Journal of Education and Learning (EduLearn)
Vol. 20, No. 2, May 2026, pp. 707~719
ISSN: 2089-9823, DOI: 10.11591/edulearn.v20i2.23199

Lived experiences of pre-service elementary teachers on blended learning

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Article Info

Article history:

Received Aug 21, 2024
Revised Apr 23, 2025
Accepted Jul 17, 2025

Keywords:

21st-century skill
Blended learning
Online resources
Pre-service teacher
Straussian grounded theory
Tangible learning material

ABSTRACT

The primary purpose of this study was to determine: i) experiences; ii) various resources; iii) varied activities; iv) 21st-century skills acquisition; v) challenges experienced; and vi) solutions to the challenges of the pre-service elementary teachers in blended learning. The study employed qualitative research and utilized Straussian grounded theory as a research design to guide data collection and coding to identify emerging categories and generate theory. Purposive sampling was employed to select the ten pre-service elementary informants with experience with blended learning. In analyzing the data gathered, Strauss and Corbin's coding methods, namely open, axial, and selective coding, were employed. The six themes were created based on the raw responses of informants, namely: i) varied online resources; ii) tangible learning materials; iii) varied learning activities; iv) acquired 21st-century skills; v) challenges of blended learning; and vi) addressing the challenges. A theory emerged, "magma theory", which further strengthens the characterization of having "shared experiences", as manifested by the pre-service elementary teachers in this blended learning. The primary findings of this study were that pre-service teachers can overcome challenges in blended learning with adequate support from tools. Furthermore, they can also improve their 21st-century skills through appropriate activities that contribute to lifelong learning.

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1. INTRODUCTION

Innovation in education has gained increasing importance in today's generation, particularly in the use of technology, while the integration of technology in education has had a significant impact on student development [1]. As a cause of the unprecedented pandemic, the educational setting suddenly shifted from face-to-face to online education, leading to a surge in the use of educational applications. As conditions improved, a blended approach-combining face-to-face and online learning-emerged as a popular teaching model that aids in continuously delivering quality education.

Blended learning combines traditional face-to-face instruction with digital and online components, creating a flexible and comprehensive teaching method. Chaeruman *et al*. [2] noted that this approach can take various forms, such as in-person classroom sessions, virtual learning environments, and synchronous and asynchronous modes. Essentially, blended learning merges activities across multiple platforms, blending classroom teaching with e-learning, each contributing unique processes. This method has been particularly

effective in preparing pre-service teachers to navigate online and face-to-face teaching environments [3]. Despite this transition, the quality of education was maintained, as students' performance during face-to-face classes was closely monitored. This was made possible as faculty members made significant efforts and adapted to emerging technologies to use them as tools for teaching effectively.

Schools in the Philippines, including a state university in Danao City, were not exempted from this sudden shift in the educational landscape, influencing the campus to adopt blended learning as its mode of instruction. Given the prominence of the new mode of instruction, pre-service teachers were required to conduct online or face-to-face teaching demonstrations. This experience presented challenges and benefits, allowing pre-service teachers to develop various skills, such as the flexibility to adapt to various teaching modalities in their future careers. Moreover, as we continue to move forward instead of going back to the "full" traditional face-to-face, blended learning will remain as a mode of teaching.

With the notion presented, the conjecture will continually explore the effects of blended learning on pre-service teachers and whether blended learning can be deemed an effective approach to teaching. In line with that, the primary purpose of this study is to explore: i) experiences; ii) resources used; iii) various activities conducted; iv) acquisition of 21st-century skills; v) challenges encountered; and vi) strategies for addressing these challenges in blended learning. Ultimately, this study aims to generate a theory based on the shared experiences of the pre-service elementary teachers during their blended learning journey.

2. METHOD

2.1. Research design

The study utilized qualitative research and employed the Straussian grounded theory [4] as a research design to guide the collection and coding of data to identify emerging categories and generate theory. Furthermore, qualitative research was used to gather in-depth information on the pre-service teachers' experiences with blended learning. With that, the researchers utilized this design to distinguish the chief phenomenon of the study, and a grounded theory that emanated from the raw data will emerge.

2.2. Research informants

The informants of this study are the Bachelor of Elementary Education (BEEd) pre-service teachers in Cebu Technological University-Danao Campus. The informants of this study were pre-service elementary teachers from different year levels, from first-year students to seniors. The study used a purposive sampling technique in selecting the informants wherein researchers select a specific group of individuals who acquire the characteristics and abilities to provide data necessary for the study [5]. Using the purposive sampling technique, ten pre-service elementary teachers who experienced blended learning for two consecutive years were chosen as informants, and the informants who experienced blended learning for less than two years could not participate in the said study.

The study acknowledges that the sample size of ten informants may appear limited; however, this number was determined based on the study's qualitative nature and the purposive sampling technique employed. Purposive sampling was utilized to select individuals with the specific characteristics necessary to provide in-depth and meaningful insights aligned with the study's objectives. The insights drawn from these carefully selected informants can serve as a valuable foundation for understanding the phenomenon under investigation. The limitations of the sample size are recognized, and further studies with larger and more diverse samples are encouraged to validate and expand upon the findings.

2.3. Research instrument

The study utilized interviews as a primary research instrument to gather necessary data from the pre-service teachers at a state university in Cebu, Philippines. The questions utilized in this study were based on the ideas of Şentürk [6] on the effects of the blended learning model on pre-service teachers' academic achievement and 21st-century skills and the study of Martín-Martínez *et al*. [7] on the evaluation of a blended learning model for pre-service teachers. The questions used were modified to fit the study's objectives and were checked and validated by an expert. The criteria for instrument validation by the expert were clarity and comprehensibility, relevance to research objectives, and content validity. An interview was conducted through a Messenger app and face-to-face meetings while observing safety protocol. The interview medium was English or Cebuano, considering the comfortability of the informants. With the informants' consent, a voice recorder was also used to record the responses. The data gathered will be coded following Corbin and Strauss's coding method [4].

2.4. Data analysis

The researchers utilized Corbin and Strauss's data analysis methods [4]: open, axial, and selective coding. The first phase is open coding, wherein information is fragmented and reduced into methodically analyzed parts. The process intends to grasp each part's core concept and develop a code that best defines it [8]. Following the open coding is the axial coding. The second phase of the coding procedure aimed to examine and explore the connections between and among the categories to formulate ties between them. Selective coding is the third phase of coding. In this phase, categories are consolidated and refined as the core category is systematically linked to other categories [9]. The researcher distinguishes the chief phenomenon of the study and can finally answer the research query. Finally, the grounded theory will emerge from the raw data gathered, analyzed, and interpreted.

3. RESULTS AND DISCUSSION

After a deliberate analysis of the data gathered, the core category that emerged was the pre-service elementary teachers shared experiences. The six essential themes under this category are:

3.1. Theme 1: varied online resources

Based on the data, researchers found that blended learning advantages the integration of digital technology and information into educational processes, as demonstrated by Attard and Holmes [10] and Kashefi *et al*. [11]. Fuady *et al*. [12] believed that e-learning could be facilitated through applications such as Microsoft, Zoom, Google Classroom, and Google Meet. Additionally, Moghavvemi *et al*. [13] support this by stating that YouTube is a helpful tool for enhancing learning. Here are some responses that support the claim:

> *"I use Google applications, especially Google Classroom, Google Meet, Zoom, Google Drive."* Informant D
> *"Google Meet, and Google Classroom."* Informant F
> *"…most commonly used tools are Google Classroom, Google Meet, Chrome, and YouTube."* Informant J
> *"I use laptop, Canva, YouTube, Jamboard, and PowerPoint."* Informant I
> *"…my teacher usually engages us in digital learning resources, including video, websites, and images."* Informant E

Furthermore, most education curricula incorporate digital technology, becoming an increasingly important component of teaching and learning [14]. As a result, teachers produce or introduce various online videos employed for blended learning. This is evident in the responses.

> *"Use of digital tools such as virtual lectures and Google to conduct online classes."* Informant G
> "*One common tool in online learning is video conferencing software like Zoom or Google Meet*." Informant H

Undoubtedly, e-learning systems meet the needs of all users, offering faster lecture delivery that saves learners' time. Thus, it became evident that online resources provided them with convenience, particularly when navigating the digital realm in blended learning scenarios. This observation is reinforced by Szymkowiak *et al*. [15] underscoring that this generation prioritizes swift access to information due to impatience. As a result, they highly value the convenience and flexibility new technologies offer. Accordingly, Informants A, B, C, and D agreed that these tools are helpful for blended learning.

> *"…These are the common applications we use that give convenience not just to us students but as well as with the teachers."* Informant D
> *"It makes me a more productive and allows me to complete my task with less difficulty and stress."* Informant A
> *"…it contributes to academic convenience by offering flexibility and accessibility."* Informant B
> *"…it makes learning easier and accessible in just one click."* Informant C

3.2. Theme 2: tangible learning materials

The information gathered signifies that physical resources are also useful in the limited in-person learning sessions where students can read and prepare beforehand. These include different types of learning resources, such as books, encyclopedias, magazines, posters, and widely available textbooks [16]. Hence, this highlights that textbooks and materials used in class are two typical and significant sources of information for students. Dorji [17] supported this, indicating that students like handouts to cover the subjects presented.

"My professors often provide physical materials like printed handouts." Informant A
"…the common resources during face-to-face learning are printed lectures, handouts, textbooks, and access to the school library." Informant G

Other tangible materials were also used during blended learning, and most of them were audio/visual materials, including television, PowerPoint presentations, video, computer technology, and visual aids. This is evident in the responses.

"…used during the discussion were the TVs and projectors." Informant B
"…common tools we use are PowerPoint, traditional visual aids, manila paper, and printed pictures." Informant C
"... laptop and television." Informant E
"... softcopy of handouts like PowerPoint presentations and videos." Informant F
"…employs various resources like whiteboard, visual aids, PowerPoint, textbook." Informant H

Moreover, Informants J and I highlighted the benefit of the mentioned physical resources, noting they provide clearer comprehension. This assertion aligns with the findings of Al-Aqad *et al*. [18] who stated that students unanimously acknowledged PowerPoint presentations to enhance lectures and make them more entertaining.

"It made our discussion easier to understand because we will just have to listen to our professor while they are discussing." Informant J
"Visual aids help students visualize and understand complex topics better." Informant I

3.3. Theme 3: varied learning activities

Various activities emerged as blended learning was implemented. Boelens *et al*. [19] and Taylor *et al*. [20] highlight that blended learning accommodates varied learning activities that provide students with multiple ways to engage with the content, encouraging more profound understanding and retention. Among the varied learning activities were brainstorming, e-portfolios, and gamified activities.

In his study, Bhairawa *et al*. [21] stated that in the brainstorming method, all thoughts can be accommodated by the group leader, then used as the main idea and developed into a complete conclusion. Furthermore, innovation in education has been widely observed and shown in educational approaches. For instance, Koraneekij and Khlaisang [22] claimed that an e-portfolio allows accessibility, the possibility to add hyperlinks, and provides a more dynamic presentation of the content. Manzano-León *et al*. [23] also stated that gamification as an educational tool has shown its potential to enable students to gain affective and cognitive skills and impact performances, attitudes, and behaviors. Thus, analogy is one of the common game activities to experience in online and face-to-face classes.

To support this idea, two informants revealed that brainstorming is a blended learning activity implemented in the classroom.

"…most of the activities include brainstorming with other colleagues," Informant B. Informant B added that *"Brainstorming made the communication skills more effective since they are enlightened to build a better relationship with others."*
"Through brainstorming activity, it enhances my critical thinking skills and the way I think on a certain topic with other people." Informant D

Informants F and H also revealed the e-portfolio as a blended learning activity.

"I have one teacher who engages us in different applications online in which they try to help us make things. For instance, in Google Docs, they made us make an online portfolio to compile and beautify the accomplishments that we've completed and write a reflection on it." Informant F
"Exploring the tools on the internet, I found out there are different websites that can create an online portfolio, like Canva and Google Docs, where I create and apply various templates and designs. It also enhances my creativity skills in accessing and exploring the tools in making the e-portfolio." Informant H

Furthermore, gamification emerges as a blended learning activity, especially with analogy, as disclosed by Informant G.

"Doing the analogy game activity makes me nervous since it will test my quick thinking on related words about certain topics." Informant G

3.4. Theme 4: acquired 21st-century skills

Blended learning allows students to acquire critical skills in the 21st-century, drastically changing the face of education. According to Faraniza [24], blended learning has substantially impacted the development of 21st-century skills, where people can use various multimedia sources for interactive learning and increase their understanding of the constantly changing demands of society. Besides critical thinking, blended learning fosters collaboration and cooperation among the pre-service teachers, enabling them to work collectively with the given tasks. George *et al*. [25] assert that cooperation is crucial for effective learning in a blended setting since it encourages students to participate in online and face-to-face interactions. Sallam *et al*. [26] also assert that cooperation helps pupils communicate more effectively and become more aware of other people's actions. Hence, communication and teamwork are essential in 21st-century talents.

Moreover, the creative side of the pre-service teachers was highlighted during the implementation of blended learning due to the activities given by their professors. Dewi and Fatkhiyani [27] study discovered that blended learning encourages students to use their imagination to create engaging and stimulating activities. It has become prevalent based on the informant's responses:

"Creative digital skills, digital literacy skills, collaboration, critical thinking skills, and interpersonal skills are among the 21st-century skills I have gained…" Informant A
"…collaboration, communication, and social skills…" Informant B
"I have acquired communication, collaboration, creativity, and critical thinking skills." Informant C
"…I have acquired creativity skills, communication skills, collaboration skills, and critical thinking skills…" Informant I
"...I am slowly becoming more information literate, and I noticed that my collaboration, communication, technology, and global awareness is shifting." Informant J
"…it harnessed my collaborative and communication skills and developed my information, media, and technology literacy skills." Informant D
"...it includes digital literacy, adaptability to technology, effective communication, collaboration, and critical thinking…" Informant G
"I have gained proficiency in navigating online platforms that improved my ability to search for information, communicate with peers, and collaborate on group projects." Informant H

Additionally, the informants highlighted adaptation and flexibility as two skills. According to Gaba *et al*. [28] online learning is flexible regarding time, location, and access to current information; however, internet speed remains a significant obstacle. In the study of Almahasees *et al*. [29] and Samatan *et al*. [30] students have recognized more flexibility as a primary benefit of distance education. Furthermore, college students like the BEEd pre-service teachers are more likely to acquire these abilities because they have personally experienced the abrupt educational shift brought on by the pandemic. Li [31] expounded that adaptation is a process nearly all college students must undergo. It is a crucial skill for modern college students since it positively and significantly impacts the individual's physical and mental components. Undoubtedly, the above-mentioned 21st-century skills reveal how blended learning aids in developing the much-needed skills in this new generation. The responses from the informants reveal what 21st-century skills they have attained during blended learning.

"Another skill I have acquired is adaptability and flexibility." Informant H
"So, I think it is being flexible and becoming information and communication technology (ICT) literate." Informant E
"I'm proud to say that I acquired almost all 21st-century skills…" Informant F

3.5. Theme 5: challenges of blended learning

Certain studies have shown positive results regarding the effects of blended learning. Nonetheless, research indicates that adopting blended learning presents difficulties for the learners. The papers by Müller and Mildenberger [32] and Ashraf *et al*. [33] claimed that regardless of how effective blended learning is, it still presents problems that could cause problems for educators and learners alike. Furthermore, Iqbal *et al*. [34] listed several reasons for online education, including a lack of technical support, ambiguous institutional policies, and guidelines, teachers' incapacity to facilitate online learning effectively, a lack of interaction, internet connectivity issues, the unsuitability of home-learning environments, restrictions regarding the practical aspects of learning in the laboratory, and vision problems. Therefore, one of the prevalent challenges faced by BEEd pre-service teachers was the reliability of internet connectivity. It cannot be assured

that every location will have a dependable internet connection, thus potentially jeopardizing the quality of learning in blended learning settings. To elaborate on the notion, the students expounded that they encountered difficulties in blended learning:

> *"During online classes, technical issues are common, including unreliable internet connections, malfunctioning hardware and software, and insufficient personalized feedback compared to traditional in-person learning. Technical difficulties during online learning, such as unstable internet connections, hardware and software malfunctions, and a lack of personalized feedback when compared to in-person instruction."* Informant A
> *"I was having a hard time facing loss of internet connection. Especially since I am in the mountain area. It potentially affects our understanding and progress."* Informant F
> *"One of the challenges students face is poor internet connection and technology. It is very difficult to attend online classes without any of those."* Informant D

Almahasees *et al*. [29] thought that students had challenges in allocating time for arranging assignments and submitting projects during the COVID-19 pandemic, where learning was blended. This is evident with the claim of Informant B.

> *"…completing the tasks with accuracy and managing my time efficiently. This left me feeling perplexed and I lost my motivation as a consequence. Instead of promptly working on the tasks, I ended up procrastinating."* Informant B

Indeed, managing time has proven challenging during blended learning due to the need to adapt to the abrupt educational transition, which emphasizes self-directed learning. With education in a home environment, balancing household duties with academic responsibilities has struggled. This claim was supported by Ahmad *et al*. [35] who state that many students need help with time management as they lack the necessary skills to manage their time effectively. This deficiency in time management skills harms both their academic and social life.

Furthermore, according to Wang *et al*. [36] various digital activities such as browsing the internet, reading, and scrolling through social media platforms can lead to digital distractions. These distractions can negatively impact a student's attention and classroom engagement, ultimately affecting academic performance.

> *"For me, blended learning is a new mode of learning wherein we need to use our cellphones and laptops. If we are in our homes, we cannot engage with our classmates. Aside from that, there were distractions during online classes and social media applications."* Informant E

Ibrahim and Ismail [37] posit that the most commonly cited obstacle or difficulty in implementing blended learning in 2021 is that it adds to the burden. According to Informant G, challenges in blended learning are prevalent.

> *"Technical issues, engagement and motivation, and balanced workloads are the challenges I encountered while implementing blended learning."* Informant G

Even though the blended learning strategy requires computer ability, some students and teachers need more computer proficiency and knowledge [38], [39]. Therefore, the rate at which technology is used in the classroom can occasionally be intimidating to both digital natives and non-natives. This is corroborated by Informant I's statement.

> *"... I was not entirely a "techy" person."* Informant I

3.6. Theme 6: addressing the challenges of blended learning

Blended learning is a hybrid approach that has changed the face of education in recent years. Coping strategies become essential in resolving these challenges by exploring various solutions to ensure a seamless educational experience and providing quality education to pre-service teachers. The majority in addressing such challenges in blended learning is being flexible. It enables students to learn at their own pace, which can be particularly advantageous for those who can gain knowledge more quickly or need to understand certain concepts [40]. Even with their busy schedules, pre-service elementary teachers admit they sometimes surpass challenges by being adaptable and flexible.

"We really have to be flexible and be open for modification." Informant D
"...we need to find ways to overcome instead of letting it pass." Informant E
"I manage it through being flexible to find ways how to address the issues or problems being faced." Informant F
"Adapting to blended learning requires flexibility and adaptability…" Informant G
"...embrace flexibility…" Informant I

Moreover, aside from being flexible, taking notes is another way of addressing the challenges. Taking notes increases memory, boosts performance in class, and raises grades overall; students are used to doing so. Strategic note-taking requires writing, careful listening, and information processing [41]. Doing so allows pre-service elementary teachers to cope with blended learning.

"...I have always come prepared by checking my internet connection…and I take notes." Informant A
"I design and share offline resources with students, including printed and handwritten notes." Informant H

Furthermore, it has become evident that the BEEd pre-service teachers uplift or motivate themselves during blended learning. Perante *et al.* [42] supported this, highlighting that blended learning enables students to be self-reliant and rely on their comprehension of the material. In addition, Informants B, E, and J revealed how blended learning has helped them realize that they must endure and put more effort into their academic pursuits.

"I just encourage myself…" Informant B
"...looking on the brighter side to make things work." Informant E
"...I just went along with it and got used to the grip of difficulty…" Informant J

As a coping strategy, pre-service elementary teachers also utilize a workload organization. Awi *et al*. [43] highlighted in their study that having a well-planned timetable will help them combine their career and academic responsibilities. Furthermore, Rotas and Cahapay [44] confirmed that for students to finish class activities, they need to develop time management skills.

"I manage these challenges through improving my skills, and look for ways to better manage situations like this again." Informant D
"I plan my online activities and assessments during periods of the day…" Informant H
"I always keep track of various things so that it is easy for me to adjust. I stay organized as possible…" Informant I

Additionally, the pre-service teachers acknowledge criticisms from their peers and teachers so that they can grow and adapt to the blended mode of learning. As stated in the study of Gray and DiLoreto [45], students who received feedback showed greater engagement in online learning than those who did not.

"...allow feedback from both students and colleagues because that can help boost and refine your approach over time." Informant C
"Be open to constructive criticisms and suggestions with the mentors and the pre-service teacher peers." Informant D
"...and also, being open to accepting feedback from learners and colleagues." Informant G

3.7. Theory generation

The emergence of the COVID-19 pandemic paved the way for schools to implement blended learning. For this reason, students experienced a new mode of learning-blended learning. Blended learning became prevalent during the pandemic, and it serves as a bridge to make learning possible despite various challenges and uncertainties that give rise to some concerns. Pruning down these ideas, the pre-service elementary teachers shared their raw experiences as this is necessitated for learning to continue, particularly in blended learning.

After thoroughly analyzing the experiences of the pre-service elementary teachers, magma theory emerged as the core category. The study found out that blended learning allows the pre-service elementary teachers to develop, utilize, and acquire online resources such as digital readings, PowerPoint presentations, Google Meet, Google Classroom, Canva, Zoom, YouTube, Google Drive, online websites, softcopy of educational files, Jamboard, Chrome (Theme 1). Also, tangible learning materials such as textbooks, printed handouts, television, projector, whiteboard, blackboard, manila paper, and printed pictures are essential for blended learning (Theme 2). Moreover, the emergence of blended learning boosts varied learning activities:

brainstorming, e-portfolios, research, demonstration, and reporting (Theme 3). It also brought significant effect towards the acquired 21st-century skills wherein the pre-service elementary teachers developed digital literacy skills, media literacy skills, collaborative skills, critical thinking skills, interpersonal skills, communication skills, life skills, problem-solving skills, information literacy skills, flexibility, and creativity (Theme 4). However, in every situation, there are challenges; despite the great outcome of blended learning, it is inevitable to face drawbacks towards blended learning, for instance, technical difficulties, poor internet connection, hardware and software problems, less personalized feedback, reliance on technology, short attention span, and difficulty in manipulation (Theme 5). Undoubtedly, there is always a solution to every problem; showcasing the pursuance of pre-service elementary teachers as they fought back against the challenge mentioned above, they keep themselves motivated, adaptive, resourceful, organized, practice active listening, seek alternative ways that are accessible, establish peer and open communication and most of all they tried to acknowledge with regards to stepping out of their comfort zone (Theme 6).

3.8. Educational resources-activities-skills-challenges addressing the challenges: magma theory

As illustrated in Figure 1, blended learning resembles a volcanic eruption, where its element represents an essential part of the emergence of blended learning. Primarily, the movement of the tectonic plates serves as the COVID-19 pandemic that poses a challenge in the educational sector. For this reason, the educational sector was obliged to seek the situation, resulting in the implementation of the online modality of learning. However, when COVID-19 gradually subsided, it transitioned to blended learning, which pertains to the eruption. Moreover, the lava flow pertains to the educational resources, skills, and activities attained by the pre-service teachers during the blended learning. Hence, the surrounding trees portray the coping mechanism that gradually aids the challenges faced by the practice teacher in blended learning.

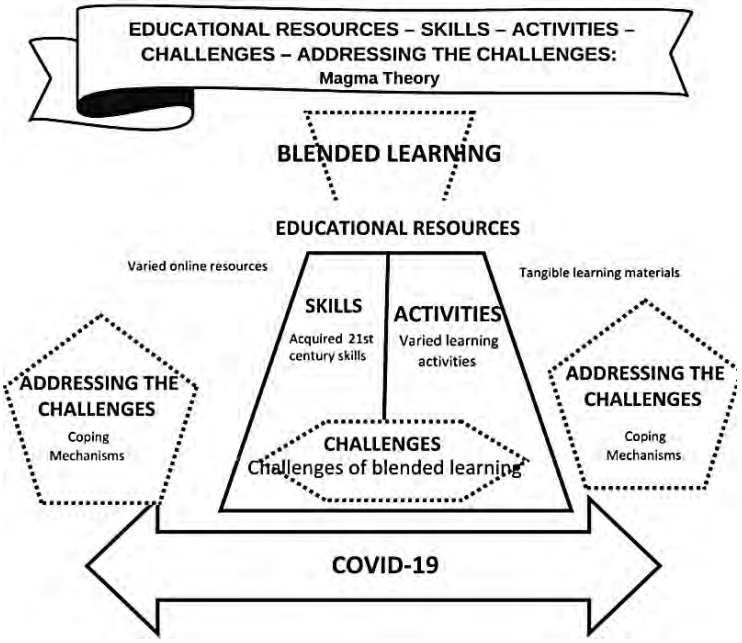

Figure 1. Magma theory

Magma theory states that educational resources, activities, skills, challenges, and coping mechanisms are considered the pre-service elementary teachers shared experiences with blended learning. Being a pre-service teacher requires access and manipulation to educational resources (varied online resources and tangible learning materials), encountering various blended learning activities (varied learning activities), and acquiring relevant and useful skills (21st-century skills) to perform well in the new educational setting. Along with that, some factors (challenges of blended learning) hindered them from exhibiting their full potential as pre-service elementary teachers. Despite the challenges, the pre-service elementary teachers were able to come up with various ways to address those challenges (addressing challenges of blended learning).

This theory further strengthens the characterization of having "shared experiences" as manifested by the pre-service elementary teachers in this blended learning. For this reason, the theory that emerged in this

study can provide a frame of reference for teachers, students, and future educators to raise awareness regarding specific situations that may occur in blended learning. This theory can also provide a better understanding for teachers, students, and aspiring educators when the same phenomenon will occur. In addition, the education sector will be guided to apply blended learning as leverage towards bridging the phenomenon's gap.

4. CONCLUSION

Based on the study's findings, adequate support and tools provided by the professors aid pre-service teachers to survive the challenges of blended learning. In addition, pre-service teachers can acquire 21st-century skills and improve their learning experiences if given appropriate and numerous activities that hone their skills. With the heightened societal demands, the acquired skills and experiences will contribute to lifelong learning.

Based on the findings, our study suggests that it is recommended for pre-service teachers to participate in digital literacy seminars to promote adaptation and flexibility amid technological innovation. Hence, tertiary professors should also participate in professional development seminars and workshops to further improve their understanding of technology and pedagogy, especially with the blended learning approaches. Furthermore, stakeholders should recognize numerous approaches to provide educational assistance and services that will benefit pre-service teachers, such as providing technological and learning resources. For future researchers the researchers recommend utilizing the findings of this study as a foundation for future research and exploring various perspectives to enhance further the adaptation of blended learning in the 21st-century classroom.

ACKNOWLEDGMENTS

We acknowledge the informants who willingly took part in the study and the anonymous referees for their useful suggestions.

FUNDING INFORMATION

Although we acknowledge the crucial role of funding in the success of the study, the research did not receive any specific grant from funding agencies in the public, commercial, not-for-profit sectors or any external financial support.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The researchers of the paper entitled "Lived experiences of pre-service elementary teachers on blended learning" declare that we have no known competing financial interests of personal relationships that could have appeared to influence the work reported in this paper. The authors state no conflict of interest.

INFORMED CONSENT

All informants who participated in this study were fully informed about the purpose, procedures and scope of their involvement prior to data collection. Each informant received a verbal briefing and a written informed consent letter, which clearly outlined their rights, including voluntary participation, the option to withdraw at any time, and assurance of confidentiality. Only those who voluntarily agreed and signed the consent form were included in the study.

DATA AVAILABILITY

All data underlying the results are available as part of the article and no additional source data are required.

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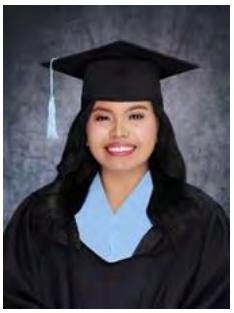

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