Article

Enhancing Critical Digital Literacy of Preservice Preschool Teachers through Service Learning: The Moderator of Online Social Capital

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Abstract: This research delves into the examination of the correlation between service learning and critical digital literacy among preservice preschool teachers in Taiwan, with a particular emphasis on the role of online social capital. The survey took place in Taiwan with preservice preschool teachers who willingly completed a questionnaire. Initially, there were 416 data samples for further statistical analysis. This study utilizes literature reviews and theoretical reflections to examine the observed variables and factors in the “Service Learning and Critical Digital Literacy Scales” (SLCDL) questionnaire. To assess these aspects, a Chinese questionnaire is used, covering “service learning”, “critical digital literacy”, and “online social capital”. Using partial least squares analysis, researchers investigate the intricate interplay of online social capital in shaping the nexus between service learning experiences and the advance of critical digital literacy competencies. These results showed that service learning increased critical digital literacy among preservice preschool teachers, and online social capital played a mediating role in this relationship between service learning and critical digital literacy. We should actively encourage preschool teachers to increase their critical awareness by understanding vulnerability and experiencing reality from the perspective of community partners. In addition, we need to provide more service learning opportunities that incorporate online social capital to enhance their critical digital literacy.

Keywords: critical digital literacy; moderation; online social capital; preservice preschool teachers; service learning

1. Introduction

In today’s world, critical digital literacy is of the utmost importance and is a crucial skill for students. This skill equips learners with the tools to understand, evaluate, and actively engage in the digital world, leading to a better grasp of the complex power dynamics involved [1]. Critical digital literacy plays a pivotal role in empowering individuals in the digital age, fostering a culture of mindful online engagement and igniting active participation in discussions surrounding the dynamic landscape of data systems [2].

Critical digital literacy encompasses the skills and attitudes individuals need for searching for information, analyzing multimodal digital texts, and facilitating reflection, narrative creation, and social actions that contribute to democracy and global justice [3]. It enables people to navigate the vast world of digital information with skill and use their abilities for content creation. This amplifies voices and addresses the needs of marginalized groups in digital culture [4]. Developing critical digital literacy skills empowers individuals to analyze online information critically and question power dynamics in the digital society, including recognizing bias, misinformation, manipulation, and actively
challenging oppressive practices [5]. Critical digital literacy encourages students to use technology for reflection and community empowerment [6]. Through critical literacy work, students become aware of how texts are crafted to promote specific viewpoints and how they can be reimagined [7].

Service learning is a crucial aspect of teacher education. It allows future educators to gain knowledge and skills by actively participating in community service initiatives that target local needs [8]. It is defined as a practice enabling preservice teachers to participate in teaching and learning experiences beyond the conventional university classroom [9]. This approach highlights how aspiring teachers’ beliefs can be positively influenced when they engage in innovative educational practices to meet community needs, observe situations that reshape their learning attitudes, and contemplate their civic duties and pedagogical beliefs [10]. Notably, service learning goes beyond just providing service opportunities; it also entails integrating these experiences into the academic curriculum and establishing a pedagogical framework for students to reflect on the world around them [11].

In the domain of educational scholarship, the significance of online social capital becomes evident as it serves as a catalyst for promoting the information sharing among students, catalyzing social transformation through service-oriented learning experiences, and proactively nurturing the digital maturation of learners [12]. Online social capital refers to the phenomenon where individuals are progressively cultivating and amassing social capital through their engagements in virtual spaces, encompassing their utilization of social networking platforms and the consequential impacts on their online presence [13]. This notion revolves around an individual’s interconnected social web and the myriad of valuable assets it encompasses [14].

In today’s interconnected world of social networks and platforms, particularly within the realm of social media, users have the ability to expand their virtual social circles while maintaining their offline relationships [15]. These platforms provide seamless opportunities for users to engage with a broad spectrum of individuals, thus bolstering their online social capital.

Students with a strong online social network can build robust relationships with community partners through social media, seamlessly integrating this into the academic curriculum [16]. They can critically analyze and reflect on social inequality or disadvantaged situations encountered in the community [17]. It is our duty to give back to society by sharing knowledge, strategies, and values through digital technology. We should also update teaching methods, change practices, and initiate innovative projects to enhance students’ critical digital literacy and overall development.

Incorporating preservice teachers into critical digital literacy practices can disrupt existing conversations and foster the pedagogical interactions that amplify their voices [18]. Regrettably, many preservice teacher education programs frequently miss opportunities for demonstrating and purposefully involving students in critical digital literacy practices, which hampers educators’ and learners’ engagement with the vital aspects of digital technology [19]. To tackle this issue, it is crucial to assist preservice teachers in recognizing prevalent ideologies, power dynamics, and cultural perspectives through service learning. Furthermore, it is imperative for educators to cultivate their digital presence, as this fosters an augmentation of their social influence and self-assurance [20]. This, in turn, equips them with the necessary tools to assist students in critically evaluating and navigating cultural depictions within the realm of social media and the digital landscape.

While Taiwanese preservice preschool teachers are skilled in and regularly utilize digital technologies, their level of critical digital literacy remains low. These teachers primarily employ digital technology for instructional purposes, seldom engaging in the critical analysis of online content and digital ideologies within early childhood education. Researchers emphasize the importance of community connections and social critical experiences facilitated by service learning to enhance the improvement of critical digital literacy among preservice preschool teachers. Additionally, they leverage online social capital to extend community service experiences, thereby assisting teachers in bolstering their critical digital literacy.
This study considers a significant gap in the critical digital literacy of Taiwanese pre-service preschool teachers, despite their proficiency in using digital technologies. This study underscores the need for service learning and online social capital to foster community connections and socially critical experiences to address the lack of critical analysis of digital content and ideologies in early childhood education.

Social service studies in Taiwanese universities often neglect the issue mentioned above. Moreover, most research on online social capital primarily focuses on interpersonal interactions and emotional development, overlooking critical digital literacy instruction. This research endeavors to fill a notable void in the existing literature by delving into the realms of service learning, critical digital literacy, and the dynamics of online social capital. It also offers valuable insights for implementing critical digital literacy and related service activities in preschool teacher education in Taiwan.

This research highlights the critical role of service learning in the development of critical digital literacy among preservice preschool teachers. It emphasizes the positive influence of online social capital on their digital literacy growth. In addition, this study clarifies how online social capital shapes the relationship between service learning and critical digital literacy. By clarifying these relationships, this research not only demonstrates the various aspects of teacher preparation, but also provides valuable insights for educational practitioners seeking to strengthen the technological skills of future preschool teachers.

1.1. The Relationship between Service Learning and Critical Digital Literacy

Service learning combines experiential learning with community engagement to enhance educators’ pedagogical development, promote civic duty, enhance academic understanding, increase confidence in teaching practices, and encourage active civic participation [21]. It integrates academic and experiential learning through purposeful activities to develop effective teaching strategies in real-world settings.

Integrating service learning into teacher education fosters meaningful community connections, enabling preservice teachers to apply their knowledge in real-world settings [22]. Engagement in and reflection on service experiences enhances pedagogical skills, supports learner-centered activity design, and motivates specific teaching roles.

Implementing service learning projects in diverse contexts enhances preservice teachers’ understanding of sociocultural diversity, promotes social cohesion, and develops civic identity [23]. These experiences help preservice teachers grasp nuances in instructing children from diverse backgrounds, fostering collaboration with schools and communities serving varied student populations [24]. This partnership empowers reflection through multicultural education and critical pedagogy lenses [25].

Preservice educators can develop their ability to challenge stereotypes and prepare for curriculum development by collaborating with diverse individuals [26]. Service learning projects led by teacher educators promote consideration of community needs and foster meaningful learning experiences, aiding preservice teachers in effectively addressing diversity [27]. Field experience enables praxis, equipping teachers with practical strategies for overcoming challenges and enhancing skills through reflective practice.

Critical digital literacy empowers individuals for active societal participation by fostering informed, independent thinking [28]. It involves understanding the digital landscape, socio-political framework, and skills to navigate media and technology, addressing social inequality and challenging oppressive uses of digital technology [29].

Critical digital literacy goes beyond basic skills, involving the exploration of power dynamics and ideologies in digital technologies [30]. It includes navigating and analyzing content, shaping meaning in online and offline interactions [31]. To achieve societal change, questioning and reshaping social norms is crucial for a more just and equitable future where digital technologies benefit society.

Preservice teachers need vital digital literacy skills for responsible guidance in ethical digital engagement, going beyond basic pedagogical abilities to critically develop digital competences and actively shape the digital society [32]. Therefore, when preservice teachers gain
understanding of the diverse needs of their community collaborators and the young children they serve in their service learning experiences, they will develop a deeper appreciation for the importance of critical digital literacy in addressing societal challenges. Engaging with digital tools in real-world service learning activities provides them with opportunities to develop the skills necessary to assess and challenge power dynamics in digital environments, ultimately preparing young learners for ethical and responsible digital citizenship. In light of our research objectives, we put forth the following hypothesis for examination:

**Hypothesis 1. Service learning enhances critical digital literacy in preservice preschool teachers.**

**1.2. The Interplay of Online Social Capital and Critical Digital Literacy**

The rise of digital technology has transformed online connections, enhancing access to social capital resources [33]. Online social capital, rooted in extensive and diverse networks, offers emotional support and improved access to online resources [34]. Digital technologies empower individuals to build and maintain social networks, promoting equitable access to online resources.

Online social capital positively influences users’ psychological well-being and motivations for identity and impression management in online environments, leading to increased engagement, trust, and civic participation [35]. People with significant online social capital are valuable for adolescents, offering diverse connections and support [36]. The proficient use of social media boosts their confidence, facilitating meaningful relationships and enhancing their overall well-being [37].

Social capital, essential for digital society insights, extends beyond social media use [38]. Critical digital literacy is crucial, empowering students for meaningful democratic engagement and fostering digital inclusiveness [39]. Students must accumulate online social capital, integrating values of inclusivity and equality to become proactive, discerning digital citizens exercising rights and responsibilities.

Therefore, when preservice preschool teachers establish and participate in online social networks, they are more likely to enhance their critical digital literacy skills. This is because online social interactions facilitate the exchange of information, collaborative learning, and exposure to diverse perspectives, ultimately benefiting from their ability to navigate and utilize digital tools and information effectively in their educational practice. This, in turn, positively impacts their professional development and teaching abilities. Consequently, we present the subsequent research proposition:

**Hypothesis 2. Online social capital positively influences the critical digital literacy of preservice preschool teachers.**

**1.3. The Role of Online Social Capital as a Moderator**

Service learning stresses collaborative community projects, fostering civic engagement, enhancing online social bonds, and promoting reciprocity for mutual gain [40]. It builds supportive networks through digital technology, cultivating students’ holistic development, including digital literacy, critical thinking, and multicultural competency [41].

Online collaborations boost teamwork, foster positive relationships among professors, students, and community members, and elevate the quality of these connections [42]. The increased accessibility of digital technology among college students and community members expands knowledge diversity and promotes greater tolerance in service learning practices [43]. The development of online social capital not only facilitates practical learning for college students but also enhances their abilities through digital technology, providing increased support to connect with community members, build communities, and empower them in online environments [44].
Social media enable college students to access digital information, shape public opinion, and engage in diverse civic activities, fostering a sense of civic duty through the interplay of online social capital and critical digital literacy [45]. This synergy promotes digital citizenship by encouraging active online engagement and participation in civic affairs, particularly among students with elevated online social capital, who excel in building connections and developing digital literacy and professional identities [46].

Based on the above information, the strength of the connection between participating in service learning practices and developing critical digital literacy in preservice preschool teachers is influenced by their level of social connections and support in online communities. Online social capital plays a pivotal role in either augmenting or diminishing the influence of service learning on the cultivation of critical digital literacy. This underscores the paramount importance of social media platforms in molding the evolution of these competencies, thereby fostering a sense of civic duty and promoting responsible digital citizenship. Consequently, we propose the following hypothesis:

**Hypothesis 3.** Online social capital plays a moderating role in shaping the connection between service learning and critical digital literacy in preservice preschool teachers.

1.4. The Hypothesis Framework

Service learning for preservice teachers offers a unique chance to grasp societal dynamics, blending community engagement with academic knowledge to tackle needs and enact social solutions [47]. Critical digital literacy empowers preservice teachers to use technology for understanding disadvantaged situations, emphasizing the evaluation of online materials for bias and reliability and recognizing the broader impact of the digital landscape on societal dynamics [48].

Online social capital enhances academic performance through knowledge sharing and improved digital literacy [49]. Active participation in virtual groups supports peer learning, impacting academic success [50]. Reflective apps and digital awareness tools empower preservice teachers in mastering digital tools and critical thinking. Social media aids students in analyzing, critiquing, and reshaping digital social norms [51]. Collaborative service learning facilitates meaningful change, fostering critical digital literacy in schools and communities within a digital society.

This study proposes a comprehensive framework to examine the interactive effects of service learning and online social capital on critical digital literacy among preservice preschool teachers. This study aims to determine how service learning contributes to the enhancement of critical digital literacy and how online social capital moderates this relationship. By examining the dynamics involved, the framework seeks to uncover the nuanced pathways through which these factors collectively shape the development of critical digital literacy among preservice preschool teachers. Based on the above, we have presented a theoretical model, as shown in Figure 1.

![Figure 1. Theoretical model.](image-url)
2. Methods

2.1. Sample Characteristics

The survey was carried out in Taiwan among preservice preschool teachers who willingly participated in a questionnaire. The researchers assembled a list of universities and colleges that met the qualifications for preservice teacher education. The researchers then sought the dean’s approval to conduct a survey, using the number of classes and students as the criteria for selecting the sample. Initially, there were 500 respondents, but after eliminating incomplete or missing data, our final sample consisted of 416. Preservice preschool teachers from Taiwan comprised the study’s focal group, with an exceptional 83.2% participation rate in the survey.

Table 1 indicates that the survey sample was predominantly female, making up a significant 98%, with male participants being minimal at only 2%. This gender distribution aligns with the typical demographics of preservice preschool teachers in Taiwanese higher education institutions.

Table 1. Sample demographics.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>408</td>
<td>98</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>83</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>146</td>
<td>35</td>
</tr>
<tr>
<td>21</td>
<td>137</td>
<td>33</td>
</tr>
<tr>
<td>22</td>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td>Service learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year</td>
<td>291</td>
<td>70</td>
</tr>
<tr>
<td>2 years</td>
<td>104</td>
<td>25</td>
</tr>
<tr>
<td>3 years</td>
<td>21</td>
<td>5</td>
</tr>
<tr>
<td>Experiences of digital use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5 years</td>
<td>104</td>
<td>25</td>
</tr>
<tr>
<td>5–10 years</td>
<td>270</td>
<td>65</td>
</tr>
<tr>
<td>More than 10 years</td>
<td>42</td>
<td>10</td>
</tr>
</tbody>
</table>

Among the survey participants, the largest segment (35%) fell into the 20-year-old age category, closely followed by those aged 21 (33%). Concerning their service learning involvement, a significant portion (70%) had dedicated one year to their instructional roles, while a quarter (25%) had amassed two years of experience. Most universities in Taiwan that provide preschool teacher education have service learning courses. Some colleges cooperate with the university’s social responsibility plan to conduct community service and some schools use the university’s required courses to conduct interdisciplinary service learning courses. The colleges selected by the researchers for the questionnaire survey all have planned service learning courses ranging from 1 to 3 years in length. The research results will reflect the learning attitudes of preservice preschool teachers, and the correlation of related attitudes can also be tested.

Regarding proficiency in digital technology, the majority of respondents (65%) reported having 5–10 years of experience, with another quarter (25%) indicating less than 5 years of familiarity with digital tools. Preservice preschool teachers in Taiwan are digital natives, having been exposed to digital technology since birth and throughout their education. Over the past decade or two, digital use of technology has progressed toward social media and mobile applications, shaping their usage behaviors and digital interpersonal interactions. It was critical to ensure that each participant fully understood the study objectives, the informed consent process, and the protection of their privacy and confidentiality in obtaining consent.
2.2. Measurement Instrument

The objective of this study endeavor was to delve into preservice preschool teachers’ viewpoints in Taiwan concerning the nexus between their involvement in service learning initiatives and the cultivation of essential digital literacy competencies. In addition, we undertook a comprehensive analysis to examine the moderating influence of online social capital in this particular correlation. Our team dedicated significant effort to the development of a meticulously designed questionnaire in the Chinese language, which we refer to as the “Service Learning and Critical Digital Literacy Scales” (SLCDL).

The content of the SLCDL was designed based on theoretical considerations derived from a thorough review of the literature. These variables were consistent with the conceptual research model. All questionnaire variables are derived from well-designed instruments found in the existing literature. To enhance the overall quality of the questionnaire, the opinions of three major experts in the fields of service learning and early childhood teacher education were gathered. Their critical feedback led to improvements in both the content and structural organization of the questionnaire.

The SLCDL questionnaire centered on three primary dimensions, as follows: service learning, critical digital literacy, and online social capital. These dimensions underwent comprehensive analysis within the questionnaire’s structure. The initial survey encompassed a total of 20 observed variables, with each fundamental concept comprising between six and seven variables.

Based on the principle of constructing reflective indicators, each factor consists of several questionnaire questions [52]. Deleting or keeping them does not change the original meaning of the factor. The researchers use the results of the statistical analysis as a guide to retain or omit questions in order to improve the statistical significance of the questionnaire. While maintaining good reliability and validity, this approach does not diminish the impact of reflective indicators on the underlying aspects of the survey.

Survey participants engaged with the questionnaire by carefully assessing the provided statements and indicating their levels of concurrence or dissent using a 5-point Likert scale, which ranged from 1 (expressing strong disagreement) to 5 (indicating strong agreement). Subsequent sections provide an in-depth elucidation of the three foundational factors incorporated within the SLCDL questionnaire.

1. Service learning (SL) involves preservice preschool teachers engaging with the community, applying their knowledge and skills in real-world settings, and reflecting on their growth as educators through service learning. To design the questionnaire variables for SL, we drew from the existing literature [9, 22, 47]. The observed variables encompass statements such as the following: “Service learning helps me connect classroom learning to real-world issues”, “Service learning has heightened my awareness of social issues”, “I consider service learning an integral part of my education”, “I feel a stronger connection to my community due to service learning”, and “Service learning has enhanced my problem-solving skills”.

2. Critical digital literacy (CDL) explores the attitudes needed by preservice preschool teachers to effectively navigate and engage with digital technology. This includes their perceptions of searching for information, analyzing diverse digital texts, promoting self-reflection, constructing narratives, and taking social actions that contribute to democratic participation and global justice. Based on the existing literature [3, 28, 30], we designed questionnaire variables for CDL. These observed variables include the following: “I can identify and analyze bias in news articles and online content”, “I critically evaluate the messages and images presented in digital content”, “I actively participate in online discussions that encourage constructive dialogue”, “I recognize the importance of critical literacy skills for understanding and analyzing digital information”, and “I use digital tools and technologies to enhance my critical thinking skills”.
3. Online social capital (OSC) measures how preservice preschool teachers view the social resources, trust, and connections they develop through online interactions, especially on social networking sites. Based on the pertinent literature [13,35,36], we designed the OSC questionnaire with the following observed variables: “Online platforms have enabled me to discover new opportunities”, “I often share information, articles, or personal experiences online”, “My digital social capital has exerted a beneficial influence on my scholastic achievements”, “Online social capital has created new career opportunities for me”, and “Online connections have facilitated my access to valuable educational resources”.

2.3. Data Analysis

The researchers employed the partial least squares methodology to analyze the survey data, with the central objective of assessing the interaction dynamics within the moderation framework. Prior studies have successfully employed the partial least squares methodology to explore moderation effects. Noteworthy examples in the academic literature include the study conducted by Hair et al. in 2016 [52] and the work of Lowry and Gaskin from 2014 [53].

To facilitate this analysis, SmartPLS 3 [54] was utilized. This software was employed to examine the raw data, assessing the consistency of items within latent factors regarding the intended concepts. We used statistical methods recommended by partial least squares to assess the validity and reliability of questionnaire variables [52,53]. To assess the internal consistency reliability, we conducted an analysis aimed at gauging the extent to which the items associated with each factor exhibited consistent correlations. Convergent validity was also assessed to ensure that items measuring the same factor produced similar responses. Furthermore, discriminant validity was examined to establish the distinctiveness among different factors. This comprehensive process enhanced the precision of the measurement model, affirming its quality and guaranteeing that the collected data accurately portrayed the theoretical concepts. To test the factor loadings of the observed variables, a confirmatory factor analysis was utilized in the assessment process. The statistical significance of these loadings was confirmed through 5000 bootstrap replications, and the measurement model’s robustness and reliability were validated using resampling techniques.

To enhance the credibility and authenticity of the latent factors, the researchers utilized a variety of metrics. Cronbach’s alpha, for instance, evaluates the internal consistency among measurement items within a factor. Composite reliability (CR), on the other hand, calculates reliability by taking into account factor loadings. Average variance extracted (AVE) measures the extent to which latent variables capture variance. Furthermore, correlation coefficients provide insights into the relationships between factors. This comprehensive array of metrics collaboratively ensures the validity and reliability of the latent factors, thereby reinforcing the robustness of the research findings.

During the examination of the structural model, we employed a variety of assessment metrics, which included $R^2$, Adj. $R^2$, $Q^2$, and the standardized root mean residual (SRMR). We thoroughly analyzed these metrics to evaluate the latent factors in the structural model, following the recommendations of partial least squares [55,56]. In the context of this analytical approach, we also addressed the identification of multicollinearity among these latent factors, utilizing the variance inflation factor (VIF) technique. These methodological steps are essential for ensuring a comprehensive validation of the model’s explanatory power, while simultaneously addressing potential concerns related to multicollinearity issues. In addition, we conducted an analysis of effect sizes ($f^2$) to provide insight into the distinct contributions of each latent factor within our analysis.

In our research, we conducted an in-depth investigation into the potential moderating influence on the anticipated relationship, utilizing the robust partial least squares (PLS) methodology as our chosen analytical framework [57]. Employing a two-step procedure, we derived latent variable scores for both the independent and moderating varia-
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variables based on the primary effects model. These variable scores were subsequently harnessed to create the product indicator, a pivotal element in the second stage examination. This indicator encompasses the interaction term, merging it with both the independent variable and the moderator, forming a crucial aspect of the subsequent analysis. It is noteworthy that standardized data were employed in the computation of these product terms, which contribute to the interaction effect. To establish the statistical significance of this moderator, we employed a rigorous approach, involving an extensive examination consisting of 5000 bootstrap resamples.

3. Results

3.1. Assessment of the Measurement Model

Within the framework of the SLCDL, we conducted a thorough analysis using confirmatory factor analysis to evaluate not only the observed indicators but also the latent factors embedded within the measurement structure. To enhance the model's robustness, we omitted the observed variables that exhibited factor loadings lower than 0.70, concerning their corresponding latent factors in the SLCDL. Consequently, the initial set of 20 observed variables was trimmed down to a more streamlined collection of 15 variables.

The 15 observed variables we selected demonstrated mean values within the range of 3.793 to 3.969 and their corresponding standard deviations varied between 0.759 and 0.836. This provides an insightful overview of the distribution and variability present within our dataset.

In our analysis of these observed parameters, it became evident that the kurtosis metrics exhibited a dispersion spanning from −1.570 to −1.240. Simultaneously, the skewness indicators displayed a relatively confined spectrum, varying between 0.059 and 0.375. Importantly, both kurtosis and skewness metrics remained within the acceptable range of −2 to +2, indicating a well-balanced distribution.

Table 2 displays the standardized factor loadings corresponding to individual variables, ranging from 0.868 to 0.945. To ascertain the significance of each item’s factor loading, we conducted a rigorous bootstrapping analysis using 5000 subsamples. The outcomes of this investigation offer compelling support for the statistical significance of the observed factors. It is noteworthy that all the variables under scrutiny in our research demonstrated t statistics that substantially surpassed the critical threshold of 3.29, denoting a high level of significance (p < 0.001). According to Table 2, these findings described the shape and relationships within the sample data distributions. They also confirmed the reliability and validity of the identified factors, thereby strengthening our understanding of the latent factors and their significance in this model.

Table 2. Findings from confirmatory factor analysis within the SLCDL framework.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>SD</th>
<th>Kurtosis</th>
<th>Skewness</th>
<th>Factor Loading</th>
<th>t Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL1</td>
<td>3.954</td>
<td>0.791</td>
<td>−1.399</td>
<td>0.081</td>
<td>0.938</td>
<td>107.380***</td>
</tr>
<tr>
<td>SL2</td>
<td>3.928</td>
<td>0.759</td>
<td>−1.259</td>
<td>0.121</td>
<td>0.934</td>
<td>96.882***</td>
</tr>
<tr>
<td>SL3</td>
<td>3.954</td>
<td>0.803</td>
<td>−1.447</td>
<td>0.083</td>
<td>0.940</td>
<td>107.552***</td>
</tr>
<tr>
<td>SL4</td>
<td>3.969</td>
<td>0.836</td>
<td>−1.570</td>
<td>0.059</td>
<td>0.894</td>
<td>71.072***</td>
</tr>
<tr>
<td>SL5</td>
<td>3.793</td>
<td>0.772</td>
<td>−1.240</td>
<td>0.375</td>
<td>0.868</td>
<td>72.431***</td>
</tr>
<tr>
<td>CDL1</td>
<td>3.873</td>
<td>0.800</td>
<td>−1.405</td>
<td>0.234</td>
<td>0.919</td>
<td>75.844***</td>
</tr>
<tr>
<td>CDL2</td>
<td>3.805</td>
<td>0.771</td>
<td>−1.245</td>
<td>0.350</td>
<td>0.907</td>
<td>93.285***</td>
</tr>
<tr>
<td>CDL3</td>
<td>3.918</td>
<td>0.789</td>
<td>−1.384</td>
<td>0.146</td>
<td>0.925</td>
<td>97.491***</td>
</tr>
<tr>
<td>CDL4</td>
<td>3.846</td>
<td>0.779</td>
<td>−1.306</td>
<td>0.276</td>
<td>0.912</td>
<td>67.155***</td>
</tr>
<tr>
<td>CDL5</td>
<td>3.853</td>
<td>0.781</td>
<td>−1.322</td>
<td>0.263</td>
<td>0.922</td>
<td>77.650***</td>
</tr>
<tr>
<td>OSC1</td>
<td>3.925</td>
<td>0.767</td>
<td>−1.292</td>
<td>0.128</td>
<td>0.885</td>
<td>50.581***</td>
</tr>
<tr>
<td>OSC2</td>
<td>3.913</td>
<td>0.819</td>
<td>−1.494</td>
<td>0.161</td>
<td>0.927</td>
<td>77.657***</td>
</tr>
<tr>
<td>OSC3</td>
<td>3.873</td>
<td>0.769</td>
<td>−1.284</td>
<td>0.222</td>
<td>0.901</td>
<td>69.972***</td>
</tr>
<tr>
<td>OSC4</td>
<td>3.962</td>
<td>0.834</td>
<td>−1.563</td>
<td>0.072</td>
<td>0.945</td>
<td>126.889***</td>
</tr>
<tr>
<td>OSC5</td>
<td>3.964</td>
<td>0.836</td>
<td>−1.569</td>
<td>0.068</td>
<td>0.945</td>
<td>130.788***</td>
</tr>
</tbody>
</table>

Note: *** = p < 0.001.
Table 3 provides an insightful abstract of essential metrics relevant to the SLCDL model. These metrics encompass various facets, such as Cronbach’s alpha, rho_A, composite reliability (CR), and the scores for average variance extracted (AVE). These metrics are specifically associated with distinct latent factors within the model. These scores ranged between 0.951 and 0.955, all surpassing the established threshold of 0.800. Similarly, the rho_A values fell within the range of 0.953 to 0.956, consistently surpassing the 0.800 benchmark. CR scores varied from 0.963 to 0.965, consistently exceeding the 0.800 benchmark, while AVE scores ranged from 0.838 to 0.848, continually surpassing the 0.500 cutoff. Based on Table 3, all of the latent factors in the SLCDL model met the testing criteria for reliability and validity, demonstrating satisfactory levels.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Cronbach’s Alpha</th>
<th>rho_A</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL</td>
<td>0.951</td>
<td>0.953</td>
<td>0.963</td>
<td>0.838</td>
</tr>
<tr>
<td>CDL</td>
<td>0.953</td>
<td>0.955</td>
<td>0.964</td>
<td>0.841</td>
</tr>
<tr>
<td>OSC</td>
<td>0.955</td>
<td>0.956</td>
<td>0.965</td>
<td>0.848</td>
</tr>
</tbody>
</table>

Table 4 illustrates the interrelationships observed among the latent factors within the SLCDL framework. In this matrix, the diagonal elements show the square root of the AVE for each pair of latent factors. Directly below the diagonal are the correlation coefficients, which offer valuable insights into the relationships among these factors. These intercorrelations spanned a spectrum from 0.714 to 0.848. An important observation arises when considering the correlation coefficients associated with each latent factor. Specifically, these coefficients consistently remained below their respective square root of AVE. The AVE values’ square roots exhibited a range of 0.915 to 0.921, providing substantial evidence to affirm that the SLCDL framework effectively emphasizes the presence of discriminant validity. This affirmation is substantiated by the well-established interconnections observed among its latent factors.

<table>
<thead>
<tr>
<th>Factor</th>
<th>SL</th>
<th>CDL</th>
<th>OSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL</td>
<td>0.915</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDL</td>
<td>0.752</td>
<td>0.917</td>
<td></td>
</tr>
<tr>
<td>OSC</td>
<td>0.848</td>
<td>0.714</td>
<td>0.921</td>
</tr>
</tbody>
</table>

Table 5 offers an exhaustive examination employing the Heterotrait–Monotrait (HTMT) Ratio of Correlations technique. Clearly, all calculated HTMT values consistently remained below the established threshold of 0.90, ranging from 0.748 to 0.890. This collective range of values robustly attests to the reliability, convergent validity, and discriminant validity of the latent factors being studied. The results obtained from this analysis have significant implications. They emphasize that the SLCDL measurement model demonstrates strong internal consistency and commendable reliability.

<table>
<thead>
<tr>
<th>Factor</th>
<th>SL</th>
<th>CDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDL</td>
<td>0.782</td>
<td></td>
</tr>
<tr>
<td>OSC</td>
<td>0.890</td>
<td>0.748</td>
</tr>
</tbody>
</table>

3.2. Assessment of the Structural Model

To evaluate the potential issue of multicollinearity, the researchers employed the variance inflation factor (VIF) statistic. The analysis produced results aligned with the latent factors included in the SLCDL. More specifically, the VIF value for SL and OSC factors concerning CDL was 3.558. Notably, all VIF values for the latent factors stayed below the
five thresholds, signifying a minimal multicollinearity influence on the latent factors represented in the SLCDL.

Employing the PLS method, the researchers assessed the structural model’s stability. All crucial statistical indicators, specifically R-squared ($R^2 = 0.586$), adjusted R-squared (Adj. $R^2 = 0.584$), and Q-squared ($Q^2 = 0.487$), met acceptable criteria for structural validity. Additionally, the standardized root mean residual (SRMR) of 0.062 affirmed the harmonious fit between the sample data and the model employed in the SLCDL framework.

Effect sizes have become crucial metrics for quantifying the strength of relationships between latent factors within the SLCDL. In a more detailed examination, the $f^2$ values associated with SL and OSC on CDL were determined to be 0.183 and 0.051, respectively. These findings clearly indicate that the predictive significance of latent factors falls within the small to medium range in both cases.

In the structural framework of the SLCDL model (see Figure 2), the influence exerted by the SL and OSC factors prominently contributed to explaining 58.6% of the proportional variance within the CDL factor. This observation becomes evident when examining the standardized regression coefficients, which are 0.520 and 0.274 for their respective factors. It is noteworthy that all path coefficients achieved exceptional statistical significance ($p < 0.05$). This affirmation was further validated through a robust bootstrap procedure, encompassing 5000 resamples. This comprehensive validation offers robust backing for the credibility of hypotheses H1 and H2.

![Figure 2. Structural model.](image)

### 3.3. The Moderating Effect of Self-Affirmation

In our study, we utilized SmartPLS 3 to standardize both our independent and moderating variables, a crucial process that facilitated the computation of interaction terms for our moderation analysis. The methodological phase is crucial when conducting moderation analysis, as it evaluates the effect of the moderator in this relationship. To rigorously assess the moderating effect’s statistical relevance, we utilized bootstrapping, undertaking an exhaustive 5000 resampling cycles to ensure and strengthen the reliability of our study results.

Figure 3 displays the standardized regression coefficients for the SL and OSC constructs on the CDL, which were 0.516 and 0.270, respectively. We found a moderating effect of 0.073 after conducting a moderation analysis. This indicates the interplay between service learning constructs and online social capital. Simultaneously, the corresponding $t$ value stood at 2.015. Importantly, when we calculated the bias-corrected bootstrap confi-
dence interval to capture the moderator’s influence, the range was determined to be between 0.002 and 0.139, all within a 95% confidence level. Remarkably, this interval definitively ruled out the possibility of zero, confirming its statistical significance.

Figure 3. Moderation analysis.

In the context of preservice preschool teachers in Taiwan, this study highlighted the significant positive moderating role played by online social capital in the connection between service learning and critical digital literacy. To elaborate, the primary impact yielded an explanatory capacity of 0.586, while the moderating influence demonstrated an explanatory capacity of 0.590. The effect size of this moderation was measured at 0.01, signifying a relatively medium moderating influence. The results in Figure 3 clearly provided substantial empirical support for Hypothesis 3.

4. Discussion

Service learning prompts preschool teachers to reflect on past schooling and biases, rejecting deficit narratives in teacher education. It fosters online social capital that connects students, teachers, and the community, fostering online learning, civic engagement, and social networking.

Digital literacy involves examining the use of technology in specific contexts, considering its connection to cultural practices. It recognizes the influence of societal norms, values, and power dynamics on technology use. Exploring power dynamics in digital environments provides insights into knowledge formation, identity construction, the impact of social relationships, and unequal advantages and disadvantages. Such awareness is critical for effective engagement in digital environments.

Online social capital mediates the relationship between service learning and improved digital literacy among preservice preschool teachers. The level of online social capital influences how service learning impacts critical digital literacy, either enhancing or diminishing its effect.

According to the results, service learning positively influenced the critical digital literacy of preservice preschool teachers (standardized regression coefficient: 0.520, p < 0.05), supporting H1. In addition, online social capital had a positive impact on the critical digital literacy of preservice preschool teachers (standardized regression coefficient: 0.274, p < 0.05), supporting H2. Furthermore, online social capital played a moderating role in strengthening the relationship between service learning and critical digital literacy of preservice preschool teachers, with a significant moderation effect of 0.073. Hypotheses H1,
H2, and H3 are supported, confirming the moderating role of online social capital in this relationship, aligning with the above literature exploration [47–49].

Preservice preschool teachers can increase critical awareness by identifying perspectives in digital multimodal texts and teacher education, as demonstrated in the literature reflection above [28,30]. Research highlights the impact of service learning and online social capital on critical digital literacy, fostering their understanding of digital documents and civic literacy skills.

Early childhood teacher educators need to provide opportunities for preservice preschool teachers to understand vulnerability and perceive reality through the lens of community partners, as demonstrated in the literature reflection above [21,23]. This includes collaborating with social organizations and organizing community outings. Assigning reflective tasks is essential to ensure that no community member is overlooked. Service learning is used to raise awareness of social diversity and its impact on early childhood education, enabling and encouraging them to appreciate and value cultural differences. This fosters the development of critical digital literacy, increases intercultural awareness, and facilitates the adoption of effective multicultural teaching practices.

Preservice teacher education for early childhood educators integrates critical digital literacy through community collaboration, multicultural access, and culturally responsive teaching. Addressing social inequalities in the digital realm, preservice teacher education programs promote digital citizenship and awareness by emphasizing digital narrative construction, historical contextualization, and addressing power inequalities in search results.

Teacher educators in the digital age should move away from traditional authority, fostering teamwork and an equitable distribution of authority with students. A curriculum that integrates interdisciplinary topics, acknowledges student diversity, and welcomes critical viewpoints is essential. The use of digital content in teacher education programs benefits preservice teachers as they navigate diverse classrooms.

Teacher educators gain valuable insights into the development of online social capital by connecting and building networks on various social media platforms. With this knowledge, they can develop effective approaches for incorporating digital elements into learning environments. Supporting preservice preschool teachers in acquiring more online social capital through digital interactions fosters new connections, increases openness, and promotes tolerance in the digital society. Integrating social media and digital content into the curriculum extends teaching beyond traditional boundaries, facilitates the inclusion of lived experiences, and encourages discussions about social differences.

Teacher educators should provide preservice preschool teachers with essential skills to effectively navigate and evaluate vast amounts of online information. Empowering them to appreciate the implications and dangers of digital technologies is achieved by incorporating service learning experiences into pedagogical methods. This approach helps them develop essential skills for responsible digital citizenship. In addition, teacher educators should adapt and apply their teaching methods to enable preservice preschool teachers to actively engage as digital content creators and responsible citizens.

International readers can benefit from understanding the interconnectedness of service learning, online social capital, and critical digital literacy in preservice preschool teacher education. Service learning promotes critical reflection and rejects deficit narratives. Online social capital plays a critical role in moderating the relationship between service learning and improved critical digital literacy. The research highlights the importance of acknowledging cultural influences on technology use, shaping identities, and addressing power dynamics in digital environments. Educators around the world can implement these findings by promoting multicultural perspectives, collaborative partnerships, and incorporating critical digital literacy skills into curricula. Embracing digital citizenship, fostering openness, and leveraging online interactions enhances the preparation of preschool teachers for diverse and dynamic digital landscapes.
5. Conclusions

This study examines the connection between service learning and critical digital literacy in Taiwanese preservice preschool teachers. It also investigates how online social capital influences this relationship. The findings show that participating in service learning activities enhances preservice preschool teachers' critical digital literacy. The study suggests that engaging in service learning positively affects their ability to assess and use digital content critically. Online social capital significantly influences the enhancement of teachers' critical digital literacy. Possessing a robust online community, encompassing relationships with colleagues, mentors, and pedagogical materials, motivates them to refine their digital competencies.

Our study revealed a significant correlation between participation in service learning activities and the development of critical digital literacy among preservice preschool teachers. By engaging in service learning, they can improve their ability to critically evaluate and use digital content. This finding highlighted the potential of service learning as a pedagogical approach to fostering critical digital literacy skills, which is consistent with the goals of sustainable education.

In addition, we focused on the impact of online social capital on the development of critical digital literacy. The presence of a supportive online community of colleagues, mentors, and educational resources motivated preservice preschool teachers to refine their digital literacy skills. This aspect is critical in the context of sustainable education, as it underscores the importance of collaborative learning environments and digital connectivity in promoting lifelong learning and skills development.

By equipping preservice preschool teachers with the digital tools to analyze the complex interplay between digital technology, power dynamics, and social structures, we can empower them to navigate digital spaces thoughtfully and to advocate for inclusive practices. Ultimately, by fostering critical digital literacy skills among preservice preschool teachers, we can contribute to the cultivation of a more equitable and sustainable digital society, in line with the goals of sustainable development.

A limitation of this study is the homogeneity of the sample, which consists mainly of Taiwanese preservice preschool teachers. This restricts the generalizability of the findings beyond the Taiwanese context. Future research could be improved by diversifying the sample to include individuals from different countries or regions to increase the external validity of the theoretical model. However, cross-cultural differences in educational systems and teaching practices may introduce more complexities that need to be addressed in comparative analyses.

Another limitation is the potential gap between self-reported digital literacy skills and actual cognitive competencies. Relying on self-reporting could introduce biases and inaccuracies that could affect the objectivity of the analysis of respondents' evaluations of digital content. This could result in findings that do not accurately represent participants' true capabilities or viewpoints. Future research could address this limitation by using more precise assessment methods, such as objective measures or qualitative interviews, to gain a deeper understanding of individuals' critical digital literacy skills and their attitudes.

Future research should re-evaluate the latent factors and observed variables within the SLCDL framework. It may also involve developing new latent factors, moderating variables, and alternative theoretical hypotheses. The methodology allows for an in-depth investigation into the perceptions of preservice early childhood educators regarding service learning and critical digital competencies. Consequently, this will provide a deeper insight into the foundational mechanisms at play in early childhood education.

Forthcoming scholars are advised to use diverse research strategies to explore different service learning and digital instructional methods in college settings. This approach can help them discover practical insights for improving critical digital literacy in preservice preschool teachers.
We encourage scholars and practitioners to broaden their viewpoints concerning the relationship between early childhood educator training and digital technology integration. Prioritizing the development of critical digital skills in early childhood education is crucial. Furthermore, we should avoid binary categorizations of practices when studying critical digital skills and the growth of online social networks.

Finally, we believe that critical digital literacy is essential for preservice preschool teachers. It provides them with a valuable framework to analyze the intricate relationship among digital technology, power dynamics, and social structures. By honing these skills, they can navigate digital spaces critically, challenge oppressive practices, and contribute to fostering a more inclusive and equitable digital society.

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**References**


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