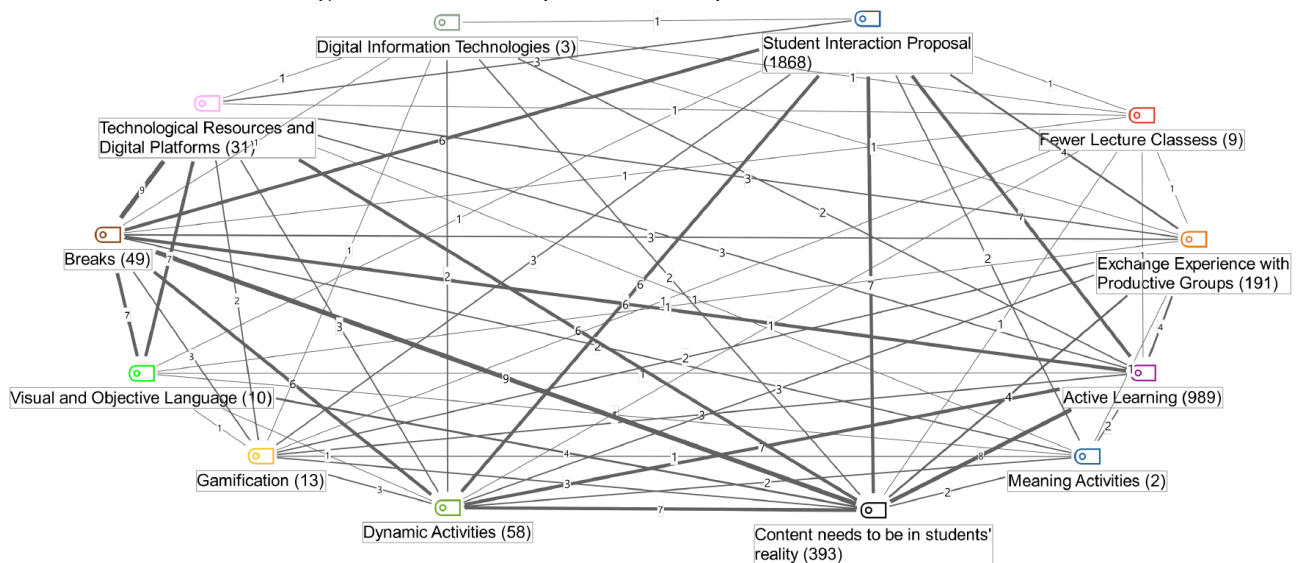
Table 1- Profile summary of the questionnaire's II respondents.

List of Codes	Frequency	Percentage (%)
Student Interaction Proposal	1868	51.66
Active Learning	989	27.35
Content needs to be in students' reality	393	10.87
Exchange Experience with Productive Groups	191	5.28
Dynamic Activities	58	1.60
Breaks	49	1.36
Technological Resources and Digital Platforms	31	0.86
Gamification	13	0.36
Visual and Objective Language	10	0.28
Fewer Classes	9	0.25
Digital Information Technologies	3	0.08
Meaning Activities	2	0.06

Source: Prepared by the authors

The relationship between the codes created in the passages from the interviews and documents can be presented in map format. Thus, it was possible to visualize the co-occurrences of these codes. Co-occurrence is the combination of factors and their relation to each other. Fig. 5 shows the relationship for Mind Map 1.

Figure 5- The three pillars of the questionnaire I – Part 2.



Source: Prepared by the authors

The codes with the most direct and intense relationship with the Student Interaction Proposal (Code most found in the analysis), that is, the codes that appeared in the most significant number of segments, were the Active Learning (7), Content needs to be in students' reality (7), Dynamic Activities (6) and Breaks with (6).

Thus, it was identified that some interviewees and the documents related to keeping a student focused on the class without being dispersed with search engines or other irrelevant sites for the planned virtual class, the prepared Content must be based on the Interaction between the teacher and student, with the student being responsible for taking action to fix the Content he (or she) has just learned (Active Learning) with the Content taught in line with the students' reality (Content needs to be in students' reality). Another point that attracted attention in the results was the positive relationship between the dynamic activities used (Dynamic Activities) and breaks (Breaks) during classes and their relationship with student learning.

The reports and passages analyzed in the interviews and documents point to the following statements.

For the development of skills that involve reasoning, students must be able, in Interaction with their colleagues and teachers, to investigate, explain, and justify the solutions presented to problems, given emphasis on mathematical argumentation processes. Although all these processes presuppose mathematical reasoning, in many situations, few skills related to representation and communication are also mobilized to express generalizations and build a consistent argument to justify the reasoning.

Such a statement corroborates the importance of the Student Interaction Proposal to help the students keep their focus without dispersing (Brasil, 1997).

Still, as discussed (Brasil, 1997),

Returning to the school environment, it is necessary to encourage actions in which teachers and students are subjects of the teaching and learning process. In this sense, they must assume an active attitude toward the contents proposed in the context of Elementary Education and establish an understanding of the topics taught.

, reinforcing the ideas of Active Learning.

For the topic, Content needs to be in students' reality (Valente, 2005) indicates that.

For this, the fundamental approach is that the teacher can observe and dialogue with the students to understand their doubts, concerns, expectations, and needs, and, when proposing activities, to negotiate the intentions and guidelines so that the activities are adequate to the needs of the students and that they can awaken the student's curiosity and desire for learning. It is thus evident that activities with projects and the use of games, for example, reverse the logic of the curriculum defined in grids of watertight thematic Content, inducing the teacher to put into play the problems that permeate everyday life. Thus, the common sense questions and concepts that emerge in the dialogue with the students are transformed into questions and themes to be investigated through projects.

Regarding Dynamic Activities, the NCCB itself indicates that.

The idea of enabling meaningful experiences of collaborative practices in face-to-face Interaction or digital environments includes articulation with other areas, fields, projects, and personal choices. These experiences allow students to collect, process, and disseminate data and information. Also, how the student uses these data in different productions, actions, and projects exercises the protagonism (Brasil, 1997).

The following passages must be highlighted for the other topics shown in Fig.2 and their respective relevance to the ideas of Mind Map 1.

Each day, we see the emergence of new hypotheses and concepts that seek to explain why we learn in a certain way or even how the brains of those who understand more and those who

learn less work. Nevertheless, what should a teacher be concerned about in the student's learning? What should a teacher know to be able to conduct his discipline in a way that facilitates everyone's understanding? To get to these discussions, we first need to go through the universe of theories (Bessa, 2008).

This means that we can only keep an eye on what interests us. Therefore, an uninteresting class, disconnected from the interests of students and their age groups, will probably not provoke enough stimuli for students to remain attentive to what teachers say or do in the classroom (Bessa, 2008).

Given the importance of the school context in child development, the educational practices used in classroom management should not be seen as a simple list of skills and routines but as activities supported by a solid theoretical basis capable of directing the teacher in the construction of favorable contexts for the development of their students in virtual environments or classrooms (Schonert-Reichl, 2017).

The role of the computer in the teaching-learning process analyzes the technical and pedagogical issues involved in using DICTs in education, showing that the great challenge of new technologies that are getting old without having been appropriated by teachers is that the emergence of other technologies may cause unpredictable impacts. There is a need to invest in the preparation of teachers so that they can understand the constitutive characteristics of the technologies available to combine and integrate technical knowledge with innovative pedagogical proposals (Bessa, 2008).

The change in the current educational paradigm results from the introduction of information and communication technologies, leading to a new institution profile and adapting the subjects' roles. Adapting to the use of technologies requires facing challenges by the school, teachers, and students. In the case of the educational institution, it is necessary to articulate, in an interdisciplinary way, the contents of different disciplines with the correct and pedagogical use of technologies in the classroom (Wallon, 1975).

Finally, for the answers to the questions related to Mind Map 1 and its respective application by teachers, some passages from the interviews must be highlighted as follows.

I notice that my students pay more attention when I use digital resources (such as videos, games, apps, websites, etc (Teacher E2).

With the advent and improvement of digital technologies, it is necessary to change teaching practices and roles in the school environment. The teacher must leave the role in which he (or she) is the main person to give space to the student's protagonism in his learning. For this to happen, it is necessary to transform the way of teaching using Digital Technologies into methodologies that make the student more active in the learning process (Teachers E1 and E4).

In virtual classes, the breaks were used because the student was in the presence of his mother or a guardian who brought him back to the task. Some students started playing with their classmates face-to-face and forgot about the activity (Teacher E5).

PowerPoint has been used extensively to make slides of the material in the physical book. So, during the video classes on TEAMS, the book contents were shared in slides. When I used to begin the remote classes, I realized that the students did not follow the instructions while I was giving an explanation following the physical book or asking them to go to the book's page. So, I started making slides and sharing screens (Teachers E3 and E5).

During the explanation of the content, the students were more attentive to the explanation in the virtual class. However, while doing the activities, the students lost their attention in the remote class and started to play or do other things unrelated to the class (Teacher E3).

It is a complicated question, as some students performed better in remote classes than others. During face-to-face classes, these same students who participated more in classes significantly dropped class performance. They looked like other students. However, others performed worse in remote classes than in face-to-face ones (Teacher E6).

The interviews and documents concentrating on Mind Map 2 and its ideas were evaluated, and 4348 segments were processed and analyzed. The three codes used in more text segments extracted from the transcripts were: Used tools that allow students' group interaction (1056), Let them choose themes to work with word cloud (768), and Stimulate Self-evaluations and group feedback (628). Table 2 exhibits the list of codes and the number of coded segments after data processing.

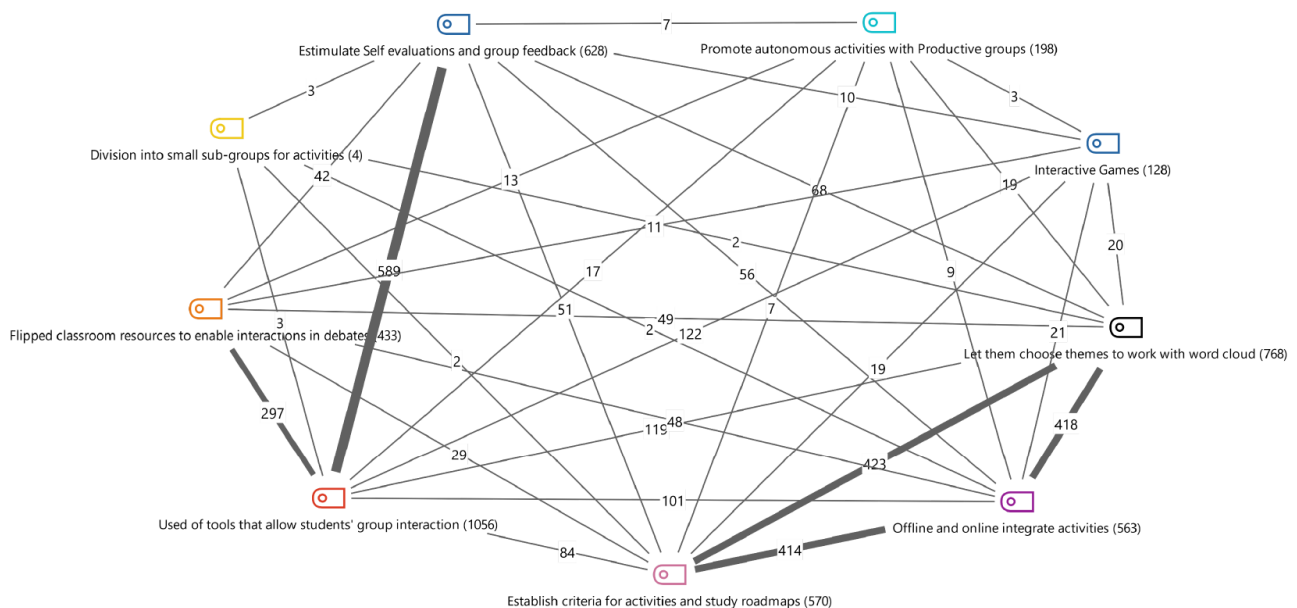
Table 2 - Profile summary of the questionnaire's II respondents.

List of Codes	Frequency	Percentage (%)
Used tools that allow students' group interaction	1056	24.29
Let them choose themes to work with Word cloud	768	17.66
Stimulate Self-evaluations and group feedback	628	14.44
Establish criteria for activities and study roadmaps	570	13.11
Offline and online integrated activities	563	12.95
Flipped classroom resources to enable interactions in debates	433	9.96
Promote autonomous activities with Productive groups	198	4.55
Interactive Games	128	2.94
The division into small sub-groups for activities	4	0.09

Source: Prepared by the authors

The association between the codes developed in the passages from the interviews and documents can be shown through map format. Thus, it was attainable to visualize their co-occurrences and the possibility of factors occurring in combination. Fig. 6 illustrates the combination for Mind Map 2.

Figure 6 - The three pillars of the questionnaire I – Part 2.



Source: Prepared by the authors

The codes with the most direct and intense relationship with the Used tools that allow students' group interaction (Code most found in the analysis), that is, the codes that appeared in the most significant number of text segments were stimulated self-evaluations and group feedback (589), Flipped classroom resources to enable interactions in debates (297), therefore, are the methodologies that facilitate group work.

However, it should be noted that the Establish criteria for activities and study roadmaps code was closely related to the Let Them Choose themes to work with Word Cloud (423) and Offline and Online integrate activities (414) codes, which leads to the conclusion that such a strategy to improve

students' Social Interaction and cooperation, relieving insecurity at times of technical failure is effective only when letting the students choose the topics to be addressed before and during classes. Also, based on the premise that there will be no internet failures, which cause demotivation and conflicts during the classes.

This statement is supported by the reports found in the interviews and documents analyzed in the research.

As indicated in (Brasil, 1997),

The Interaction during play characterizes the daily life of childhood, bringing with it a lot of learning and potential for the integral development of children. By observing the interactions and play between children and between them and adults, it is possible to identify, for example, the expression of affection, the mediation of frustrations, the resolution of conflicts, and the regulation of emotions.

In this sense, the Interaction supported by technologies is the central pillar for developing new significant pedagogical tasks for the student in virtual environments.

Owing to the context reported in (Bessa, 2008),

As a result of the advancement and multiplication of information in communication technologies and the growing access to them due to the greater availability of computers, cell phones, tablets, and the like, students are dynamically inserted in this culture, not only as consumers. Young people have increasingly engaged as protagonists of digital culture, getting involved in new forms of multimedia and multimodal Interaction and social network action, which are carried out increasingly agilely. In turn, this culture also has a strong emotional appeal. It induces the immediacy of responses and the ephemerality of information, favoring superficial analyses and the use of images and more synthetic forms of expression, different from the ways of saying and arguing characteristic of school life.

Another pillar for learning in virtual environments is stimulating self-evaluations and group feedback to motivate students in class.

The following excerpts will highlight the other topics shown in Fig. 4 and their respective relevance to the ideas of Mind Map 2.

Therefore, it is essential to train teachers to prepare them for using these technologies in the classroom and incorporate methodologies that advocate student action from their learning. Thus, to promote the changes that the inclusion of Digital Technologies requires, the adoption of new technological resources is required, a structure that fosters Interaction between subjects and a teacher training model for the construction of new knowledge but does not disregard classic scientific knowledge (Lévy, 1998).

Interactivity concerns using different question formats, positive reactions from the teacher, taking advantage of the student's speech or activity, requesting an opinion, probing, moderating, and stimulating interaction with and between students (Bessa, 2008).

Finally, some passages must be highlighted for the answers to the questions related to Mind Map 2 and its respective application by teachers.

The study group did their research and took photos from the internet, among other activities. Some preferred to present their activity results orally, and others suggested using slides, but in a nutshell, their activity presentations were always successful (Teacher E9).

I notice that my students pay more attention when I use digital resources (video, games, apps, websites, etc.) (Teacher E11).

Group work is essential for developing negotiation and critical skills (Teacher E7).

When I compared virtual classes to face-to-face ones, I realized the students' insecurity when writing on paper. In moments of social Interaction using notebooks, pens, or pencils, some students were ashamed of their handwriting, especially when they were criticized by a classmate

or peer who said he (or she) had unreadable handwriting. I noticed that when using the technologies, students did not need to worry about their handwriting aesthetic once they were typing and not writing (Teachers E8 and E10).

Students were well entertained by the news and ways of interacting with virtual classes. I saw some enthusiasm initially as they wanted to understand how to form groups in Microsoft TEAMS and join groups (Teacher E12).

The students enjoyed using Padlet and Kahoot. I had a problem using Kahoot with all the students because some did not have access to cell phones, others could not, and each was in their home. The questions had time to be answered. It was not possible to do a group activity using only 4 or 5 cell phones available during class (Teacher E9).

Students used to playing online games maintained the same type of social interaction as when playing online, while students who were not used to online interaction felt shy. Some students missed physical contact with classmates and teachers (Teacher E7).

I usually use the interactive didactic material on the computer, and the students participate by watching the screen. There have not been many changes regarding technologies. However, I felt insecure when dealing with social Interaction during virtual classes. Both teachers and students felt social distance, even a particular fear of how to interact with each other (Teacher E12).

Social Interaction happens differently when comparing virtual and face-to-face classes. In face-to-face classes, some students feel insecure about expressing their opinions in front of other classmates but feel more comfortable working with small study groups. In virtual classes, the quality of communication resources, such as the camera and microphone, was decisive when students interacted (Teacher E10).

I used flipped classroom methodology a lot. I adopted the theme from the programmatic planning and added the Content to the platform with available resources: slides, video podcasts, and interactive games, among others. Access was open a few days before, and in the face-to-face classroom, there was a conversation round and several other forms of interaction (Teacher E7).

In the face-to-face mode, it is possible to retain focus more effectively. However, I think attention is linked to how the class is taught and how these resources are used. The flipped class was a type of class that proved to be efficient. They came to class with repertoire and could participate and contribute (Teacher E8).

In a nutshell, the main goal of the qualitative analysis was to listen to the teachers who applied the ideas raised in the two mind maps and utilize the literature review to emphasize and validate the importance of the proper deployment of DICT's for improving the pedagogical practices in the period of virtual classrooms imposed by the COVID-19 pandemic. Through the analysis of the responses, it was possible to identify that implementing the digital tools was challenging and fast, especially in such a short period available to do so, and that by itself did not result in effective learning. Thus, the design of the pedagogical activities, as proposed in this research, must be carried out in such a way as to adapt the contents to the students' reality and the technological limitations inherent to the students' unequal access to technology to obtain effective learning.

The positive evaluation of the activities planned in the mind maps is almost unanimous among the interviewees, who report on the influence of such activities on learning, as they present results more quickly, mainly problem-solving and internet failures. Therefore, the proposed methodology provides meaningful learning opportunities to all students. In addition, the results presented in the virtual classes, developed in line with the technological assumptions and Brazilian educational norms reviewed in the literature, were fundamental to better understanding the social Interaction between students and teachers during virtual classes. The proposed methodology can be replicated in other educational levels and contexts, such as high school, academic, and corporate education.

FINAL CONSIDERATIONS

The results of this research showed that the use of DICT's in conjunction with pedagogical activities developed according to the reality of students' access to technology helps in the development

of socio-emotional skills because, during virtual classes, it was recognized the positive impacts on the sense of organization both in group dynamics in which students demonstrated empathy and collaboration with colleagues who had difficulties using DICTs in individual activities, such as the use of digital calendars and agendas.

The first step of the proposed methodology was to identify impairments in the students' behavioral and emotional states, such as dispersion, feelings of insecurity when screens freeze, and frustration with the excess of information found in digital media. Based on the analysis of the answers (questionnaire I), challenges were identified in the emotional state of students from public and private schools using DICTs in virtual classes. In addition, it was possible to identify that specific teaching materials for this type of class are necessary to avoid student dispersion during virtual classes and to avoid socio-emotional damage, such as insecurity and withdrawal. Continuous improvement of the internet and functions is needed to make the virtual classes more productive and eliminate screen freezes, crashes in synchronous classes, and robotized or clipped.

In the next step, dynamic brainstorming was used to find pedagogical tasks following the reality detected and resulted in the use of learning and active methodologies, which are interconnected with the DICTS, to encourage social interaction and cooperation, the feeling of insecurity and improvement of focus.

Finally, two mind maps were proposed, as shown as follows: 1) Mind Map with activities to provide improvements in the emotional state of students, which participants in this stage suggested pedagogical activities of gamification and active learning to provide better student focus; 2) Mind Map to avoid socio-emotional losses such as insecurity and giving up as a result of technological failures, where participants suggested that a combination of integrated online and offline pedagogical activities can be a solution in times of technical failures in digital media.

The result is that using DICTs in conjunction with pedagogical activities developed from the proposed methodology positively impacted the student's sense of organization in elementary school because, due to the format and architecture of digital tools, students can organize the content taught within the virtual environment platform. Moreover, students can organize online groups and take notes on what is being discussed, improving social interaction and cooperation. Furthermore, as future work, it is recommended that the proposed methodology be applied at other educational levels to verify its impacts.

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AUTHORS' CONTRIBUTION

All authors contributed equally to the survey and data analysis and the text's writing.

DECLARATION OF CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FINANCING

There is no financing to be declared.

ETHICS COMMITTEE APPROVAL STATEMENT

This investigation follows the ethical guidelines in the 2010 Singapore Declaration on Research Integrity. The principles of confidentiality and anonymity are communicated in the informed consent that the Federal University of ABC Research Ethics Committee approved. The ethical documents used were authorization letters from school directors and informed consent and confidentiality terms from directors, pedagogical coordinators, and teachers.

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