

ENSINO, SAÚDE E AMBIENTE

Health Education: from uncertainty to awareness about vaccination*Educação em Saúde: da incerteza à conscientização sobre vacinação**Educación para la salud: de la incertidumbre a la concienciación sobre la vacunación***Aline da Silva Goulart; ^{I*} Kellen Mariane Athaide Rocha; ^I Andreia Caroline Fernandes Salgueiro; ^{II} Silvana Peterini Boeira; ^{III} Vanderlei Folmer; ^{III}**^I Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brasil^{II} Universidade Estadual do Norte do Paraná (UENP), Jacarezinho, PR, Brasil^{III} Universidade Federal do Pampa (UNIPAMPA), Uruguaiana, RS, Brasil**Palavras-chave:**

ensino; educação em saúde; intervenção - pedagógica; imunização; saúde pública.

Resumo: A partir da crescente desinformação sobre vacinas é fundamental que as escolas desempenhem um papel ativo na conscientização dos alunos sobre a importância da imunização na prevenção de doenças e na promoção da saúde. Além disso, a avaliação do conhecimento prévio dos alunos sobre temáticas de saúde é essencial para verificar a eficácia das intervenções educativas e identificar as possíveis lacunas a serem abordadas. Assim, este estudo visa apresentar uma intervenção pedagógica sobre vacinas, com enfoque na imunização contra a COVID-19 e avaliar o conhecimento dos alunos acerca do tema. A intervenção foi realizada com alunos do ensino fundamental. A atividade foi desenvolvida em 3 etapas: 1º de diagnóstico do conhecimento, 2ª intervenção por meio de diálogo e 3º investigação do conhecimento adquirido. Nossos dados apontam que os estudantes sabem sobre a importância da vacina, mas demonstraram não saber sobre assuntos pós-vacinação e acreditam em mitos acerca da imunização. Diante desse cenário, conclui-se que a educação em saúde desempenha um papel fundamental na promoção da vacinação. Da mesma forma, infere-se que intervenções possam contribuir para aumentar a conscientização dos alunos sobre a importância da vacinação e para preencher possíveis lacunas de conhecimento.

Keywords:

teaching; health education; pedagogical intervention; immunization; public health

Abstract: Given the increasing misinformation about vaccines, it is crucial for schools to play an active role in raising students' awareness of the importance of immunization for disease prevention and health promotion. Additionally, assessing students' prior knowledge of health topics is essential to determine the effectiveness of educational interventions and to identify potential knowledge gaps to be addressed. Thus, this study aimed to present a pedagogical intervention on vaccines, with a focus on COVID-19 immunization, and to evaluate students' knowledge about the subject. The intervention was conducted on elementary school students. The activity was divided into three stages: 1) knowledge diagnosis, 2) intervention through dialogue, and 3) investigation of the acquired knowledge. Our data indicate that students are aware of the importance of vaccines but demonstrated a lack of knowledge regarding post-vaccination topics and belief in immunization myths. In light of this, it can be concluded that health education plays a fundamental role in

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vaccine promotion. Similarly, it was inferred that interventions can contribute to increasing students' awareness of the importance of vaccination and filling potential knowledge gaps.

Palabras clave:
enseñanza; educación
para la salud;
intervención -
pedagógica;
inmunización; salud
pública.

Resumen: Dada la creciente desinformación sobre las vacunas, es esencial que las escuelas desempeñen un papel activo en la concientización de los estudiantes sobre la importancia de la inmunización para prevenir enfermedades y promover la salud. Además, evaluar los conocimientos previos de los estudiantes sobre temas de salud es esencial para verificar la eficacia de las intervenciones educativas e identificar posibles brechas que deben abordarse. Así, este estudio tiene como objetivo presentar una intervención pedagógica sobre vacunas, centrándose en la inmunización contra la COVID-19 y evaluando el conocimiento de los estudiantes sobre el tema. La intervención se realizó con estudiantes de educación primaria. La actividad se desarrolló en 3 etapas: 1º diagnóstico de conocimientos, 2º intervención a través del diálogo y 3º investigación de los conocimientos adquiridos. Nuestros datos indican que los estudiantes conocen la importancia de la vacuna, pero demostraron que desconocen los problemas post-vacunación y creen en mitos sobre la inmunización. Ante este escenario, se concluye que la educación sanitaria juega un papel fundamental en la promoción de la vacunación. Asimismo, se infiere que las intervenciones pueden contribuir a aumentar la conciencia de los estudiantes sobre la importancia de la vacunación y a llenar posibles vacíos de conocimiento.

Introduction

Vaccines have been a great medical achievement of the past century, given their fundamental contribution to reducing the spread of rapidly spreading diseases among the population and thus significantly reducing mortality (Germani; Biller-Andorno, 2021). Additionally, vaccines are an economically more effective method when compared to the use of medications or other forms of treatment for established diseases. Therefore, the use of vaccines for the prevention of infectious diseases is cheaper than the purchase of medications or hospitalization (Fiocruz, 2019).

However, vaccine development is a slow and bureaucratic process, with several well-defined stages and control of the manufacturing process, distribution, and monitoring of effects in vaccinated populations. This process is divided into three stages (Lurie et al., 2020). The first stage corresponds to basic research in which theoretical approaches and initial methods for vaccine production or other medications are proposed. In the second stage, preclinical phase, in vitro, and/or in vivo tests were conducted to assess the safety of the proposed drug. The third stage involves clinical trials with humans and is divided into four phases. After all these stages, the vaccine is approved by the regulatory agency (ANVISA) and becomes available to the population (Homma et al., 2003).

Although vaccine development can take years, it is important to remember that continuous research and development of new technologies, as well as global collaboration, have allowed for the rapid production of increasingly effective and safe vaccines to prevent infectious diseases. In this context, the pandemic scenario triggered by COVID-19 served as a

space for reflection and understanding of immunization, with this topic becoming popular and discussed both in the race for vaccine development and the uncertainties regarding the safety and efficacy of vaccination, which began in January 2021 (OPAS, 2021).

Indeed, even after the panic caused by the high number of deaths from COVID-19, a significant portion of the population, faced with an abundance of fake news and a scenario of scientific denial, chose not to be vaccinated. Ruggiero et al. (2021) emphasized that the fear of children and adolescents regarding COVID-19 vaccination reflects the opinion of their parents or guardians, who ultimately make decisions for their children. This fear stems from a lack of belief in vaccines or their suppliers due to numerous misinformation sources, creating a barrier to vaccine uptake (Ruggiero et al., 2021).

In Brazil, vaccination began in the 20th century and has historically witnessed large successful campaigns and high adherence of the population to immunization (Fiocruz, 2013). The National Immunization Program (PNI) was created in 1973 to ensure the population's access to quality vaccines throughout their lives. The PNI serves as a reference for vaccination in Brazil and worldwide because of its proven excellence in vaccination campaigns and its commitment to providing the vaccines specified in the National Vaccination Calendar publicly and free of charge (Barbieri et al., 2021).

In this context, children and adolescents are among the priority groups for the National Immunization Program (PNI), due to their high susceptibility to certain vaccine-preventable diseases and, mainly, due to the low vaccine coverage observed during adolescence (Chipkevitch, 2017). In fact, research conducted by the Brazilian Society of Pediatrics indicates that more than half of adolescents do not receive the recommended vaccine booster for their age (Brasil, 2010).

Teenagers and young adults have shown less propensity to receive vaccination than other age groups. In addition, Brazil already had low vaccination adherence rates among teenagers and young adults even before the pandemic, which further aggravated the situation and put this population in a vulnerable situation, at risk of contracting serious diseases that can lead to death (Barbieri et al., 2021).

Unfortunately, there has been an increase in the number of cases of infectious diseases that have been considered eradicated in some regions. An important factor contributing to this trend is the increase in anti-scientific and anti-vaccine tendencies. Other factors that may also contribute are a lack of awareness about the importance of vaccination, misinformation about the risks and benefits of vaccination, and the approach of vaccination campaigns (Brasil, 2022).

Vaccination campaigns must be promoted and encouraged so that people can protect themselves and their communities from infectious diseases. However, it is a fact that national vaccination campaigns and primary healthcare actions neglect the adolescent population (Galvão; Araújo; Rocha, 2022). This is evidenced by the significant proportion of adolescents and young people who lack immunity to certain endemic diseases in the community.

Additionally, it is observed that during adolescence, both research and public health concerns are more focused on specific areas such as drugs, pregnancy, sexuality, and abortion. (Chipkevicy, 2017). Consequently, adolescents may represent an important group of susceptible individuals if they remain unvaccinated and are exposed to new diseases.

According to Stubbs et al. (2014), a crucial strategy for encouraging adolescent vaccination adherence is partnership between the local health department and schools. The authors and their collaborators state that this strategy plays a fundamental role in increasing vaccine adherence by implementing vaccination programs as extracurricular activities in schools, thus making immunization more accessible. It is important to highlight that during the implementation of such strategies, parents or guardians should be informed to understand the importance of immunizing their children. In Stubbs' study and its collaborators, guardians received information and a consent package containing details about the vaccine. This transparent communication and involvement of parents is also essential to ensure that they are aware of the benefits of vaccination and can make informed decisions (Stubbs et al., 2014).

Furthermore, it is essential to combat vaccine resistance, as this attitude can worsen an endemic scenario and potentially lead to another pandemic, especially when anti-vaccine groups use social media to spread false and unscientific information. Thus, promoting vaccination in schools, in collaboration with parents and healthcare professionals, plays a vital role in safeguarding the health of adolescents and preventing communicable diseases.

Additionally, the vaccination theme is included in educational guidelines, such as the National Common Curricular Base (BNCC). According to the BNCC guidelines, vaccination-related topics are addressed within the health theme. This approach focuses on learning basic healthcare (Brasil, 2018).

Given this, the development of pedagogical interventions focused on students' health education becomes essential to promote a comprehensive and conscious understanding of the importance of vaccination in safeguarding individual and collective health. Additionally, these pedagogical actions aim to create a favorable environment for the development of scientific knowledge.

Health Education is understood as an educational process that aims to familiarize the population with health-related topics, with the objective of increasing autonomy in self-care

and improving dialogue with healthcare professionals and administrators. Its purpose is to sensitize, raise awareness, and mobilize individuals to address individual and collective situations that impact their quality of life (Nogueira et al., 2022).

This strategy, integrated with the concept of health promotion, is considered essential for disease prevention and healthcare. It is defined as a set of participatory and emancipatory pedagogical practices that extends across various fields of action. In this context, the school becomes a privileged and suitable space for health promotion (Malacarne et al., 2021). The school environment is particularly indicated as a place of coexistence and learning, where effective health prevention and promotion actions can be developed.

Furthermore, health education in the school context can contribute to the formation of healthy habits among students, such as regular physical activity, proper nutrition, as well as the adoption of conscious attitudes regarding healthcare, self-care, and caring for others. In this way, health education becomes a key element in this process, promoting individuals' understanding of the benefits of vaccines and helping to combat the dissemination of false information and myths about immunization.

Given the above, it is emphasized that approaches to the topic of "Health" and related content should be varied and appealing, in order to cater to all student profiles and capture their attention. Therefore, it is necessary for teachers to adopt diversified pedagogical practices, as examples are cited:

- Videos and Visual Resources
- Dialogues and debates with the class
- Educational apps and websites
- Pedagogical interventions

However, it is essential for teachers to be willing to experiment with different pedagogical strategies, taking into consideration each student's profile, learning diversity, and the possibilities that exist today with technological advancements. In this regard, it is possible to spark students' interest and engagement in the topics of health and everything related to the subject. Moreover, the teacher, as a guide in this educational process, should utilize various educational resources to foster positive and constructive interaction between knowledge and students' learning (Neves, 2016).

Therefore, the objective is to present a pedagogical intervention on vaccines, with an emphasis on COVID-19 immunization. This study also assessed elementary school students' knowledge of vaccines. This approach is justified by increasing misinformation about vaccines, making it important for schools to take an active role in teaching disease prevention

and health promotion. In this sense, evaluating students' knowledge is crucial for assessing the effectiveness of the intervention and identifying possible gaps that need to be addressed.

Methodology

This is qualitative and descriptive research (Gil, 2008) based on pedagogical interventions (Daminani et al., 2013). This type of research aims to evaluate the impact of an educational intervention that involves a set of intentional pedagogical actions aimed at promoting learning, development, and/or behavioral change in a specific group of subjects (Daminani et al., 2013).

The participating school was selected based on a positive response to an interest questionnaire sent in advance to several institutions. To conduct the activities, the proposal was first presented via "Google Meet" to the teachers and the school administration. Students in the final years of Elementary School (7th to 9th grade) from a public school in southern Brazil were invited to participate in the pedagogical intervention. The choice is due to the fact that they already have notions about the theme of the intervention, they are in the age group with the lowest vaccination coverage, and health education is one of the required contents by the BNCC at this school stage. The activities were also developed through "Google Meet." Pedagogical intervention was divided into three stages and was carried out over three consecutive weeks. The intervention took place after acceptance by the school, teachers, and parents.

- **1st Stage: Pre-test (Assessment of prior knowledge)**

Initial data were collected through a survey designed on the "Mentimeter" platform. This tool allows interactive and enjoyable questioning to understand and enhance the comprehension of subjects, thus enriching learning. The survey was sent to students through a link. It consists of four questions, with two open-ended and two closed-ended questions (Table 1). The questions were related to the topic of "vaccines and COVID-19." The purpose of these questions was to evaluate the students' initial understanding and perceptions.

Table 1: Survey

<i>Number of Question</i>	<i>Question</i>
1	Why is the vaccine important?
2	Regarding the vaccine, which statement is true? (Options: Modifies the body; Does not save lives; Helps the organism protect against

	certain diseases; The vaccine cures diseases)
3	After being vaccinated against Covid-19, is the individual fully protected?
4	After being vaccinated against Covid-19, can the individual transmit the virus to another person? (Options: Yes; No)

- **2nd Stage: Pedagogical Intervention**

In the second week, the intervention was conducted through the "Google Meet" platform. A group discussion was held with the students, focusing on topics related to vaccines, with an emphasis on vaccines for COVID-19, discussing their functioning mechanism and importance. In this stage, educational videos were also used as a didactic resource to explain the subject.

During the pedagogical intervention, a video created by the Group of Studies in Nutrition, Health, and Quality of Life (GENSQ) was shown, available on the YouTube channel (<https://youtu.be/10B9qQi4pWM?si=MkHAKTSqxIRUmF0d>). Additionally, other educational tools available on the "Google Meet" platform were employed to encourage greater interaction and participation from the students. It is worth noting that some parents also took part in the activities, as the classes were conducted in their homes.

- **3rd Stage: Post-test (Assessment of acquired knowledge)**

Finally, in the third week, the students' knowledge was evaluated regarding the results obtained from the interventions conducted. For the assessment, the "Wordwall" tool was used, which allowed the creation of a questionnaire in the form of a QUIZ, containing five questions related to the topic covered (Table 2).

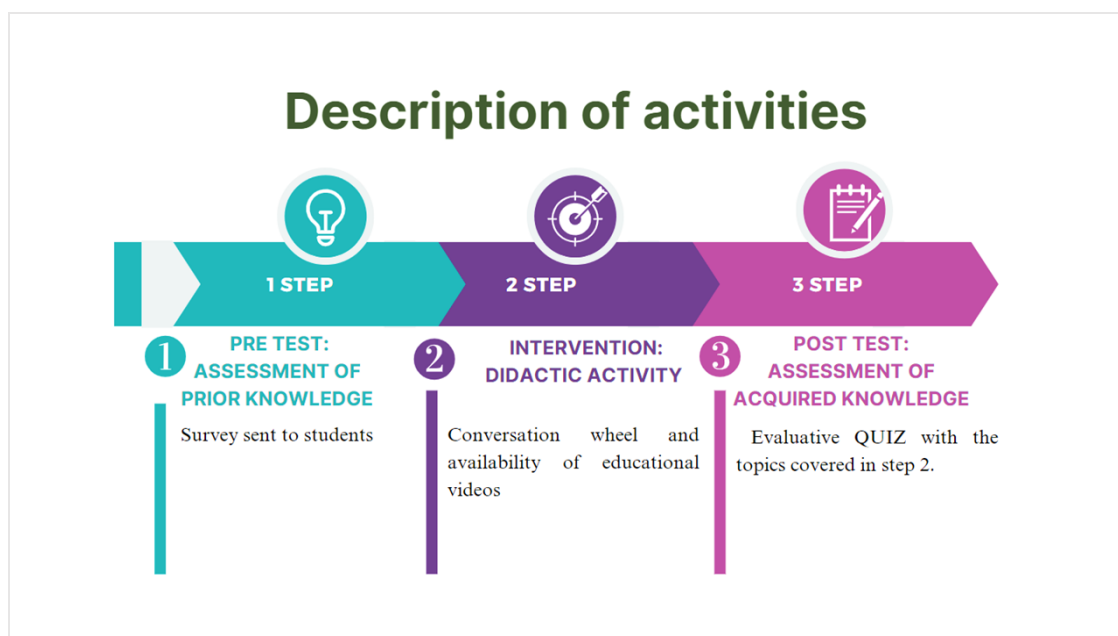
Table 2 - Quiz Questions

<i>Number of Question</i>	<i>Question</i>
1	Is the vaccine important for preventing diseases?
2	Is it normal to experience some symptoms after taking the vaccine?
3	Does the individual become fully protected after vaccination?
4	After taking the vaccine, can a person still transmit the virus to another?
5	After taking the vaccine, can a person still transmit the virus to another?

Source: Authors.

This process aimed to assess the impact of activities developed during the intervention period on students' learning. The link to QUIZ was sent by the teacher responsible for the class to the students' parents through the WhatsApp messaging application. The methodology of this study is presented in Figure 1.

Figure 1 – Methodological Design of the Research



Source: Authors

The results obtained from the intervention stages were analyzed through exploratory and descriptive analysis (Gil, 2017), which served to investigate the understanding of the obtained responses. Additionally, a quantitative analysis was used to record the frequency of students' responses and calculate the percentage of correct answers in the post-test stage.

The results are presented using spreadsheets, word clouds, and reports obtained from the observation of the intervention. Word clouds were generated using the software WordArt® (<https://wordart.com/>), which allows for a graphical visualization of the most recurring words, highlighting the relevance and importance of the investigated topic. To protect the students' privacy, they were assigned numbers from E1 to E10.

Results and Discussion

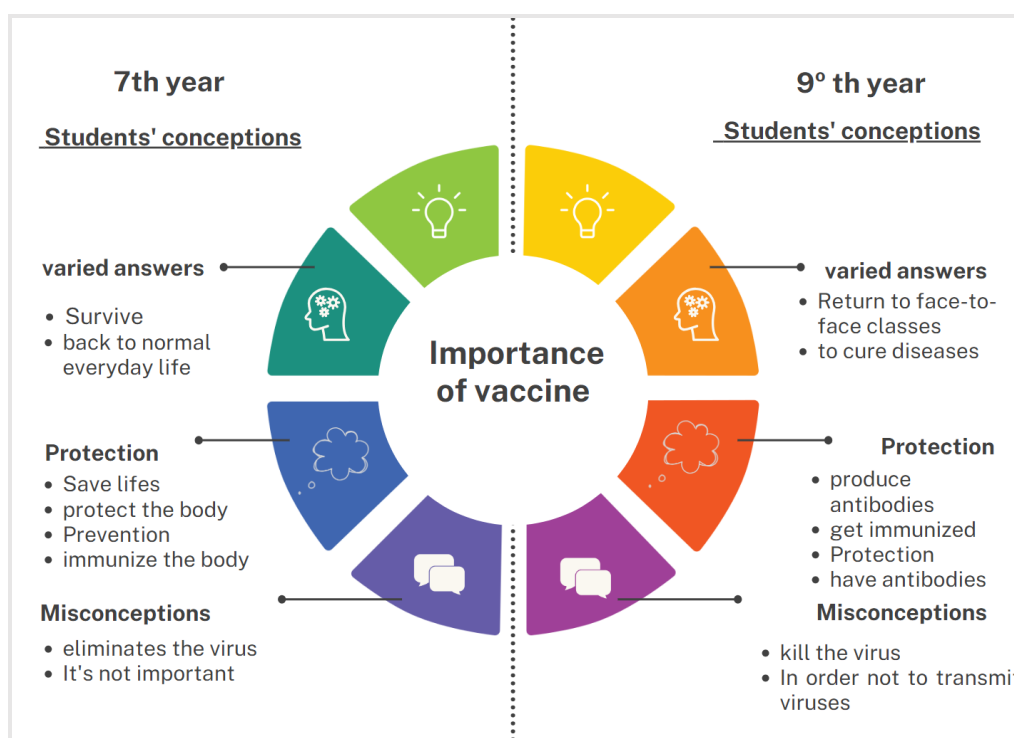
A total of 20 students participated in the research, ten from the 7th grade and ten from the 9th grade. It is essential to note that during the research, only three students from the 8th grade had access to remote learning but did not participate in the study because of

their dependency on mobile data access. The results were presented and described in accordance with the methodological design of the study.

• 1st Stage: Pre-test (Assessment of prior knowledge)

Initially, the objective was to investigate adolescent students' knowledge about vaccines. Therefore, in the first week, an initial questionnaire in the form of a survey was administered to the students. The first question asked the students was related to the importance of the vaccine for COVID-19. Based on the analysis of the responses, they were classified into: **Varied Responses**, **Protection**, and **Misconceptions**, as shown in Figure 2.

Figure 2 - Conceptions of 7th and 9th-grade students regarding the Importance of the Vaccine.



Source: Authors

In general, both 7th-grade and 9th-grade students state in the "**Varied Responses**" classification that the vaccine is essential to return to normal routines, with the idea that we would go back to experiencing the same scenario as before the pandemic. Furthermore, it was observed in the "**Protection**" classification that both 7th-grade and 9th-grade students express in their responses the purpose of vaccination, which is the production of antibodies, protection, and immunization. However, in the "**Misconceptions**" category, it becomes evident that some students in both 7th and 9th grades have misconceptions, such as believing that the COVID-19 virus can be completely eliminated with the vaccine or that immunization is not essential.

They are an effective way to summarize and visualize the frequency and relevance of words in a given context. Thus, Figure 3 presents the general conceptions of students regarding the importance of the vaccine. Word clouds (A) and (B) display the conceptions of 7th-grade and 9th-grade students, respectively.

Figure 3 - Word Clouds about Students' Conceptions of Vaccines



Source: Authors

It is evident that most students consider vaccines to serve immunization, prevention, saving lives, virus eradication, and promoting cure, among other purposes. The results of our study are in line with the research conducted by Tavares and Gois (2020), who analyzed the knowledge of 23 elementary and high school students about the importance of vaccines. The interviewed students recognized the importance of vaccination for disease cure (8.7%), prevention (78.3%), and treatment (13.0%). Additionally, the authors found that most of the interviewed adolescents were not well informed about the vaccination schedule. Similarly, in our work, although it was not a formal question in the questionnaire, during their participation in the intervention in Stage 2 of the research, where one of the topics was the vaccination calendar, students also showed various doubts about the subject in question.

In another population-based cross-sectional study based on a questionnaire, 784 Brazilians were surveyed regarding their level of knowledge of the COVID-19 vaccine. Assessing the overall context, 44.13% of the respondents stated that they did not know the vaccine's composition and mechanism of action in the body (Paiva et al., 2020). Based on

these findings, we emphasize the importance of strengthening vaccine education, both in schools and other settings, to provide adolescents with concrete and accessible information. Furthermore, it is essential for them to understand not only the importance of vaccination but also the details of the vaccination schedule, so that they can make informed decisions about their health and well-being.

Furthermore, in the survey, some questions were asked about the vaccine and relevant topics for the society at that time. For example, it was inquired whether the vaccine could cause changes in people's bodies. Among the 7th-grade students who responded to the survey, two stated that **"the vaccine modifies the body"**, seven mentioned that **"the vaccine helps the body protect against certain diseases"**, and one stated that **"the vaccine cures"**. Regarding the 9th-grade students, two responded that **"the vaccine modifies the body"**, and six mentioned that **"the vaccine helps the body protect against certain diseases"**. None of the 9th-grade students selected the option **"the vaccine cures"**. It is important to highlight that none of the students, both from the 7th and 9th grades, selected the option **"Does not save lives"**, which was included in the survey.

Our results show that most students correctly answered that the vaccine helps the body to protect itself from certain diseases. Specifically, COVID-19 vaccines have been developed at an unprecedented speed. However, studies prove the efficacy and safety of different types of vaccines, developed from existing technologies and new technologies, which represent important innovations for the future treatment of several diseases (Gadelha et al, 2022 Lima et al., 2022).

Despite different approaches, all vaccines aim to induce the body's immune response, leading to the production of defenses against the COVID-19 virus, SARS-CoV-2. Thus, in our study, we observed some misconceptions, such as the idea that the vaccine kills or eliminates the virus as well as the belief that the vaccine has the power to cure diseases when, in reality, it acts on prevention. Moreover, it is essential to emphasize that some students did not consider the vaccine important.

Based on the analyses conducted, we understand the relevance of incorporating these discussions into the environment in which adolescents are situated, especially within the school context. Schools play a fundamental role in providing individuals access to systematic knowledge through educational approaches, particularly for health promotion. This contributes to an informed and conscious decision-making process regarding one's health and others' well-being.

From this perspective, it is also necessary to consider adolescence as a transitional period between childhood and adulthood, marked by a complex process of changes and beliefs that can influence how adolescents think, act, and behave in society. According to Salles (2005), adolescence gradually consolidates and is influenced by both individual factors (related to biological maturity) and social factors (associated with the environment in which the adolescent is embedded).

• 2nd Stage: Pedagogical Intervention

Based on the analysis of the intervention observation records, it was evident that the students were highly engaged, active, and highly interested in the topic. It is worth mentioning that due to the online nature of the intervention, some guardians also participated and showed equal interest in the subject matter. In addition, the teacher in charge of the class actively engaged in discussions throughout the activities. Dialogues with the class were also recorded and made available to the researcher (Figure 4).

Figure 4 –Pedagogical Intervention through Dialogue and Dynamics.

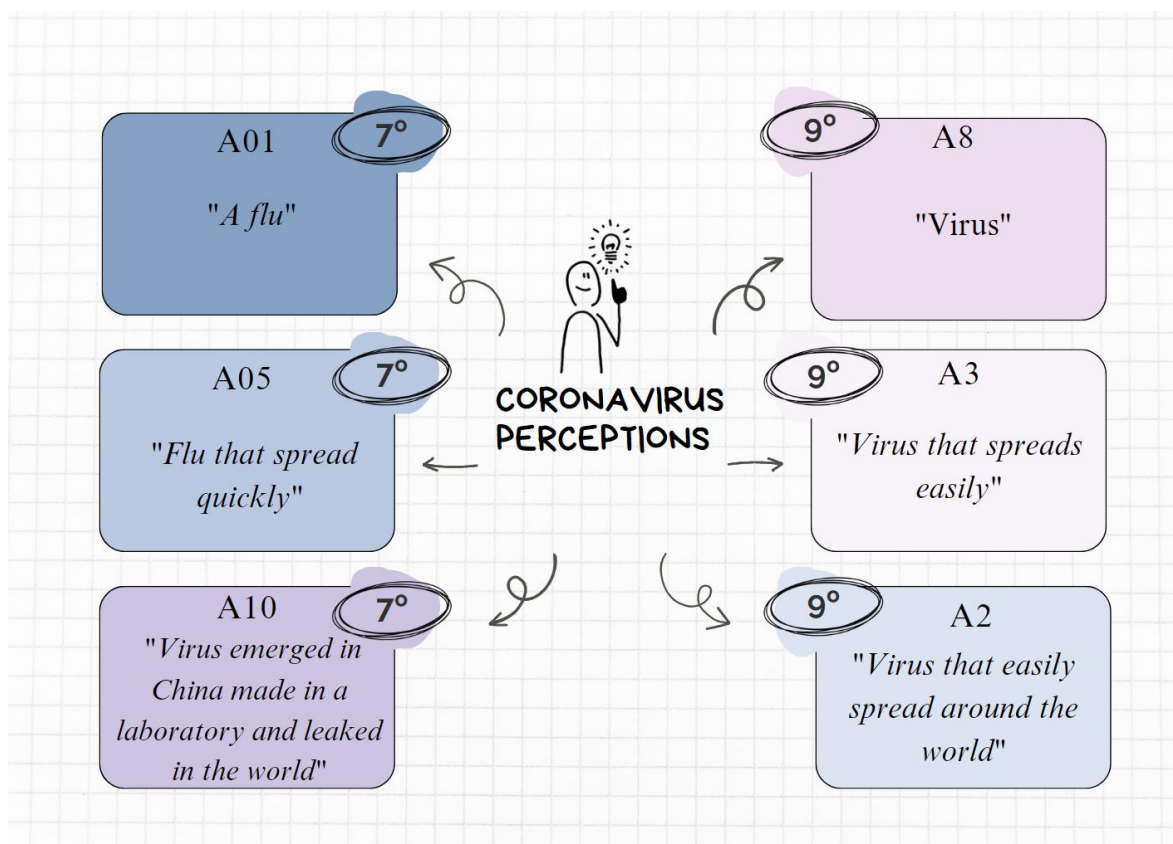


Source: Authors

Initially, the students were asked about what they knew about the coronavirus. In summary, both 7th-grade and 9th-grade students mentioned in their narratives that the coronavirus is a rapidly spreading flu-like illness. The same trend of responses was observed in the narratives of the 9th-grade students. One response that caught attention was from a 7th-grade student, who stated that *"the coronavirus was a virus originated in China*

through a laboratory experiment that ended up leaking to the rest of the world". Some of the students' narratives are presented in a brainstorming format, as shown in Figure 5

Figure 5 –Student narratives.



Source: Authors

After that, an educational video with animations about the coronavirus was presented. The video covered topics such as virus classification, origin, transmission, and prevention methods. Additionally, it addressed the precautions that students should take when returning to in-person activities.

• Dialogue about the vaccination topic

Regarding the theme of vaccinations, the importance of vaccination in general was explained, including how it originated and the vaccination schedule covering the main immunizations for adolescents. Additionally, the different types of COVID-19 vaccines were discussed, explaining how they act in the body and why some are single-dose vaccines, while others require multiple doses.

Since the emergence of COVID-19 caused by the SARSCoV-2 virus in late 2019, there has been an explosion of issues related to vaccination and the development of a series

of vaccines. This is because vaccines are considered a key part of the strategy for enabling a return to previous patterns of work, schooling, and social interaction.

In this context, Brazilians not only had to deal with the challenges of the pandemic but also faced a turbulent political scenario and the spread of Fake News and public statements that generated insecurity and distrust regarding scientific achievements (Paiva et al., 2020). Thus, despite the available evidence and scientific consensus on the need and safety of vaccines, anti-vaccine movements contributed to a decline in vaccination rates and the potential resurgence of diseases that were once eradicated by vaccines, such as measles (Hammond, 2020).

In addition, the media is also able to influence people, as the then-president himself at the time in question conspired against vaccines in the media. This is evident in Stage 1, when two students assert that the vaccine is capable of altering people's bodies. As a result, many people did not adhere to immunization and even protested the use of vaccines.

Likewise, the perception that a vaccine can alter the body may be attributed to the fact that many pieces of information are acquired by people from unreliable sources. A study conducted by Archila et al. (2021) showed that the main source of information for people is the Internet. The authors also demonstrated that people consider healthcare professionals reliable sources to provide more accurate information about diseases, but they also trust government media sources.

Moreover, to enrich the discussions about vaccines, the students were asked what they heard at home while taking the vaccine. According to the students' accounts, their family members were not vaccinated due to various factors, but many of them were waiting for the appropriate time to be vaccinated. Some of the reasons for non-immunization are presented in Chart 1.

Chart 1- Students' narratives about what they hear about vaccines.

[...] Hearing on TV that the vaccines were expired and they could get Covid. (7th grade student)

[...] I also saw on TV that people were giving vaccines and the syringe was empty and they were not being immunized. (7th grade student)

[...] Here at home, I'm already taking the vaccine. (9th grade student)

Immediately after these responses, another educational video on vaccines was provided. To continue the dialogue with the students, guiding questions were asked based on the video. The questions were as follows: **1) Is an individual fully immune after vaccination? 2) Can a vaccinated person transmit the virus to another person? 3. Is it normal for a vaccinated person to experience symptoms such as pain and fever after vaccination?**

For these questions, there was unanimity in the answers of the students. Both 7th graders and 9th graders said “**Yes**” to questions one and two. And regarding question three, students answered “**No**”, both 7th and 9th grade students. From this, it was explained about the questions as well as the effectiveness of vaccines in general, with emphasis on immunizations for COVID-19.

Indeed, knowledge about immunization is foreseen in the documents aimed at healthcare guidance in education. The approach to this subject focuses on the importance of vaccination for public health, how immunization works in the body, its historical role in preserving individual and collective health, as well as its role in eradicating diseases (Brazil, 2018). Therefore, it is believed that post-vaccination topics may not be emphasized in the classroom.

Furthermore, the level of misinformation about the pandemic was still high at the beginning. According to the World Health Organization, the COVID-19 outbreak and its response were accompanied by an enormous "infodemic": an excess of information, some accurate and some not, making it difficult to find reliable sources and guidance when needed (Paho, 2021). In the information age, this phenomenon was amplified by social media and spread more rapidly, like a virus (Zarocostas, 2020). These data may also justify the different opinions of students when questioned about the level of protection and transmissibility after COVID-19 vaccination.

Based on this, it is essential to develop actions focused on health promotion and disease prevention, so that individuals understand the subject in all its aspects: historical, social, economic, and functional. Some of the activities that can be developed in the school context include playful activities and pedagogical interventions focused on health care.

According to Sierra et al. (2021), pedagogical interventions have proven to be alternatives to enhance teaching methods and assist teachers in their practices, providing them with different approaches to foster the construction of new knowledge for students; besides being a source of scientifically grounded information. Furthermore, the authors state

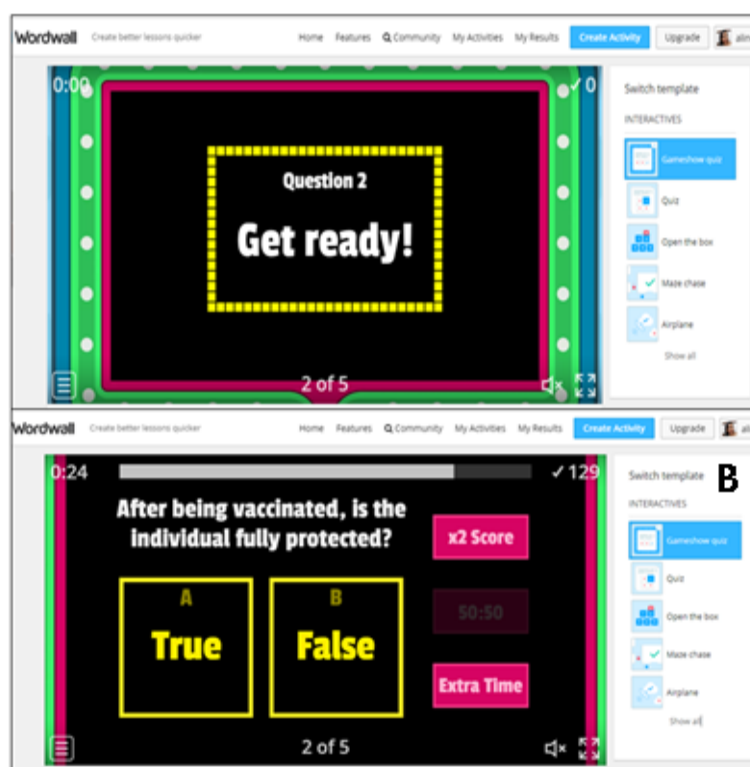
that pedagogical interventions enable solutions for the teaching profession as a meaningful means in the comprehensive education of students, improving the teaching and learning process.

- **3rd stage: Post-test (Investigation of acquired knowledge)**

To analyze the students' learning about the topics addressed in the pedagogical intervention, in the third week, a link was provided for them to participate in a Quiz prepared on the Wordwall platform (<https://wordwall.net/pt/>), as shown in the illustrative image in Figure 6A.

The Quiz consisted of five true or false questions, with a specified time for the student to answer (Figure 6B). It is worth noting that at the end of the Quiz, the student was directed to another page where they could evaluate their correct and incorrect answers, as well as their score and maximum time. Additionally, students could view the highest scores in a ranking list among the students in their class.

Figure 6 –Representative image of Quiz question 2.



Source: Authors

One of the objectives of the pedagogical intervention is to generate knowledge through educational actions. Based on the Quiz analysis, it was noticeable that the students learned about the topics addressed in the intervention, particularly the issue of vaccination.

For this purpose, the Quiz questions were prepared based on the survey (Step 1) and the questions and dialogues (Step 2). In summary, it was observed that most 7th-grade students answered the questions correctly, with only one student making an error on one of the questions. However, all 9th-grade students answered all the Quiz questions correctly. Table 1 presents the questions and the students' answers (correct and incorrect) for the Quiz.

Table 1 – Quiz Show with questions presented to the students.

About Vaccine to COVID-19	7th year Elementary school (n=8)	7th year Elementary school (n=8)	9th year Elementary school (n=6)	9th year Elementary school (n=6)
	Correct	Incorrect	Correct	Incorrect
Is the vaccine important to prevent disease?	8	0	6	0
After taking the vaccine, is it normal to feel some symptoms?	8	0	6	0
After being vaccinated, is the individual fully protected?	8	0	6	0
After taking the vaccine, can a person still transmit the virus to someone else?	7	1	6	0

Source: Authors

Next, the researcher resumed the questions, presented the correct alternatives, and explained the reasons for the incorrect questions. At that moment, the students showed interest in repeating the game and were asked if they could answer the quiz again, in order to get all the questions right. Considering these situations, it is believed that diversified and dynamic activities, combined with traditional teaching, can make teaching more attractive to subjects. For Reis and Pereira (2022), playfulness, when used well through games, becomes an important ally to provide more attractive teaching, increasing the chances for the development of meaningful and effective learning. Other resources that can be used are also digital technologies, as in this study, the platforms: Worwal, Youtube, Google and Quiz.

According to Neves (2016), with technological advancement, future generations are increasingly moving away from traditional teaching methods, as new devices emerge, leading to new ways of learning. Consequently, using devices, applications, and digital resources and incorporating them into pedagogical practices has become an attractive teaching strategy. From this perspective, we emphasize pedagogical intervention and the use

of digital technologies as strategies for health promotion, enabling a shift in understanding and practicing health in the school environment.

According to Costa et al. (2022), the use of digital resources can help minimize negative impacts on learning. The authors also emphasize that the use of digital tools plays a crucial role in education, as they contribute to the learning process of young individuals born in the digital era. Moreover, research with pedagogical intervention proposals helps improve the learning environment (Fumagalli et al., 2022) and arouses student interest, providing a pleasurable learning experience (Nascimento et al., 2017). In line with this, Teles and Oliveira (2020) argued that technologies can be informative tools for health education, contributing to the scientific literacy of individuals.

In conclusion, it is important to highlight that our intervention provided an opportunity to reflect on issues related to students' understanding of vaccines, with a focus on COVID-19 immunization. Activities such as that presented here are essential for promoting the intersection between health and education in the school environment, providing useful tools for health promotion and disease prevention for individuals and the community. The acquired skills and competencies also serve as a foundation for building reflective and active citizens (Júnior & Araújo, 2020).

It is important to mention as a limitation of our study the variability in the number of students participating in different stages due to technological issues. However, despite this restriction, the data found provide a basis for further and broader research on this topic. As a perspective, it is hoped that new studies will be conducted aiming at the intersection of health and teaching issues in the school environment. It is also expected to encourage studies in this area that not only promote the dissemination of information but also support autonomy in students' learning, aiming to combat fake news and encourage the search for scientifically supported information. Moreover, we believe that well-informed citizens are more likely to participate in national immunization campaigns.

Conclusion

Our results show that elementary school students demonstrated knowledge of COVID-19 vaccines. Regarding the post-vaccination questions, students, regardless of their grade level, showed a lack of knowledge. Despite their doubts and limited knowledge, the students expressed concern about the pandemic and were eager to vaccinate.

Based on the post-test analysis, it was possible to verify that the students learned from the actions carried out in the pedagogical intervention. The students showed a change in

their level of knowledge compared to their previous conceptions. Therefore, this pedagogical intervention proved effective in addressing topics aimed at promoting health education.

Furthermore, our data allowed us to conclude the importance of health actions in the school environment. These actions serve to instigate teachers and students to include multidisciplinary themes in pedagogical practices aimed at personal growth, citizenship exercises, and students' quality of life. Ultimately, we believe that our actions in pedagogical intervention played a fundamental role in providing scientific information about vaccines to students in a general manner. This approach also fostered the development of a preventive culture, self-care, and immunization.

Thus, based on our study, we hope to promote awareness so that these educational approaches continue to have a positive impact on the formation of individuals, making them transformative and conscious agents in their communities, disseminating scientific knowledge, contributing to health promotion, and minimizing the risk of future devastating pandemics.

Acknowledgment

Coordination for the Improvement of Higher Education Personnel – CAPES

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