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Instructional Leadership, Competency Skills, and Supervisory Practices toward the Development of Science, Technology, Engineering, and Mathematics (STEM) Learning Continuity Model

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ABSTRACT: Instructional leadership, competency skills and supervisory practices are crucial factors in ensuring STEM learning continuity during class disruptions, yet the correlation among these variables as predictors of learning continuity in STEM education need further explorations. In this study, the researcher investigates these dynamics among curriculum implementers in the City Schools Division of Cabuyao in the SY 2025-2026. Using a descriptive correlational research design, the study determines the level of instructional leadership, competency-skills, supervisory practices and how they affect the STEM Learning Continuity during class disruptions. Using purposive sampling, 340 curriculum implementers responded to a validated survey questionnaire which was analyzed Pearson moment correlation and multiple regression analysis using the SPSS software. The findings indicated a very high level of supervisory practices (mean=3.66, SD=0.28), followed by competency skills (mean= 3.52, SD=0.44), and instructional leadership (mean=3.57, SD=0.30), among curriculum implementers. The level of STEM learning continuity (mean=3.61, SD=0.27) was also found very high. The test of significance unveiled a strong and significant correlation between instructional leadership and competency-skills (r = 0.620) and between instructional leadership and supervisory practices (r = 0.632), while a moderate yet significant correlation between competency skills and supervisory practices (r = 0.568) at p-value <0.001. Regression analysis revealed that instructional leadership, competency skills and supervisory practices are significant moderate predictors of STEM learning continuity (R^2= 0.423, Adj.R^2 = 0.418 at p-value <0.001). It was further revealed that only instructional leadership (□=0.150, P-value = 0.11) and supervisory practices (□=0.472, P-value=<0.001) are significant predictors of STEM learning continuity during class disruptions. Based on these results, the researcher recommends implementing MLMN Model: A Systems and Leadership Approach on STEM Learning Continuity as a guide for curriculum implementers in ensuring STEM learning continuity during class disruptions.

KEYWORDS: Competency Skills, Curriculum Implementers, Class Disruptions, Instructional Leadership, Supervisory Practices, STEM Learning Continuity.

INTRODUCTION

STEM (Science, Technology, Engineering, and Mathematics) education plays a vital role in fostering innovation, scientific literacy, and economic growth in the 21st century. As explained by Hasanah (2020), STEM may be understood as a discipline, an instructional approach, a field of study, and a career pathway, highlighting its multidimensional nature in modern education. In the Philippine context, STEM education is institutionalized through the K to 12 Basic Education Curriculum under Republic Act 10533, which emphasizes interdisciplinary integration to develop critical thinking, problem-solving, and technological competencies. Globally, education systems have likewise prioritized learning continuity as part of the Sustainable Development Goals, particularly Goal 4, which ensures inclusive and equitable quality education for all (UNESCO, 2020). The increasing frequency of class disruptions—ranging from pandemics to natural disasters and climate-related hazards—has significantly challenged the delivery of STEM education. Reports from UNICEF (2023) and the Philippine Institute for Development Studies (PIDS) revealed substantial learning loss and declining student performance, a trend further reflected in the country's low ranking in reading, mathematics, and science in the Programme for International Student Assessment (PISA) results (OECD, 2023). These realities underscore the urgent need to strengthen systems that can sustain STEM learning continuity amid persistent disruptions.

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Curriculum implementers are taking initiatives and support in the implementation of Learning and Service Continuity Plan (DO 12, s.2020 & DO 22, s. 2024) during class disruptions. Instructional leadership in times of class disruptions requires expertise in goal setting, leading the instructional program, and creating the conditions for a successful school environment (Bixler & Ceballos, 2025). Alongside supervisory practices that play vital roles in school effectiveness and ensuring learning continuity (Leithwood, et.al., 2020 and Le Fevre, 2021) shifting for flexible learning modalities, teacher support, system strengthening and driving educational reforms that seek to reshape conventional teaching and learning methodologies (Hallinger et al., 2020). Despite its prominence globally, research on instructional leadership continues to evolve, especially in the context of post pandemic educational recovery, digital transformation, and equity in under-resourced schools (Ma and Marion, 2024; van der Meer, 2024).

In this study, the researcher posits on the underpinning theoretical foundations as its framework, namely the (a) Transformational Leadership Theory (b) Instructional Leadership Model; and (c) Systems Theory. Transformational leaders foster supportive organizational climates, enhance teacher commitment, and improve instructional practices by encouraging collaboration and change relevant in STEM learning continuity, where rapid shifts—such as digital transformation and flexible modalities—require leaders who can mobilize stakeholders, promote innovation, and sustain motivation despite disruptions. In an open system, the Systems Theory take all these components of learning continuity indispensable from each other. Strong competency skills affect learning alongside the support of instructional leaders and supervisory practices.

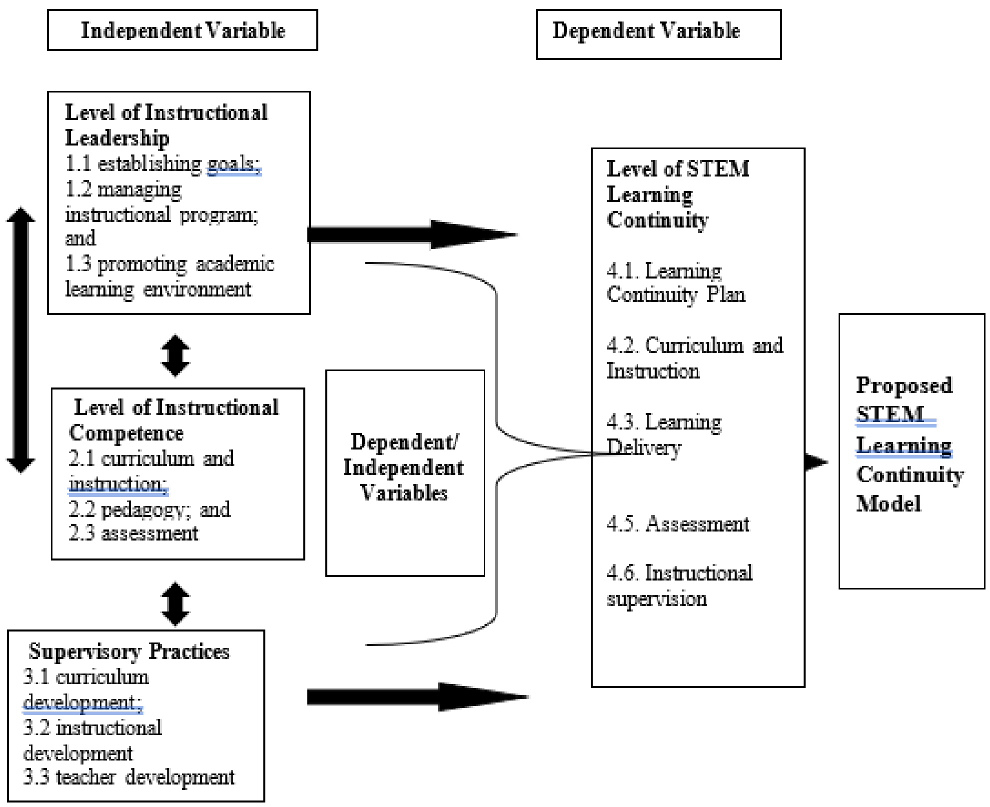

Figure 1. *The operational model of the study showing the relationships of variables*

Figure 1 above shows the operational model of the study. The level, relationships, and predictive power of instructional supervision, competency skills, and supervisory practices of the study are treated as the independent variables and STEM Learning Continuity as the dependent variable and the results of which was used by the researcher to develop a proposed STEM Learning Continuity Model.

Research suggests that schools with well-established continuity models are more resilient, maintain higher student engagement, and achieve better learning outcomes despite external challenges (OECD, 2021). Studies have documented various approaches to STEM learning continuity. For instance, Lin and Chen (2021) propose a flexible STEM instruction model combining digital simulations, modular learning, and project-based activities to mitigate interruptions. Similarly, Adedoyin and Soykan (2020) emphasize the integration of remote laboratory simulations and inquiry-driven tasks within continuity frameworks, highlighting the importance of teacher competence and leadership support. These models demonstrate that learning continuity is not solely dependent on technology; it also requires human capacity—effective leadership, competent teaching, and structured supervision.

There is no study conducted yet on the characteristics of the respondents and no empirical evidence on relationships and predictive power in terms of instructional leadership, competency skills and supervisory practices of curriculum implementers and STEM learning continuity during class disruptions. A dearth study on the dynamics of these variables was also considered by the researcher, thus, further research on this study was made.

Specifically, the study was guided by the following questions:

1. What is the level of instructional leadership of curriculum implementers in terms of:
    1.1. defining and establishing goals;
    1.2. managing instructional program; and
    1.3. promoting academic learning environment?
2. What is the level of competency-skills of curriculum implementers in terms of:
    2.1. curriculum and instruction.
    2.2. pedagogy; and
    2.3. assessment?
3. What are the supervisory practices of curriculum implementers in terms of:
    3.1. curriculum development;
    3.2. instructional development; and
    3.3. teacher development?
4. Is there a significant relationship between the:
    4.2. level of instructional leadership and competency skills.
    4.3. level of instructional leadership and supervisory practices.
    4.4. level of competency skills and supervisory practices?
5. What is the level of STEM learning continuity during class disruptions in terms of:
    5.1. learning continuity plan
    5.2. curriculum and instruction
    5.3. learning delivery
    5.4. assessment
    5.5. instructional supervision
6. How predictive are the variables, the level of instructional leadership practices, competency skills, and supervisory practices, taken singly or in combination to predict STEM learning continuity in the City Schools Division of Cabuyao?
7. Based on the results, what STEM Learning Continuity Model during class disruptions can be proposed?

MATERIALS AND METHODOLOGY

This study utilized a quantitative descriptive-correlational design with regression analysis, that describes and correlates the instructional leadership, competency skills, supervisory practices of curriculum implementers, and the STEM learning continuity.

The researcher used purposive sampling of 340 curriculum implementers in public schools during the School Year 2025-2026 consisting of 29 School Heads, eight (8) Assistant Principals, 70 Master Teachers, 12 supervisors, 136 elementary and 85 secondary teacher respondents. These curriculum implementers were selected based on the criterion set in the study that only Math and Science (STEM) curriculum implementers with at least three consecutive years' experience in implementing Science and Math curriculum were included in the study.

The researcher utilized a researcher-made survey questionnaire using a 4-point Likert Scale with a scale of 4 rated as Always (A) with verbal interpretation as Very High (VH) and a scale of 1 rated as Never (N) verbally interpreted as Very Low (VL). It was subjected to pilot testing at DepEd SDO Sta Rosa City. Also, the research instrument was validated by three (3) field experts. The Item Content Validity Index (I-CVI) and Scale Content Validity Index (S-CVI) were computed as 1.00, respectively indicating excellent validity. Moreso, the result of the Cronbach alpha reliability test in validating and assessing the reliability and internal consistency of the research instrument for all the indicators were found to have an excellent internal consistency on instructional leadership with Cronbach Alpha of 0.929, competency skills ($\alpha = 0.960$), supervisory practices ($\alpha = 0.907$) and learning continuity ($\alpha = 0.942$) indicative of a higher agreement between items for each participant across a set of questions that were found to be consistent.

The survey questionnaire was administered at SDO Cabuyao City in adherence to Data Privacy Act of 2012 using the Google Form by which the researchers allowed two weeks prior to data collection. The data was then cleaned, tallied and submitted to a statistician for data analysis. The weighted mean with standard deviation and ranking were used to determine the level of instructional leadership, competency-skills, supervisory practices and STEM learning continuity in the study. To determine the relationships among these variables, Pearson r moment correlation was used while the predictive power of each variable was analyzed using the correlational design of Multiple Regression utilizing the SPSS Package.

RESULTS AND DISCUSSION

The findings of the study are presented in accordance with the research questions, focusing on the levels of instructional leadership, competency-skills, supervisory practices, STEM learning continuity and the relationships among variables.

Table 1. Summary of the Overall Level of Instructional Leadership of Curriculum Implementers

Scale	Domains	*WM*	*SD*	Interpretation
Instructional Leadership	Defining and establishing goals	3.58	0.34	Very High
	Managing instructional program	3.48	0.36	Very High
	Promoting academic learning environment	3.64	0.39	Very High
OVERALL		**3.57**	**0.30**	**Very High**

Legend: Scoring Range (Verbal Interpretation): 3.25 – 4.00 (Very High); 2.50 – 3.24 (High); 1.75 – 2.49 (Low); 1.00 – 1.74 (Very Low)

Table 1 shows the summary of the overall level of instructional leadership of curriculum implementers. The overall weighted mean of 3.57 (SD=0.30) rated as Very High indicates that the respondents have perceived Very High extent of their instructional leadership focusing on promoting academic school climate (WM=3.64, SD=0.39), followed by defining and establishing goals (WM=3.58, SD= 0.34) and lastly, managing instructional program (WM=3.48, SD=0.36).

The findings affirm that instructional leadership plays a central role in shaping a supportive and academically focused learning environment. For instance, Rivera (2024) reported that school administrators exhibited effective instructional leadership practices in creating a student-centered learning climate, which contributed to a highly satisfactory level of school performance (Delgado-Galindo et al. (2025) and is closely associated with higher academic performance and school effectiveness.

However, managing instructional program posits several challenges as revealed in the study which was ranked the least (WM=3.48, SD=0.36) among the three domains of instructional leadership. As such, Professional Development (PD) program plays key role in aligning training with the current needs of the curriculum. Relative to this, Shahat et al. (2025) evaluated competency-based STEM training and found that highly effective leaders ensure PD is not just available, but accessible to all. This is supported by Baniqued and Bautista (2024) arguing that the driver for tomorrow's classroom is leadership that provides "transformative" rather than "reactionary" PD as majority of training is still extremely general, compliance-driven, and unrelated to the real difficulties faced by teachers, which ranges from integrating digital technologies to controlling student conduct (PIDS, 2025). Nevertheless, studies also flagged rising behavioral and mental health issues among students, particularly anxiety, attention issues, and a lack of socialization, which the current teacher training programs rarely address.

This implies further that leadership efforts directed toward fostering a conducive learning environment are positively perceived and highly rated by teachers and stakeholders. Similarly, Akomodi (2025) emphasized that instructional leaders significantly influence school culture, teacher collaboration, and student achievement by establishing clear academic expectations and fostering environments that support teaching and learning. Research consistently shows that promoting academic learning environment improves academic performance and engagement (Munna & Kalam, 2021).

Table 2. Overall Level of Competency Skills of Curriculum Implementers

Scale	Domains	*WM*	*SD*	Interpretation
Competency skills	Curriculum and instruction	3.55	0.46	Very High
	Pedagogy	3.51	0.47	Very High
	Assessment	3.49	0.51	Very High
OVERALL		**3.52**	**0.44**	Very High

Legend: Scoring Range (Verbal Interpretation): 3.25 – 4.00 (Very High); 2.50 – 3.24 (High); 1.75 – 2.49 (Low); 1.00 – 1.74 (Very Low)

The overall level of competency skills of curriculum implementers in Table 2 above shows an average weighted mean of 3.52 (SD=0.44) indicates that curriculum implementers have very high competency skills in curriculum and instruction (WM=3.55, SD=0.46), followed by pedagogy (WM=3.51,SD=0.47) and lastly in terms of assessment (WM=3.52, SD= 0.51). This is supported by a study conducted by Capillanes (2025) that school heads exhibited a very high level of instructional competence, particularly in curriculum development and assessment, suggesting strong competence in curriculum planning and instructional alignment. These competencies enable curriculum implementers to guide teachers in delivering standards-based instruction and achieving desired learning outcomes.

Similarly, Pana (2024) found that school heads received high ratings in instructional leadership, emphasizing their strengths in managing instructional programs and supporting curriculum implementation, which contributes to improved teacher performance and instructional quality. Likewise, Rodulfa (2023) found that instructional leadership enhances teachers' sense of efficacy in implementing instructional modalities, further supporting the high competency levels of curriculum implementers in managing teaching and learning processes.

The results also indicate that while curriculum implementers generally demonstrate high competency in curriculum and instruction, their assessment competencies tend to receive comparatively lower ratings, with pedagogy often positioned between these two domains. This pattern suggests an imbalance in professional competencies, where curriculum alignment is prioritized more than assessment literacy and pedagogical refinement. These results further confirm that under the domain of curriculum and instruction, high levels of competence were consistently reported among instructional leaders. These results are consistent with Aquino (2025) which found that curriculum implementers in high-performing institutions demonstrate strong capabilities in curriculum coordination, alignment with standards, and quality assurance mechanisms, contributing to effective teaching-learning systems. These findings affirm that curriculum-related competencies are well-developed and often receive higher evaluation ratings due to structured frameworks and institutional support.

While strong performance in curriculum alignment reflects structured institutional support, the relatively lower ratings in assessment underscore the need for enhanced capacity-building in data-driven instruction, assessment design, and feedback utilization. Strengthening these competencies is essential to achieve a more balanced and holistic instructional leadership profile.

Table 3. Overall Level of Supervisory Practices

Scale	Domains	WM	SD	Interpretation
Supervisory Practices	Curriculum development	3.68	0.35	Very High
	Instructional development	3.68	0.34	Very High
	Teacher development	3.62	0.41	Very High
OVERALL		**3.66**	**0.28**	**Very High**

Legend: Scoring Range (Verbal Interpretation): 3.25 – 4.00 (Very High); 2.50 – 3.24 (High); 1.75 – 2.49 (Low); 1.00 – 1.74 (Very Low)

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The overall level of supervisory practices of curriculum implementers at SDO Cabuyao City is presented in Table 3 above. The results show that curriculum implementers, demonstrate overall weighted mean of 3.66 (SD=0.28) was very high levels of supervisory practices in the areas of curriculum development (WM=3.68,SD=0.35), instructional development (WM=3.68, SD=0.35), and teacher development (WM=3.62, SD= 0.34) , reflecting strong supervisory practices .

This is clearly stated in the research findings of Hallinger and Murphy (2022) that leaders often fall back on structured supervision during crises because it provides a sense of normalcy and control. While this leads to high scores in supervisory practices, it often fails to measure the actual effectiveness of the STEM pedagogy being observed.

Corollary to this, Baniqued and Bautista (2024) noted that without active leadership support for at-home lab kits or mobile-based inquiry, STEM teachers default to passive instruction during interruptions. Their study highlights that a low rating in "resourceful leadership" directly correlates to a decline in student engagement in inquiry-based science.

Similarly, Abio (2026) found that school heads consistently practiced curriculum review, program development, and adaptation, with ratings ranging from high to very high, demonstrating their capability to lead curriculum reforms and ensure effective implementation. A note of caution is due here since in a study of Amor (2025) that investigated the qualities of school heads and teachers, their supervisory practices, and teaching performance in the Almagro District, findings revealed that School heads displayed strong efficiency in supervision, especially in strategic leadership and relationship building while teachers demonstrated positive performance, outshining in community linkages and content knowledge but seeking enhancement in the learning environment and curriculum planning.

These practices are explicitly aligned with the Philippine Professional Standards for School Heads (PPSSH) on Domain 3 (Focusing on Teaching and Learning), which highlights the role of school heads in monitoring instruction, supporting pedagogical innovation, and ensuring learning effectiveness. Likewise, Philippine Professional Standards for Supervisors (PPSS) underscores instructional supervision and quality assurance, requiring supervisors to mentor teachers and promote evidence-based instructional practices.

The results imply that the high ratings of supervisory practices among curriculum implementers are strongly attributed to their effectiveness in leading curriculum development, enhancing instructional practices, and supporting teacher development. These domains function synergistically, as strong curriculum leadership informs instructional improvement, while continuous teacher development sustains effective teaching and learning. Consequently, curriculum implementers who excel in these supervisory areas are perceived as highly competent instructional leaders capable of driving educational quality and student achievement.

Table 4. Overall Level of STEM Learning Continuity during Class Disruptions

Scale	Domains	WM	SD	Interpretation
Learning continuity	Learning continuity plan	3.63	0.31	Very High
	Curriculum and learning support	3.74	0.29	Very High
	Learning delivery	3.61	0.41	Very High
	Learning assessment	3.67	0.31	Very High
	Instructional supervision	3.41	0.47	Very High
OVERALL		**3.61**	**0.27**	**Very High**

Legend: Scoring Range (Verbal Interpretation): 3.25 – 4.00 (Very High); 2.50 – 3.24 (High); 1.75 – 2.49 (Low); 1.00 – 1.74 (Very Low)

Table 4 summarizes the overall level of STEM Learning Continuity during class disruptions in the City Schools Division of Cabuyao based on five key domains arranged from the highest to the least rank namely (1) Curriculum and learning support (WM=3.74,SD=0.29) ; 2) Learning assessment (WM=3.67, SD=0.31); (3) Learning continuity plan (WM=3.63,SD=0.31); (4) Learning delivery (WM=3.61,SD=0.41) and lastly, (5) instructional supervision (WM=3.41, SD=0.47) with an overall weighted mean of 3.61 (SD=0.27) interpreted as very high. The results show that there is a consistent pattern in STEM learning continuity where curriculum implementers demonstrate high competency in curriculum and learning support, often exceeding performance in learning assessment exceeding learning delivery, while placing learning continuity planning and instructional supervision emerge

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as comparatively weaker areas. This implies that even in adverse situations, instructors and students stay guided by targeted learning outcomes.

These results show that in the domain of curriculum and learning support in STEM education research, it was emphasized that well-structured, relevant, and adaptive curricula—supported by instructional materials and teacher capacity-building—are central to sustaining STEM learning continuity (Lavi et al. (2021), McIntyre et al. (2021), and Huang et al. (2022). These elements contribute significantly to student engagement and achievement, and in the Philippine context, instructional leaders prioritize curriculum alignment, resource provision, and learning support systems, which are essential in maintaining continuity across modalities. Aquino (2025) found that high-performing institutions demonstrate strong curriculum coherence, alignment with standards, and provision of instructional resources, reinforcing the high rating of curriculum implementers in this area.

In comparison, learning assessment, while still rated high, is often slightly lower than curriculum support. Research indicates that although teachers, school leaders and supervisors implement varied and flexible assessment strategies, challenges remain in ensuring consistency, validity, and effective use of assessment data. Studies on learning continuity highlight that assessment practices are implemented but require further strengthening in terms of data-driven feedback and alignment with learning outcomes, which explains why assessment, though strong, does not surpass curriculum-related competencies.

On the other hand, learning continuity planning tends to receive relatively lower ratings due to the complexity of designing responsive and sustainable systems. This is observed in the drastic and unpredictable class disruptions that compelled curriculum implementers to do necessary adjustments and re-entry in the Learning Continuity Plan (LCP) which is directly affected by prevailing policies, regulatory requirements and accounting procedures that hinder most of the resources available to be fully utilized under various circumstances (DepEd Order 22, s. 2024). As supported by the study of Dayagbil et al. (2021), while institutions implemented continuity plans, they encountered significant challenges such as limited infrastructure, inadequate preparation, and difficulties in planning for diverse learner needs, particularly during abrupt transitions to remote and flexible learning. These findings suggest that planning processes, are not always fully optimized or context-responsive, resulting in comparatively lower performance ratings. Research highlights that STEM learning environments demand innovative pedagogical approaches and technological integration, which are not always consistently achieved, thereby affecting delivery effectiveness.

This result ties well with the current educational system in the Philippines demonstrating that the Basic Education Learning Continuity Plan (BE-LCP) effectively ensured curriculum adjustments and learning support that maintained high engagement in STEM subjects. However, this is inconsistent with what has been found in previous reports of UNESCO and EDCOM 2 which highlighted that despite national policies, the actual allocation of hardware (laptops, e-readers) at the school level remains inconsistent which is attributed to school heads' "limited vision" on how to pivot from traditional modular instruction to integrated technology-mediated learning (UNESCO, 2022) for learning delivery during class disruptions.

Furthermore, contemporary STEM education research emphasizes that effective learning continuity requires a holistic integration of curriculum, pedagogy, assessment, and delivery systems. However, the literature shows that curriculum support is often the most structured and supported domain, while planning and delivery require more dynamic, context-sensitive competencies that are still developing among curriculum implementers.

Table 5. Relationship Between the Level of Instructional Leadership and Level of Competency Skills of Curriculum Implementers

Independent	Dependent	Pearson's *r*[a]	*p*-value	Interpretation[b]
Instructional leadership	Competency skills	0.620 (strong)	< .001	Significant

Note. [a]Correlation: 0.00 – 0.19 (very weak); 0.20 – 0.39 (weak); 0.40 – 0.59 (moderate); 0.60 – 0.79 (strong); 0.80 – 1.00 (very strong).
(Evans, 1996) [b]Significant at <.05.

Table 5 above presents the relationship between instructional leadership and competency skills of curriculum implementers. The analysis revealed a strong positive correlation between instructional leadership and competency skills (r = 0.620),

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which is statistically significant at $p < .001$ suggesting that instructional leaders often possess high competency levels, creating a synergistic effect on school management particularly in areas such as pedagogical strategies, assessment practices, and instructional delivery in STEM education. These findings align with Shaked (2024), who posits that instructional leadership serves as the strategic engine of school improvement. While competency provides the tools, leadership provides the direction. This is supported by Aquino et al. (2021) which claimed that school heads' leadership practices are significantly correlated with teachers' performance.

Similarly, the study of Mina and Sanchez (2025) revealed that instructional leadership efficacy is significantly associated with competencies such as mentoring, supervision, and instructional planning. Their findings highlight that teachers who experience strong leadership support demonstrate higher levels of competence in instructional delivery and classroom management. This aligns with the present study, confirming that leadership-driven interventions contribute to competency development.

Furthermore, recent research in STEM education underscores the importance of teacher competencies in sustaining effective learning. For instance, a study on STEM teachers' professional knowledge and self-efficacy found that competency development, particularly in digital and inquiry-based teaching, is essential for effective instruction in modern learning environments.

Instructional leadership, therefore, plays a vital role in equipping teachers with these competencies, especially during class disruptions where adaptive teaching strategies are required.

Table 6. Relationship Between the Level of Instructional Leadership and Supervisory Practices of Curriculum Implementers

Independent	Dependent	Pearson's r^a	*p*-value	Interpretation[b]
Instructional leadership	Supervisory Practices	0.632 (strong)	< .001	Significant

Note. [a]Correlation: 0.00 – 0.19 (very weak); 0.20 – 0.39 (weak); 0.40 – 0.59 (moderate); 0.60 – 0.79 (strong); 0.80 – 1.00 (very strong). (Evans, 1996)
[b]Significant at <.05.

Table 6 shows the test of significance in the relationship between the level of instructional leadership and supervisory practices of curriculum implementers at SDO Cabuyao City revealed a strong positive relationship ($r = 0.632$), which is statistically significant at $p < .001$ indicating that as the level of instructional leadership increases, the quality and effectiveness of supervisory practices among curriculum implementers also tend to improve. It reinforces the idea that school leaders who prioritize instructional guidance are more equipped to implement robust supervisory frameworks.

These findings align with the notion that instructional leadership is the backbone of effective school supervision with strong instructional leadership behaviors—such as setting clear goals, monitoring instruction, providing feedback, and supporting teacher development—are more likely to foster effective supervisory practices. According to Amri et al. (2024), instructional leadership is not merely administrative but serves as a catalyst for academic supervision, where school heads bridge the gap between curriculum policy and classroom execution.

Furthermore, Timona (2025) notes that strong instructional leadership—characterized by collaborative decision-making—directly enhances the quality of supervisory feedback, leading to better teacher performance. Hallinger and Walker (2021) found that instructional leadership significantly shapes the quality of instructional supervision by promoting structured monitoring systems and professional support mechanisms. Similarly, Liu and Hallinger (2022) reported that schools with strong instructional leadership exhibit more effective and collaborative supervisory practices, which contribute to improved teaching quality.

The results imply that supervisory practices even rated as very high are significantly needing further attention during class disruptions, as these provide structure, direction, and support when normal systems are unstable. Without strong supervision, teaching and learning can quickly become fragmented and inconsistent. Supervisory practices act as the stabilizing force that keeps teaching, learning, and assessment organized, effective, and responsive ensuring that students continue to learn meaningfully despite challenging circumstances.

Moreover, a study by Sebastian et al. (2021) highlighted that instructional leadership indirectly influences student outcomes by strengthening supervisory practices and teacher collaboration. Recent research by Tan et al. (2023) demonstrated that leadership-driven supervision enhances teachers' ability to deliver STEM instruction effectively in blended and remote learning environments.

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The strong relationship identified in this study further implies that supervisory practices are not isolated functions but are significantly shaped by leadership quality. However, while the correlation is strong, it does not establish causality. Other variables such as teacher experience, institutional resources, and policy support may also influence supervisory practices. Nonetheless, the findings highlight instructional leadership as a key determinant of effective supervision.

Table 7. Relationship Between the Level of Competency Skills and Supervisory Practices of Curriculum Implementers

Independent	Dependent	Pearson's r^a	*p*-value	Interpretation[b]
Competency skills	Supervisory practices	.568 (moderate)	<.001	Significant

Note. [a]Correlation: 0.00 – 0.19 (very weak); 0.20 – 0.39 (weak); 0.40 – 0.59 (moderate); 0.60 – 0.79 (strong); 0.80 – 1.00 (very strong).
(Evans, 1996) [b]Significant at <.05.

Table 7 presents the relationship between the level of competency skills and supervisory practices of curriculum implementers which was analyzed using Pearson's correlation coefficient. The findings revealed a moderate positive relationship between competency skills and supervisory practices ($r = .568$), which is statistically significant at $p < .001$.

Based on the correlation interpretation scale, the obtained coefficient falls within the moderate correlation range (0.40–0.59). This indicates that as the competency skills of curriculum implementers increase, their supervisory practices also tend to improve. The very low p-value suggests that the relationship is statistically significant, leading to the rejection of the null hypothesis.

This finding implies that competency skills—such as pedagogical knowledge, communication skills, instructional planning, and assessment literacy—play an important role in shaping the effectiveness of supervisory practices. Curriculum implementers who possess higher levels of competency are more capable of conducting meaningful supervision, providing constructive feedback, and supporting instructional improvement.

The result is supported by recent studies emphasizing the link between teacher competence and supervision effectiveness by Quilala and Tantiado (2025) found that instructional supervision is significantly associated with teacher-related variables, highlighting that supervision enhances teaching practices and overall instructional quality. This suggests that competent educators are better able to engage in and benefit from supervisory processes.

Similarly, Daigon and Alcopra (2024) reported a significant relationship between instructional supervision practices and teacher efficacy, emphasizing that effective supervision contributes to improved teaching performance and confidence. Their findings imply that competency and supervision are interconnected, where stronger competencies lead to more effective supervisory engagement.

Competency skills significantly influence supervisory practices, other factors such as leadership support, organizational culture, availability of resources, and professional development opportunities may also play important roles. These challenges were compounded by technological limitations in delivering instructional materials in subjects such as pure mathematics (Irfan& Widodo, 2020). The learning environment also played a crucial role, particularly in terms of distractions at home, limited resources for completing requirements (e.g., the absence of laboratory tools at home), and difficulties in managing learning areas and study schedules (Landicho, 2021).

This pattern suggests that curriculum implementers excel in structured and system-driven domains but face challenges in more dynamic, context-dependent aspects of STEM learning continuity, particularly planning and delivery. Research by Darling-Hammond et al. (2021) highlighted the importance of structured and well-implemented classroom observation in improving instructional quality. Effective observation not only enhances teacher performance but also fosters a culture of reflective practice and continuous improvement.

These practices are explicitly aligned with PPSSH Domain 3 (Focusing on Teaching and Learning), which highlights the role of school heads in monitoring instruction, supporting pedagogical innovation, and ensuring learning effectiveness. Likewise, PPSS underscores instructional supervision and quality assurance, requiring supervisors to mentor teachers and promote evidence-based instructional practices.

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The results imply that the high ratings of supervisory practices among curriculum implementers are strongly attributed to their effectiveness in leading curriculum development, enhancing instructional practices, and supporting teacher development. These domains function synergistically, as strong curriculum leadership informs instructional improvement, while continuous teacher development sustains effective teaching and learning. Consequently, curriculum implementers who excel in these supervisory areas are perceived as highly competent instructional leaders capable of driving educational quality and student achievement.

Moreover, school-based continuity plans highlight the provision of technical assistance, coaching, and Learning Action Cell (LAC) sessions, which enhance teachers' instructional competencies and contribute to improved learning outcomes. Research by Kraft and Papay (2021) highlights that sustained and meaningful instructional coaching improves teaching practices and student outcomes, underscoring the importance of collaborative reflection and action planning. In the context of STEM education and learning continuity, competency skills become even more crucial. Curriculum implementers with strong competencies are better able to adapt supervisory practices to flexible learning environments, integrate technology, and ensure quality instruction despite disruptions.

Table 8. Model Summary of the Combined Predictive Power of Level of Instructional Leadership, Level of Competency Skills and Supervisory Practices of Curriculum Implementers on the Level of STEM Learning Continuity during Class Disruptions

Model	R^2	Adj. R^2	F	df	p-value	Interpretation
1	0.423	0.418	81.49	3, 333	<.001	Significant

Note. Predictors: (Constant) Instructional leadership, competency skills, supervisory practices.
Dependent Variable: Learning Continuity

Table 8 presents the model summary of the combined predictive power of instructional leadership, competency skills, and supervisory practices on the level of STEM learning continuity during class disruptions. The regression analysis yielded an R^2 value of .423, indicating that approximately 42.30% of the variance in STEM learning continuity can be explained by the combined effects of the three predictor variables.

The adjusted R^2 value of 0.418 further confirms the robustness of the model, suggesting minimal shrinkage and indicating that the model has good explanatory power. The computed F-value of 81.49 with a p-value less than .001 signifies that the model is statistically significant. This means that the combination of instructional leadership, competency skills, and supervisory practices significantly predicts STEM learning continuity, leading to the rejection of the null hypothesis. These findings suggest that STEM learning continuity during class disruptions is not influenced by a single factor but rather by a combination of leadership, competencies, and supervisory mechanisms. The relatively high R^2 value indicates that these variables collectively play a substantial role in ensuring the continuity of STEM education.

Furthermore, instructional leadership has been identified as a significant predictor of teacher professional development and instructional improvement, which are critical for adapting to disruptions. In addition, contemporary research underscores the importance of a systems-based approach in education, where leadership, teacher competencies, and supervision interact to influence learning outcomes as connected to Systems Theory that focuses attention on the interactions between the systems. It looks at the 'whole' rather than the parts that make up the whole (Bouchrika, 2024) .

Supervisory practices, as part of this system, ensure that instructional standards are maintained and that teachers receive continuous feedback and support. Competency skills, on the other hand, enable curriculum implementers to execute instructional tasks effectively. However, their combined influence—rather than their isolated effects—creates a more powerful impact on STEM learning continuity.

The findings also imply that while each variable contributes uniquely, their synergistic interaction is what drives effective learning continuity. This supports the principles of Systems Theory, which posits that organizational outcomes are the result of interconnected and interdependent components. Thus, the significant model indicates that improving STEM learning continuity requires a holistic approach, integrating strong instructional leadership, well-developed competencies, and effective supervisory practices.

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Table 9 presents the predictive power of level of instructional leadership, competency skills and supervisory practices of curriculum implementers on the level of STEM learning continuity during class disruptions

Table 9. Predictive Power of Level of Instructional Leadership, Level of Competency Skills and Supervisory Practices of Curriculum Implementers on the Level of STEM Learning Continuity during Class Disruptions

Predictors	B	SE	Beta (β)	*p*-value	Decision	Interpretation
Instructional leadership	0.137	0.054	0.150	0.011	Reject H_0	Significant
Competency skills	0.067	0.035	0.108	0.053	Fail to Reject H_0	Not Significant
Supervisory practices	0.458	0.054	0.472	<.001	Reject H_0	Significant

Note. Dependent Variable: Learning Continuity

The results in Table 9 revealed that instructional leadership significantly predicts STEM learning continuity (B = 0.137, SE = 0.054, β = 0.150, p = 0.011). This indicates that for every unit increase in instructional leadership, there is a corresponding increase in STEM learning continuity. Since the p-value is less than .05, the null hypothesis is rejected. This finding suggests that instructional leadership plays a meaningful role in sustaining STEM learning during disruptions.

This result is supported by recent studies emphasizing instructional leadership as a key driver of educational outcomes. A study by He, Guo, and Abazie (2024) found that instructional leadership significantly predicts teachers' professional development, highlighting its role in improving instructional quality and adaptability. Moreover, a systematic review in STEM education reported that instructional leadership contributes to improved learning outcomes through enhanced pedagogical practices and teacher support mechanisms. These findings affirm that strong instructional leadership enables schools to maintain continuity in STEM education even under disruptive conditions.

The findings denote that instructional leadership as predictor of STEM learning continuity enable the school heads and leaders to acquire not just the equipment, but they also establish a "digital architecture" (AI-driven platforms and virtual labs) that ensures instruction continues seamlessly during disruptions (Shaked ,2024). This is supported by research done by Philipp-Muller et al. (2024**)** that highlighted high-performing leaders act as "conduits" where they mobilize external resources by partnering with industry experts to bring real-world STEM data into the classroom, thereby bridging the gap between theoretical curriculum and practical application.

On the other hand, competency skills were found to have no significant predictive effect on STEM learning continuity (B = 0.067, SE = 0.035, β =0 .108, p =0 .053). Since the p-value exceeds .05, the null hypothesis is not rejected. Although competency skills show a positive relationship, they do not significantly predict STEM learning continuity when combined with other variables in the model.

This suggests that while competency skills are important, they may not independently determine learning continuity without the support of leadership and structured supervision. This aligns with contemporary research indicating that teacher competencies alone are insufficient unless supported by organizational and leadership structures. Studies emphasize that competencies must be complemented by leadership guidance and systemic support to effectively influence educational outcomes.

It's not that competency skills are unimportant—they're essential. But by themselves, they often don't strongly predict STEM learning continuity because continuity depends on how those skills are supported, coordinated, and applied within a system, not just whether they exist. Skills don't automatically translate into consistent practice. Teachers may possess strong content knowledge or pedagogical skills, but during disruptions (e.g., modality shifts, limited resources), those competencies may not be consistently applied. Without guidance and monitoring, practice can become uneven across classes. Ccompetency skills are necessary but not sufficient. They provide the capacity to teach effectively, but continuity emerges only when that capacity is activated, guided, and sustained through strong supervisory practices, system alignment, and supportive conditions.

In contrast, supervisory practices emerged as the strongest predictor of STEM learning continuity (B = 0.458, SE = 0.054, β = 0.472, p < .001), indicating a highly significant effect. The null hypothesis is therefore rejected. The high beta value suggests that supervisory practices have the greatest influence among the three variables.

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This finding highlights the critical role of supervision in ensuring instructional quality and continuity. Effective supervisory practices—such as monitoring, coaching, mentoring, and feedback—directly influence how instruction is delivered during disruptions. Recent studies confirm that instructional supervision enhances teaching effectiveness and ensures the consistent implementation of curriculum standards. Furthermore, supervisory support has been shown to strengthen teachers' ability to adapt to flexible and technology-mediated learning environments, which are essential for STEM education continuity.

Supervisory practices are a strong predictor of STEM learning continuity because they directly shape how consistently, effectively, and adaptively STEM instruction is delivered, especially under changing or disruptive conditions. Supervisory practices function as the link between policy and classroom practice. When supervision is strong—characterized by clear direction, continuous support, and data-informed decision-making—STEM instruction remains coherent, adaptive, and sustained. That is why it predicts whether STEM learning will continue effectively despite challenges.

This implies that supervisory practices keep the STEM curriculum moving forward, as STEM learning is sequential (e.g., math concepts build on prior skills; science investigations rely on earlier knowledge), thus, supervisory practices ensure that teachers stay aligned with competencies, pacing guides, and learning standards. Through lesson monitoring and curriculum checks, supervisors prevent gaps that could break the chain of understanding.

Moreover, these consistently support teacher adaptability and innovation during disruptions where STEM teachers must redesign labs, simulations, and hands-on tasks into alternative formats. Supervisory practices (mentoring, LAC sessions, technical support) build teachers' capacity to adapt lessons while preserving core learning outcomes. This adaptability is essential for continuity. The combined findings indicate that while instructional leadership and supervisory practices significantly influence STEM learning continuity, supervisory practices exert a more direct and substantial effect. Competency skills, although important, appear to function as a supporting factor rather than a primary predictor in the presence of strong leadership and supervision.

Based on the results of the study, the researcher proposed **MLMN Model**: **A Systems and Leadership Approach on STEM Learning Continuity**.

Figure 2 below shows The MLMN Model: A Systems and Leadership Approach on STEM Learning Continuity that is a holistic, adaptive, and systems-oriented framework designed to ensure STEM learning continuity during class disruptions such as pandemics, natural disasters, or other interruptions to traditional schooling.

Figure 2. MLMN Model: A Systems and Leadership Approach for STEM Learning Continuity

Grounded in the principles of instructional leadership, systems thinking, and stakeholder collaboration, the model integrates four interdependent components: Mobilization, Leadership, Maximization, and Nurturing. These components function synergistically to sustain uninterrupted curriculum implementation, maintain student engagement, and secure intended learning outcomes.

A comprehensive and detailed explanation of the MLMN Model: A Systems and Leadership Approach for STEM Learning Continuity is presented below:

M –*Mobilization of Stakeholders and Resources*. This refers to the strategic engagement and alignment of internal and external partners—such as school leaders, teachers, parents, community members, and technology providers—to ensure that all necessary resources, support systems, and innovations are available. This includes leveraging digital tools, partnerships, and collaborative networks to respond effectively to class disruptions.

L – *Leadership in Instruction and Supervision*. It focuses on strengthening instructional leadership and supervisory practices that guide teachers in delivering quality STEM education despite disruptions. School leaders and supervisors ensure that teaching strategies, assessment practices, and curriculum implementation remain adaptive, responsive, and aligned with learning standards.

M – *Maximization of Adaptive Systems and Processes*. It highlights the optimization of systems, processes, and instructional mechanisms to sustain learning continuity. This includes flexible learning delivery modalities, data-driven decision-making, and continuous monitoring through systems like school-based evaluation and feedback loops to maintain uninterrupted curriculum progress.

N – *Nurturing of Competencies and Learning Outcomes*. It centers on developing learners' STEM competencies, skills, and engagement while ensuring that intended learning outcomes are achieved. It emphasizes maintaining student motivation, participation, and performance, even in disrupted learning environments, through innovative, inclusive, and resilient teaching approaches.

The MLMN Model represents a holistic and adaptive framework that integrates stakeholder mobilization, strong instructional leadership, system optimization, and learner-centered development. It ensures STEM learning continuity by sustaining curriculum delivery, preserving student engagement, and securing learning outcomes despite educational disruptions.

1. Mobilization → Leadership (Input to Process Activation)

The arrow from Mobilization of Stakeholders and Resources to Leadership in Instruction and Supervision signifies that effective leadership is enabled by strong support systems. When stakeholders (e.g., DepEd officials, school heads, parents, and tech partners) are mobilized, they provide resources, policies, training, and infrastructure. These inputs empower school leaders and supervisors to make informed decisions, guide teachers, and implement responsive instructional strategies. In essence, mobilization fuels leadership capacity.

2. Leadership → Maximization (Process to System Optimization)

The arrow from Leadership to Maximization of Adaptive Systems and Processes represents how instructional leadership drives system efficiency and adaptability. Leaders translate policies and resources into actionable systems, such as flexible learning modalities and assessment strategies. Through supervision, monitoring, and coaching, leaders ensure that systems are properly implemented and continuously improved. This shows that strong leadership operationalizes and optimizes systems.

3. Maximization → Nurturing (System to Learner Outcomes)

The arrow from Maximization to Nurturing of Competencies and Learning Outcomes indicates that well-functioning systems directly impact student learning. When systems are adaptive (e.g., effective LMS, flexible schedules, responsive assessments), they create conducive learning environments. These environments support the development of STEM competencies, skills, and engagement. This relationship highlights that efficient systems enable meaningful learning experiences.

4. Nurturing → Mobilization (Feedback Loop to Sustain the System)

The arrow from Nurturing back to Mobilization completes the cycle, representing a feedback and sustainability loop. Evidence of student performance, engagement, and outcomes provides data for decision-making. These results inform stakeholders and encourage continued or enhanced support (e.g., policy refinement, additional resources, partnerships). This means learner outcomes drive renewed stakeholder engagement and resource mobilization.

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5. Circular Arrows Around the Core (Continuous Cycle of Improvement)

The circular arrows connecting all components emphasize that the MLMN Model is non-linear, no single starting or ending point; iterative, processes are continuously refined; systemic, each component affects and depends on the others. The arrows collectively show a continuous improvement cycle where:

- Inputs → Processes → Outputs → Feedback → Improved Inputs

6. Arrows Toward the Core: STEM Learning Continuity (Unified Goal)

All directional arrows pointing toward the center (the gear labeled *STEM Learning Continuity*) signifies that every component contributes directly to the goal. The system works cohesively to ensure uninterrupted curriculum progress, sustained student engagement and secured learning outcomes. This reflects goal convergence, where all actions and processes are aligned toward a single educational purpose.

As guide for curriculum implementers in crafting programs projects, activities, strategies, and interventions, the model serves as a model that reiterates Mobilization → Leadership = Support enables action; Leadership → Maximization = Action improves systems; Maximization → Nurturing = Systems produce outcomes; Nurturing → Mobilization = Outcomes inform and sustain support in a continuous adaptive cycle looping around a unified focus on STEM learning continuity.

The MLMN Model symbolizes a living system of leadership and learning, where each component continuously interacts, influences, and strengthens the others. Rather than functioning in isolation, they operate as a cohesive cycle of improvement, ensuring that STEM education remains resilient, adaptive, and outcome-driven, even in the face of disruptions.

Strategies in the Operationalization of the MLMN Model

1. Mobilization of Stakeholders and Resources (M)

The first component emphasizes the strategic mobilization and alignment of stakeholders and resources necessary to support continuous STEM education. This includes school leaders, teachers, learners, parents, local government units, private partners, and technology providers. Mobilization goes beyond mere participation—it involves active collaboration and shared accountability. Schools establish partnerships with technology providers to ensure access to digital platforms, learning management systems, and connectivity solutions. Community stakeholders contribute to resource augmentation, while parents are engaged as co-facilitators of learning, particularly in remote or blended environments. This component ensures that inputs—such as infrastructure, instructional materials, digital tools, and human resources—are available and responsive to the demands of disrupted learning contexts. It creates a strong support ecosystem that enables the other components of the model to function effectively.

2. Leadership in Instruction and Supervision (L)

The second component focuses on the critical role of instructional leadership and supervisory practices in maintaining the quality of STEM education. School heads, master teachers, and supervisors act as drivers of instructional coherence, ensuring that teaching practices remain aligned with curriculum standards and learning competencies. Leadership in this model is adaptive and transformative. It involves guiding teachers in the use of flexible learning modalities (e.g., modular, online, blended learning), supporting the design of contextualized and differentiated STEM instruction; monitoring teaching practices through classroom observations, coaching, and feedback mechanisms and ensuring that assessment practices remain valid, reliable, and responsive to learning conditions. Instructional supervision also includes continuous professional development, enabling teachers to strengthen their competencies in digital pedagogy, assessment innovation, and learner engagement strategies. Through strong leadership, the model ensures that processes of teaching and learning remain effective, even in rapidly changing educational environments.

3. Maximization of Adaptive Systems and Processes (M)

The third component highlights the importance of optimizing systems, structures, and processes to support continuous learning. It reflects a systems-thinking approach, where all elements of the educational process are interconnected and continuously improved. Maximization involves implementing flexible learning delivery modalities (e.g., synchronous, asynchronous, modular); utilizing data-driven decision-making through monitoring and evaluation tools such as school-based assessment data, learning analytics, and feedback systems; strengthening mechanisms like the School Monitoring, Evaluation, and Plan Adjustment (SMEPA) to ensure responsiveness and continuous improvement; streamlining communication systems among stakeholders for efficient coordination

This component ensures that the educational system remains adaptive, resilient, and efficient, capable of responding to disruptions without compromising curriculum progression.

4. Nurturing of Competencies and Learning Outcomes (N)

The fourth component centers on the learner, emphasizing the development of STEM competencies, skills, and values while ensuring that learning outcomes are achieved. Nurturing involves promoting active and sustained student engagement through interactive, inquiry-based, and problem-solving approaches in STEM; supporting learners' cognitive, affective, and psychomotor development; providing timely feedback and interventions to address learning gaps; ensuring inclusivity and accessibility, particularly for learners in disadvantaged contexts. This component also focuses on maintaining learners' motivation, resilience, and autonomy, which are critical during periods of disruption. It ensures that despite challenges, students continue to develop the competencies necessary for academic success and real-world application.

The MLMN Model provides a comprehensive and strategic framework for ensuring STEM learning continuity in the face of disruptions. By integrating stakeholder collaboration, strong instructional leadership, adaptive systems, and learner-centered practices, the model addresses both the structural and pedagogical dimensions of education.

It provides a structured yet dynamic flow of educational transformation. The model ensures that resources are effectively utilized, processes are optimized, and outcomes are achieved, while continuously evolving through feedback—making it a robust framework for sustaining STEM learning continuity during disruptions. The strength of the MLMN Model lies in its integrated and cyclical nature. Each component reinforces the others. **M**obilization provides the necessary inputs and support systems while **L**eadership ensures the effective implementation of instructional processes. **M**aximization optimizes systems for efficiency and adaptability, and **N**urturing guarantees that learner outcomes are achieved.

These components operate within a feedback loop, where data and experiences from implementation inform continuous improvement across all areas. When effectively implemented, the MLMN Model leads to three key outcomes namely uninterrupted curriculum progress (*learning competencies are delivered consistently despite disruptions*); Maintained Student Engagement (*learners remain actively involved, motivated, and connected to the learning process* and secured Learning Outcomes (*students achieve the intended STEM competencies, ensuring quality education is not compromised*).

CONCLUSIONS

Based on the findings of the study, these conclusions were drawn:

1. The curriculum implementers in the SDO Cabuyao City exhibit a very high level of instructional leadership of skills defining and establishing goals, managing instructional programs and promoting academic learning environment.
2. The curriculum implementers in SDO Cabuyao City exhibit a very high level of competency-skills in curriculum development, instructional development and teacher development.
3. The supervisors, school heads, assistant school head, master teachers, Math and Science teachers as curriculum implementers exhibit a very high level of supervisory practices in ensuring STEM Learning Continuity during class disruptions in the domains of implementing the Learning Continuity Plan, curriculum and learning support, learning delivery, learning assessment and instructional supervision.
4. Instructional leadership of SDO Cabuyao City curriculum implementers significantly influences supervisory practices indicates that enhancing competency skills leads to improvements in supervision quality. Curriculum implementers at SDO Cabuyao City are knowledgeable, skilled, and adaptive to carry out supervisory roles to apply flexible, innovative, and responsive supervisory practices.
5. The high ratings of STEM learning continuity among curriculum implementers at SDO Cabuyao City are driven by their effectiveness in implementing comprehensive continuity plans, aligning curriculum and learning support, adopting flexible delivery modalities, ensuring robust assessment practices, and sustaining instructional supervision. These dimensions operate synergistically to maintain the quality and continuity of STEM education, even in challenging and rapidly changing educational contexts.
6. STEM learning continuity during class disruptions is significantly influenced by instructional leadership and supervisory practices, with supervisory practices serving as the strongest predictor underscores the importance of structured, consistent, and supportive supervision in maintaining instructional quality. While competency skills of curriculum implementers at SDO Cabuyao City are essential, they do not independently predict STEM learning continuity when considered alongside leadership and supervision to translate into meaningful educational outcomes adopting a systems-oriented approach in

education, where these variables function collaboratively. Strengthening only one aspect is insufficient; rather, a balanced and integrated framework is necessary to ensure effective STEM learning continuity.

7. The MLMN Model: A Systems and Leadership Approach on STEM Learning Continuity. The study confirms the instructional leadership, transformational leadership and systems theory as the framework of the study yielded the combined model of instructional leadership, competency skills, and supervisory practices that significantly predict STEM learning continuity which embodies the coherence of these predictors in sustaining the STEM learning continuity.

RECOMMENDATIONS

Based on the study's findings, the following recommendations aim to ensure effective STEM learning continuity during class disruptions. These are directed toward key stakeholders and future researchers to foster continuous improvement in education.

1. Curriculum Implementers at SDO Cabuyao are encouraged to establish a mechanism to improve resource allocation for technology-based education by integrating in the School Improvement Plan and Division STEM Programs the budget allocation for digital infrastructure, maximize the use of Virtual Learning Environment or Learning Management System and other technology-based applications toward effective instruction and assessment, support the use of digital assessment using Khan Academy, managing school data by data-driven networks and live dashboard of STEM curriculum innovations and contextualization, and information using technology/ICT and increase stakeholder engagement to ensure STEM Learning Continuity at the brink of sustaining 21st century skills of learners during class disruptions.
2. SDO Cabuyao City curriculum implementers are encouraged to participate in strengthening Competency Development Program by benchmarking and cultural exchange scholarships to notable universities and institution particularly in instructional supervision, assessment, and STEM pedagogy for supervisors, school leaders, and teachers as curriculum implementers in managing STEM learning during class disruptions.
3. The curriculum implementers are suggested to promote a regular collaborative instructional supervision where a system of network of curriculum implementers will provide real time feedback, recognition and open system of providing technical assistance based on the needs as a professional learning engagement particularly in the adoption of coaching, mentoring, and reflective supervision strategies to support teachers effectively, strengthening the instructional leadership skills and supervisory practices alongside with competency-skills following the principles of System Theory.
4. It is also recommended that curriculum implementers should integrate technology in supervision utilizing digital tools for supervision, such as virtual classroom observations, online feedback systems, and data-driven monitoring, tailored to the unique needs of STEM education, including home-based laboratory instruction, inquiry-based learning, and problem solving approaches in the context of STEM learning continuity during class disruptions.
5. The curriculum implementers at SCO Cabuyao City are needing adequate support, resources, capacity building programs and guidelines to strengthen instructional leadership and supervisory practices in schools to ensure STEM learning continuity. The programs and projects may be proposed to alleviate the leadership supervision into collaborative supervision with real time feedback in a loop manner not boxed in a top-down mandates.
6. The district and education program supervisors are encouraged to adopt the MLMN model in crafting Division Education Development Plan (DEDP) in ensuring quality of learning outcomes and mitigate learning loss due to unprecedented class disruptions, to effectively utilize MLMN Model: A Systems and Leadership Approach on STEM Learning Continuity as a guide among curriculum implementers to be integrated as a localized and contextualized learning model in teaching and learning STEM.
7. For future researchers, conducting further studies on instructional supervision models to align with the pressing AI-driven and technology-enhanced STEM Learning Continuity model is recommended. Exploring additional factors through action and basic research in schools and in the division such as digital literacy, organizational culture, and access to resources can provide a deeper understanding of the dynamics within the educational system and focus on linking these variables to work on programs and activities contributory to improve Program for International Student Assessment (PISA) structure to test programs aimed at improving instructional leadership, competency-skills and supervisory practices in STEM Learning continuity.

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The researcher offers this noble action in public service to all STEM educators in pursuit of learning continuity and continuous improvement in quality education despite class disruptions.

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[11] For I know the plans I have for you," declares the Lord, "plans to prosper you and not to harm you, plans to give you hope and a future. - Jeremiah 29:1

REFERENCES

1. Abio, K. B. C. (2026). *School head's instructional leadership practices in public schools*. International Journal of Research and Innovation in Social Science.
2. Bixler, K., & Ceballos, M. (2025). Principals Leading AI in Schools for Instructional Leadership: Conceptual Model for Principal AI Use. *Leadership and Policy in Schools*, *24*(1), 137–154. https://doi.org/10.1080/15700763.2024.2428297
3. Akomodi, J. O. 2025. In-Depth Analysis: The Importance of Instructional Leadership in Education. DOI: 10.4236/ojl.2025.142008 https://www.scirp.org/journal/paperinformation?paperid=142021&utm_source=
4. Amri, S., et al. (2024). Influence of instructional leadership and academic supervision on the quality of learning. *Journal of Educational Leadership and Management, 12*(1), 45-60.
5. Aquino, J. M. D. R. (2025). Best practices of high-performing higher education institutions in the Philippines towards the development of a harmonized quality-assured instructional leadership framework. Frontiers in Education, 10, 1663289. https://doi.org/10.3389/feduc.2025.1663289
6. Aquino, C., Afalla,B. & Fabelico, F. (2021). Managing educational institutions: School Heads leadership practices and teachers` performance. International Journal of Evaluation and Research in Education (IJERE). Vol. 10, No. 4, December 2021.
7. Amor, R,C. et.al. 2025. School Heads' Supervisory Practices and Teachers' Teaching Performance in Almagro District. International Journal of Advanced Multidisciplinary Studies. Vol. V, Issue 7 July 2025. eISSN: 2799-0664https://doi.org/10.1080/07294360.2023.2240710
8. Baniqued, W. B., & Bautista, R. G. (2024). Teachers' preparedness on pedagogical practices in K-12 science education: Foundations for crafting an effective science program. American Journal of Educational Research, 12(8), 291-297. 20(5), em2440. https://doi.org/10.29333/ejmste/14453

9. Bouchrika, I. (2024). *What is systems theory? Social work theories in* 20024. https://research.com/education/what-is-systems-theory
10. Capillanes, M. J. A. (2025). *School heads' instructional leadership on teachers' work performance*. GEO Academic Journal, 6(1). https://doi.org/10.56738/issn29603986.geo2025.6.115. *sustainable development program*.
11. Daigon, M. E., & Alcopra, A. R. (2024). Instructional supervision practices and efficacy of teachers. *International Journal of Multidisciplinary Research and Analysis.*
12. Darling-Hammond, L., Schachner, A., & Edgerton, A. (2021). Restarting and reinventing school: Learning in the time of COVID and beyond. *Learning Policy Institute.*
13. Dayagbil, F. T., Palompon, D. R., Garcia, L. L., & Olvido, M. M. J. (2021). Teaching and learning continuity amid and beyond the pandemic. Frontiers in Education, 6. https://doi.org/10.3389/feduc.2021.678692
14. DepEd Order No. 12, s. 2024. Amendment to DepEd Order No. 10,s. 2024. Policy Guidelines on the Implementation of the MATATAG Curriculum.
15. DepEd. 2024. DepEd pushes for learning continuity amid disasters, updates class suspension guidelines. Retrieved online at https://www.deped.gov.ph/2024/12/27/deped-pushes-for-learning-continuity-a/mid-disasters-updates-class-suspension-guidelines on December 2,2025**.**
16. Go, M., & Eslabon, J. (2024). School heads' instructional supervisory skills and teachers' performance. Philippine Global Journal of Social Research and Teaching.
17. Hallinger, P., & Murphy, J. (2022**).** Instructional leadership and school improvement: A 40-year retrospective. Journal of Educational Administration, 60(4).
18. Hallinger, P., & Walker, A. (2021). Leading learning in Asia: Emerging empirical insights from five societies. *Journal of Educational Administration, 59*(2), 197–214.
19. Hahn, A. (2021). Instructional supervision. *EBSCO Research Starters.*
20. Hasanah, U. (2020). Key definitions of STEM education: Literature review. Interdisciplinary Journal of Environmental and Science Education, 16(3), Article e2217. https://doi.org/10.29333/ijese/8336
21. He, P., Guo, F., & Abazie, G. A. (2024). School principals' instructional leadership as a predictor of teachers' professional development. Asian-Pacific Journal of Second and Foreign Language Education, 9, Article 63. https://doi.org/10.1186/s40862-024-00290-0.
22. Irfan, M., Kusumaningrum, B., Yulya, Y., & Widodo, S. (2020). Challenges during the pandemic: Use of e-learning in mathematics learning in higher education. Infinity Journal, 9(2), 147–157. https://doi.org/10.22460/infinity.v9i2.p147-158
23. Kraft, M. A., & Papay, J. P. (2021). Developing effective teachers: What we know about professional development and coaching. Educational Evaluation and Policy.
24. Landicho, C. J. (2021). Changes, challenges, and opportunities in teaching senior high school Earth science. Journal of Learning and Teaching in Digital Age, 6(1), 55–57.
25. Leithwood, K., Harris, A., & Hopkins, D. (2020). Seven strong claims about successful school leadership revisited *School Leadership & Management, 40*,1, 5-22.
26. Le Fevre, D.L. (2021). Instructional Leadership and Why it Matters. https://theeducationhub.org.nz/instructional-leadership-and-why-it-matters/
27. Liu, S., & Hallinger, P. (2022). Principal instructional leadership, teacher collaboration, and student learning outcomes: A multilevel analysis. *Educational Management Administration & Leadership, 50*(3), 1–20.
28. Ma, X., & Marion, R. (2024). Perceptions and practices of principals: Examining instructional leadership for curriculum reform. Frontiers in Education. https://doi.org/10.3389/feduc.2025.1591106
29. OECD,2023. https://www.oecd.org/en/about/programmes/pisa.html
30. Pana, E. (2024). *School heads' instructional leadership and performance: Basis for strategic leadership program*. International Journal of Scientific and Management Research, 7(2), 26–40. https://doi.org/10.37502/IJSMR.2024.7203
31. PIDS (2025). Making Philippine Educations and Reforms Transformative. https://pidswebs.pids.gov.ph
32. Quilala, R. L., & Tantiado, R. C. (2025). Instructional supervision and teachers' efficacy. *International Journal of Multidisciplinary Research and Analysis.*

33. Rivera, B.H. Jr. 2024. Relationship of Instructional Leadership Practices among Schools Administrators and School Performance: Input Development of Annual Improvement Plan. DOI: https://dx.doi.org/10.47772/IJRISS.2024.807040
34. Rivera, JP R., Sinsay-Villanueva,L.M., Tanyag, I.H., Garcia,G.D., Berroya,J.D. and Lim,V.L. 2025). Revitalizing the Philippine education system: Facilitating access and participation to In-Service Training (INSET) and Teacher Professional..Development (TPD). Second Congressional Commission on Education
35. Rodulfa, L. (2023). *School heads' instructional leadership and teachers' sense of efficacy in the implementation of blended teaching modality*. AIDE Interdisciplinary Research Journal, 2(1). https://doi.org/10.56648/aide-irj.v2i1.35
36. Sebastian, J., Allensworth, E., Wiedermann, W., Hochbein, C., & Cunningham, M. (2021). Principal leadership and school performance: An examination of instructional leadership and organizational management. *Educational Administration Quarterly, 57*(3), 1–38.
37. Shaked, H. (2024). How principals' instructional leadership impacts schools' middle leadership. Educ. Manag. Adm. Leaders. 53, 977–990. doi: 10.1177/17411432241238888
38. Shahat, M. A., et al. (2025). Enhancing middle school science education: Evaluating a competency-based STEM training program for teachers. *Social Sciences and Humanities Open*, 11. www.sciencedirect.com/journal/social-sciences-and-humanities-open
39. Tan, C., Chua, C., & Goh, K. (2023). Instructional leadership in STEM education: Supporting teachers in blended learning environments. *International Journal of STEM Education, 10*(45), 1–15.
40. Tan, CY, Gao, L & Shi, M. 2020, 'Second-order meta-analysis synthesizing the evidence on associations between school leadership and different school outcomes', Educational Management Administration & Leadership, June 2020, pp. 1–22.
41. Timona, J. (2025). Influence of principal's instructional supervisory practices on teacher's job performance. *European Journal of Education Studies, 11*(3), 88-104.Vol. 9, No. 4, pp. 402-408, December 2023. doi: 10.18178/ijlt.9.4.402-408 https://www.theeducatoronline.com/k12/news/final-report-into-classroom-disruption-released/284053
42. UNESCO. (2022). *Technology in education: A case study on the Philippines*. UNESCO Digital Library. https://unesdoc.unesco.org/ark:/48223/pf0000387743
43. UNESCO. (2023). *Ensuring effective distance learning during disruptions: Guidelines for education systems.* UNESCO Publishing.

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