A Structural Equation Modeling Approach to ICT Engagement, Digital Leadership, and Teaching Performance of ALS Teachers

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ABSTRACT

As the Philippine Department of Education advances its digital transformation agenda, understanding how teachers' engagement with Information and Communication Technology (ICT) translates into instructional effectiveness has become increasingly important, particularly in non-formal education contexts such as the Alternative Learning System (ALS). This study examined the structural relationships among ICT Engagement, Digital Leadership, and Teaching Performance of ALS teachers in Northern Mindanao using Structural Equation Modeling (SEM). Data were collected from 200 ALS teachers through an online survey utilizing adapted measures of ICT Engagement, perceived Digital Leadership of Education Program Specialists (EPS), and IPCRF-based Teaching Performance ratings. Descriptive results indicated generally low ICT engagement, moderate levels of perceived digital leadership, and high teaching performance ratings. SEM results showed that ICT Engagement significantly predicted both Digital Leadership and Teaching Performance, while Digital Leadership also had a significant effect on Teaching Performance. Mediation analysis revealed that Digital Leadership partially mediated the relationship between ICT Engagement and Teaching Performance. These findings highlight ICT Engagement as the primary driver of instructional performance in ALS, with digital leadership serving a reinforcing role. The study contributes empirical evidence to the limited body of research on digital leadership and ICT integration in non-formal education and underscores the need for sustained ICT capacity-building and strengthened EPS-led digital support to enhance teaching quality in ALS.

Keywords: ICT engagement, Digital Leadership, Teaching Performance, Alternative Learning System, Structural Equation Modeling

INTRODUCTION

The high rate of growth of digital technologies has altered the education system in all countries of the world changing the methods of delivering instructions, evaluation methods and how learners obtain information. The Department of Education (DepEd) in the Philippines has been working harder to achieve digital transformation by implementing various programs like DepEd DigiEd 2028 that support digital transformation and develop future-ready teachers and learners (DepEd, 2024). In line with this vision, the updated DepEd Computerization Program (DCP) has been reinforcing the ICT integration by introducing digital infrastructure, hardware, software, and ICT-enabled classrooms in the public schools (DepEd, 2023).

Under this dynamic educational environment, ICT engagement has become a key competency of teachers. ICT engagement is the perceived competence (confidence) of teachers, their interest, social exposure, and active engagement in using digital tools (Kunina-Habenicht and Goldhammer, 2020). These elements allow teachers to navigate the technology-enriched learning environments, adjust to the instructional innovations, and support the learner-centered approaches. In the case of teachers of the Alternative Learning System (ALS) where teaching is flexible, community-based and may occur in resource limited environments, ICT tools can offer useful possibilities to increase access, personalize learning, and facilitate self-study. Therefore, the study of ICT use among teachers of ALS is not only timely but directly corresponds to the national priorities of digital transformation.

Although there is continuous policy backing, ALS teachers are still struggling with ICT integration (Mahinay and Manla, 2025). In contrast to the formal school environment, community learning centers are quite diverse in terms of digital preparedness, internet access, and technological assistance. Besides, ALS teachers have strong dependency on the leadership, mentoring, and supervision of their Education Program Specialists (EPS), which is a strategic position in directing digital initiatives in ALS at the division level. Nevertheless, the current studies are more inclined towards ICT competence, digital readiness, and technology adoption among formal school teachers, which creates a significant gap in the perception of how digital leadership can impact teaching performance in the ALS setting.

The other gap is related to the mediation of Digital Leadership. Despite the fact that the role of leadership has been widely accepted as a key element in the context of ICT integration, empirical research on EPS Digital Leadership specifically on its innovative and supportive aspects is scarce. The interactions between ICT engagement and leadership practices to influence teacher performance are rarely examined, and fewer studies use a sophisticated statistical method, including Structural Equation Modeling (SEM), to assess these relationships. Based on these gaps, a more analytical and comprehensive exploration is required to comprehend the way ICT engagement is converted into better instructional practices in ALS.

In order to fill these gaps, the current research examines the structural associations between ICT Engagement, Digital Leadership, and Teaching Performance of ALS teachers through Structural Equation Modeling (SEM) method. In particular, the research evaluates the idea of whether Digital Leadership as perceived by the teachers in terms of their perception of the innovative and supportive digital leadership behavior of their EPS mediates the relationship between ICT Engagement and Teaching Performance. The study has offered a holistic insight into the impact of ICT engagement on teaching performance based on leadership processes by modeling both direct and indirect effects.

The results should be used to add to the existing literature on integration of ICT, digital leadership, and quality of instruction in non-formal education. In addition, the findings will be beneficial to the current digital transformation efforts at DepEd as they will serve to inform the current efforts with evidence-based information that can inform leadership development, ICT-related professional capacity-building, and instructional improvement strategies in ALS. Finally, the research aims to justify the improvement of teaching practice in ALS, which can be linked to the overall objectives of the DepEd digital reform agenda.

LITERATURE REVIEW

This section will be a review of literature that is important and informative of the relationship between ICT Engagement, Digital Leadership and Teaching Performance in the Alternative Learning System (ALS) of the Department of Education. It places the variables in the global and Philippine education context, especially the peculiarities of the ALS teaching that need flexibility, technological flexibility, and robust supervisory support. The following discussion provides the fundamental ideas and recent findings concerning Teacher Performance in ALS, ICT Engagement, and Digital Leadership.

Teacher's Performance in ALS

Teaching performance in the Alternative Learning System (ALS) is the effectiveness with which teachers and mobile instructors in the ALS plan, facilitate and assess learning in non-formal, flexible learning contexts. ALS teaching, unlike the classroom-based teaching, needs flexibility, community-based teaching, and individualized teaching. According to recent Philippine studies, ALS teaching performance is multidimensional. Pakino and Ubayubay (2024) discovered that motivation and job satisfaction play a crucial role in the performance of ALS teachers, so that teacher attitudes can be involved in the delivery of instructions. Borja (2022) showed that the professional qualities of ALS teachers, including preparedness to teach, communication skills, and learning modules mastery, have a positive connection with the performance of ALS systems.

Similarly, Salen and Porcincula (2025) found that instructional competencies of ALS teachers especially content knowledge, pedagogy, and classroom management have a positive impact on their teaching performance, which indicates the necessity of continuous professional growth. Taken together, these studies

confirm that the performance of ALS teachers depends on the competence of teachers, their personal qualities, and the support mechanisms in the classroom, so it will be appropriate to examine how ICT use and leadership practices can lead to the performance results.

ICT Engagement

ICT Engagement is the interest, confidence, exposure, and active participation of a teacher in the usage of the digital tools. It is regarded as a behavioral and psychological construct, which predicts technology-enhanced instructional readiness and digital competence. Kunina-Habenicht and Goldhammer (2020) theorize ICT Engagement as a multidimensional construct comprising of ICT interest, perceived ICT competence (self-concept), ICT-related social interaction, and active technology use. Its applicability to performance is supported by empirical research. Multilevel structural equation modeling found that ICT resources are associated with student ICT engagement, and academic performance through the mediation of student ICT engagement in digital learning settings (Wang and Wang, 2023). Radiamoda and Ngo (2024) discovered that the more teachers are ICT engaged, the more digital competence and confidence they have in integrating technology in the Philippine context. On the same note, Caratiquit and Javier (2025) found that the technology-related engagement manifested through the teacher ICT competence and techno-efficacy was found to be a strong predictor of the teacher attitudes towards the use of ICT in teaching. These research studies place ICT engagement as a crucial factor in teacher effectiveness, especially in the digital and flexible learning process like ALS.

Digital Leadership

Digital Leadership Digital Leadership is a leadership practice that facilitates the incorporation of technology, innovation, and organizational change in education. Eberl and Drews (2021) define digital leadership as the capacity to lead digital change through integrating both technological skills and human-oriented leadership behaviors. According to Tigre, Henriques and Curado (2025), digital leadership is a multidimensional concept that combines technological vision with human-oriented leadership skills that include empowerment, communication and support, which are key qualities in driving digital transformation. Its effects on performance are backed by empirical research. Erhan et al. (2022) discovered that the perceptions of digital leadership are important and significant predictors of the innovative behavior of employees. Abbu et al. (2025) created and tested a multidimensional Digital Leadership Scale (DLS), which demonstrated that digital leadership behaviours in various human-centred dimensions can be reliably assessed and apply to the readiness to transform an organization. Ariate and Bacasmot (2025) discovered in the Philippine education setting that technology leadership by school heads has a significant impact on the ICT attitudes of teachers, and that technology literacy skills mediate this effect, which implies the importance of leadership in equipping teachers with technology-enhanced instruction. This is consistent with the point of view of the current study that digital leadership of ALS Education Program Specialists can mediate the impact of ICT Engagement on Teaching Performance.

Synthesis of Gaps

The literature has proved that ICT engagement contributes to the digital competence and instructional preparedness of teachers (Kunina-Habenicht and Goldhammer, 2020; Radiamoda and Ngo, 2024), and digital leadership has been found to support the adoption of technology, innovation, and conducive instructional contexts (Eberl and Drews, 2021; Tigre et al., 2025). The studies of the Philippine ALS setting also prove that teachers motivation, competence, and professional qualities influence the teaching performance (Pakino and Ubayubay, 2024; Borja, 2022).

Although these contributions have been made, there are still some significant gaps. To begin with, no research has explored the ICT engagement as predictor of teaching performance in ALS teachers in particular since non-formal, community-based teaching contexts are quite different in formal school settings. Second, digital leadership, especially the leadership practiced by Education Program Specialists in ALS, has not been empirically investigated and it is not clear how leadership influences the digital practices, attitudes, and performance of ALS teachers. Third, even though there is also an emerging evidence that ICT-related

constructs might work via mediating processes (Wang & Wang, 2023), no study has measured digital leadership as a mediating factor between ICT engagement and teaching performance in Philippine education, and none in ALS specifically.

These gaps indicate the necessity of analyzing how teachers' ICT engagement connects with supervisory digital leadership and how this relationship contributes to improvements in ALS instructional performance.

Theoretical Framework

The present research is grounded on three significant theories that, in combination, explain the interaction between ICT Engagement, Digital Leadership, and Teaching Performance in the framework of ALS.

The *Social Cognitive Theory* (SCT) by Bandura is the basis of explaining ICT Engagement. According to SCT, human behavior is formed as a result of mutual interaction between personal beliefs, behavioral patterns, and environmental factors. Self-efficacy is a key element of SCT and it is a personal conviction that one can successfully cope with a task. When considering ICT, it can be stated that teachers with a higher level of ICT self-efficacy, interest, and motivation tend to be more engaged with digital tools and continue to work through technological activities. Therefore, SCT provides the reason why ALS teachers who are more engaged in ICT can plan lessons, prepare learning materials, and deliver instructions more effectively, thus, improving their performance in teaching.

Transformational Leadership Theory also supports the study because it focuses on the importance of leaders in motivating the followers, encouraging innovation, and professional development. Digital transformation in education has broadened this theory to Digital Leadership whereby leaders mentor and coach teachers to embrace new technologies, manage digital transformation, and gain confidence in the incorporation of ICT into teaching. Education Program Specialists (EPS) are instructional leaders in the ALS environment supervising, coaching, and mentoring ALS teachers. Transformational Leadership Theory postulates that by these leaders exhibiting innovative supportive digital leadership behaviors including modeling ICT use, promoting experimentation, and offering guidance teachers are more willing and able to utilize technology. This theoretical approach can be used to explain how digital leadership can directly positively contribute to the performance of ALS teachers by influencing their professional behaviors, motivation, and preparedness to teach using technologies.

Finally, the research relies on the *Technology Acceptance Model (TAM)* that suggests that the use of technology by a person depends on two main perceptions, perceived usefulness and perceived ease of use. ICT Engagement is very close to these constructs because when teachers think that ICT is useful and controllable, they are more likely to use digital tools in their instruction. TAM also recognizes the external factors like leadership, training and organizational support to the technology acceptance of individuals. In the ALS framework, digital leadership is an important external driver and can reinforce the perception of teachers that ICT is helpful and easy to use. With the example of EPS having good digital leadership, they assist the teachers of ALS to break through the obstacles, gain digital confidence, and understand the importance of technology in enhancing learning achievements. This supports the assumption that ICT Engagement can more effectively mediate the effect on teaching performance through the mediating roles of supportive digital leadership.

Combining these three theories forms a rational basis of the structural model of the study. The Social Cognitive Theory describes the internal motivational and confidence-based processes of ICT Engagement, the Technology Acceptance Model explains how attitudes and beliefs are translated into the use of technology, and Transformational Leadership Theory explains how digital leadership practices influence teacher engagement and performance. All these theories support the need to explore the mediating effect of Digital Leadership in the relationship between ICT Engagement and Teaching Performance in ALS teachers. This theoretical perspective in combination with the other two allows the proposed pathway: ICT Engagement affects Teaching Performance both directly and indirectly via Digital Leadership, which provides a full picture of how technology behavior and leadership relationships can influence teaching performance within the Alternative Learning System.

Research Model

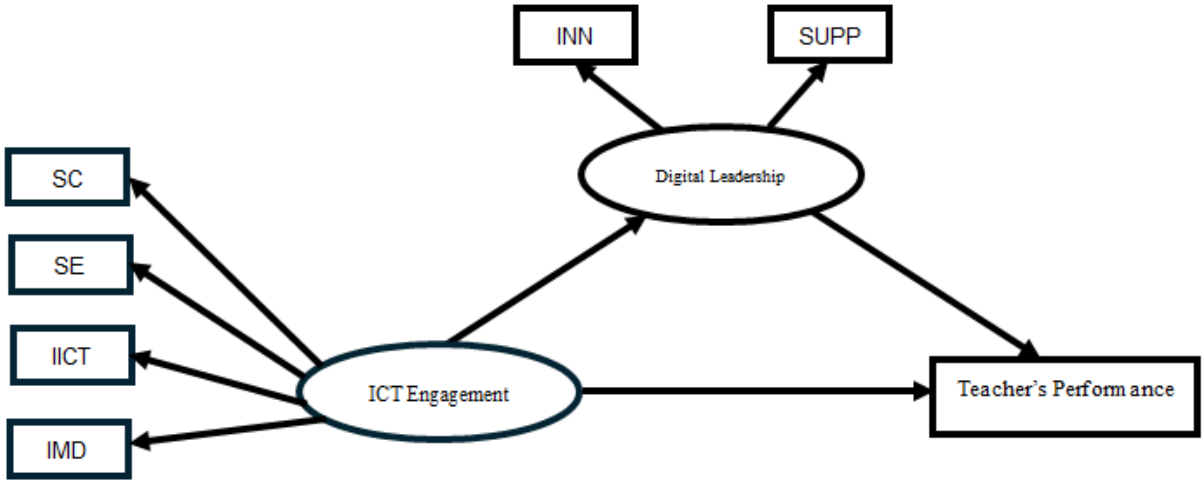

Figure 1. Hypothesized Model of the Study

The proposed research model positions ICT Engagement-ICT Self-Concept (SC), ICT Social Exposure (SE), Interest in ICT (IICT), Interest in Mobile Devices (IMD) as the exogenous latent variable, Digital Leadership-Innovative (INN), Supportive (SUPP) as the mediating latent variable, and Teaching Performance as the endogenous variable. The model assumes that ALS teachers' level of ICT Engagement predicts the extent to which their Education Program Specialists (EPS) demonstrate Digital Leadership, and in turn, these leadership practices influence teachers' Teaching Performance. Furthermore, ICT Engagement is hypothesized to exert both direct and indirect effects on Teaching Performance, with Digital Leadership serving as the mediator in the indirect pathway.

Research Questions

1. What is the level of ICT Engagement among ALS teachers in terms of:

1.1 ICT Self-Concept

1.2 ICT Social Exposure

1.3 Interest in ICT

1.4 Interest in Mobile Devices

2. How do the respondents assess the Digital Leadership demonstrated by Education Program Specialists (EPS) in terms of:

2.1 Innovative digital leadership

2.2 Supportive digital leadership?

3. What is the level of Teaching Performance among ALS teachers?

4. Does ICT Engagement significantly predict Digital Leadership among ALS teachers?

5. Does ICT Engagement significantly predict Teaching Performance among ALS teachers?

6. Does Digital Leadership significantly predict Teaching Performance among ALS teachers?

7. Does Digital Leadership significantly mediate the predictive relationship between ICT Engagement and Teaching Performance among ALS teachers?

8. Does the proposed Structural Equation Model demonstrate an acceptable model fit?

Hypotheses

$H0_1$: ICT Engagement does not significantly predict Digital Leadership among ALS teachers.

$H0_2$: ICT Engagement does not significantly predict Teaching Performance among ALS teachers.

$H0_3$: Digital Leadership does not significantly predict Teaching Performance among ALS teachers.

$H0_4$: Digital Leadership does not significantly mediate the predictive relationship between ICT Engagement and Teaching Performance among ALS teachers.

$H0_5$: The proposed Structural Equation Model does not demonstrate an acceptable model fit.

METHODOLOGY

Research Design

The research design used a quantitative research design based on Structural Equation Modeling (SEM) to investigate the predictive and mediating relationship of ICT Engagement, Digital Leadership, and Teaching Performance of ALS teachers. The levels of the variables were determined by a descriptive-correlational approach, and SEM offered a strict model to test both direct and indirect effects.

SEM was chosen due to the possibility of estimating several pathways simultaneously, modeling latent constructs, measuring measurement error, and evaluating the overall model fit (Kline, 2016; Hair et al., 2019; Schumacker and Lomax, 2016). The analysis was conducted in two steps. First, the Confirmatory Factor Analysis (CFA) was used to measure the two latent variables, ICT Engagement and Digital Leadership, and Teaching Performance was considered an observed variable. Second, the structural model was used to test the hypothesized paths: ICT Engagement predicting Digital Leadership, ICT Engagement predicting Teaching Performance, Digital Leadership predicting Teaching Performance and the mediating effect of Digital Leadership.

It was a non-experimental and cross-sectional study where data was gathered at a single time. The design is suitable in investigating predictive relationships and mediation in actual educational contexts like the Alternative Learning System (ALS) that gives evidence on how ICT behaviors and leadership practices affect teaching performance.

Although Structural Equation Modeling enables the testing of theoretically grounded predictive and mediating pathways, the cross-sectional nature of the data limits causal interpretation. Thus, the findings are interpreted as associative and explanatory rather than causal.

Respondents and Sampling

The study involved 200 teachers under the Alternative Learning System (ALS) of the Department of Education (DepEd) in Northern Mindanao. The respondents included Mobile Teachers and District ALS Coordinators (DALSCs). Of the total respondents, 47 were male (23.5%) and 153 were female (76.5%). They were selected because they regularly utilize ICT in the implementation of ALS and maintain direct coordination with Education Program Specialists (EPS), whose digital leadership is the central focus of the study.

The convenience sampling method was used because of the scattered field placements and the different accessibility of ALS implementers to different communities. Available, reachable and willing teachers during the data collection period were included. Field-based research with geographically dispersed respondents is suitable to convenience sampling and is frequently applied in SEM studies.

The research aimed to achieve the minimum number of respondents to use Structural Equation Modeling, which is 200 respondents, in line with the suggested sample size (Kline, 2016; Hair et al., 2019). The respondents needed to have one year of experience in ALS teaching.

This was done by use of the online survey form that was distributed through online communication channels frequented by ALS teachers.

Instruments

The ICT Engagement was assessed on the basis of the adapted version of the *ICT Engagement Scale* created by Nikolopoulou and Gialamas (2016). The scale was adjusted to the ICT-related activities of the ALS teachers, including the preparation of digital learning resources, the communication in online platforms, the involvement in digital trainings, the use of ICT in teaching and monitoring of the learners. The items were assessed using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), and the greater the score, the greater the engagement with ICT.

Digital Leadership was measured based on a modified version of *Digital Leadership Scale (DLS)* created by Buyukbese, Dikbas, Klein, and Batuk Unlu (2022). The initial instrument provides the necessary leadership practices in the digital transformation environment. In this research, the scale was modified to explain the digital leadership practices of Education Program Specialists (EPS) as perceived by ALS teachers. The adapted version had two dimensions, which are Innovative Digital Leadership and Supportive Digital Leadership on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Teaching Performance was assessed through the use of selected indicators based on the *Individual Performance commitment and Review Form (IPCRF)*, the official performance evaluation form as required by DepEd as DM 017, s. 2025. The IPCRF evaluates teachers in a number of competence areas that correspond to the Philippine Professional Standards of Teachers (PPST) that are lesson planning and delivery, learner engagement, assessment practices and professional responsibilities.

The obtained numerical scores of the IPCRF were transformed into performance categories based on the official PMES Rating Transmutation Table where: 4.500-5.000 = Outstanding (5), 3.500-4.499 = Very Satisfactory (4), 2.500-3.499 = Satisfactory (3), 1.500-2.499 = Unsatisfactory (2), and 1.000-1.499 = Poor (1). To be analyzed with Structural Equation Model, the transmuted numerical rating was considered the measure of teaching performance. This will guarantee consistency with the performance evaluation system stipulated by DepEd and will offer an objective and standardized foundation on which the performance of ALS teachers will be evaluated.

Data Analysis

The descriptive statistics were calculated to find out the levels of ICT Engagement, Digital Leadership, and Teaching Performance. The frequency distributions, mean scores and standard deviations were created to summarize the characteristics of the respondents and the tendencies of the variables.

In the case of measurement model, a Confirmatory Factor Analysis (CFA) was performed to test the factor structure of the two latent variables ICT Engagement and Digital Leadership. Fit indices like CFI, TLI, RMSEA, SRMR, and χ^2/df were used to determine the model fit.

The structural model was tested after the acceptable measurement properties were established to test the hypothesized causal relationships between the study variables: ICT Involvement - Digital Leadership, ICT Engagement - Performance in Teaching, and Digital Leadership - Performance Teaching.

The interpretation of path coefficients, significance values, and effect sizes was used to establish the strength and direction of the relationships.

Bootstrapping (5,000 resamples) was used to investigate the mediating role of Digital Leadership. The bootstrapped indirect effect was deemed to be significant and the confidence intervals (CI) were not found to

contain zero, which led to the establishment of mediation. The analysis established the extent to which Digital Leadership moderated the impact of ICT Engagement on Teaching Performance partially or completely.

Ethical Consideration

The research also conformed to the accepted ethical principles in research involving human subjects. The institutional research committee was approached before data collection. All teacher-respondents in the ALS were informed about the purpose of the study, procedures involved, and their right to withdraw at any point in time, which informed consent was obtained.

The confidentiality and anonymity of participants were assured; no personal data were gathered, and all the answers were coded. Data were also kept in password-protected files that only the researcher could access, in accordance with the Data Privacy Act of 2012 (RA 10173), and were only utilized in the academic field.

The involvement was fully voluntary, and no incentives or force were applied, and the research was not dangerous because all questions in surveys were connected only with professional activity and impressions. The IPCRF and PMES guidelines were used in accordance with the DepEd policies in DM 017, s. 2025, which stipulates ethical management of the information about teacher performance.

RESULTS AND DISCUSSION

This chapter presents and interprets the findings of the study in relation to the research questions posed.

Descriptive Statistics

Table 1 Respondents' Level of ICT Engagement

Dimensions	**Mean**	**SD**	**Interpretation**
ICT Self-Concept	2.38	0.134	Low
ICT Social Exposure	2.46	0.086	Low
Interest in ICT	2.63	0.194	High
Interest in Mobile Devices	2.54	0.200	High
Total	**2.50**	**0.107**	**Low**

Legend: 1.00-1.179 (Very Low); 1.80-2.59 (Low); 2.60-3.39 (Moderate); 3.40-4.19 (High); 4.20-5.00 (Very High)

Table 1 presents the level of ICT Engagement of the respondents across four dimensions: ICT Self-Concept, ICT Social Exposure, Interest in ICT, and Interest in Mobile Devices. The findings indicate a generally low level of ICT engagement among ALS teachers. ICT Self-Concept (M = 2.38) and ICT Social Exposure (M = 2.46) were both rated as Low, suggesting limited confidence in ICT skills and minimal participation in digitally mediated professional interactions and collaboration. These results imply that, despite access to technology, many teachers may lack the confidence and social integration necessary for sustained ICT-supported instructional practice. Similar patterns have been observed in resource-limited and community-based learning environments, where restricted access to digital tools, unstable internet connectivity, and limited opportunities for technology-mediated instruction constrain ICT competence development (Radiamoda et al., 2024; Mahinay & Manla, 2025).

In contrast, higher mean scores were observed for Interest in ICT (M = 2.63) and Interest in Mobile Devices (M = 2.54), indicating a relatively high level of motivation and openness toward using digital technologies in

both personal and professional contexts. This finding suggests that ALS teachers possess motivational readiness to engage with ICT, even when technical competence and institutional support remain limited. Consistent with Pakino and Ubayubay (2024), teachers may demonstrate strong interest in ICT use despite constraints related to training and organizational support.

However, despite these interest-based strengths, the overall mean ICT Engagement score (M = 2.50), interpreted as Low, underscores that motivation alone does not translate into effective ICT utilization. Confidence and social exposure remain critical gaps that require targeted support. This observation aligns with previous research indicating that high motivation does not necessarily result in effective ICT integration in contexts characterized by limited infrastructure and geographically dispersed learning environments (Paudel, 2020; Joshi & Khatiwada, 2024). Collectively, these findings highlight the need for sustained professional development, mentoring, and structured digital collaboration spaces to enhance ICT competence among ALS teachers.

Although ICT Engagement was modeled as a higher-order construct in the structural equation model, the descriptive results reveal meaningful variation across its underlying dimensions. Lower levels of ICT self-concept and social exposure may constrain teachers' ability to translate interest into effective instructional practice, while higher interest-based scores reflect motivational readiness that has not yet been fully supported by skills development or collaborative digital environments. This imbalance helps explain why ICT Engagement emerged as a strong predictor of teaching performance while still requiring reinforcing mechanisms such as digital leadership and structural support within ALS contexts.

Table 2 Respondents' Assessment of Digital Leadership demonstrated by Education Program Specialist

Dimensions	**Mean**	**SD**	**Interpretation**
Innovative Digital Leadership	3.05	0.203	Moderate
Supportive Digital Leadership	3.12	0.131	Moderate
Total	**3.08**	**0.049**	**Moderate**

Legend: 1.00-1.179 (Very Low); 1.80-2.59 (Low); 2.60-3.39 (Moderate); 3.40-4.19 (High); 4.20-5.00 (Very High)

Table 2 shows the evaluation of the Digital Leadership exhibited by Education Program Specialists (EPS) by the respondents along two dimensions, namely, innovative and supportive digital leadership. The findings indicate that, both Innovative Digital Leadership (M = 3.05) and Supportive Digital Leadership (M = 3.12) had a rating of Moderate. This means that EPS are viewed to have been digital leaders to a decent degree, but not at all times with high levels. The moderate score of innovative digital leadership implies that although EPS introduce digital tools, model ICT use, and encourage technology-based initiatives, the practices are not yet well integrated and uniformly exhibited in all the ALS learning settings. This is consistent with the results of the recent research that revealed digital leadership in education systems tends to be uneven in cases where leaders themselves are not exposed, trained, or institutionally supported to maintain digital innovation (Eberl and Drews, 2021).

Equally, a moderate rating of supportive digital leadership indicates that teachers believe that EPS is offering some degree of digital guidance, motivation, and support, however, the support might not be as extensive or sustained as to yield a profound impact on the digital competence of teachers. Research conducted at the national and international levels indicates that successful digital leadership is based on sustained mentoring, the presence of technical assistance in time, and a clear example of technology-based practices, which are not always well-developed in decentralized or resource-limited education (Erhan et al., 2022). The small values of standard deviations also suggest similar perceptions among teachers on the EPS leadership behaviors.

The general average of 3.08, which can be translated into the concept of Moderate, supports the notion that EPS reflect digital leadership to the functional but not optimal extent. This aligns with the findings that indicate that most education supervisors and middle-level leaders have positive orientations with regard to digital transformation, yet they still lack the systemic, professional development, and strategic frameworks to embrace strong digital leadership in totality (Joshi & Khatiwada, 2024). Therefore, although EPS are currently contributing significantly towards the integration of ICT in the ALS program, there is still a lot to be desired. The empowerment of EPS by means of specific capacity-building initiatives, digital coaching, and long-term mentoring can further enable ALS teachers to improve their ICT usage and digital teaching.

Table 3 Teaching Performance Among ALS Teachers

Rating	**Description**	**Frequency (f)**	**Percentage (%)**
4.50 – 5.00	Outstanding	30	15.00%
3.50 – 4.99	Very Satisfactory	170	85.00%
2.50 – 3.49	Satisfactory	0	0%
1.50 – 2.49	Unsatisfactory	0	0%
1.00 – 1.49	Poor	0	0%
Total		**200**	**100%**

Legend: 1.00-1.179 (Very Low); 1.80-2.59 (Low); 2.60-3.39 (Moderate); 3.40-4.19 (High); 4.20-5.00 (Very High)

Table 3 shows the ALS teacher ratings on teaching performance according to the standard DepEd performance descriptors. The findings indicate that a significant percentage of the respondents, which was 170 teachers (85%), had a rating of Very Satisfactory (3.50-4.49). This implies that the majority of the ALS teachers are in consistent and often above the required standards of performance in such aspects as the preparation of lessons, their delivery, the support of learners, documentation, and professional duties. Also, 30 teachers (15%) received an Outstanding rating (4.50-5.00) indicating outstanding performance in terms of strong instructional effectiveness, initiative, and dedication to providing quality ALS services.

It is worth noting that there were no respondents who were rated as Satisfactory, Unsatisfactory, or Poor. Although this can be true strengths of the ALS instruction, recent studies also indicate that teacher evaluation systems especially those based on supervisory appraisals tend to generate high scores or poor differentiation between ratings. As an example, Sartain (2024) has discovered that the results of teacher evaluations are often the same and highly rated because of the perceived fairness, accuracy, and relationships with supervisors. Similarly, Prieto et al. (2023) reported large improvement and concentration in teacher evaluation scores over time, which raises the question of whether such systems are reliable in discriminating real changes in teacher performance. These results indicate that the concentration of the Very Satisfactory and Outstanding ratings in the current study could be caused not only by the competence of teachers but also by the structural predispositions of performance evaluation systems.

Overall, the results indicate a very positive performance profile of ALS teachers, as all of the respondents were located in the highest rating descriptors. Such a high performance can be contributed by their adherence to the ALS mission, continuous professional growth, and their supervisor Education Program Specialists (EPS). Other studies also point out that adaptability, learner-centered strategies, and regular administrative support are linked to high performance in alternative learning settings (Mahinay and Manla, 2025). But when this distribution is interpreted, one should take into consideration the possibility of ceiling effects in the processes of rating in DepEd which might explain the lack of lower scores to some extent.

Measurement Model

Confirmatory Factor Analysis (CFA) was used to initially test the measurement model to determine the reliability and validity of the latent constructs used in the study which are ICT Engagement and Digital Leadership. In the case of ICT Engagement, the four-factor model, which included ICT Self-Concept, ICT Social Exposure, ICT Interest, and Mobile Device Interest, provided an excellent overall fit to the data. The results of the model were kh2(588) = 643.051, p =.057, kh2/df = 1.094, CFI =.978, TLI =.977, SRMR =.0523, RMSEA=.022, and PCLOSE=1.000, which are all above the recommended good model fit thresholds. These findings prove that the conceptualization of ICT Engagement in a four-dimensional model is quite consistent with the observed data. All the standardized factor loadings were found to be significantly significant ($p < .001$) with a range of .50 to.86 with respect to ICT Self-Concept, ICT Social Exposure, ICT Interest, and Mobile Device Interest. These values are above the.50 minimum requirement and are a sign of strong item reliability and convergent validity. Inter-factor correlations were moderate (r =. 09 to.52), which is evidence of discriminant validity and demonstrates the fact that the four domains are related, even though they are empirically separate.

In the same way, the two-factor Digital Leadership model of Innovative Digital Leadership and Supportive Digital Leadership also exhibited good psychometrics. The CFA gave k2(169) = 210.580, p =.016, k2/df = 1.246, CFI =.984, TLI =.982, IFI =.984, GFI =.906, AGFI =.884, SRMR =.0316 and RMSEA =.035 with PCLOSE =.955. Even though the chi-square value was significant, this index is very sensitive to the size of the sample, and the combination of the alternative fit indices is a confirmation of a well-fitting model. The loading of all items was high and strong ($p < .001$), the values were between.75 and.95 in the case of Innovative Digital Leadership and between.69 and.96 in the case of Supportive Digital Leadership. These large loadings show good convergent validity, which means that the sets of indicators are effective measures of their respective dimensions. The internal consistency and the adequacy of the model are also supported by the low RMR and SRMR values. In addition, the values of parsimony indices (PNFI = .821; PCFI = .875) and desirable values of information criteria (AIC = 292.580) support the fact that the measurement structure proposed can be considered parsimonious and theoretically justified.

In general, the CFA findings support the claim that all latent constructs in the study have a high level of reliability, convergent validity, and discriminant validity. The high factor loadings and strong model fit indices show that both ICT Engagement and Digital Leadership are both accurately and consistently measured. As the measurement models are clear, the constructs are considered suitable to be analyzed further in the structural model to test their predictive and mediating relationships.

Structural Model

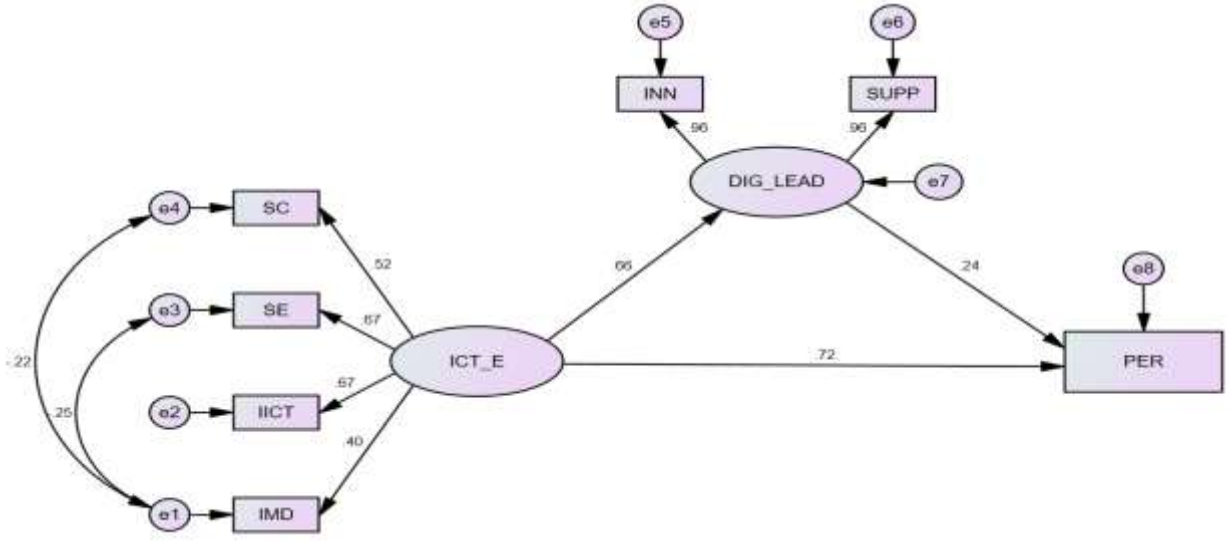

Figure 2. Final Model of the Study

Table 4 Structural Model Results (Direct, Indirect, and Total Effects)

Path	Standardized Estimate (β)	S.E.	p-value	Interpretation	Decision
ICT_E→DIG_LEAD	.658	.496	<.001	Significant	Reject $H0_1$
ICT_E→PER	.716	.270	<.001	Significant	Reject $H0_2$
DIG_LEAD→PER	.237	0.38	.003	Significant	Reject $H0_3$

Note: ICT_E (ICT Engagement); SC (ICT Self Concept); SE (ICT Social Exposure); IICT (Interest in ICT); IMD (Interest in Mobile Devices); DIG_LEAD (Digital Leadership); INN (Innovative); SUPP (Supportive); PER (Teacher's Performance); S.E. (Standard Error)

As indicated in Table 4, path analysis in ICT Engagement was a strong predictor of Digital Leadership, and the standardized coefficient (b =.658, p <.001) was high. This result suggests that teachers of ALS who exhibit greater confidence, interest, and active use of ICT tend to feel that their Education Program Specialists (EPS) exhibit greater digital leadership behaviors. This is in line with the studies that indicate that the digital behaviors and attitudes of teachers are closely associated with the perception of supervisory support and leadership practices associated with technology use (Abu-Tineh et al., 2025). This confirms the theoretical perspective that leadership and ICT engagement is a reciprocal relationship, with increased teacher ICT engagement being associated with increased awareness of digital leadership efforts.

The direct impact of ICT Engagement on Teaching Performance was also significant and strong (b =.716, p <.001). This implies that the more teachers become active in the use of ICT either in terms of competence, confidence or frequent use of digital tools, the more they are likely to reach higher levels of instructional performance as evaluated by DepEd indicators of IPCRF. This observation aligns with the recent research of Abimbola et al. (2025) that indicated that ICT competence and use enhance instructional preparation, efficiency of delivery, assessment, and support to learners. It has also been found out that teachers who possess better ICT-related self-efficacy tend to be more likely to integrate technology, which then improves classroom performance and teacher performance (Singh and Singh, 2023).

Digital Leadership also had a substantial yet the small direct impact on Teaching Performance (b =.237, p =.003). This signifies that EPS digital leadership in its innovative and supportive aspects has a positive contribution to the performance outcomes of teachers. Although this pathway is not as large as the impact of ICT Engagement, its importance is worth highlighting the importance of such leadership behaviors as modeling digital practices, providing guidance in a timely manner, and promoting the integration of technology. This observation is consistent with the larger body of literature, which highlights that leadership is an enabling factor in the uptake of technologies and that positive digital leadership makes teachers confident, innovative, and leads to better pedagogical performance (Saeed and Kang, 2024). All in all, the structural model indicates that individual ICT engagement and supervisory digital leadership are both significant predictors of ALS teacher performance, and teacher-level engagement is the key contributor.

It is also likely that contextual constraints common in ALS settings such as unstable internet access, limited digital infrastructure, and heavy community-based workloads shape both ICT engagement and the effectiveness of digital leadership, even though these factors were not directly modeled.

Table 5 Indirect Effects (Bootstrapped, 5,000 samples)

Indirect Path	Standardized Indirect Effect (β)	SE	95% CI (Lower-Upper)	p-value	Interpretation
ICT_E→DIG_LEAD→PER	.156	.052	.040 - .242	.016	Significant (Partial Mediation)

Bootstrapping was done to test mediation using 5,000 samples. The indirect impact of ICT Engagement on Teaching Performance via Digital Leadership was also substantial yet insignificant (b =.156, 95% CI [.040, .242], p =.016). Since the direct effect (b =.716) and the indirect effect (b =.156) were significant, it proves a partial mediation. The fact that the indirect effect is rather small suggests that Digital Leadership is a booster but not a complete determinant of the effect of ICT Engagement on teaching performance. ICT Engagement is thus the most dominant predictor.

This trend is in line with the recent research that indicated that digital leadership enhances digital competence of teachers and facilitates successful digital practice but its impact is generally subordinate to teacher-level ICT capability (Lukman and Yune, 2025). Present-day findings also indicate that digital competence, confidence, and ICT engagement of teachers have direct impacts on instructional performance and digital preparedness more than leadership variables (Ozan, 2025). High ICT engagement in teachers is an intrinsic characteristic that leads to better instructional efficiency, innovativeness, and support to learners, and therefore, teacher-level ICT capacity is the main cause of performance outcomes.

The findings of the mediation also correspond to the studies, which state that digital leadership is an enabling or reinforcing factor, which establishes positive digital environments, exemplifies ICT use, and directs teachers, but not the more dominant causal role of teacher ICT competence (Antonopoulou et al., 2025). Leadership has a positive contribution to the pathway but does not act as a complete mediator.

The combination of the evidence allows concluding that the teaching performance of the ALS teachers is influenced by their ICT Engagement, whereas Digital Leadership is a complementary effect that reinforces but not substitutes teacher-level predictors. Leadership is an enhancing condition, which supports the impact of teacher ICT engagement instead of being the primary causal pathway.

Table 6 Model Fit Indices of the Structural Model

Fit Index	**Value**	**Interpretation**	**Decision**
χ^2 (df = 10), p-value	7.409 (.686)	Non-significant; good fit	Reject $H0_5$
χ^2/df	0.741	Excellent fit (< 3)	
GFI	.971	Excellent	
AGFI	.971	Excellent	
CFI	1.000	Excellent (> .95)	
TLI	1.007	Excellent (> .95)	
RMSEA	.000	Excellent (< .05)	
SRMR	.004	Excellent (< .08)	

Table 6 shows the model fit indices of the structural model and all the model fit indices are an excellent fit between the hypothesized model and the observed data. The chi-square value was not significant, kh2(10) = 7.409, p =.686, which shows that the model is not significantly different than the sample data, which indicates good fit especially when there is support by other strong fit indices. The chi-square/df (kh2/df = 0.741) is much less than the suggested level of 3, which proves that the model has an excellent level of parsimony. The Goodness-of-Fit Index (GPI = .971) and the Adjusted Goodness-of-Fit Index (AGFI =.971) are both above the.90 threshold, indicating that a large percentage of the variance in the sample covariance matrix is explained by the model.

Additional evidence of the model fit is that Comparative Fit Index (CFI = 1.000) and Tucker-Lewis Index (TLI = 1.007) values exceed the suggested cutoff point of.95, which implies that the model exhibits a better performance as compared to a null model. The root mean square error of approximation (RMSEA =.000) with PCLOSE value exceeding.05 indicates that the model fits well and the Standardized root mean square residual (SRMR =.004) is significantly lower than the.08 level, indicating that there are no significant residual values between the predicted and observed covariances. Together, these indices give solid grounds that the structural model is statistically sound, highly stable and suitable in interpreting the hypothesized relationship between ICT Engagement and Digital Leadership and Teaching Performance.

These fit values are within the suggested SEM ranges, with CFI and TLI values of over .95, RMSEA of less than.05, and SRMR of less than.08 being the best model fit (Kline, 2020; Hair et al., 2022).

CONCLUSION

This research paper has analyzed structural relationships between ICT Engagement, Digital Leadership and Teaching Performance of teachers in ALS school through a Structural Equation Modeling method. The results showed that ICT Engagement is the most consistent and the strongest predictor of teaching performance, and it has direct and indirect effects. The performance of teachers in terms of planning, delivering and assessing instruction will be better as shown by their IPCRF based performance ratings with higher confidence, interest, and active use of ICT. This highlights the main contribution of ICT-related beliefs and behaviors to improving the quality of instruction in non-formal learning institutions.

As shown by Education Program Specialists, Digital Leadership also played a significant predictive role in teaching performance, but with a smaller effect size. The mediation analysis established that Digital Leadership mediates the effect of ICT Engagement on teaching performance partially. This implies that although ICT Engagement in itself leads to improved performance, facilitating and innovative EPS digital leadership enhances the instructional performance of teachers. These results confirm the interactive nature of individual technological activity and leadership conditions on teaching effectiveness.

The results of the SEM showed that there was an excellent fit to the model, which empirically supported the theoretical pathways that were based on the Social Cognitive Theory, Transformational Leadership Theory, and the Technology Acceptance Model. A combination of these theories assists in explaining the role of internal ICT beliefs of teachers, external leadership support, and perceived usefulness of digital tools in a combined effect on performance in ALS.

In general, the research provides novel findings on ICT and digital leadership in the Alternative Learning System. The results highlight the importance of long-term ICT capacity-building, enhanced EPS-based digital coaching, and support systems facilitating technological competence and innovation. The improvement of ICT Engagement and Digital Leadership will additionally enable DepEd to improve the quality of teaching in ALS and create more equitable and future-oriented outcomes of learning.

The findings may further inform policy through the development of structured Education Program Specialist (EPS) digital coaching frameworks and targeted ICT professional development programs that address both motivational and competence-based gaps among ALS teachers.

Limitations of the Study

Although the findings of this study are robust, several limitations should be acknowledged. First, the study relied primarily on self-reported and perception-based measures, which may be subject to response biases such as social desirability, particularly in the assessment of teaching performance and perceptions of digital leadership. Second, the cross-sectional research design limits causal inference; thus, the identified relationships should be interpreted as predictive and associative rather than causal, and the design does not allow examination of changes in ICT engagement, digital leadership practices, or teaching performance over time.

Third, the sample was limited to ALS teachers from a specific geographic division, which may restrict the generalizability of the findings to other regions or educational contexts where levels of ICT access, infrastructure, and supervisory support differ. Fourth, the structural model focused on three primary constructs such as ICT Engagement, Digital Leadership, and Teaching Performance and did not explicitly include contextual variables such as digital infrastructure availability, internet connectivity, workload, or access to professional development, which are particularly salient in ALS environments.

These limitations should be considered when interpreting the results. Future research may address these concerns by employing longitudinal designs, incorporating contextual and organizational variables, and using multi-source or observational data to provide a more comprehensive understanding of ICT integration and leadership influences in the Alternative Learning System.

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