ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)

Vol 10, Issue 9, September 2023

Transforming Crisis into Opportunity: Exploring the Educational Potential of the Corona Pandemic through a STEM Approach

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***Abstract*— The Corona pandemic has sparked widespread fear and uncertainty among pupils worldwide, but it has also presented an unexpected educational opportunity for fostering critical thinking skills through a STEAM discipline in relation to COVID-19. Recognized this global challenge as a platform to develop an interdisciplinary study module for elementary school pupils that integrates health and education.**

***The study module facilitated exploration of different facets of the pandemic. Pupils developed an understanding of the virus, delved into the science of the immune system using interactive learning games. Pupils researched vaccination technology in small groups, they research antigen detection kit focusing on the product features of components, materials and ease of use and the reliability of home antigen testing. Mathematical models were constructed to analyze COVID-19 data and comprehend epidemiological concepts, empowering students to interpret infection rates, transmission patterns, and the impact of preventive measures.**

***Furthermore, the integration of art within the STEM framework played a crucial role in solidifying the acquired knowledge. Pupils employed their design and engineering skills to visually represent viral antigens and antibodies, create educational games for identifying cells, and develop age-appropriate health information tools for their peers. By leveraging artistic elements such as language, color, and technical designs, students actively contributed to the production of effective resources that promoted health education and infection prevention among their peers.**

***The STEAM approach facilitated interdisciplinary learning, critical thinking, and creativity, equipping students to navigate complex health crises by reducing fear and anxiety through enjoyable academic experiences.**

***Index Terms*— Corona pandemic, Teacher Training, health education, anxiety ,STEAM education.**

I. INTRODUCTION

The coronavirus disease (COVID-19) pandemic has exerted a profound and multifaceted impact on global public health systems, necessitating unprecedented responses to mitigate its consequences [1]. From its initial emergence, COVID-19 swiftly traversed international boundaries, placing healthcare systems under severe strain and revealing their vulnerabilities. The pandemic has illuminated the critical need for preparedness and robust infrastructure to effectively manage such widespread health crises. Stringent measures like lockdowns, travel restrictions, and quarantine protocols were implemented across nations to curb transmission rates. Public health campaigns advocating preventive behaviors like mask-wearing, social distancing, and hand hygiene have become ubiquitous [2].

The emergence of coronavirus (COVID-19) has entered an unprecedented era of disruption and change, affecting many aspects of everyday life, including education. Among the most vulnerable populations to these changes are primary school students, whose years of development are characterized by developmental growth, social interaction and the establishment of routines. With the sudden closure of schools and the transition to online education, students must adapt to a new learning environment while managing the loss of interpersonal relationships. These changes were accompanied by increased levels of stress, anxiety and disturbance of emotional well-being [3]. Recent research explores the relationship between hope and well-being during the COVID-19 pandemic. The study found that hope is a potential source of resilience associated with improving overall well-being during the Coronavirus pandemic. In addition to the direct effect of hope, hope indirectly affects stress and anxiety associated with COVID-19, promoting more adaptive perceptions of emotional control. The study also found that hope is a future-oriented protective factor that may enable people struggling with coronavirus to look to future possibilities rather than obstacles. Overall, the study suggests that hope is an important factor in promoting well-being during the COVID-19 epidemic [1].

The transition to remote learning is a necessary response to the pandemic, but it has presented several challenges for elementary school students. Physical separation from the school environment, teachers, and students has disrupted the routine and predictability that is crucial to children's emotional stability. Lee's study [4] highlights that sudden closure of schools can cause feelings of separation, leading to a decline in children's psychological well-being. Moreover, the introduction of online learning platforms requires students to navigate new technologies and educational

models, which may worsen feelings of frustration and anxiety. Brooks [5] emphasizes that prolonged interactions with screens and lack of contact can have harmful effects on mental health, especially in young children who are still developing social emotional skills.

The lack of inter-agency interaction, which is integral to the social development of children, has been another important consequence of the epidemic. Primary students often rely on the school environment to foster friendships, develop social skills and establish a sense of belonging. The sudden transition to remote learning limits the opportunities for informal interaction, such as family holidays and group activities, which are essential to children's social development. Xie [6] Discuss that lack of social interaction can lead to loneliness and isolation, thereby reducing mood and overall well-being. In addition, inability to engage in face-to-face interaction with teachers and students can affect students' ability to express themselves, seek support, and develop emotional resilience.

The uncertainty surrounding the COVID-19 epidemic, including health concerns, changes in routine and the global context, has brought stress and anxiety into the secondary schools. Racine [7] highlights that the ambiguity of the situation can cause feelings of anxiety and fear, especially for children who do not fully understand the complexities of the epidemic. The constant exposure to news and discussions about the virus can increase the levels of anxiety, leading to sleep disorders, changes in food patterns, and difficulties in emotional regulation. These concerns may be further exacerbated by the influence of parents' stress and anxiety, because the family environment plays an important role in shaping children's emotional experiences [8].

The optimal approach for addressing fear and anxiety involves introducing students to current scientific information, equipping them with tools, and fostering the development of self-regulation abilities. The **STEM** (Science, Technology, Engineering and Mathematics) teaching approach has emerged as an important component of modern education aimed at preparing students for the challenges of an increasingly technologically driven world. This interdisciplinary approach integrates these subjects and encourages students to apply theoretical concepts to practical situations in the real world. Through hands-on projects and collaborative learning, STEM education promotes critical thinking, problem solving skills and creativity. The STEM approach not only improves students' understanding of STEM fields, but also equips them with the essential skills required in the rapidly changing technological landscape. Furthermore, the emphasis on teamwork and communication in STEM education has developed skills that are essential to success in a variety of professional contexts. The adoption of a STEM learning approach has the potential to develop a generation of rounded learners capable of solving complex challenges with innovative solutions [9].

The integration of epidemiological teaching within the STEM approach into educational environments has gained importance due to its ability to address real world challenges and develop students' critical thinking skills. Epidemic education includes studying outbreaks, their spread and the measures taken to control them. By incorporating epidemic-related content into STEM programs, students not only learn deeper knowledge of scientific concepts, but also learn about the interdisciplinary nature of problem solving. Integrating epidemic education into STEM education improves students' ability to analyze complex situations, collect and interpret data and make informed decisions. Furthermore, it emphasizes the interconnection of different STEM fields and reinforces the idea that global health challenges require cooperation and a holistic perspective. Introducing students to the study of epidemics can encourage their interest in STEM fields and prepare them to deal with pressing public health issues in the future [10,11].

Ultimately, the COVID-19 pandemic has had a significant impact on students' mood and mental condition, prompting challenges related to distance learning, social isolation and future uncertainty. As the epidemic continues to evolve, understanding these challenges becomes crucial for educators, parents and policy makers. Although schools and communities are using various strategies to mitigate this impact, it is essential to recognize that the emotional well-being of students requires comprehensive support systems involving both academic and social emotional aspects. With the development of future research, a broader understanding of the long-term effects of the epidemic on children's mental health and strategies to promote resilience and well-being will be imperative in promoting the holistic development of young learners.

In the context of the ongoing epidemic of COVID-19, the role of faculty training colleges has become increasingly important in promoting comprehensive health literacy education and a multidisciplinary approach to the teaching of corona diseases. Health literacy is defined as the ability to obtain, understand, evaluate and apply health information and is a vital skill to people's understanding of the complex landscape of health information [12]. The Teacher Training College is a key institution responsible for the formation of future teachers' educational practices and is well placed to equip future teachers with the skills needed to effectively teach health literacy skills.

The multifaceted nature of corona disease requires an interdisciplinary perspective in education. Through the integration of health literacy into the various subject areas, the Faculty of Teacher Training can equip educators with a nuanced understanding of the biological, social, psychological and economic aspects of diseases. The interdisciplinary approach encourages teachers to work in a variety of disciplines to provide students with a holistic perspective of the effects of the pandemic. This approach also enables students to develop critical thinking skills that are

ISSN (Online) 2456 -1304
International Journal of Science, Engineering and Management (IJSEM)
Vol 10, Issue 9, September 2023

particularly relevant for the era of misinformation and uncertainty [13].

Teacher training colleges play an important role in the development of the curriculum and teaching methods that teachers use in classrooms. These institutions emphasize the education of health literacy and ensure that future teachers are equipped to guide students to understand complex health information, to understand prevention measures and to make informed decisions on their health and well-being. Furthermore, an interdisciplinary approach enables educators to contextualize corona diseases in broader social and global contexts and promotes a broader understanding of their impact [12].

In addition, the Teacher Training College is the center for the development of innovative teaching strategies that adapt to different styles and learning needs. These strategies include experiential learning, active participation in real-world health problems and integration of technology to improve health literacy education. By imparting these innovative methods to aspiring teachers, the Teacher Training College contributes to the development of educational practices to address the complexity of corona disease from a multiple perspective [13].

College of Teacher Training holds an important responsibility in preparing teachers to teach health literacy and adopt an interdisciplinary approach to corona disease. These institutions, by fostering educators who can effectively integrate health literacy education into different disciplines, contribute to cultivating informed and competent citizens who can navigate health information and understand the multidimensional impact of epidemics.

Oranim College is a famous institution for the training of educators that has actively participated in the global initiative, recognizing health challenges as educational opportunities and Transforming Crisis into Opportunity. As part of its education programs, the College has, in collaboration with the school, launched specialized projects that enable aspiring teachers to gain hands-on experience with health challenges.

This model is intended to create meaningful learning by designing innovative teaching programs and interdisciplinary activities aimed at achieving learning objectives, including understanding viruses, human biology, the environment, public health, analysis, critical evaluation and dissemination of public health information. Teaching and learning take place in classrooms, online, individually and in groups. The evaluation was formative and summative.

II. METHODOLOGY

Participants

As part of a practical teacher training program, Oranim's trainee teachers developed and implemented projects-based learning modules. 27 elementary school children all in grade 6 (16 females and 11 males). All participants came from middle class backgrounds as determined by the methodology of Hollingshead and Redlich (1958) [14].

Procedure

As an integral component of the teacher training curriculum at Oranim College, students are assigned to elementary school teacher advisor, where they gain insights into the practical aspects of teaching.

In the second year of this immersive experience, students devote two days each week to their engagement at the school. This extended presence fosters a profound sense of affiliation and dedication not only to the educational institution but also to the students they instruct.

Throughout the academic year, the students are guided by a pedagogical instructor from the college. This mentor interacts with them during one day of their practical involvement at the school, engaging the group in discussions encompassing their experiences, challenges encountered, and consultations on diverse subjects.

Within these meetings, a collective recognition emerged—a need to initiate a project addressing practical themes. The project's essence entailed the creation of distinct study units spanning various disciplines, with the intention of instructing the school's pupils. After thorough deliberation with the teacher advisor, two potential themes surfaced for the project: the climate crisis and the COVID-19 pandemic. Although both subjects held pertinence, the decision was ultimately made to center the project around the COVID-19 crisis.

Commencing with comprehensive explorations, the students delved into multifaceted facets of the COVID-19 crisis. Each student was assigned a specific aspect (such as mask-wearing, psychological effects during quarantine, viral transmission dynamics, etc.), prompting them to engage in thorough investigations. Subsequently, the individual student disseminated their findings within the student group, thus facilitating the exchange of insights across the entire cohort regarding diverse dimensions of the COVID-19 crisis.

In the subsequent phase, the students once again sought counsel from the teacher advisor regarding the project's trajectory. After thorough consultations, a decision was reached to execute the project through the lens of STEAM (Science, Technology, Engineering, Arts, and Mathematics) principles.

Notably, the student group displayed a heterogeneous composition, hailing from a spectrum of disciplines encompassing linguistic education, Old Testament studies, natural science and environmental education, mathematical education, and informal education. Given this diversity, a strategic choice was made whereby several students collaborated to formulate study units pertinent to their respective fields of study. Consequently, students specializing in mathematics curated a unit rooted in mathematical concepts, while peers focused on natural science and environmental education crafted a corresponding scientific unit. Students pursuing language education collaborated with their counterparts in natural science and environmental education to create units intertwining

ISSN (Online) 2456 -1304
International Journal of Science, Engineering and Management (IJSEM)
Vol 10, Issue 9, September 2023

engineering, technology, and art, thereby seamlessly amalgamating linguistic proficiency and scientific knowledge within the instructional framework.

Teaching methods

The project was meticulously structured in alignment with the framework of project-based learning and grounded in Kolb's experiential learning cycle [15]. The instructional activities embedded within the curriculum exhibited a rich diversity. Certain tasks necessitated collaborative efforts within groups, followed by the presentation and discussion of outcomes during plenary sessions – a format exemplified by the mathematical graph exercise. Conversely, other tasks demanded autonomous and innovative cognitive processes, as exemplified by the conceptualization and construction of a prototype for the flow device.

Throughout the course of the instructional study units, a spectrum of educational tools was employed to enhance learning outcomes. These encompassed dynamic presentations, tactile engagement facilitated by air dry clay, the utilization of magnets to elucidate core principles, and pedagogical games meticulously designed to elucidate and illustrate the subject matter under study.

Project goals of the unit:

- To Study authentic and relevant topics through research learning project
- To collect data and Information
- To increas motivation and enjoyment in learning through project-based learning
- To define the components of the immune system
- To apply the design process regarding the home antigen tests
- To summarize the product components of the home antigen tests
- To build a graph representing the number of children who got infected with Corona and the number of children who didn't get infected.
- To build a prototype for the flow facility out of air-dry clay

The study unit

Aspect	Number of lessons (45 minutes)	Subject
Science	2	Epidemiology of the disease and structure and function of the immune system.
Technology	1	Researching antigen detection kits focusing on the product features of components, materials and ease of use and the reliability of home antigen testing.
Engineering and Art	3	Investigating the design process on home antigen test kits and build age-appropriate flow devices out of air-dry clay.
Mathematics	2	Study local Ministry of Health COVID-19 data and create mathematical models for analysis and graphical representation.

III. FINDINGS

During the execution of the instructional module, it becomes evident that the students' enthusiasm and drive are notably pronounced, evident in their wholehearted engagement with interdisciplinary connections and the subsequent learning outcomes detailed herewith.

Within the realm of science education, the exploration of the immune system entailed the utilization of an educational game designed to emulate the intricate dynamics and interplay of viral antigens, T cells, B cells, memory cells, antibodies, and mechanisms underlying vaccination. This immersive approach facilitated students' comprehension of the disease's epidemiological aspects, concurrently affording them an in-depth insight into the architecture and operational mechanisms of the immune system (pic 1).

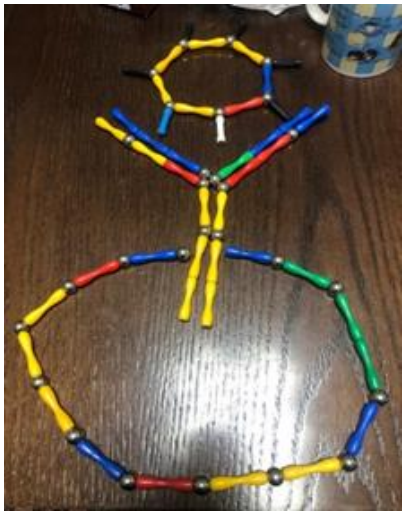

Figure 1 . A scientific model that a student built on a receptor on the cell membrane.

In collaborative clusters, students undertook comprehensive research into vaccination technology, delving into the specifics of antigen detection kits. Their investigation centered on scrutinizing the distinctive attributes of various components, evaluating the materials employed, assessing usability, and gauging the reliability of home antigen testing.

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)

Vol 10, Issue 9, September 2023

Subsequently, a comprehensive discourse unfolded, encompassing the perusal and analysis of instruction manuals for diverse antigen kits (pic 2).

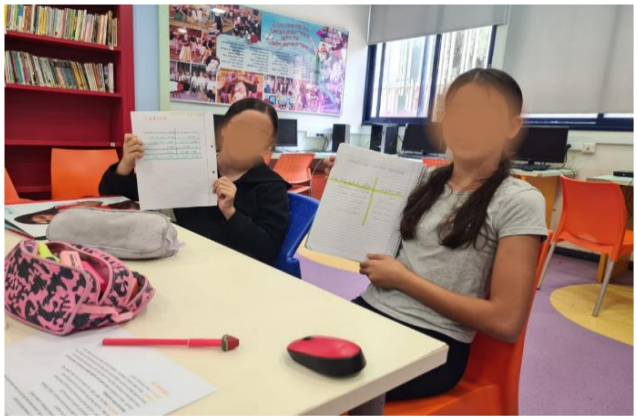

Figure 2- In the Figure, a tableau meticulously delineates the constituents and materials integral to the antigen tests, as presented by the students.

Pupils investigated the design process involved in all stages of **engineering** on home antigen test kits. The pupils worked in small research groups and presented their findings in a plenary session. Pupils were then asked to improve on the designs and build age-appropriate prototypes for use by children without parental assistance.

The initial lesson concerning the design process did not revolve around COVID-19; rather, its purpose was to introduce the topic to the students. This lesson was titled "Mister Bean Has a Problem," wherein the pupils were tasked with identifying a solution that would aid Mister Bean in diminishing train noise, while allowing him to maintain unobstructed hands for holding a book. The students formulated various solutions in response to this challenge.

The subsequent lesson maintained its focus on the design process; however, this time it centered on refining the flow device designs and fabricating prototypes tailored to the appropriate age range for children, thereby eliminating the need for parental guidance. Initially, the students sketched their designs before embarking on the creation of individual prototypes utilizing air-dry clay (Figure 3).

Figure 3- Pupil building a prototype utilizing air-dry clay.

Among the prototypes, a "Mickey Mouse" design was crafted to serve as a casing for the flow device, facilitating its detachment and reintegration. Another design, featuring a blue star, followed a similar concept, while the third design incorporated an emoji motif, imparting a distinct aesthetic to the flow device. In this arrangement, the "nose" element was designated as the entry point for drops, complemented by two stripes serving to display the test results (Figure 4).

Figure 4- Pupils design a prototype.

The students engaged in a study involving local COVID-19 data provided by the Ministry of Health. They proceeded to construct **mathematical** models for analysis and graphical portrayal. Epidemiological data encompassing infection and transmission rates, the impact of facemasks, adherence to social distancing and home quarantine, as well as the ramifications of vaccination, were analyzed through a mathematical lens. This approach facilitated the comprehension and explanation of epidemiological objectives such as achieving the "flattening of the curve." (Figure 5).

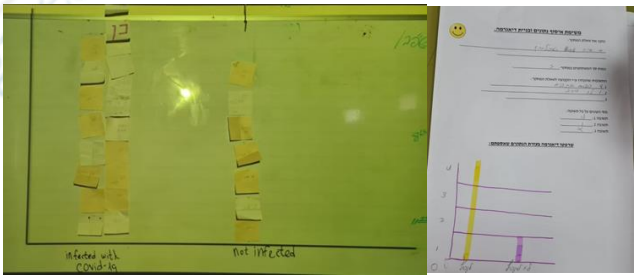

Figure 5 - diagram formulated by the pupils on the board, effectively depicting the count of students infected with COVID-19 versus those who remained uninfected.

While debates persist concerning the role of **art** within STEM, our learning model employed art as a unifying medium to synthesize the comprehensive knowledge the pupils garnered regarding COVID-19. Leveraging their grasp of design and engineering principles, the students harnessed their acquired skills to visually represent and construct age-appropriate flow devices. By integrating language, color, and the technical designs they had studied, the students embarked on the research and creation of effective, age-appropriate instructional guides. The accompanying images below aptly illustrate the clay prototypes meticulously crafted by the Pupil (Figure 6,7).

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)

Vol 10, Issue 9, September 2023

Figure 6- Clay prototypes meticulously crafted by a pupil

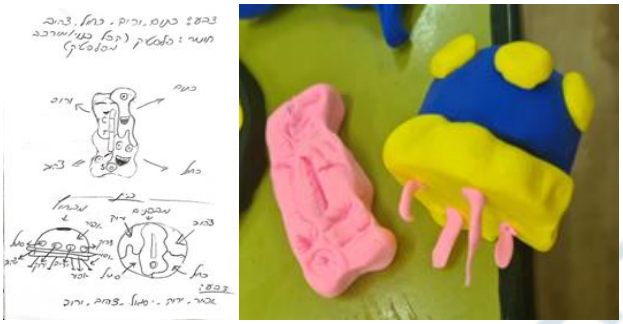

Figure 7- Clay prototypes meticulously crafted by a pupil

Adjacent to each prototype's side lies a sketch, meticulously detailing the planned prototype, replete with chosen colors and materials intended for the final product. We afforded our students a unique opportunity to showcase their innovation and creativity, ultimately resulting in a product poised for presentation to prominent corporations engaged in the production of antigen kits. This specialized product caters specifically to a target audience—children. To elucidate, consider the "Mickey Mouse" design (Figure 4); it could be proposed to "Disney," enabling them to focus solely on crafting the casing designed to house the flow device. Consequently, corporations such as "Disney" need not concern themselves with the intricate process of antigen test creation. This strategic approach holds the potential to engage children in voluntarily undergoing antigen tests, effectively alleviating any apprehension they might harbor.

IV. CONCLUSION

The proposed educational initiative is a fundamental response to the prevailing need to address crucial public health issues in the field of education. In particular, our focus was on the profound concern posed by the COVID-19 pandemic, an unprecedented global challenge. In particular, the theme of this pandemic had not yet found its place in the conventional curriculum of education. However, this challenge marks a unique juncture for teacher training institutions to equip teachers with interdisciplinary teaching methods capable of traversing unexplored territories.

The results of this educational activity show the remarkable potential inherent in the implementation of a multidisciplinary approach in STEM education. The adoption of such an approach has had a transformative impact on the daily life of students and plays an important role in strengthening their cognitive and emotional resilience to health-related obstacles. The results of our research clearly confirm the feasibility and efficacy of integrating STEM education techniques at the primary level. This assertion is highlighted by the deep engagement of students within the field of research-based learning.

The insights gained from our experience revealed a convincing and powerful strategy for addressing the fear and anxiety generated by circumstances such as the global COVID-19 pandemic. The heart of this strategy lies in the dissemination of modern scientific knowledge, the cultivation of open dialogue with students, and the empowerment of students by equipping them with self-regulation tools based on scientific knowledge and authenticity. This approach is a powerful antidote to emotions and fear, which often cause anxiety and anxiety among students. As a result, we strongly support the seamless integration of future health challenges into STEM education. This integration will promote health literacy to a level similar to a therapeutic mechanism for building resilience among students, especially in the field of primary education. By adopting this forward-looking perspective, future challenges in the health, environment and various fields can be considered as valuable learning opportunities. Such an approach seamlessly integrates STEM principles into the process of spreading knowledge and facilitates practical and meaningful learning that is transformative and enduring.

Our educational activities underlined the need to adopt a comprehensive and systemic perspective that includes adaptable management practices within the education system. This approach serves as a channel for seamlessly integrating relevant and timely content that cannot find its home within the framework of established curriculum.

In conclusion, our shared experience underlines the immense potential of STEM education as a means of disseminating scientific knowledge, engaging in authentic investigations, and nurturing personal experiences that effectively mitigate fears and fears. This multifaceted approach not only equips students with information, but also empowers them with the tools they need to navigate challenges with resiliency and resolve. As educators, administrators, and policy makers, we have the responsibility to create an environment that fully embraces inter-disciplinary teaching methods. Through these collective efforts, students can acquire the skills necessary to navigate confidently in a complex world with scientific knowledge.

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