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# Learning action cell as an in-house professional development training

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**ABSTRACT**

Learning action cell (LAC) sessions are structured professional development activities tailored for schools to enhance pedagogical skills, teaching methodologies, and assessment methods to improve student academic achievement. This study investigated the implementation of the LAC as an internal development training program for science teachers in remote regions of the Philippines. A total of 403 science educators participated in the study to collect implementation strategies seen in the LAC. The science teachers' experiences in the LAC implementation were assessed using a survey questionnaire and a case study through focus group discussions (FGD). Based on the findings, LAC enhances educators' perceptions of professional development training. As a professional development tool, the LAC helped science teachers develop students' science holistic development, technology innovation, and cultural knowledge. The idea creates a community of scientific educators who collaborate to improve their facilitation, innovation, and research skills, promoting professional leadership and competency in the field. Consequently, the efficacy of LAC necessitates high-quality training aimed at specific objectives. Science educators acknowledged that LAC enhances instructional leadership and pedagogical proficiency.



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## 1. INTRODUCTION

Teacher education programs are responsible for developing skilled and proficient teachers. The professional development of teachers helps enhance and reinforce educational practice. It is seen as an essential component of curricular reform in numerous countries, including China [1], Greece-Cyprus [2], and the Netherlands [3]. To guarantee the quality of teacher education and the progression of the educational sector, teachers must maintain their practice and expertise in line with the latest information in their discipline. Basma and Savage [4] identify four critical areas requiring enhancement for professional development success. It is defined by their ability to identify professional development needs, select the most effective methodologies, implement them with quality and dedication, and evaluate professional development outcomes. Nevertheless, most research regarding the effectiveness of professional development in enhancing teachers' knowledge and instructional techniques has produced unsatisfactory outcomes [5]–[8]. The impact on student learning and achievement is further evidenced by the PISA 2018 results [5]–[8].

The organization for economic cooperation and development (OECD) [9] reported the Philippines' Mathematics, Science, and English performance through the program for international student assessment (PISA). The Philippines ranked lowest among 79 participating nations in reading and second to last in

mathematics and science. The unfavorable data indicates a need for Philippine schools, and the quality of teachers must be enhanced to provide quality education to Filipino students. The quality of education schools offer significantly depends upon the quality of teachers [10]–[12]. Sugano and Nabua [13] emphasized that educators should enhance the quality of education and implement innovative assessment tools for evaluating teaching effectiveness to facilitate essential pedagogical improvements. Educators possess limited possibilities for continuous professional development that aligns directly with their instructional practices [11]. It requires innovative pathways for professional growth that enable educators to explore diverse roles throughout their careers without leaving the classroom teaching [11]. Therefore, it is recommended that more teacher training and professional development programs be implemented to enhance teacher quality [14].

The department of education (DepEd) in the Philippines mandates the utilization of the learning action cell (LAC) as a school-based continuing development strategy in the K to 12 basic education programs. It seeks to enhance educators' knowledge, competencies, and dispositions following the K to 12 standards [15]. The DepEd [15] has determined that the LACs are the principal mechanism for teacher development. LACs are structured professional development and cost-effective initiatives to enhance pedagogical skills, teaching methodologies, and assessment methods to improve student academic achievement. Nonetheless, despite DepEd's promotion and increasing interest in LACs as a means of professional development in educational institutions, more empirical evidence indicates that the program requires implementation to enhance teacher performance. This discovery is supported by educators, as indicated in multiple research investigations [16]–[18].

Teachers had concerns about the quality of the LAC session in their institutions. Teachers said that the LAC had no direct influence on the content delivered by science teachers, and specific needs remained unsatisfied due to the generalist approach in LAC sessions, which disregarded teachers' specialization in science [16]. The typical subject pertains to a discussion focused on the K to 12 basic education program content and methodology, 21st-century competencies, information and communication technology (ICT) incorporation in teaching and assessment, and the contextualization of the curriculum. Furthermore, certain schools inside the LAC session must tackle learner diversity, student inclusion, assessment, and reporting of the K to 12 basic education program and indigenization [18].

The effectiveness of LAC as a professional activity needs evaluation. Hubers *et al.* [19] asserted that effective professional development in scientific education requires teachers to engage in active learning environments. An effective professional development program emphasizes classroom practices and pedagogical strategies teachers can implement. The concept of LAC requires improved contextualization, undermining the objective of professional growth. Correos and Paler [20] also found that teachers need a better understanding of implementing what they learned during the LAC session. School administrators and teachers should receive intensive training programs on implementing and monitoring LAC to equip them with the knowledge and skills necessary for improving teaching and learning outcomes. Moreover, research [21]–[28] emphasized that school learning action cell (SLAC) must be planned and implemented in accordance with the DepEd's call for schools to continuously provide professional community of practice that would empower teachers and make them more productive teachers in front of their students. Consequently, this study applies the essential elements of effective professional development to address the challenges addressed in the LAC session.

This study asserts that the LAC, a mechanism for professional development training, is essential for investigating and evaluating schools in Eastern Visayas. Enhancing the implementation of LAC sessions in school settings can yield greater effectiveness and efficiency while also improving the community of practice within schools. The objective is to strengthen the implementation of the LAC in the distant regions of Eastern Visayas, particularly in the domain of science. This study examined the implementation practices of the LAC as an in-house teacher development training program in rural regions of the Philippines. This study aims to address the following research questions:

- What are the science teachers' experiences in schools' pre-, mid-, and post-LAC sessions?
- What essential elements emerged from converging the science teachers' experiences in the LAC implementation?
- What are the principles that emerged from the implementation of the LAC for policy recommendations?

## 2. METHOD

This study specifically used a mixed methods research design to examine quantitative and qualitative measures in implementing the LAC session in schools in Eastern Visayas. The implementation measures cover the prevalence and experiences of science teachers in the LAC sessions. The study is divided into three components of LAC sessions as professional development. It explored and examined the implementation of LAC sessions in the pre-LAC, mid-LAC, and post-LAC implementation. These are explained using a mixed methods design by integrating quantitative results from a survey questionnaire and qualitative results from case

studies. Before utilizing the tool, the survey instrument underwent content validation and pilot testing to refine its context. Content validation was conducted utilizing the provided validation checklist, wherein experts and scientific educators were invited to evaluate the instrument's content. This encompassed the content and face validity of the instrument in both its printed and digital formats.

The study's population consisted of 403 science teachers from six division offices in Eastern Visayas (Region VIII). Furthermore, this study used purposive sampling to select respondents from the survey questionnaire participants. Inclusion criteria were used in the selection process, and this includes the following: i) Science teachers handling biology, chemistry, physics, and earth science; ii) science teachers working in secondary schools of DepEd; iii) science teachers from Region VIII; and iv) participants must have been part of any LAC sessions.

The data collection was divided into two parts: the quantitative variables were obtained using a survey, and the qualitative variables were generated from focus group discussions (FGD). The researcher completed the five-month administration period, providing the returns required to meet project objectives. The survey was cross-sectional, where the information was gathered in one setting. Because some schools needed better internet connection, some data was collected through printed survey questionnaires. In contrast, some schools that prefer online received Google links corresponding to the Google Forms surveys. This study followed a case study design for the qualitative data. FGD were conducted to capture the dynamics of science teachers in their LAC sessions. FGD and interviews were conducted onsite and online via Google Meet, and responses were recorded and transcribed.

This study used a side-by-side comparative methodology. The researcher initially presented the quantitative statistical results of the empirical data, followed by a discussion of the qualitative findings organized into themes and codes derived from the observed data. The two datasets were analyzed separately and combined in a concurrent mixed methods design. The closed-ended survey was encoded, and the corresponding responses from different locations within the subgroups were identified. The data was then analyzed using version 10 of the SPSS. For quantitative data, descriptive statistics were used to calculate the percentages, means, and standard deviations of the questionnaire's scientific responses based on the Likert scale presented in the sections of the survey questionnaire. Concurrently, the qualitative data employed a case study in which the researcher collected findings from both empirical data while simultaneously evaluating the two datasets. The researcher meticulously examined the qualitative data analysis procedures and determined which findings needed to be elaborated.

The study's validity was determined by triangulating the validity of the quantitative construct and qualitative validity. The quantitative method was used to check the concept validity of the empirical data in Excel. Using different concepts or factors on both the quantitative and qualitative sides led to very different outcomes. Three validators were asked to check and validate the results and findings of the quantitative and qualitative data per domain of empirical data after the data was analyzed. Moreover, the validators act as inter-coders to improve the study's results.

The researchers adhered to all ethical procedures during the study. The researchers were permitted by the superintendents of the different school divisions in Eastern Visayas (Region VIII). The participation of the teachers in the study was voluntary, and an informed consent form was requested from the participants. Teachers were informed ahead of time to take time to answer the survey, and they were also informed about the protocols for online data gathering. The collection tools were free from gender, class, ethnicity, and cultural bias and were considered neutral and respectful. Private information and responses submitted online were kept in data storage and not publicly shared. There was no mention of the participants' names to protect their privacy. Moreover, the study's results were shared with the participants, schools, and the funding agency.

## 3. RESULTS AND DISCUSSION

This section presents the quantitative and qualitative data obtained in this study. The discussion is divided into three parts to feature the implementation domain of the LAC. The first part presents the science teachers' experiences conducting the LAC sessions. The second explains the essential elements that emerged from converging experiences in the LAC. Then, the last part details the principles of the LAC for policy recommendations.

### 3.1. Science teachers' experiences in the LAC implementation practices

#### 3.1.1. Pre-LAC planning

Science teachers' experiences are considered the external domain in LAC implementation. This domain serves as the external source of information for relevant modification that will further equip teachers with knowledge, skills, and attitudes to enhance teaching and learning. Also, it pertains to the learning activities of a

focal point, such as the LAC, in which the teacher participated. The discussion is divided into three components explaining the implementation style and processes (pre-, mid-, and post) for conducting LAC sessions.

Table 1 shows the science teachers' experiences based on the pre-LAC planning practices mandated by DepEd [15] according to the LAC policy. Hence, the DepEd [15] provides a framework for the conduct of LAC, allowing schools to amend and adjust it according to their need. These practices in the pre-LAC sessions were assessed to see if they are evident, practiced, and experienced by teachers in the conduct of LAC. The result shows that science teachers perceived the importance of all the pre-LAC planning activities: assessment of needs, prioritization of topics or agenda, assessment of needs, formation of LAC, identification of appropriate intervention, the role of assignment of work, scheduling of meetings, and setting up resources. This means that science teachers believed that the implementation domains in the pre-LAC planning are evident and practiced in the LAC sessions in their schools. Normally, LAC teachers are expected to identify areas for professional development and prioritize topics for the LAC session before its implementation. In addition, LAC planning must include information on how the procedure will be conducted and how schools can customize a mechanism to meet their specific needs and environments. LACs must be prioritized since they serve as a support system for teachers responsible for providing basic education, which is the primary objective of DepEd. Students' learning needs must precede activities that are needed to meet this objective.

Table 1. Science teachers' experiences in the implementation of pre-LAC planning

| Pre-LAC planning | Mdn | R | Q |
|---|---|---|---|
| Assessment of needs | 5 | 4 | CWHI |
| Prioritization of topics or agenda | 5 | 4 | CWHI |
| Formation of LAC | 5 | 4 | CWHI |
| Identification of appropriate intervention | 5 | 4 | CWHI |
| Scheduling of meetings | 5 | 4 | CWHI |
| Setting up of resources | 5 | 4 | CWHI |
| Role assignment of work | 5 | 4 | CWHI |

Note: Mdn-median; R-range; and Q-qualitative description.
CWHI-considered with high importance (Mdn-5), CWMI-considered with moderate importance (Mdn-4), CWLI-considered with low importance (Mdn-3), NCA-not considered at all (Mdn-2), and IDNKC-I do not know if it was considered (Mdn-1).

Also, the prevalent experiences of science teachers were narrated to see how well the pre-LAC tasks were carried out and to find gaps between what was expected and what happened. It can be observed that the pre-LAC experiences of teachers are identified and classified according to structure, function, and resource. Table 2 discusses science teachers' narratives in pre-LAC activities concerning structures based on the emerged codes: topic session preference, session structure, and schedule. Topic session preference is one of the themes that emerged from the structure under pre-LAC activities. According to Case #1, *"The indicators are based on the Philippine Professional Standard for Teachers (PPST). The indicators that need to be developed are the things that should be focused on. Those are the things that we will conduct, some training, in-service trainings (INSET's), the things that we will focus on,"* (FGD1-T3). According to the prioritization of topics, LAC members could choose which content to be prioritized by LAC. As mentioned in Case #2, "*With regards to the topic, since we already have the consolidated result from the department, the facilitator for the LAC will convey, then they will try to select a topic suitable for the needs of teachers. So, from learning and development (L&D), it will be passed to the coordinators and the LAC facilitators,"* (FGD2-T1). The significance of the topic could serve as the basis for prioritizing. The length of time required to address it and the overall interest of the school. All issues should always be consistent with the subjects covered by kindergarten-grade 12 (K-12) curriculum programs and in PPST. Another pre-LAC category is session structure. According to science teachers' responses from different schools, Case #4 said, *"Like, for example, contextualization, whatever other educational program specialists (EPS) will do, it will be uniform for all,"* (FGD3-T2).

Concerning the structure of LAC sessions, LACs could be formed based on the identified needs and the number of teachers in each school or group. These divisions, however, are flexible and subject to change depending on the circumstances. A LAC could have five (5) to fifteen (15) teachers as members. A school may set up as many LACs as necessary, considering the school has identified needs. Teachers may meet in groups that have been carefully chosen in any school. These might be categorized by crucial stage, grade level, subject area, or programs the school offers. However, other teachers said they often follow the division office's directions. As stated by Case #3, *"It is like the pattern of implementation, they follow the bureaucratic policy in DepEd. Whatever the national commands, it will be adopted in the region and followed by the division office,"* (FGD3- T4). Added by Case #3: *"However, in the early intervention program (EIP), there is, but it is not applied to whatever in the plan because it always depends. They will just automatically give us this memo to follow,"* (FGD3-T1).

Table 2. Science teachers' experiences in the LAC implementation of structure

| Pre-LAC categories | Themes | Initial codes/illustrative science teachers' experiences in the LAC implementation |
|---|---|---|
| Structure | Topic session preference | *"The indicators are based on the PPST. Those are the things that we will conduct, some training, INSETs, the things that we will focus on,"* (FGD1-T3). |
| | | *"The topic, the consolidated result of the ASAT from the department., So the facilitator for the LAC will convey, then they will try to select a topic… from L&D then to the coordinators to the LAC facilitators,"* (FGD2-T1). |
| | | *"It is fine if the topic is general and can be integrated into all subject areas. However, it must be in a small group if it is specific to science,"* (FGD4-T2). |
| | | *"We have prioritization topics coming from the division,"* (FGD3-T1). |
| | Session structure | *"Like, for example, contextualization, whatever other EPS will do, it will be uniform for all,"* (FGD3-T2). |
| | | *"This LAC started long ago, but it is divided based on the number of MTs because the MT will act as the facilitator for each group. That is why each MT has 3-4 or 5-6 members. If subjects are without MT, the head teacher will be their LAC leader,"* (FGD4-T3). |
| | | *"Based on the result of the INSET and self-assessment, we start the LAC session,"* (FGD1-T2). |
| | | *"Aside from LAC, we also have INSET, five days of training. Twice a year,"* (FGD2-T2). |
| | | *"Like, for example, contextualization, whatever other EPS will do, it will be uniform for all,"* (FGD3-T2). |
| | | *"It is like the pattern of implementation they follow is the bureaucratic policy in DepEd. Whatever the national commands, it will be adopted in the region and followed by the division office,"* (FGD3-T4). |
| | Schedule | *"Although not on an annual basis, in the division, they automatically tell us to conduct LAC sessions, which you will echo in your school. Whatever other EPS will conduct; other EPS will also follow,"* (FGD3-T3). |
| | | *"We conducted LAC sessions every month,"* (FGD4-T6). |

LAC relies on both the quantity and accessibility of teachers in each school. Additionally, the LAC structure can be altered for each school. However, all teachers across all subject areas are required to be a part of a LAC. Additionally, groupings can be variable and can be made based on need and context, grade level, or a cluster. Members can set the meeting agenda, duration, and frequency regarding the LAC schedule. Typically, one to two hours per week is formed and should occur at least once a month. As mentioned by Case #3, *"Although not on an annual basis, in the division, they automatically tell us to conduct LAC sessions, and these are the things you will echo in your school. Whatever other EPS will conduct; other EPS will also follow,"* (FGD3-T3). In addition, data from the individual interviews were agreed on schedule as part of the LAC implementation, as observed in Table 2. Since it can be hard to get all the teachers together for face-to-face meetings, especially in big schools, there are different ways to conduct LAC to connect. Moreover, all schools are encouraged to prioritize LAC and put them ahead of administrative meetings. LAC meetings should be conducted at least once a month.

Science teachers' prior experience with pre-LAC implementation of function was identified in three themes: function assignment, resource person selection, and LAC coordinator selection. Table 3 presents teachers' experiences in the LAC implementation related to function. Based on the data presented, the function assignment has emerged under the function category in pre-LAC implementation. A science teacher from Case #1 stated, *"The department LAC coordinator will assign the facilitator and the documenter of the session and its different facilitators for each session, for example, and the documenter is different. This allows us to document the progress of our LAC correctly,"* (FGD1-T2). As stated by Case #3, *"For the roles, the LAC proponent will decide on the LAC assignment,"* (FGD3-T2). DepEd [15] mandates that on the assignment of work, LAC members may be assigned specific tasks to complete during LAC sessions, which is not evident in the implementation of the LAC sessions. Moreover, DepEd [29] stated that the facilitator could assign tasks to LAC members during LAC sessions. These responsibilities could be rotated among the group members, ensuring that the content should capture individual or group insights or realizations, problems encountered, and suitable instructional practices.

Another theme that has emerged is the selection of a resource person. Before the sessions start, resources, which include resource persons and material, should be organized. As mentioned by Case #1, *"We sometimes invited external speakers related to the pandemic like we invited city health personnel,"* (FGD1-T4). Also, another teacher from a different school said, "They proceed to plan and decide who will be the speaker. DepEd [29] emphasized that the resources should be chosen and identified during the school LAC planning process in the LAC implementation. As per DepEd order 35 [30], the LAC leader or school head shall take the initiative in determining the resources required, ensuring availability and sustainability. It does not preclude the school from requesting faculty input and suggestions on the instruments required for LAC conduct. Moreover, a critical consideration in the pre-LAC implementation is the role of the LAC coordinator, which is the final theme that emerged from the respondents' responses. Case #1 stated, *"It is usually the school LAC coordinator because we have an LAC coordinator in the school, then every department has an LAC coordinator who plans,"* science

teachers explained (FGD1-T1). They also said, *"It is the LAC coordinator, the learning development team or coordinator, the umbrella of all the LAC coordinators,"* (FGD1-T2).

Table 3. Science teachers' experiences in the LAC implementation of function

| Pre-LAC categories | Themes | Initial codes/illustrative science teachers' experiences in the LAC implementation |
|---|---|---|
| Function | Assignment of function | *"Every LAC session or before the LAC session, the Dept LAC coordinator will assign the facilitator and the documenter of the session and its different facilitators for every session; for example, documenters are different. With that, we document the progress of our LAC properly,"* (FGD1-T2). |
| | | *"For the roles, the LAC proponent will decide on the LAC assignment,"* (FGD3-T2). |
| | Selecting Resource person | *"We sometimes invite external speakers related to the pandemic like we invited city health personnel,"* (FGD1-T4). |
| | | *"They proceeded to plan and decide who will be the speaker. And since the division approved the action research, we thought of getting a speaker from the division,"* (FGD4-T3). |
| | LAC Coordinator | *"It is usually the school LAC coordinator because we have an LAC coordinator in the school, then every department has an LAC coordinator who plans,"* (FGD1-T1). |
| | | *"It is the LAC coordinator, the learning development team or coordinator, the umbrella of all the LAC coordinators. Then, the LAC coordinator will coordinate and hold a meeting or conference. Then, they will discuss what training has already been conducted and what training should be based on the teachers' needs. After every training, all those reports will be gathered, will be given to the LMD coordinator, and those reports will be given to the division,"* (FGD1-T2). |

According to DepEd [15], the school head is responsible for spearheading the LAC organization and ensuring the establishment, maintenance, and sustainability of the DepEd-mandated practice of conducting regular LAC sessions. The school Head should also oversee LAC activities and assess their effect on overall school enhancement. They will establish secure environments for educators to converse, facilitating mutual learning and assistance. Administering assistance and academic guidance to LACs will facilitate the establishment of professional learning communities in schools that emphasize student learning and comprehensive development rather than their practice communities. Moreover, findings are supported by Gamboa [31] that stressed the significant variations to demonstrate the influence of SLAC efficacy with the identified intervening factors such as workloads, school head support, and motivation. The use of SLAC in the inclusion of themes was shown to be a strong predictor of the monitoring and evaluation methodologies used.

Finally, science teachers' prevalent experiences on the pre-LAC implementation concerning LAC resources were presented as observed in Table 4. The responses emerged into two themes: LAC planning tools and activity forms. One identified theme was the resource that was emphasized in the LAC planning form. Case #1 said, *"We have LAC tools provided by the division office, and there are different tools for LAC. Although we can see the documenter, evaluation, and reflection, there are many more,"* (FGD1-T2). Schools can modify the template to meet their specific requirements. This plan should be integrated with or linked to the school improvement plan (SIP) or annual implementation plan [15]. The activity forms are a recurring theme in the FGD, as seen in Table 4, and Case #4 said, *"The burden part is to prepare the form and complete it,"* science teachers said. FGD4-T6: "*We have three forms to fill out for the participant alone,"* (FGD4-T3).

Table 4. Science teachers' experiences in LAC implementation of lac resource

| Pre-LAC categories | Themes | Initial codes/illustrative science teachers' experiences in the LAC implementation |
|---|---|---|
| Resource | LAC planning tools | *"We have LAC tools provided by the division office, and there are different tools for LAC. Although we can see the documenter, evaluation, and reflection, a lot exists. The LAC coordinator and school head will answer the other tools,"* (FGD1-T2). |
| | Activity forms | *"The burden part is to prepare the form and accomplish it.* FGD4-T6: *"To the participant alone, we have three forms to fill out,"* (FGD4-T3). |

### 3.1.2. Mid-LAC implementation practices

Table 5 demonstrates how science teachers perceived the importance of the mid-LAC norms. The activities in this implementation phase should be practiced and observed [15]. This includes sharing expectations, writing participation, monitoring attendance, efficiency, teamwork, LAC participation, and professionalism. Based on the findings, it was found that all these norms were of high importance (with a median of Mdn-5), as evaluated by the science teachers. Also, preparing line-item budgets was considered moderately important *(*with a median of Mdn-4), as rated by the science teachers.

LAC implementation norms are the guidelines that members agree to use and follow when conducting LAC sessions. Additionally, creating standards and upholding them help members deal with difficult situations

and ensure the group's success. Teachers should discuss how their community connections can support the curriculum and how the LAC sessions may help them advance their careers [15]. The data explains how science teachers strongly emphasized during-LAC implementation norms. Based on the findings, all activities in the implementation norms except preparing line-item budget were given special attention and considered highly important for science teachers. Science teachers value the importance of these norms, which also determines the success of the LAC session. When science teachers share their expectations, become efficient with LAC, and prepare budgets, it fosters an environment of accountability for their learning. Also, the working relationship and teamwork are part of the implementation norms. Researchers' [32], [33] argued that engaging in practice to collaborate with co-teachers in LAC activities is an exceptionally successful method for enhancing collaboration skills with peers and fostering teamwork.

Furthermore, the respondents' prevalent experiences during the LAC implementation were presented. Based on the findings, two essential aspects of the LAC implementation were identified: the LAC setting and the implementation directives. Table 6 presents the respondents' experiences in the LAC implementation based on how it is conducted. Science teachers identified two settings–online and onsite sessions- for how LAC is conducted in their respective schools.

Table 5. Science teachers' experiences in the implementation of mid-LAC norms

| During-LAC implementation norms | Mdn | R | Q |
|---|---|---|---|
| Sharing of expectations | 5 | 4 | CWHI |
| Preparing line-item budget | 4 | 4 | CWMI |
| Writing participation | 5 | 4 | CWHI |
| Lac participation | 5 | 4 | CWHI |
| Monitoring attendance | 5 | 3 | CWHI |
| Working relationship | 5 | 3 | CWHI |
| Teamwork | 5 | 3 | CWHI |
| Professionalism | 5 | 3 | CWHI |
| Efficiency | 5 | 3 | CWHI |

Note: Mdn-median, R-range, and Q-qualitative description.
CWHI-considered with high importance (Mdn-5), CWMI-considered with moderate importance (Mdn-4), CWLI-considered with low importance (Mdn-3), NCA-not considered at all (Mdn-2), and IDNKC-I do not know if it was considered (Mdn-1).

Table 6. Science teachers' experiences in the LAC implementation setting

| Mid-LAC categories | Themes | Initial codes/illustrative science teachers' experiences in the mid-LAC implementation |
|---|---|---|
| LAC setting | Online session | *"It is virtual, adapting to the 21st-century. Because of the pandemic, even in our house, we keep in touch with our science teacher through virtual LAC sessions. However, we are encouraged to be in school and attend some limited face-to-face LAC sessions,"* (FGD1-T2). |
| | Face-to-face session | *"However, we are encouraged to be in school and attend some limited face-to-face LAC sessions,"* (FGD2-T4) |

Online LAC sessions were conducted in different schools, as the teachers responded. It was implemented in this manner during the pandemic. Case #1 said, *"It is virtual, adapting to the 21st-century. Because of the pandemic, even in our house, we stay connected with our science teacher through virtual LAC sessions. However, we are encouraged to be in school and attend some limited face-to-face LAC sessions,"* (FGD1-T2). The face-to-face session was also conducted during LAC sessions. Before the COVID-19 pandemic, they frequently provided their services in person. Most of the time, only a few teachers are trained, and these teachers must train others. However, Case #2 states *"That we are encouraged to stay in school and attend some limited face-to-face LAC sessions,"* (FGD2-T4). In addition, science teachers experienced face-to-face LAC sessions despite the limited face-to-face due to the pandemic caused by COVID-19.

Based on the responses, teachers have continued exposure to the LAC even during the pandemic, adapting flexible learning modes. This significantly helps teachers enhance their knowledge and skills, and there is continued upgrading even on various platforms. Teachers' ability to communicate constantly in a virtual environment positively impacts their motivation. It is critical to remember that rules must be established regarding contact frequency and timing [34]. The continued implementation of the LAC allows teachers to develop context-specific teaching units centered on a scientific topic or problem of their choice, illustrating how their proposed methodology and learning activities would enable students to enhance their scientific and essential competencies [35]. This is supported by Medina *et al.* [36] that emphasized the role of the school in providing teachers with resources including internet connection and appropriation of workload as key factors affecting their decision to join LAC session. The fully online mode nature may have given them more flexibility as also cited but may not be properly utilized due to the said factors. Therefore, it is recommended to include

administrator and expert teacher working with classroom teachers at the program design, implementation and evaluation stages of online LAC to better address curriculum needs and facilitate the delivery of high-quality professional development for teachers' professional growth. This pertains not only to professional areas but to their time schedule, available technology, internet access and workload.

Consequently, science teachers have experienced the mid-LAC as part of the implementation initiative. DepEd [15] mandates that implementation initiatives include LAC topics, session group mandates, and DepEd mandates should be observed and evident in every LAC program. Priorities of the LAC plan is carried out through various activities, including stimulus (such as lectures, practical activity, orientation, coaching, workshops, development, and use of instructional materials), followed by group discussion of a potential course of action. The session's final activity was individual and group action planning for implementing selected activities in the classroom, as shown in Table 7.

Table 7. Science teachers, experiences in LAC implementation initiatives

| Mid-LAC categories | Themes | Initial codes/illustrative science teachers' experiences in the mid-LAC implementation |
|---|---|---|
| LAC implementation | LAC topics | *"We conducted action research, but it is from the INSET,"* (FGD2-T4).<br>*"Like the recent LAC robotic, we conducted it in f2f,"* (FGD3-T5).<br>*"In our school, all of us are joined if the topic is general like mental health,"* (FGD3-T1).<br>*"Like sexual education, it should be seen in the lesson plan,"* (FGD3-T1).<br>*"It is fine if the topic is general and can be integrated into all subject areas,"* (FGD4-T2) |
| | Session groups | *"There were also times when we needed to meet to have implementation. Improvement is evident because it is observable to our students. This afternoon, we have a LAC session, and our topic is the weekly home learning plan (WHLP). However, meeting the specific needs of our mentees will be catered to through a small group,"* (FGD4-T5)<br>*"Last year, the LAC session combined with the math and science group became ineffective. They were assigned for the assessment and strategies, but since they have different subjects, it is difficult to integrate them into our lesson, plus we have different views,"* (FGD4-T2). |
| | DepEd mandates | *"LAC is for professional growth, and there is something to learn, whether in a small group or general. It so happens that this year, the principal instructed us to submit an LAC planning based on the DepEd order,"* (FGD4-T5).<br>*"We also follow a guideline from DepEd, although it is in our NEAP. When we join the NEAP, there is something that changes: instruction analysis; it is almost the same in our LDM. They get the template in LAC from the NEAP, LDM, and from the old that's modified,"* (FGD4-T6). |

As presented in Table 7, LAC topics are one theme that emerged under the implementation initiatives. Case #2 reported, "*We conducted action research, but it is from the INSET,"* (FGD2-T4). Also, Case #3 mentioned, *"Like the recent LAC robotic, we conducted it in f2f,"* (FGD3-T5). The same school also stated, *"In our school, all of us are joined together if the topic is general like mental health,"* (FGD3-T1). *"Like sexual education, it should be seen in the lesson plan,"* (FGD3-T1). Another theme that has emerged from the data is the session groups. Case #4 said, *"When doing the LAC plan, we cannot remember the forms like evaluation forms. Concerns will indeed be catered to in a small group. There were times as well when we needed to meet to have implementation. Improvement is evident because it is observable to our students,"* (FGD4-T5). *"This afternoon, we have an LAC session, and our topic is the WHLP, which is our current issue in school. So, as a subject coordinator, I will call teachers and assess what is happening in their classrooms,"* (FGD4-T5). The DepEd mandates are the last theme that emerged from the data during the Mid-LAC session. Case #4 stated, *"It is the same; in general, LAC is for professional growth, and whether it is in a small group or in general, there is something to learn," the teachers explained. "This year, the principal instructed us to submit a LAC plan based on the DepEd order,"* (FGD4-T5). This was supported by another teacher who said, *"We also follow a DepEd guideline, though it is in our NEAP. When we join the NEAP, one thing changes: instruction analysis, which is identical in our LDM. They get the template in LAC from the NEAP, LDM, and the modified old,"* (FGD4-T6). Based on the findings, teachers are called upon to engage in numerous structured professional development activities that are not tailored to their individual needs. As a result, teachers are less successful and effective in developing their own teaching [37]. Therefore, it is imperative that school heads review the content of the training before implementing the action cell for the school learning to ensure consistency and efficiency.

### 3.1.3. Post-LAC implementation practices

Table 8 demonstrates that science teachers perceived the post-LAC activities as highly important in every LAC session. These activities include development in teacher quality, impact on student performance, the effectiveness of implemented strategies, monitoring and assessment, lesson research, and classroom application with a median of (Mdn-5). As presented in the Table 8, science teachers rated classroom application, teacher quality, impact on student achievement, effectiveness of implemented strategies, and monitoring and assessment as essential parts of post-LAC activities.

Table 8. Science teachers' experiences in the implementation of post-LAC activities

| Post-LAC | Mdn | R | Q |
|---|---|---|---|
| Classroom application | 5 | 3 | CWHI |
| Lesson research | 5 | 3 | CWHI |
| Development in teacher quality | 5 | 3 | CWHI |
| Impact on students' performance | 5 | 3 | CWHI |
| Effectiveness of the implemented strategies | 5 | 3 | CWHI |
| Monitoring and assessment | 5 | 3 | CWHI |

Note: Mdn-median, R-range, and Q-qualitative description.
CWHI-considered with high importance (Mdn-5), CWMI-considered with moderate importance (Mdn-4), CWLI-considered with low importance (Mdn-3), NCA-not considered at all (Mdn-2), and IDNKC-I do not know if it was considered (Mdn-1).

It can be implied based on the findings that is advantageous to tailor metrics and evaluations of success to find the ideal configuration of a professional development program for a particular school or environment. It allows the professional development program to be precisely contextualized. Moreover, the post-LAC activity aims to enhance learning outcomes by improving classroom application and lesson research to achieve a preset goal while organizing professional development activities, teacher training, program management, or teaching professionals. In general, the findings collectively align with the emphasis on the importance of professional development in enhancing teacher performance and adapting to evolving educational demands like integration of digital literacy and sustainable practices, global policy trends and interdisciplinary programs [9], [38]–[43]. Hence, SLAC underline the need as a professional development program that is personalized, tech-integrated, and research-oriented to meet both global standards and local educational needs.

Moreover, science teachers' prevalent post-LAC experiences are assessed and classified as evaluation and monitoring. Table 9 discusses the post-LAC narrative on evaluation, as per the DepEd order on LAC policy. LAC members should implement the proposed strategies or activities in their classrooms, schools, or communities as appropriate, and their success should be evaluated. LAC members should be prepared to provide feedback on how well these initiatives worked at upcoming meetings. LAC leaders and facilitators should monitor these activities and assess how much they improve student outcomes in the classroom. School administrators or principals can help LACs and students learn better by conducting class observations and encouraging teachers to improve instruction continuously, as seen in Table 9.

LAC evaluation forms are the themes that emerged from the FGD, as seen in Table 9. Case #1 said, *"Yes, we have LAC tools to complete and submit after the session,"* teachers said (FGD1-All). Also, in Case #4, *"There is an Annex BCDE, as well as a reflection, documenter, and facilitator,"* (FGD4-T6). The same happened during the individual interview; a teacher from one division stated, *"As the basis for our learning, the LAC leader will monitor the evaluation through reflection,"* (II ST4). Case #2 said, *"Through LAC tools, such as evaluation forms after the LAC and reflection,"* said one of the teachers (FGD2-T2). Also, Case #3 mentions, *"I saw about this monitoring evaluation and assessment (MEA), a report from the CIDF, it has data, and in the elementary, they had 37 LAC sessions conducted, while in the secondary, there were only six. Also, according to another school, the stated, the elementary school has the right to conduct their LAC because it is less common in the secondary,"* (FGD3-T4). *"At the end of LAC, we have the LAC form, there are suggestion comments and feedback"* (FGD3-T2), it is supported by another teacher that *"Concerning the implementation, the speaker gave an expectation and its part of the matrix,"* (FGD3-T2). Then, attendance and certificates are the final themes that emerged from the evaluation. Case #3 said that teachers stated *"That attendance is monitored because we have a template to fill out,"* (FGD3-T3). *"Additionally, we have certificates prepared by the technical working group (TWG),"* (FGD3-T2).

Table 9. Science teachers' experience in LAC implementation evaluation

| Post-LAC categories | Themes | Initial codes/illustrative science teachers' experiences in the post-LAC implementation |
|---|---|---|
| Evaluation | LAC evaluation forms | *"Yes, we have LAC tools to accomplish and submit after the session,"* (FGD1-All). |
| | | *"There is an Annex BCDE; there is also a reflection, documenter, and facilitator,"* (FGD4-T6). |
| | | *"Through LAC tools, like evaluation form after the LAC and reflection,"* (FGD2-T2). |
| | | *"I saw about this MEA, a report from the CIDF; it has data. In the elementary school, 37 LAC sessions were conducted, while in the secondary school, there were only six. I think the elementary has the prerogative to conduct their LAC. It is less practiced in the secondary,"* (FGD3-T4). |
| | | *"At the end of LAC, we have the LAC form; there are suggestion comments and feedback,"* (FGD3-T2). |
| | Attendance and certificates | *"The attendance is also monitored since we have a template to fill out,"* (FGD3-T3). |
| | | *"To add, we also have certificates that are prepared by the technical working group (TWG),"* (FGD3-T2). |

Professional development evaluation forms including certificates and attendance sheets are the primary tools used in monitoring and evaluating the conducted training. Moreover, these tools aim to gather information about how effective professional development is and to determine what may be improved and be changed in the professional development activities for continued service improvement. The identified tools are essential elements for a thorough and logical evaluation of professional development programs.

Science teachers' experiences in the post-LAC activities on monitoring resulted in two themes: classroom observation and classroom observation as seen in Table 10. One theme that occurred from the monitoring category under post-LAC is classroom observation. Teachers must share their practices and participate in peer coaching, classroom observations, and discussions to advance professional development [44]. When teachers' accounts of how the INSET experience affected their lesson plans were compared to classroom observations of the teachers' science instruction, it became clear that specific outcomes were more likely than others to result in changes in practice. As a result, a rough hierarchy or sequence of results was established, as shown in Table 10.

Table 10. Science teacher's experiences in LAC implementation monitoring

| Category | Themes | Initial codes/illustrative science teachers' experiences in the post-LAC implementation |
|---|---|---|
| Monitoring | Classroom observation | *"We have a conversation, follow-up, and FGD to talk about how the teachers apply the strategies in the classroom. There is monitoring,"* (FGD4-T4). |
| | | *"Yeah, we have COT or classroom observation for teachers twice a year. We asked the teacher to choose what day to be observed,"* (FGD4-T3). |
| | | *"The COT is used to plan; sometimes, due to a busy schedule, we cannot plan in the group and prefer our group chat to communicate, and sometimes it is recorded,"* (FGD4-T5). |
| | Classroom observer | *"We have COT or classroom observation for teachers twice a year. We asked the teacher to choose what day to be observed,"* (FGD4-T3). |
| | | *"Firstly, during the face-to-face, we can easily apply the concept of LAC in the classroom; now, in the pandemic, it is difficult. The COT is used to plan; sometimes, due to a busy schedule, we cannot plan in the group and prefer our group chat to communicate, and sometimes it is recorded,"* (FGD4-T5). |

According to Case #4, *"We have a conversation, follow-up, and FGD to discuss how the teachers apply the strategies in the classroom. There is monitoring,"* (FGD4-T4). Sometimes, some teachers need to follow it because they have different styles or approaches in the classroom. As an MT, I let them do what they want in their classroom. Teachers 1 and 2 usually follow it without hesitation. I ensure that it is applied responsibly and that there is feedback from the students.

Collegiality and good relationships are required for productive classroom observation. Four aspects of relational trust that are essential facilitators of professional learning are respect, competence, personal regard for others, and integrity [45]. The feeling of safety may be impacted if facilitators are not mentioned, particularly trust and respect from peers. Teachers' mutual respect and trust strengthen collaboration, reflective discussion, and deprivation characteristics. These characteristics directly impact members who participate in classroom observation and feedback, monitoring partnerships, pedagogical discussions, and curriculum innovations [46]–[48].

The last theme that emerged from the monitoring was the classroom observers. Case #4 said, "*We have COT or classroom observation for teachers twice a year. We asked the teacher to choose what day to observe,"* (FGD4-T3). The COT is used to plan, sometimes due to being busy. Another teacher also supports it: *"Firstly, during the face-to-face, we can easily apply the concept of LAC in the classroom, but now, during the pandemic, it is difficult. We cannot plan in the group and prefer our group chat to communicate; sometimes it is recorded,"* (FGD4-T5). Feedback impacts teachers' reflections and helps them become better practitioners than before. However, numerous academics warn against prescriptive feedback [49]–[52]. Instead, they advocate for constructive feedback adapted to the teachers' needs [53], [54]. As a result of the quantitative measures and qualitative constructs, this study presents the converging data in defining science teachers' experiences in the LAC session in remote areas in the Philippines. It is essential to note the salient elements and principles of LAC that emerged in converging quantitative and qualitative data.

### 3.2. Essential elements emerged from converging the science teachers' experiences in the LAC implementation

Structure and resources. LAC establishes the structure and resources of the focal event. LAC concentrates on planning when looking into the environment, and the role of LAC coordinators is significant. The structure of LAC also includes assessment of needs, prioritization of topics, formation of LAC, identification of appropriate intervention, scheduling of meetings, and role assignment of work. A resource is any material readily available in the environment, economically viable, culturally sustainable, and helps to meet the needs of internal-house professional development training.

Setting, sharing of expectations, efficiency, and budgeting. LAC does implement exclusivity in a particular setting. Wherein, mid-LAC covers the mode, expectations, efficiency, and budgeting in establishing the focal event. The LAC mode settings define the guidelines for how teachers acquire, process, and maintain knowledge. Depending on the person, most people prefer different combinations of visual, auditory, reading, or kinesthetic (VARK) learning modes. Moreover, sharing of expectations helps teachers work on their LAC and develop stronger bonds based on a shared understanding of what is expected of them and a strategy for going above and beyond those expectations. In the same way, LAC includes a concept called understanding the effectiveness of training. Teaching methods and student learning are more likely to change due to ongoing professional development, which provides teachers with frequent opportunities to partake in learning centered around a particular set of concepts or procedures. Finally, creating a budget entail planning how to spend for the meeting. By creating a spending plan, teachers can predict whether they will have enough money to accomplish the tasks they need or want to. Balancing expenses and income are what budgeting is all about.

Monitoring and evaluation, classroom application and lesson research. LAC monitors the progress and development of science teachers through monitoring and evaluation, classroom application, and lesson research. Monitoring and evaluation are crucial parts of LAC. For professional support, one-on-one coaching in a teacher's classroom is typical. Professionals also led workshops where they shared their knowledge with audiences or worked with teachers online as virtual mentors. Also, LAC performs in a learning environment. Starting with a task focusing on teacher inquiry is crucial for LAC. These activities include things like lesson planning, peer observation, and other tasks related to teaching. The knowledge that educators have learned through analysis in this field is abstracted. To boost student achievement, teachers design action plans for incorporating their learning into the classroom (application). Then, research lessons are actual lessons taught in the classroom to students that are: i) concentrated on a particular teacher-generated problem or practice goal; ii) carefully planned, typically in collaboration with one or more colleagues; iii) observed by other teachers; iv) recorded for analysis and reflection; and v) evaluated.

### 3.3. Principles of LAC for policy recommendations

#### 3.3.1. LAC establishes the structure and resources of the focal event

Science teachers follow specific directives in the LAC procedures; however, they recognize the authenticity of its implementation. LAC is a context-based approach to strategy that considers the forms, structure and needs analysis. When someone uses the term "professional development," they refer to a formal process like a conference, seminar, or workshop, group learning among coworkers, or a college or university course. Professional development can occur in informal settings like office discussions, personal reading, research, peer learning, or watching a colleague at work. The opportunity to consider the professional development's focus is another excellent method for enhancing teacher professional development. The reflection part was crucial because teachers talked about how challenging it was to alter the talk patterns they noticed in their teaching videos, giving them a way to highlight the change in teacher dialogue. This reflection opportunity's value is increased when done in a learning community. This reflective activity conducted by a group of students illustrates the sociocultural constructivist theory of science learning [55], [56]. Teachers' conversations with one another thus contribute to education and are socially satisfying.

#### 3.3.2. LAC does implement exclusivity in a particular setting

It covers the mode, expectations, efficiency, and budgeting needed to establish the events. Professional development provides networking opportunities. Numerous professional networking activities, including workshops, conferences, and other gatherings, enable professionals to network with others in their industry who can assist them with future employment prospects. The teachers' professional network and the contacts developed with other professionals will be helpful should they decide to change or advance in their careers. Professionals use professional growth and training opportunities to broaden their expertise, acquire new procedures and techniques, and adopt new technology because every professional industry constantly grows. Professional growth brings professionals up to date on industry trends. It is essential to stay updated on industry knowledge and trends, and professional development, continuing education, and learning opportunities are excellent methods to do this.

Thus, the relevance of LAC is determined by the context in which it is delivered, planned, and implemented, focusing on the environment, scientific literacy, and technological literacy. External approaches to instructional improvement should be more powerful, specific enough, or sustained enough to change the classroom and school culture [57]. New teachers have many unfamiliar topics, including discipline, curriculum, school culture, test administration, state standards, parent relations, and interactions with other teachers. Many schools provide new teachers with mentors and training programs. Thus, the most significant finding is that after just two years, intensive mentoring for new teachers significantly impacted teachers' performance and student achievement [58]. Cartilla and Rondina [59] found that LAC participants demonstrated better

performance and improved class achievement. It also showed that teachers and implementers were excellent in the measures relevant to the basic education program of K to 12, such as learner diversity and inclusion of students, teaching content and pedagogy, and assessment process [60], [61].

## 4. CONCLUSION

The study implies that the LAC can be utilized to evaluate subject competence and effectiveness in professional development. LAC establishes the structure and resources of the focal event. Science teachers follow specific directives in the LAC procedures; however, they recognize the authenticity of its implementation. LAC does implement exclusivity in a particular setting. Mid-LAC covers the mode, expectations, efficiency, and budgeting needed to establish the focal event. LAC monitors the progress and development of science teachers through monitoring and evaluation, classroom application, and lesson research. The LAC is a tool for professional development aimed at helping science teachers, resulting in the holistic development of students by promoting mutual understanding of the nature of science, technology innovation, and cultural competence. In addition, science teachers are essential to quality education. Teachers should be empowered, motivated, professionally qualified, and supported within well-resourced, efficient, and effectively governed systems, as they are fundamental to ensuring quality education.

Also, the LAC fosters a community of science teachers who work together to develop science teachers as facilitators, science literate as innovators, and science leaders as researchers, which results in the growth of teachers' competence and will eventually result in professional leadership and aptitude toward professional leadership. Hence, this study recommended developing a professional development model for the LAC contextualized to the Philippine setting. With the development of a framework, implementing the LAC sessions in schools can be more effective and efficient, and the community of practice in schools will be improved.

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## AUTHOR CONTRIBUTIONS STATEMENT

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

## CONFLICT OF INTEREST STATEMENT

The authors declare no known conflicts of interest, whether financial, professional, or personal, that could have influenced the conduct, analysis, or reporting of this research. All research procedures, including data collection, interpretation, and publication, were conducted with impartiality and in accordance with ethical academic standards. Any potential sources of bias were assessed and mitigated to ensure the integrity and objectivity of the study.

## INFORMED CONSENT

The authors confirm that informed consent was obtained from all participants involved in this study prior to their participation. Participants were provided with a comprehensive explanation of the research objectives, procedures, potential risks, benefits, and their rights, including the voluntary nature of participation and the right to withdraw at any time without consequence. Written consent was secured where applicable, and all data were collected, processed, and reported in strict accordance with ethical guidelines to ensure confidentiality and anonymity. This study was conducted in compliance with relevant institutional research ethics regulations.

## ETHICAL APPROVAL

The research related to human use has been complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration and has been approved by the authors' institutional review board or equivalent committee.

## DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author, [MGAV]. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

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