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TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE OF TEACHERS AT PRIMARY SCHOOL IN COVID ERA

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Abstract

During the COVID-19 epidemic, scientific instruction must use technological pedagogical content knowledge (TPACK). This study examines the TPACK of primary school teachers in Delhi while using blended learning (BL) to teach EVS during the COVID-19 pandemic. The examination of the interview data was done by deductive content analysis. According to the report, all instructors used instructional technology to provide lesson material, learning activities, and student assessments in their virtual classrooms. The online teaching platforms that were used were Zoom, CISCO and MS Teams. Experimentation was the primary teaching strategy used in both forms of training. To maximise the scientific learning experience for their students receiving online instruction, most instructors took educational technology into consideration at every stage of the process. During BL, a variety of direct and technology-mediated interaction formats emerged, particularly during online instruction. These formats may be planned and examined within the framework of the TPACK model.

Keywords : *TPACK, Blended learning, Pendemic, Primary School*

Introduction:

Every change in society is gradual. Over the last 20 years, there have been significant developments in how technology is used in teaching and learning around the globe. Nowadays, technology is a part of everyone's daily existence. However, knowing how to incorporate technology into the classroom has become a major concern for instructors when it comes to the teaching-learning process. While certain government policies of today are willing to invest in integrating technology into the classroom, most teachers are not eager to adopt new practises or depart from the conventional methods of teaching that they have been taught for many years. It is possible to argue that, in comparison to more experienced instructors, the beginner teachers are more tech-savvy. A teacher must possess both pedagogical expertise and a firm understanding of the subject matter to effectively employ instructional technology. According to Agyei and Voogt (2012), integrating technology into the classroom should be seen as a tool rather than a final step. According to the study, instructors' TPACK is unaffected by the number of years of experience they have spent teaching. Over the last 20 years, TPACK has been more and more popular, and several laws and educational initiatives have been implemented to improve technology integration in the classroom. However, the practise is still insufficient since these policies' contribution is not evident in

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OPEN ACCESS Original Research Article

current practise. The government has supplied classrooms with a plethora of resources, including computers, smart boards, and other educational supplies.

The 21st century also placed a strong focus on selecting and implementing effective teaching strategies in the classroom. These days, sufficient technical assistance is given to both public and private schools by both public and commercial organisations. Therefore, it is the duty of educators to make use of technology to improve the learning process and provide students with a sufficient level of knowledge. Therefore, it is the duty of the instructor to utilise the resources at their disposal to deliver the students relevant instructions effectively and efficiently. Therefore, the instructors lack the confidence necessary to incorporate such elements into their lesson plans and conduct successful classroom instruction. Thus, the most vital and significant aspect of a teacher's job is their training. When a teacher walks into the classroom, they must have a lesson plan in full proof. Here, he or she must have a well-thought-out strategy for using instructional technology in addition to pedagogical and topic understanding. In comparison to the older generation, the younger generation of today is thought to know more about technology as they have been around it from the start. Therefore, it is believed that the future generation, known as the "tech savvy generation," would know more about technology than previous generations. However, it seems that these instructors are only able to use technology in their daily lives, not in a classroom setting. Thus, the management of the school is assuming that the instructors of the new generation can fill the knowledge and use gap in technology in the classroom. Therefore, they are eager to fill the void left by these two by hiring instructors from the younger generation. According to some studies, more inexperienced instructors than more seasoned one's struggle to incorporate technology into their lessons.

There seems to be a deficiency in training about the integration of these three technologies, according to several educationalists who have conducted study on modern education and technological integration. There have been reports that the instructors at the rural school are not receiving the necessary training, and that there is not nearly enough technology in the classrooms. The principal and headmaster are also accountable for keeping an eye on how these items are being used in the classroom. Certain institutions have inadequate oversight and supervision, which has resulted in improper implementation. The principals or headmasters of the institutions should be aware that they are responsible for keeping an eye on these matters.

Literature Review:

Safriana, Safriana & Irfan, Ade & Fitri, Zahratul (2023) The achievement of raising the standard of education in metropolitan areas is largely dependent on the TPCK of the instructors. Using a TPACK survey instrument with seven components—Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and TPACK on a Likert scale—the goal of this study was to ascertain how science teachers in Lhokseumawe City perceived TPCK. Descriptive statistics were used to examine the TPACK perception data. The findings demonstrate that TPACK's impression of it. Lhokseumawe City teachers fall into an excellent category. Using digital platforms that are suggested in the curriculum for autonomous study, high school science instructors are beginning to use technology into scientific instruction.

Bhebhe, Sithulisiwe & Schlebusch, Luzaan (2023) The purpose of this research was to ascertain how lecturers from certain Southern African institutions were supported in continuing to integrate digital pedagogies

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AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XII, Issue– VI Nov – Dec, 2023

OPEN ACCESS Original Research Article

to prepare in-service teachers during the COVID-19 epidemic. As part of an interpretative research paradigm, the study used a multiple case study design and a qualitative research methodology. The researchers simply selected two institutions in Southern Africa to conduct the study at as their places of employment. The instructors at the education faculties who provide in-service teacher training were chosen as a purposeful sample. Data were acquired by means of the examination of publications deemed pertinent to the investigation from the colleges under investigation. Twelve academics participated in a focus group discussion, nine lecturers answered an open-ended questionnaire, and six heads of departments of education participated in open-ended interviews. Thematic analysis was used to assess participant data and the papers that were reviewed. According to the study's results, lecturers from both institutions originally lacked sufficient expertise since they were still adjusting to face-to-face teaching pedagogies. As a result, they needed to know how to include technology pedagogies into their in-service teacher training.

Thy, Savrin & Rany, Im & Iwayama, Tsutomu (2023) In this study, the knowledge domains of Technological Pedagogical Content Knowledge (TPACK)—including content knowledge (CK), pedagogical knowledge (PK), technological knowledge (TK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and TPACK—as well as their perceptions by science teachers in high school in Cambodia are evaluated. Additionally, the relationship between these knowledge domains and certain demographic variables—like gender, age, qualification, and teaching experience—as well as the type of school and its location—are examined. A self-rating questionnaire was used in the research to survey 240 science instructors at high schools in Cambodia. To arrive at conclusions, data analysis used Pearson's correlation statistics, One-Way ANOVA, and independent samples t-test. According to the survey's findings, science teachers in high schools in Cambodia who responded ranked their level of knowledge for CK, PK, PCK, and TK as being reasonably high, but for TCK, TPK, and TPACK as being relatively poor. Only the school-type variable showed a difference in the four TPACK technology-related knowledge areas, according to difference analyses. Only the four technology-related areas showed negative relationships with age and prior teaching experience. To sum up, science instructors in high schools in Cambodia possess sufficient expertise in three areas: (1) topic material, (2) subject matter teaching methodologies, and (3) information and communication technology for supporting administrative tasks and subject matter-related activities. To better their instruction and help pupils learn more about their topic, high school science instructors in Cambodia need to have a deeper understanding of specialist ICT for education.

Gözüm, Ali Ibrahim Can & Demir, Özden (2021) The COVID-19 epidemic has brought attention to the pre-service teacher education requirements due to the utilisation of technology and educator capabilities to enhance early childhood education. Examining the connection between pedagogy, technology, and the subject matter that pre-service teachers learn might be important in this situation. The purpose of the research was to determine how prospective preschool teachers' confidence in their Technological Pedagogical Content Knowledge (TPACK) for Science Education related to the TPACK sub-scales. The quantitative research paradigm-based relational screening approach was used in this investigation. For the purpose of structural equation modelling, path analysis was done. 280 prospective preschool teachers who attend two distinct state colleges in the eastern part of Turkey for their education degrees made up the study group for this research. Timur and Taşar (2011) translated the

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AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XII, Issue– VI *Nov – Dec, 2023*

OPEN ACCESS Original Research Article

"Technological Pedagogical Content Knowledge Self-Confidence Scale" to Turkish and used it to gather data. It was created by Graham, Burgoyne, Cantrell, Smith, and Harris (2009). The validity and reliability tests conducted on the data set acquired from the prospective preschool instructors served as a means of testing the theoretical validity of the data collecting instrument. The findings demonstrated a direct and positive relationship between the TPK and TCK variables and the TPACK variable. The TK variable has a direct and positive impact on the TPK and TCK variables.

Mohd Tajudin, Nor'ain & Kadir, Noor (2014) The purpose of this research is to evaluate the technical pedagogical content knowledge (TPCK) of Universiti Pendidikan Sultan Idris (UPSI) mathematics trainee instructors and to investigate their methods of instruction during in-class practical training. The research was carried out utilising a variety of methods in two stages. In the first phase, 156 trainee teachers of the Bachelor of Science (Mathematics) with Education (AT48) and Bachelor of Mathematics Education (AT14) were subjected to a survey technique employing a questionnaire. A questionnaire measuring subject understanding, pedagogy, technology, and TPCK of mathematics was the tool used. The mean, a descriptive statistic, was used to analyse the data. Four trainee instructors participated in the interview procedure used in the second round. To evaluate the trainee teacher's integration of TPCK into their teaching practise, a semi-structured interview technique was used as the instrument. The content analysis was used to examine the data. The results showed that trainee instructors had a modest degree of TPCK knowledge, with an overall mean score of 3.60. At this level, the two programmes' mean scores—3.601 for the AT14 group and 3.603 for the AT48 group—did not demonstrate any discernible differences.

During The Covid-19 Pandemic, We Learn About The Technology Used By Primary Teachers:

When the epidemic struck in the spring of 2020, educators were forced to quickly adapt their regular teaching methods by attempting to use new technology to meet educational objectives. For some instructors, this sudden shift in pedagogy went more well than for others. The COVID-19 epidemic forced educational institutions to adopt technology-mediated instruction and learning immediately. Since instructors had no other choice, this significant transition gave us an incredible chance to learn about the role that technology plays in the classroom. Research conducted over many decades has shown that teachers' views influence their readiness to utilise technology, which in turn influences how likely they are to use it. Because of this, it has been proposed that rejection of technology usage often stems from a lack of desire and a bad attitude towards utilising it. What occurs when instructors with varying degrees of desire are asked to teach primarily using technology is not well understood. According to research by Spoel and colleagues, instructors who employed technology in their instruction even a little bit before to COVID-19 had happier experiences during the first month of distant learning. This implies that instructors' prior experiences and readiness to use technology may have an impact on how they perceive certain technology-mediated educational situations (such as perceived barriers). If we want to assist teachers' intentional use of technology at varying degrees of willingness and experience after the epidemic as well, we may better understand which components of attitudes and experience need to be addressed by having a greater understanding of these experiences.

Willingness to Use Technology:

Behavioural intention has been seen as the "gate" between attitudes and conduct since the 1980s, when the Theory of Planned conduct was developed. Attitudes can only affect behaviour via altering intention. According to Ajzen, behavioural intention

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AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XII, Issue– VI *Nov – Dec, 2023*

OPEN ACCESS Original Research Article

may be defined as "a person's readiness to perform a behaviour" or as the desire to participate in a certain activity. By asking individuals whether they plan to participate in the conduct, expect to engage in the behaviour, are preparing to engage in the behaviour, will attempt to engage in the behaviour, and, most importantly, if they are willing to engage in the behaviour, one may operationalize their readiness to act. Consequently, the way educators feel about using technology in the classroom influences their willingness to do so, which in turn determines how much of it they actually use. Many research has examined willingness as a dependent variable, assuming that there would be no behaviour without willingness, based on the prior theoretical paradigm. Subsequent research, however, indicates that the attitudes, willingness, and behaviour link may be more dynamic than the ideas derived from the Theory of Planned behaviour (TPB) imply. Similar findings were discovered by Scherer et al. in a meta-analysis, which demonstrated that attitudes towards technology acceptance directly influence technology usage rather than via willingness. Similar findings were reported by Adov, Pedaste, Leijen, and Rannikmäe (submitted), demonstrating that attitudes may predict conduct in addition to the willingness-mediated impact. Adov et al.'s recent research demonstrated that, when examining more particular attitude elements, we may see various connections with willingness and conduct. Scherer et al. had used general technological accepting attitude to aggregate more specific attitude factors. The assessments of the value of technology in education seem to interact with willingness to predict conduct, whilst some attitudes (social influence and enabling conditions) or link directly to reported behaviour (social influence and self-efficacy) seem to predict others. Tsybulsky and Levin suggested looking past individual attitudes and observing how teachers' worldviews around technology are changing. They conceptualised this as a system of beliefs where it is crucial to comprehend not only the ideas themselves but also how they interact with one another and how they coexist in different patterns. The authors describe an approach to the digital worldview using Wilber's (1995) three-dimensional construct, which includes objective ("how I relate to digital content"), intersubjective ("how I relate to others through digital means"), and subjective dimensions ("how I see myself represented in the digital world"). The authors imply that modifications to pedagogical practises and teachers' perspectives on the digital world will have an effect. Various research has shown that attitudes, such as the desire to utilise technology, are important in understanding the behaviour itself.

Frequency and Variety in the Use of Technology:

Most research endeavours that assess the experience of technology use gauge the frequency of the habit using questionnaires, for example. While analysing frequency gives us some insight into how technology is being utilised, it does not provide us with detailed information about its specific use. Research has also attempted to assess how often instructors and students engage in certain activities (such as communication, content production, or information search) that are associated with digital literacy or related literacies. Still, this has only provided a very shallow understanding of the depth and breadth of technological usage by educators.

To assess the use of technology in education, Puentedura presented the SAMR (substitution, augmentation, modification, and redefinition) framework, which focuses on how technology is incorporated into the teaching-learning process. In a systematic study, Cromton and Burke used the SAMR framework to assess the degree of technology adoption according to how much it improves educational opportunities. The authors experimentally expanded the framework and provide a summary of the use cases

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AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XII, Issue– VI *Nov – Dec, 2023*

OPEN ACCESS Original Research Article

for each level of the framework based on this investigation. The first two stages, replacement and augmentation, are referred to as enhancements together. In these stages, the emphasis is on replacing routine chores with analogous ones via the use of technology or including a basic function, such slides that have embedded videos to demonstrate the subject. In the first level, substitution, technology replaces the tool directly and doesn't alter its functionality; in the second level, augmentation, however, the direct replacement is improved with some functional enhancement. The following two stages, modification, and redefinition, are called transformative because the technology employed makes it possible to rethink learning activities to the extent that using it would be impossible without it—for example, when writing text or working cooperatively to solve problems. When it comes to redefinition, technology allows the creation of a new task that would not be possible without technological solutions (e.g., students recording experiments and editing them to illustrate the learning process). In the case of modification, technology enables significant task redesign (e.g., finding stars in the sky using augmented reality).

According to Cromton and Burke's findings, out of the 186 studies, 54% achieved the transformative level, while 46% employed technology at the augmentation level. As it would be impossible to communicate with students without the use of technology, one might argue that many technology-mediated activities in the context of distance learning go towards the transformative level. The SAMR framework, however, challenges academics to go a step further and concentrate on the mechanisms of learning, questioning if they may occur without the aid of technology.

What Makes Technology Difficult to Use?

Teachers' assessments of how hard (effort expectation or perceived ease of use) or beneficial (technology for teaching) are predictive of willingness and, eventually, of use, according to studies on technology adoption. For example, the "degree of ease associated with the use of the system" is defined as the "effort expectancy" or perceived ease of use, which researchers have attempted to measure in an effort to better understand potential barriers to using technology. In the context of teaching, this can be understood as the teachers' perceptions of how easy or difficult it would be to use technology for teaching or how inhibiting the foreseen obstacles might be. According to Bowman et al., there are two categories of barriers to the use of technology: internal barriers, which are within the control of teachers, and external barriers, which are determined by factors such as institutional decisions and available infrastructure (e.g., skills and knowledge, attitudes, and beliefs in technology use). According to a number of research, views towards effort and usefulness may overlap to the point that it is illogical to distinguish between them. Scherer and associates also suggested that impediments need to be seen as a component of usefulness, as experiencing or foreseeing issues with technology usage also influences how beneficial people find it. But these sentiments have often been assessed by surveys that ask teachers to rate how difficult they think it would be to use technology and to indicate whether they agree or disagree with certain assertions. However, this doesn't tell us anything about how educators see the challenges that technology presents in the classroom or how these challenges can vary across educators who have varying degrees of willingness and experience using technology in the classroom.

Moreover, it has been shown that depending on their goal orientation, instructors may see usefulness differently. For instance, a teacher whose objective is to prepare kids for tests would assess a technology's value in the classroom differently from a teacher who wants to inspire pupils. As a result, perceptions may

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AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XII, Issue– VI Nov – Dec, 2023

OPEN ACCESS Original Research Article

vary, and the perceived challenges of employing technology may shift depending on the objective. For example, training students for an exam is likely to provide a different set of challenges than encouraging them. In their meta-synthesis, colleagues demonstrated how instructors' attitudes might prevent students from adopting new technologies. Three recurring themes were found by colleagues when analysing the barriers that teachers face when utilising technology: a lack of time, a sense of being in the dark about students' progress, and traditionalist views that hold that teachers don't need technology because they can continue to use traditional methods. The latter requires addressing and altering teachers' beliefs and attitudes. The first two obstacles to technology development may be overcome by shortening the time it takes to use technological solutions or by providing training courses to demonstrate to teachers that technological solutions take less time than expected. Tsybulsky and Levin distinguished three categories of instructors according to their digital worldview, which reflected varying degrees of interaction with the digital world, in addition to certain attitudes and beliefs. Despite not being the primary objective of the research, there seems to be a correlation between instructors' openness to navigating and exploring digital teaching possibilities and their worldview. According to the authors, a subset of educators referred to as "outside observers" stated in their professional lives a lack of involvement, curiosity, or trust towards the digital solutions. These educators also reported the lowest degree of engagement with all three aspects of the digital worldview. On the other hand, the "circumspect participants" and "conscientious participants" shown increased readiness to interact with the digital environment and more favourable sentiments towards it. In conclusion, examining the challenges raised by educators who vary in their desire and expertise to utilise technology in the classroom might provide interested parties a chance to resolve these issues.

Integration of Technology During the Covid-19 Pandemic:

The COVID-19 pandemic has impacted all human activities worldwide, leading to significant shifts in human-related activity. In reaction to the global pandemic, university pedagogy has drastically altered worldwide. Attempts to stop the virus's spread have had an influence on higher education institutions, which have moved away from in-person instruction and towards digital learning. On January 13, 2020, a new case of COVID-19 was reported in Bangkok, India becoming the first nation outside of China to do so. In India, the demand for educational reform has increased dramatically in response to the pandemic. Blended learning (BL), which combines online and in-person instruction, was introduced in July 2020 to meet the demands of technology integration in India (SEAMEO Regional Centre for Higher Education and Development). India has seen a steady rise of COVID-19 cases ever since. Students were then forced to study at home without any other option. In line with a state of emergency proclamation in India, all higher education institutions (HEIs) in the country began using full-scale online learning systems. This was done to minimise traffic and the possibility of disease transmission. This has a big effect on the way that all Indian colleges educate. Some colleges far from the COVID-19 events did not have an all-online teaching policy prior to the state of emergency being declared. Several colleges started out offering online education before moving to in-person instruction. All instructors, however, are compelled to teach online in the event of an emergency declaration. To differentiate between emergency remote teaching and online teaching during the COVID-19 epidemic, emergency remote teaching has become a popular alternative term among online education researchers and educators. Emergency

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AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XII, Issue– VI *Nov – Dec, 2023*

OPEN ACCESS Original Research Article

remote teaching is a reaction to unforeseen circumstances, while online instruction is meticulously prepared. In addition to offering schedule flexibility, remote learning for emergencies enables instruction to continue even in the event of a lockdown. In the event of a pandemic, students may not have an option except to study online.

Online education:

The concept of online learning is not new to higher education in India; several scholars have already examined and explored it. But considering the epidemic, educators, academics, administrators, and other stakeholders—such as children and their parents—have reexamine and contentiously debated this teaching methodology in relation to its applicability, advantages, and drawbacks. Considering the epidemic in India, online learning is presented as a way to deal with the interruption. Technology usage is inextricably linked to online education (i.e., web-based materials or software). To effectively instruct pupils, higher education instructors must acquire and integrate ICT abilities. Students have benefited much from online learning, but there are drawbacks as well, which are discussed in the following section.

The rapid COVID-19 epidemic has compelled higher education professors and students to work and study fully from home, leading to the implementation of online education in Indian university environments. The stakeholders (teachers and students) have unavoidably experienced both advantages and disadvantages from the usage of online learning. Previous research indicates that the COVID-19 pandemic has an impact on the health of college students in the Asia Pacific area, especially India, because of difficulties with online learning. Overall, students said that anxiety was the biggest issue, followed by stress and despair.

According to Tadesse and Muluye (2020), parents, teachers, students, and schools in poor nations have all been impacted by the COVID-19 epidemic. Some underprivileged pupils attend schools in remote locations with inadequate ICT infrastructure and instructional resources. Disadvantaged pupils therefore lack the necessary digital infrastructure needed to receive instruction remotely during online instruction. The study's findings showed that pupils had significant levels of stress, anxiety, and depressive disorders throughout the school shutdown. Particularly during the COVID-19 epidemic, there were repeated mentions of the significant effects that online learning had on instructors. According to Almazova et al. (2020), there are both potential and difficulties for Russian higher education in the context of COVID-19. Teachers are facing issues related to their degree of computer literacy, the electronic environment and support provided by the institution, the preparedness of academic staff, and students for online learning. According to König et al.'s 2020 research, German instructors will need to adjust to teaching remotely during COVID-19 school closures. To educate online, the study's instructors had to be proficient in both digital technology and teaching. The COVID-19 instructors were guided by everything mentioned above to ensure they were competent and equipped with the necessary abilities for teaching remotely. Based on these conditions, it seems that instructors are being forced to become proficient in online instruction via online learning. In order to engage students and foster learning, it is anticipated that online learning would include well-designed evaluation, assessment, and teaching methodology. Teachers must be well-prepared for online learning as they are stakeholders as well. The most important competencies for online language instructors must be emphasised.

Conclusion:

Finally, to get acquainted with common student misconceptions, all the participating instructors in both nations used TPACK in their online scientific

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AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XII, Issue– VI *Nov – Dec, 2023*

OPEN ACCESS Original Research Article

instruction during COVID-19. They designed their teaching using educational technology, considering the needs of the students for learning assessments, learning activities, and lesson material. While the Finnish participants used MS Teams for videoconferencing, the Indian participants used Zoom to train the students. Every participant included technology into their scientific classroom instruction. For instance, they used PowerPoint, YouTube videos, and pre-recorded films to show the experiment or convey the lesson's topic. To maximise the students' scientific learning, they incorporated educational technology into every aspect of their online training. In on-site experiments, each participant tried to influence the way the students learned (e.g., the idea of the science lesson, scientific skills, communication, and interaction). The researchers' emphasis in this work is on elementary teachers and the use of TPACK in lesson planning during the COVID-19 pandemic. As a result, we paid more attention to the standards set by instructors than to those for the schools. In this case study, the emphasis was on teachers as cases. The COVID-19 pandemic is one instance of an unforeseen circumstance that educational institutions must deal with, but it also offers a chance to comprehend how schools could react in an emergency. The organisation of youth refugee education is now a problem in several European and Asian nations. Any research on unforeseen occurrences in educational systems might benefit from the insights gained from the COVID-19-time experiments.

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