Research Article

Online and Offline Internship Experiences of Science Pre-Service Teachers in Delhi: Implications for Teacher Education

Kothai Nayagi N

Research Scholar, Department of Education, University of Delhi, Delhi

Email: kothainayaginatarasan@gmail.com

Abstract

The advancement of web technologies and their applications is tremendously changing education around the world, which requires teachers to acquire techno-pedagogical competencies and experiences of it. The present study explored the secondary science pre-service teachers (PSTs) lived experiences of both online and offline teaching in their internship during the third wave of the COVID-19 pandemic. This phenomenological research conducted semi-structured interviews with 14 science PSTs just after their internship. The analysis revealed that participants got oriented and familiarised with using the technologies to explore more ways of teaching and had meaningful experiences despite the challenges they faced. The study highlighted the significance of school students' interaction in developing participants' pedagogical competencies and for the effective teaching and learning process both online and offline. The study recommended the strategies of blending online and offline internships to develop the science PSTs' techno-pedagogical competencies to facilitate the digital transformation in education.

Keywords: Internship experiences, Online teaching, Offline teaching, COVID-19, Science pre-service teachers

Introduction

Internship is essential because it develops the Pre-Service Teacher (PST)'s professional identities, social interactions and pedagogical practices (Caires et al., 2012). An internship programme is where the knowledge of subject content, pedagogy and technology are connected, and PSTs can practically apply it in the actual classroom (Ismaeel & Al Mulhim, 2022). A productive and meaningful internship experience is significant for every PST. The advancement of web technologies has the potential to continuously change the face of education. The COVID-19 pandemic made it obligatory for teacher education institutions to use digital platforms to provide internship experiences to future teachers. The crisis created an opportunity for PSTs to have their internship in online mode, which requires new skills and self-efficacy. Even though online internships are not common in many countries, many studies have documented the challenges and opportunities of an online internship and called for teacher education programmes worldwide to incorporate more space for online internships.

In the post-COVID-19 pandemic era, online courses will proliferate at all levels of education. Hence, teacher education curriculum must be reviewed regularly to ensure it can develop the PSTs' competencies relevant to the emerging education scenarios. The National Education Policy 2020 (MHRD, 2020) of India envisioned digital transformation in education and stressed integrating technologies to improve education at all levels. Further, it proposed bringing new technologies (artificial intelligence,

machine learning, blockchains, smart boards, handheld computing devices, adaptive computers, etc.) to the teaching and learning process as well as to the assessment. Hence, the technological competencies of future teachers are essential for integrating technology into their pedagogical subjects. Science teachers, in particular, must have techno-pedagogical competencies due to the subject's numerical and practical nature. It will enable the science teachers to provide their students with quality hands-on and experiment-based learning experiences.

Understanding PSTs' online internship experiences will help the teacher education curriculum and policymakers to know the potentials and pitfalls of online internship environments and further strengthen them through necessary modifications. In this context, the study aims to understand the secondary science PSTs' both online and offline teaching experiences in schools during the third wave of COVID-19 in Delhi, India. The information gained from this study will benefit teacher education programmes by providing the appropriate training and adjustments to future teachers during their internship program to handle the students both online and offline.

Review of related literature

To effectively engage in the online teaching and learning process, the teacher requires the knowledge of integrating technology and pedagogy to specific content. The sudden change from the traditional mode to distance online education during the COVID-19 pandemic was not smooth for many teachers, students and other stakeholders. The lack of techno-pedagogical competencies among teachers and PSTs has often been stated in many studies conducted in India (Tabassum, 2022; Kamel & Illiyan, 2021). Teacher education institutions in India offer a specialised paper on Information and Communication Technology (ICT) to enhance the PSTs' professional capacity in fulfilment of the National Curriculum for Teacher Education (2014) norms and regulations. However, Tabassum (2022) stated that one of the significant challenges faced by the PSTs during their virtual internship was a lack of training in choosing appropriate pedagogical techniques to teach mathematics in online classes. Moreover, PSTs learned theoretical aspects of different pedagogy from their teacher education course; however, it was not sufficient to teach on the online platform (Iradel et al., 2021). It indicates the gap in teacher preparation programs, as it ignores the importance of incorporating the teachers' technological skills with professional competencies.

Annamalai et al. (2022) pointed out that PSTs developed a negative experience towards online teaching due to students' lack of participation in online learning as they had insufficient digital infrastructure. Bansal et al. (2019) mentioned a discrepancy between teacher education orientations and school internship experiences. The limited infrastructure facilities at Indian schools also challenge the PSTs to engage a constructivist approach in their teaching and learning process, which was expected from the teacher education course. During the pandemic time, the challenges were acute due to limited digital infrastructure.

Cavanaugh et al. (2009) claimed that student interaction is the key to an effective online class. However, studies (Al Abiky, 2021; Bunyamin et al., 2021; Tabassum, 2022; Yusnilita, 2020) highlighted that student had low motivation in the online learning environment, which challenged the PSTs' practice. Especially, PSTs found it difficult to cope with students' diversity

in learning (Tabassum, 2022). Brinia and Psoni (2021) asserted that a lack of interaction between the teacher and students contributed to the low engagement level in online learning. Iradel et al. (2021) explained that the PSTs had trouble in adjusting and managing the online class as they were majorly prepared for face-to-face. In addition, time management was another obstacle faced by PSTs during their virtual internship (Dhimmar & Patel, 2023; Waters & Russell, 2016).

Avsar Erumit et al. (2021) surveyed PSTs' beliefs towards online science education, and they found a negative belief towards the online platform, as it was not appropriate for the practical nature of subjects. Further, PSTs faced difficulties assessing the student's progress on online platforms due to limited training (Al Abiky, 2021; Iradel et al., 2021; Tabassum, 2022). Iradel et al. (2021) propounded that PSTs should be trained for the rapidly changing learning styles and online modalities.

Despite many challenges, the online internship helped the PSTs to develop their pedagogical and technological skills (Pepito, 2022) with a supportive system from teacher education institutions (Iradel et al., 2021). A study conducted by Annamalai et al. (2022) revealed that online practicum increased the PSTs' confidence level in teaching and facilitated active learning. Similarly, Yusnilita (2020) study found that online classes provide more flexibility for students to work collaboratively and reduce the learning gap during the crisis (Kamel & Illiyan, 2021). Moreover, PSTs mentioned in a study by Avsar Erumit et al. (2021) that online education supports their teaching with various materials, which could be easily accessible through the proper platforms. Regarding the effectiveness of virtual internships, Waters and Russell (2016) mentioned that online teaching gave a more realistic image of teaching for PSTs. Similarly, Theelen et al. (2020) recommended the virtual internship for teacher education as it helps in reducing PSTs' anxiety in teaching.

Nevertheless, Ismaeel and Al Mulhim (2022) argued that the traditional face-to-face teaching practice would help PSTs adopt proper teaching methods in the actual teaching context. Ismaeel and Al Mulhim (2022) conducted a survey to compare the traditional and online internship experiences of 120 PSTs during a pandemic. The study concluded that a traditional internship is generally better than an online internship as per the Technological Pedagogical Content Knowledge (TPACK) model. Further, the study suggested blending the traditional and online internships to develop the PSTs' skills to integrate the technology and pedagogy in the given teaching context.

Besides, online internship facilitates a range of opportunities for pre-service teachers. It gives limited scope on real school experiences and a grip on their learning experiences. Many studies have been associated with the challenges and opportunities of the online internship. The present study tries to understand the secondary pre-service science teachers' lived internship experiences, where they had both online and offline teaching experiences. It represents the gap in the literature that the current research aims to address.

Research Methodology

This qualitative study used phenomenology research. "A phenomenological study describes the common meaning for several individuals of their lived experiences of a concept or a phenomenon" (Creswell & Poth, 2016, p.75). It was considered most appropriate for this study since it focused on the lived experiences of science PSTs during their internship. Purposefully selected 14 secondary

science PSTs from the Department of Education, University of Delhi, for the academic year (2020-2022) participated in this study. Given that, due to the third wave of COVID-19 and hazardous air pollution levels that caused subsequent lockdowns in Delhi, they had a few weeks of simulation followed by both online and offline teaching experiences as per their allotted school requirements in their 16-week internship period (between November 2021 to February 2022). Nine of them were males, and five were females. Table 1 details the type of schools where the science PSTs were placed for their internship.

Table-1: Type of schools where the science PSTs were placed for their internship

Type of School	Government	Government-aided	Private	Kendriya Vidyalaya
Science PSTs	P1, P3, P4, P7, P8, P12, P13, P14	P6	P2, P5, P9, P10	P11

At the beginning of data collection, consent to participate in this study was obtained from the participants. Semi-structured interviews were conducted with the science PSTs after completing their internship programme. Interviewees' anonymity is ensured by using the initial letter of the word "Participants (P)" and a number from 1 to 14.

Creswell and Poth's (2016) steps in the phenomenological analysis were used to analyse the data. First, the researcher's judgments and prejudices were kept aside to not to affect the analysis process. Second, the relevant quotes from the participants' textual descriptions were identified. Third, the relevant topics were grouped into themes to give meaning. Fourth, the textual descriptions were written, and verbatim quotations were added to discuss the meaning of the science PSTs' experiences. Fifth, the structural descriptions were written to identify the true essence of the phenomenon. Further, to represent the participants' teaching experiences accurately, they were asked to validate the findings.

Findings

Challenges

Lack of infrastructure

The science PSTs who practised in government schools struggled to conduct online classes due to the unavailability of devices (e.g., smartphones, laptops) and limited accessibility of good internet connections among students. These technology barriers minimalised the science PSTs' online teaching experiences and influenced their pedagogical approaches. For example, P7 stated:

> I thought to use Socrative quiz and all other online apps to teach science. However, students did not have devices. They could not join and participate. That is why I did not use those apps. I just posted PPTs, videos and images in WhatsApp.

To ensure effective teaching for students learning in that difficult time, participants made YouTube videos on their own and posted them in WhatsApp groups. However, the inaccessibility of technology and the overload of online assignments affected poor students' participation and learning. P1 underlined:

> Even though online learning was just through discussion via WhatsApp, the number of participants was meagre. We got a few responses for our videos, homework and worksheets, which the Delhi government gave.

Also, the science PSTs faced problems in conducting activities during offline classes due to a lack of lab and other basic facilities in government schools.

Students' less motivation in learning

The science PSTs stated several problems concerning students' lack of previous knowledge, varied levels of students' participation while doing activities, higher class students' non-participation in discussions, and irregular attendance, which affected the teaching-learning process. The lack of contact between the school system and students reduced their motivation for online learning. The science PSTs did not have enough time and opportunities to develop a good rapport with the students, so they faced challenges in managing both online and offline classrooms. P8 pointed out:

> When I was teaching the concept number of image calculation for the 8th class, I noticed that students did not know odd and even numbers, so I started explaining what odd and even numbers are. So, I did not complete the lesson plan.

and P4 stated:

> Every day, I saw 5 or 6 new students' presence, so mostly, I revised and was not able to continue the chapter.

One big problem stated by the participants was that students were copying answers from online sources during assessment. Hence, science PSTs faced the problem of assessing the student's understanding level in learning during their teaching. Due to access and technological barriers, participants could not ask students to open their cameras and see their reactions during the teaching and learning process. P2 explained:

> If I ask certain things, what do you think about them? Students searched the definitions on Google and spoke. Sometimes, their answers were beyond their comprehension level. So, when I asked for an explanation, they were blank and unaware. This was the case in online classes.

and P6 added:

> Students who participated in regular classes did more cheating. They just copied the answer from online sources without Mindy. So, the assessment was a major problem in getting them to understand.

Science PSTs' fewer opportunities

The participants who practised in private schools had few opportunities to practice the different pedagogical approaches and to teach in a regular class. Mostly, they just revised the topics during extra class time. For instance, P10 mentioned:

> We only got a few extra periods for practice, which are not compulsory for the students to attend. So, we interacted with only a few students. We did not get school cooperation and exposure of other activities like assembly, making time tables, sports etc.

Most of the time, the participants were

informed about the content to be taught just before the day or just a few hours ago. So, they did not get enough time to plan the pedagogical approach, homework, or assessments for that lesson and discuss them with their respective pedagogy teacher.

Overcoming hardships

Adopting interactive tools

The science PSTs got opportunities to develop their pedagogical and technological skills in both online and offline platforms. Their varied pedagogical approaches were based on the topic, the class level and the mode of the classes they got. Mostly, participants used the lecture cum discussion method in online classes (in the platform like google meet and zoom). They made PPTs, images, and YouTube videos. Additionally, they incorporated Graphics Interchange Format (GIF) and 3D images in their teaching to get students' full participation and tried to connect science with their everyday life experiences.

Some science PSTs with enough infrastructure (e.g., laptop, internet connection) and opportunities have used various online apps that are freely available to teach specific topics. They found that those learning apps gave the students real experiences, helped them understand the complex concepts better, and increased their curiosity to learn more about it beyond the textbook content. For example, P6 stated:

> I introduced students to the Stellarium mobile app, saying it is like a personal telescope; you can install it on mobile. The next day they just searched the whole galaxy, observed the International Space Station and asked many questions about it. So, ICT tools were handy to engage students more.

Similarly, P8 mentioned:

> I used one video, a kind of GIF, to show the students how the light passes through their pupil and lens and how it forms an image on the retina. It was a successful method because I took the test of 10 things to recognize from the human eye. They could able to recognize what the retina and optics are. So, they were able to understand because of the video.

and P11 detailed:

> I want to teach beyond the textbook content, so I tried one virtual trip with the 7th class to teach about water conservation. I showed a 360^{0} view of Stepwell in Gujarat through the Google Arts and Culture app. I also used Zygote body (3D anatomy atlas) to teach 'The Respiratory system' to the 11th class students. I showed them how actually the lungs are placed and the functions of the heart, muscles and skeleton. I used that app because I could remove each part one by one so that students could see the internal and external anatomy of the human body.

Additionally, P7 explained:

> *To teach the 'Sound' concept, I used* YouTube videos to help students understand different sounds. First, I played sounds like trumpet, harmonium and guitar. Then I asked them questions. They answered correctly. It was also kind of an assessment. Students liked the videos and participated well.

Moreover, participants mentioned that teaching through online platforms enables them to show or cite real-time examples that are not available in textbooks to connect science with the student's experiences and make them

think about it. For instance, P11 stated that,

> To teach water-related problems, I showed recent newspaper clippings and video of the Chennai and Mumbai floods. Further, I asked the students what do you think about the flood problem? What do you think about urban planning? How do we plan a city? students responded to those.

Also, participants used various assessment apps like Kahoot, Quizizz and Google Forms to asses students' learning at the end of the classes. They also did some activities with students during offline classes.

Students' curiosity in learning

All the participants stated that students' interests and curiosity contributed much to the teaching and learning process. The science PSTs' most liked part of the internship was interaction with the students in offline class as it helped them understand their needs. Students' curiosity in doing activities, questions and answers during discussions motivated the science PSTs to improve their teaching strategies. P11 cited his experience with students in discussion as their lesson progressed:

> In teaching the 'Why do we fall ill?' chapter in class 9th, I had to explain prevention and treatment. So, I kept citing many examples related to COVID-19. Students were asked many questions about COVID-19 and oral and breast cancer. They might be willing to know about that. All their questions were addressed.

Support system

The science PSTs pointed out that feedback and suggestions from their regular/rotational supervisors during simulation teaching and internship were constructive in developing their lesson plans, managing the classroom and practical teaching during difficult times. Peers' appreciation and feedback gave them confidence in teaching. P9 underlined:

> During blended mode class, I got suggestions from my supervisor and peers like paying equal attention to all sets of students, the vocabulary I should use, keeping less text in PPT, sequence of lesson planning and the necessity of connecting the concepts. Those helped me to develop my confidence in teaching. In the later classes, my supervisor complimented my efforts.

Similarly, P7 stated:

> My supervisor appreciated how the chapter 'Reaching the Age of Adolescence' was taught. In those classes, girls participated more in the discussions, which went well. It gave me confidence in teaching.

Accomplish success

Feeling of Satisfaction

The science PSTs felt satisfied with their teaching practice despite the challenges. They felt happy when they saw that students had learned from their instruction. The third wave of COVID-19 created an opportunity to learn and practice more online pedagogy to teach science. Those experiences developed their skills to manage to teach both online and offline during difficult times.

P13 stated:

> My experience was great with students. They were very interactive, very encouraged and curious to inquire about things. I learnt a

> lot, especially how to manage and cater to the class's needs, even in difficult times.

and P14 added:

> It was a good experience; we want to learn how to use and progress with the developing technologies. We learned and explored a lot of apps and interactive class forms. I enjoyed the company of peers and had good online and offline teaching experiences.

Meaningful learning

The participants mentioned that their internship experience was enriching since they developed many skills like time management, giving autonomy to students in learning, and practising open-mindedness and reflective thinking based on their experiences at school. P14 underlined:

> Initially, my lesson plan was short, and my supervisor pointed out that my teaching style led to rote learning. I have reflected on why I was doing that. The reason that I comprehended was that my learning experiences at school as a student influenced me greatly. Later, I developed my teaching skills through more activities.

and P2 mentioned:

> I have learned from my peers' classes that we should give students space to pose questions. So, that they will learn. The classes should not be monotonous, it should be interactive.

Moving ahead

The teaching experiences of PSTs have led them to provide a few suggestions to improve the internship programme. They suggested improving the infrastructure facilities and opportunities for proper training at schools. Further, they added that the teacher education programme should include demonstrations of pedagogy teachers' teaching by using different pedagogical approaches with the school students and more training on peer observation and reflective journal writing. Continuous feedback from their supervisors was also requested, along with financial support during their internship. For example, P14 stated:

> It is challenging to engage students based on child-centered educational theories. I want to see our pedagogy teachers' teaching style to learn how to use different constructivist teaching methods.

Discussion

Based on the experiences from the first and second waves of the COVID-19 pandemic, the secondary science PSTs in this study were also trained to teach online. The findings revealed that limited digital infrastructure restricted the participants' online teaching practices. This result is in agreement with many recent studies (Annamalai et al., 2022; Bunyamin et al., 2021; Pepito, 2022; Tabassum, 2022), which suggested providing sufficient digital infrastructure facilities for students and teachers to maximize online teaching and learning like the findings of Bansal et al. (2019), the participants in this study underlined the need to develop school infrastructure facilities and ample opportunities for constructivist practice and learning. Also, they have been asked for financial assistance

during their internship, as suggested by Tabassum (2022).

One of the study findings highlighted that the student's lack of previous knowledge and irregular participation placed the science PSTs in a difficult position to develop confidence in their efforts to continue the online teaching. This may be attributed to the findings of Bunyamin et al. (2021) and Yusnilita (2020), who claimed that the COVID-19 pandemic created a learning gap and decreased the students' interest in learning, which challenged the PSTs to continue their teaching. Waters and Russels (2016) suggested improving the PSTs' communication skills to motivate the students to learn in an online environment. Like Tabassum's (2022) finding, the study disclosed that the online platform had some constraints in tracking the students' genuine learning and progress. Al Abiky (2021), Iradel et al. (2021) and Tabassum (2022) suggested developing the skill set among PSTs to assess the student's performance in the online environment.

Many challenges have significantly affected the participants' facilitation of practice teaching. This study's findings highlighted that meaningful input from the pedagogy teachers in developing lesson plans and supervisors' and peers' advice and suggestions during simulation classes were helpful for improvement. The participants also received feedback after teaching in the actual classroom for further improvement. Similar to Iradel et al. (2021) and Ugalingan et al. (2021) findings, the encouragement and support from teacher education institutions and students' curiosity helped the participants in their meaningful practice as they tried out varied strategies in online teaching.

Unlike Tabassum (2022) finding, the participants used different technological tools/applications that were readily available to them to maximize the students' learning, indicating their advanced techno-pedagogical skills. This also confirmed the previous findings (Dhimmar & Patel, 2023; Ismael & Al Mulhim, 2022) that online internships facilitated the PSTs to use various technological applications to present the content and develop their skills to integrate technology and pedagogy. Participants were satisfied with the learning apps and other teaching-learning platforms as they facilitate collaborative learning. Avsar Erumit et al. (2020) study also suggested incorporating more training on web-based applications such as web 2.0 tools and virtual labs to support students' learning in science.

Moreover, the students' participation in online discussions, activities and quizzes motivated the science PSTs to adopt various strategies to teach science. It supports the notion that students' engagement is critical for developing pedagogical competence among PSTs (Rospigliosi, 2020). Like Pepito's (2022) findings, the science PSTs in this study were promptly accommodated in an online environment. Further, they developed the skill of time management and how to facilitate the students' autonomy for effective teaching and learning during their internship. Figure 1 illustrates the challenges, overcoming hardships, accomplishing success and their suggestions observed from the science PSTs' online and offline internship experiences.

Figure-1: Challenges, overcoming hardships, accomplishing success and suggestions observed from the science PSTs' online and offline internship experiences

Challenges	Overcoming hardships	Accomplish success and suggestions

• Lack of digital and physical infrastructure in government schools
• Limited access to digital devices and poor internet connection at home
• Lack of opportunities in private schools
• Students' lack of previous knowledge and their irregular participation
• Students' less motivation to learn in online classes
• Classroom management
• Difficulties in assessing students' learning in an online environment
	• Adopting various technological tools/ applications to teach science and to do assessment
	• Students' curiosity in learning
	• Support and feedback from teacher educators (pedagogue, supervisors) and peers
		• Meaningful learning (online and offline teaching, time management, students' needs, students' autonomy and reflective thinking)
		• Suggestions
		  • Proper training at schools
		  • Teaching demonstrations from a pedagogy teacher
		  • Training on peer observation and reflective journal writing
		  • Financial support
		  • Continous feedback from supervisors

Overall, the study's findings indicated that science PSTs developed and used their techno-pedagogical competencies in their teaching. However, in agreement with Avsar Erumit et al. (2020), this study finding also revealed that the science PSTs' online teaching experience was not up to the level of offline teaching experience as it eased the interaction with students (Brinia & Psoni, 2021) to realize their problems and understand the functions of the schools' system. Similarly, Ismaeel and Al Mulhim (2022) and Theelen et al. (2020) argued that online internships were ineffective in developing the PSTs' skills of reinforcement managing students and their problems. Further, they asserted the importance of providing offline teaching experience to develop PSTs' pedagogical content knowledge for actual classroom teaching. Finally, virtual internships can be used as peer-to-peer training or positive models to reduce the PSTs' anxiety as suggested by Theelen et al. (2020). Similar to Ismaeel and Al Mulhim (2022), this study suggested adopting blended teaching internships to develop the PSTs' skills to meaningfully integrate technology, pedagogy, and content into their teaching for future education.

Conclusion and Implication

The science PSTs in this study had very distinctive internship experiences. The study findings witnessed that technologies facilitate science PSTs to explore more ways of teaching, and they got familiarised with new technologies. They developed the skills to use various technological applications and handle the students in the online class, which they would not have developed in an offline internship setting. Hence, teacher education courses should pay more attention to the practical aspects of integrating technologies into the teaching and learning process to equip PSTs with more subject-specific tools.

At the same time, offline teaching experiences are also significant since they provide opportunities to understand students' diversity in learning and facilitate interaction with students, which flourished the PSTs' pedagogical competencies. Thus, the study propounded a blended internship mode to prepare highly qualified

teachers for more effective online and offline teaching and learning. In order to enrich the PSTs' competencies, more constructive feedback and interaction with the supervisors need to be strengthened in the new educational environment. Teacher education programmes in India and elsewhere need to examine the chances and challenges of the blended internship mode for further improvement.

Reference

Al Abiky, W. B. (2021). Lessons learned for teacher education: Challenges of teaching online classes during covid-19, what can pre-service teachers tell us?. *Revista Argentina de Clínica Psicológica*, *30*(2), 110. https://www.revistaclinicapsicologica.com/data-cms/articles/20211111071437amSSCI-583.pdf

Annamalai, N., Ab Rashid, R., Alqaryouti, M. H., Sadeq, A. E., Al-Smadi, O. A., & Kumar, J. A. (2022). Online Teaching Practicum in Malaysia in the Time of COVID-19 Pandemic. *Frontiers in Psychology, 13*. https://www.frontiersin.org/articles/10.3389/fpsyg.2022.871971/full

Avsar Erumit, B., Tanis Ozcelik, A., Yuksel, T., & Tekbiyik, A. (2021). Examining the Views of Preservice Teachers about Online Science Education during the COVID-19 Lockdown: Expectations, Opportunities, Threats, Motivations, and Beliefs. *Journal of Turkish Science Education, 18*, 2-26. https://www.tused.org/index.php/tused/article/view/1704/685

Bansal, G., Ramnarain, U., & Schuster, D. (2019). Examining Pre-service Science Teachers Pedagogical Orientations in an Era of Change in India. In R. Koul, G. Verma, & V. Nargund-Joshi, *Science Education in India* (pp. 67-89). Singapore: Springer.

Brinia, V., & Psoni, P. (2021). Online teaching practicum during COVID-19: The case of a teacher education program in Greece. *Journal of Applied Research in Higher Education*. https://doi.org/10.1108/JARHE-07-2020-0223

Bunyamin, M. A. H., Hanri, C., Rameli, M. R. M., & Alhassora, N. S. A. (2021). The Pre-service Teachers' Internship Program during the Pandemic: Prospects for a New Landscape of Teacher Education. *REVISTA GEINTEC-GESTAO INOVACAO E TECNOLOGIAS, 11*(3), 807-824. https://revistageintec.net/wp-content/uploads/2022/02/1977.pdf

Caires, S., Almeida, L., & Vieira, D. (2012). Becoming a teacher: Student teachers' experiences and perceptions about teaching practice. *European journal of teacher education, 35*(2), 163-178. https://doi.org/10.1080/02619768.2011.643395

Cavanaugh, C., Barbour, M., Brown, R., Diamond, D., Lowes, S., Powell, A., ... & Van der Molen, J. (2009). Research Committee Issues Brief: Examining Communication and Interaction in Online Teaching. *International Association for K-12 Online Learning*. https://eric.ed.gov/?id=ED509630

Creswell, J. W., & Poth, C. N. (2016). Qualitative inquiry and research design: Choosing among five approaches. *Sage publication*

Dhimmar, S. J., & Patel, R. C. (2023). The Experiences of student-teachers' on virtual school internship programme: A qualitative study. *Indian Journal of Educational Technology, 5*(1), 188-195.

Ismaeel, D. A., & Al Mulhim, E. N. (2022). E-teaching internships and TPACK during the covid-19 Crisis: The case of saudi pre-service teachers. *International Journal of Instruction, 15*(4), 147-166. https://doi.org/10.29333/iji.2022.1549a

Iradel, C. M., Cadosales, M. N. Q., & Perez, N. (2021). Lived experience of teaching interns during the COVID-19 Pandemic. *Journal of Research, Policy & Practice of Teachers and Teacher Education, 11*(2), 74-87. https://doi.org/10.37134/jrpptte.vol11.2.6.2021

Kamal, T., & Illiyan, A. (2021). School teachers' perception and challenges towards online teaching during COVID-19 pandemic in India: an econometric analysis. *Asian Association of Open Universities Journal,16*(3), 311-325. https://doi.org/10.1108/AAOUJ-10-2021-0122

MHRD (2020), National Education Policy 2020. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

NCTE (2014), National Council for Teacher Education Regulations 2014. https://www.ncte.gov.in/website/PDF/regulation/regulation2014/english/appendix4.pdf

Pepito, G. M. (2022). Student Teaching Internship Amidst the Pandemic: The Lived Experiences of Early Childhood Education Student Interns. *Multicultural Education, 8*(3). https://doi.org/10.5281/zenodo.6373538

Rospigliosi, P. A. (2020). How the coronavirus pandemic may be the discontinuity which makes the difference in the digital transformation of teaching and learning. *Interactive Learning Environments, 28*(4), 383-384. https://doi.org/10.1080/10494820.2020.1766753

Tabassum, F. Virtual Internship Programme: Issues and Challenges Faced by Prospective Mathematics Teachers During 2nd Wave of Covid-19. *Journal of Xi'an Shiyou University, Natural Science Edition, 18*(01), 468-479. https://www.xisdxjxsu.asia/V18I01-47.pdf

Theelen, H., Willems, M. C., Van den Beemt, A., Conijn, R., & den Brok, P. (2020). Virtual internships in blended environments to prepare preservice teachers for the professional teaching context. *British Journal of Educational Technology, 51*(1), 194-210. https://doi.org/10.1111/bjet.12760

Ugalingan, G., Edjan, D., & Valdez, P. N. (2021). Online Internship Experiences among Pre-Service ESL Teachers in the Philippines: Challenges and Opportunities. *TESL-EJ, 25*(3), n3. https://files.eric.ed.gov/fulltext/EJ1332291.pdf

Waters, S., & Russell, W. (2016). Virtually ready? pre-service teachers' perceptions of a virtual internship experience. *Research in Social Sciences and Technology, 1*(1). https://www.researchgate.net/publication/306254943

Yusnilita, N. (2020). The impact of online learning: Student's views. *ETERNAL (English Teaching Journal), 11*(1). https://doi.org/10.26877/eternal.v11i1.6069