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TEACHING COMPETENCE AND PEDAGOGICAL CONTENT KNOWLEDGE OF SCIENCE TEACHERS IN THE FIRST DISTRICT OF CAPIZ, PHILIPPINES: BASIS FOR A SUSTAINABLE INSTRUCTIONAL PROGRAM

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Abstract:

The teachers are expected to ensure effective practices on instructions in the classroom to achieve competitive and relevant learning among students. This survey-correlational type of research was conducted to determine the teaching competency and pedagogical content knowledge of Senior High School Science Teacher in the First District of Capiz. This is a basis for the instructional enhancement program for the school year 2018-2019. The data were gathered using adopted teaching competency and researcher-made pedagogical content knowledge questionnaires. The teaching competence questionnaire comprised of two (2) components such as personal competencies and instructional competencies. The pedagogical content knowledge questionnaire comprised of three (3) components such as knowledge of the subject matter, knowledge of instructional strategy, and knowledge of learners conception. The independent variable in this study was the pedagogical content knowledge and the dependent variable was the teaching competency. The findings revealed that in general, Senior High School Science Teachers in the First District of Capiz were "highly competent" and "outstanding" in terms of pedagogical content knowledge. There was a highly significant relationship between the teaching competence and pedagogical content knowledge of Senior High School Science Teachers in the First District of Capiz

Keywords: Instructional Program, Knowledge, Pedagogy, Science Teachers, Teaching Competence

1.INTRODUCTION

The Philippine basic education curriculum introduces the K to 12 program which aims to produce globally competitive graduates and adequately prepared for the world of works and entrepreneurship. To achieve this aim, the K to 12 programs provide competencies that may help the students focus and master certain concepts, skills, and values suited for their level of understanding. It also gives the students enough time to master the lessons that are needed for the next level (Okabe, 2013).

In science education, the teachers are the indispensable key players in developing the scientific literacy among students that will prepare them to become participative citizens who can make decisions and judgments regarding applications of scientific knowledge with a positive impact on social, health-related, and environment. The teachers are expected to ensure effective practices on instructions in the classroom to achieve competitive and relevant learning among students.

The two aspects of instruction are teaching and learning. To be efficient and effective, the teacher must possess teaching competency and pedagogical content knowledge. A teacher's competencies involve a related set of knowledge, skills, and attitude that enables her/him to effectively perform responsibility. Knowledge alone is not sufficient for assuring success in the classroom. A teacher must possess a sense of caring and competencies that includes a focus on their own personal and professional development as well as attention to the various needs of their students.

Pedagogical content knowledge conceptualizes the ways of representing and formulating subject that makes comprehensible to others (Guerriero, 2014). Pedagogical content knowledge is also a unique form of knowledge for teaching which is based on subject matter knowledge, knowledge of potential student learning difficulties, and students' prior knowledge of specific concepts (Even, 1993). It is important to focus on teachers' goals and purposes if we are to construct pedagogical content knowledge representations that Science Teachers use in their classrooms

to improve the teaching of a specific subject. The teacher should meet these standards to be competent to teach the subject and to achieve the desirable outcomes on the students' performance.

The schools need quality teachers who have the appropriate knowledge about the art of teaching. Trainings and Programs for teachers must be suited to what they need to improve. Since Senior High School is a newly implemented program. Schools must help the Department of Education to organize and disseminate quality education and being armed with the design to come up with effective instructional enhancement programs for teachers that would improve teaching competence and pedagogical content knowledge.

Instructional Program is a replicable instructional act and implemented to achieve instructional goals for learners. An instructional enhancement program is important to enhance teaching competency. Professional development should be differentiated according to the diverse need of the teachers because they have different pedagogical skills, mathematical skills, and experience in teaching the subject (Gentry *et al.*, 2013).

A well designed sustainable instructional program will help sustain teaching competence and pedagogical content knowledge. The melding of subject matter expertise with competency and pedagogical strategies and knowledge will produce high-quality classroom practices (Heggart, 2016).

This study is anchored with the teaching competence theory of Jackson (2009) which states that competencies are the skills that enable a teacher to be successful. To maximize student learning, teachers must have expertise in a wide-ranging array of competencies in an especially complex environment where hundreds of critical decisions are required each day. In the education process, the instructional delivery, classroom management, formative assessment, and personal competencies yield the greatest result on the competencies that the teacher must-have.

This study is furthermore anchored with Borg (2008) pedagogical content knowledge theory which states that pedagogical content knowledge represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners and presented for instruction.

The conceptual framework of the study is shown in Figure 1. The independent variable is pedagogical content knowledge, while the dependent variable is teaching competence, and the output is the instructional enhancement program.

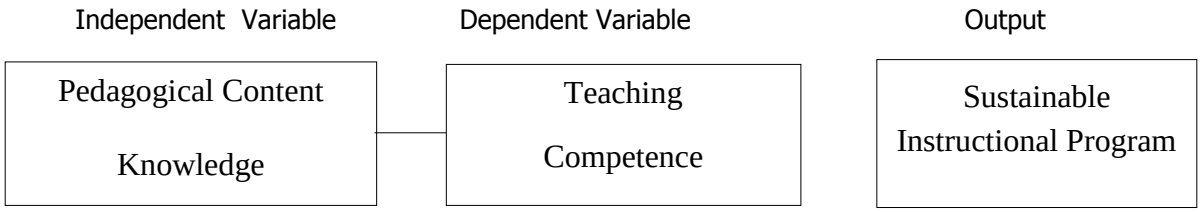

Figure 1. A schematic diagram showing the relationship between pedagogical content knowledge to teaching competence intervented by the sustainable instructional program

This study was conducted to determine the teaching competence and pedagogical content knowledge of the Science Teachers as a basis for a sustainable instructional program.

Specifically, this study sought to find answers to the following questions:

1. What is the level of teaching competence of Science Teachers?
2. What is the level of pedagogical content knowledge of Science Teachers?
3. Is there a significant relationship between teaching competence and pedagogical content knowledge of Science Teachers?
4. What sustainable instructional program could be crafted for Science Teachers based on the results of the study?

Based on the above problems, the hypothesis was formulated that there is no significant relationship between teaching competence and pedagogical content knowledge of Senior High School Science Teachers.

2.METHODOLOGY

This study utilized the survey-correlational method of research. This survey is used as a descriptive method to further analyze the quality and accuracy of the study objectives. Surveys can be useful when a researcher wants to collect data on phenomena that cannot be directly observed. On the other hand, correlational research attempts to ascertain if relationships are existing between or among quantifiable variables utilized in the study and as to what extent or degree they are related to each other.

The data in this study was collected using the teaching competence questionnaire adopted from the study of Dacula *et al.,* (2011) and pedagogical content knowledge researcher-made questionnaire among the Senior High School Science Teachers of the First District of Capiz. The independent variable was the pedagogical content knowledge while the dependent variable was the teaching competency.

The descriptive statistics used in the study were frequency count, percentage, mean, and standard deviation. The inferential statistic was spearman rho. All inferential tests were set at .05 alpha level.

3.PARTICIPANTS

The respondents in this study were the sixty-one (61) Senior High School Science Teachers in the First District of Capiz for the School Year 2018 – 2019. This study utilized the total enumeration of the teachers from the First District of Capiz Division.

Table 1. Respondent's Profile

Variables	f	%
Age		
20-29 yrs old	25	41.0
30-39 yrs old	22	36.1
40-49 yrs old	10	16.4
50 yrs old & above	4	6.6
Sex		
Male	10	16.4
Female	51	83.6
Civil Status		
Single	29	47.5
Married	28	45.9
Separated	1	1.6
Widowed	3	4.9
Educational Attainment		
Bachelor's degree holder	12	19.7
With master's units	26	42.6
Master's degree holder	16	26.2
With doctoral units	6	9.8
Doctor's degree holder	1	1.6
Major		
Biological Science	38	62.3
Chemistry	1	1.6
Physical Science	15	24.6
General Science	5	8.2
Other major	2	3.3
Total	61	100.0

4.DATA GATHERING INSTRUMENTS

An adopted and researcher-made survey-questionnaire was used to gather the needed data. The personal data sheet of the respondents was attached in the research instruments to gather personal information in terms of sex, age, civil status, highest educational attainment, major, and subject taught.

Teaching Competence Questionnaire. A 48–item teaching competence questionnaire was adopted from the study of Dacula *et al.* (2011). Items in the questionnaire were divided into two (2) which include personal competencies and instructional competencies.

The responses were rated as,

Score	Responses
5	Highly Competent
4	Competent
3	Moderately Competent
2	Slightly Competent
1	Less Competent

To describe the teaching competence, the scale adopted from the study of Dacula *et al.* (2011) below was used.

Scale	Verbal Interpretation
4.21 – 5.00	Highly Competent
3.41 – 4.20	Competent
2.61 – 3.40	Moderately Competent
1.81 – 2.60	Slightly Competent
1.00 – 1.80	Less Competent

Pedagogical Content Knowledge Questionnaire. The research-made questionnaire contained twenty-one (21) items. The items were divided into three parts which include knowledge of the subject matter, knowledge of instructional strategy, and knowledge of learners conception.
It is answerable with any of the following responses:

Score	Responses
5	Outstanding
4	Very Satisfactory
3	Satisfactory
2	Poor
1	Very Poor

To describe the pedagogical content knowledge, the scale below was used.

Scale	Verbal Interpretation
4.21 – 5.00	Outstanding
3.41 – 4.20	Very Satisfactory
2.61 – 3.40	Satisfactory
1.81 – 2.60	Poor
1.00 – 1.80	Very Poor

Pilot testing was conducted on thirty (30) teachers who were teaching Science in the Junior High School. The result of the pilot testing was used in determining the computer-processed factor analysis, construct validation, and reliability testing of the research instrument using the Statistical Package for Social Science (SPSS) software

5.STATISTICAL DATA ANALYSIS PROCEDURE

The data gathered from the study were analyzed using computer-processed statistics (SPSS).

Frequency count and Percentage. This was used to determine the Senior High School Science teachers' profile in terms of age, sex, educational attainment, age, sex, civil status, highest educational attainment, major, and subject taught.

Mean. This was used to determine the level of teaching competence and pedagogical knowledge of the teachers.

Standard Deviation. This was used to determine the extent of dispersion of scores from the means obtained from the research instrument.

Spearman rho. This test set at .05 level was used to determine the significance of the relationship between a teacher's competence and Pedagogical content knowledge of the Senior High School Science Teachers.

6.RESULTS AND DISCUSSION

6.1Teaching Competency of Science Teacher

Table 2.a presents the mean and standard deviation of the teaching competence of Science Teachers in terms of personal competencies.

Data revealed that in general, the level of personal competencies was "highly competent" (M=4.25, SD=0.62). As to its component, the data revealed that respondents are "highly competent" in terms of personal characteristics (M=4.31, SD=0.39), physical and mental competence (M=4.24, SD=0.49), judgment competence (M=4.30, SD=0.67), social competence (M=4.24, 0.59), classroom management (M=4.41, SD=0.58) and evaluation and remedial procedure (M=4.30, SD=0.58). On the other hand, the level of Aesthetic Competence was found to be "competent" (M=3.96, SD=0.56).

Table 2.a. Mean and standard deviation of teaching competence of science teachers in terms of personal competencies

VARIABLES	MEAN	DESCRIPTION	SD

Personal Competencies	4. 25	Highly Competent	0.62
Personal Characteristics	4.31	Highly Competent	0.39
Physical and Mental Competence	4.24	Highly Competent	0.49
Judgment Competence	4.30	Highly Competent	0.67
Social Competence	4.24	Highly Competent	0.59
Aesthetic Competence	3.96	Competent	0.59
Classroom Management	4.41	Highly Competent	0.58
Evaluation and Remedial Procedure	4.30	Highly Competent	0.88

Scale	Verbal Interpretation
4.21 – 5.00	Highly Competent
3.41 – 4.20	Competent
2.61 – 3.40	Moderately Competent
1.81 – 2.60	Slightly Competent
1.00 – 1.80	Less Competent

This implies that the Science Teachers high personal competent were due to their high self-confidence level, mental alertness, social and emotional stability, physically fit, ability in weighing ideas and solving problems intelligently, possess skills in interpersonal and human relation, thus, they were able to meet the standards of having an efficient and effective way of teaching. This indicated that the teachers' high personal competence was acquired from their teaching experiences, trainings, skills and dedication in teaching. Teachers are competent in catering to student needs. The Science Teachers have high personal competence that motivates them to maintain needed abilities, skills, and attitudes. This helped them be equipped in delivering quality teaching and become efficient and effective teachers in the classroom.

Furthermore, the result also implies that even though teachers showed highly competent personal competencies yet when it comes to aesthetic sense they were not fully able to show greatness in arts, show creativity, and resourcefulness. This indicated that the teachers are not specialized and do not have enough trainings in arts. Some teachers are not well equipped with technology and computer literacy. This may be due to the insufficient funds and budget for classroom beautification and making instructional materials which makes it difficult for them to create a conducive and well-constructed classroom environment and in making contextualize instructional materials.

This result conforms to the study of Morallos, *et. al*. (2014) that there is a need to develop more personal competencies along with creativity, awareness of social issues and problems, and injecting a sense of humor and professional competencies along with classroom management.

Furthermore, it also conforms to the study of Dacula, *et. al*. (2011) which concluded that knowledge alone is not sufficient for assuring success in the classroom. The teacher must possess a sense of caring and competencies that includes a focus on their own personal and professional development as well as attention to the various needs of their students.

6.2Teaching Competency of Science Teacher

Table 2.b presents the mean and standard deviation of the teaching competence of Science Teachers in terms of instructional competencies.

Data revealed that in general, the level of instructional competencies is "outstanding" (M=4.30, SD=0.39). As to its components, the respondents are "highly competent" in terms of knowledge of the subject matter (M=4.31, SD=0.39), use of instructional materials(M=4.28, SD=0.53), use of appropriate method ad strategies(M=4.38, SD=0.55), and art of questioning(M=4.52, SD=0.50). However, the data revealed that the level of planning is "competent" (M=4.18, SD=0.49).

Table 2.b Mean and standard deviation of teaching competence of science teachers in terms of instructional competencies

VARIABLE	MEAN	DESCRIPTION	SD
Instructional Competencies	4.30	Highly Competent	0.39
Knowledge of the subject matter	4.33	Highly Competent	0.45
Planning	4.18	Competent	0.49
Use of Instructional Materials	4.28	Highly Competent	0.53
Use of appropriate method and strategies	4.38	Highly Competent	0.55
Art of questioning	4.52	Highly Competent	0.50

Scale	Verbal Interpretation
4.21 – 5.00	Highly Competent
3.41 – 4.20	Competent
2.61 – 3.40	Moderately Competent

1.81 – 2.60	Slightly Competent
1.00 – 1.80	Less Competent

This implies that the teachers are highly competent in their instructional competencies that they can show a broad, accurate and up to date knowledge on a specialized subject, they were able to organize well the teaching by choosing wisely learning experience, subject matter and content materials for instruction, they used a variety of teaching aids and instructional materials to stimulate thinking and imagination of the learners, they effectively used a variety of teaching methods and help students articulate their ideas and thinking process. Furthermore, the Science Teachers' high instructional competence implies that they have mastery of the lesson, used varied instructional strategies, very good communication skills, and classroom management. In means that teachers are competent in instruction as effectively experienced by their colleagues and students.

The result indicated that the teachers' high instructional competencies were acquired from specialized seminars and trainings. Most of the teachers teach their specialized subjects so they were able to show knowledge and mastery of the subject matter and deliver the lesson with the appropriate strategy and methods suited to learners. This implies that the teachers as the soul of the classroom can meet the needs of the learners effectively and efficiently.

Furthermore, the result implies that even though teachers showed highly competent instructional competencies yet when it comes to planning they were not fully able to organize well the teaching by choosing wisely learning experience, subject matter and content materials for instruction. Since the Senior High School curriculum is newly implemented, schools do not have enough science books, teaching guides and learning materials. Teachers may not be able to plan lessons ahead of time and maybe lack time in making daily lesson log (DLL) because aside from their personal matters, teachers are given additional load, chairmanship and tasks to perform inside and outside the school campus.

This result conforms to the study of Shyles (2012) that teachers must be competent with sufficient knowledge and skills to teach efficiently and effectively, so that, students could perform well.

6.3Pedagogical Content Knowledge of Science Teacher

Table 3 presents the mean and standard deviation of the pedagogical content knowledge of Science Teachers. The result revealed that in general the level of pedagogical content knowledge of SHS Science Teacher was "outstanding" (M=4.23, SD=0.47). The majority of its components were "outstanding" in terms of the knowledge of instructional strategy (M=4.30, SD=0.47), and knowledge of learners conception (M=4.24, SD=0.47).

Furthermore, the level of knowledge of the subject matter was "very satisfactory" (M=4.14, SD=0.61).

Table 3. Mean and standard deviation of pedagogical content knowledge of science teachers

VARIABLE	MEAN	DESCRIPTION	SD
Pedagogical Content Knowledge	4.23	Outstanding	0.47
Knowledge of Subject matter	4.14	Very Satisfactory	0.61
Knowledge of Instructional Strategy	4.30	Outstanding	0.47
Knowledge of Learners Conception	4.24	Outstanding	0.48

Scale	Verbal Interpretation
4.21 – 5.00	Outstanding
3.41 – 4.20	Very Satisfactory
2.61 – 3.40	Satisfactory
1.81 – 2.60	Poor
1.00 – 1.80	Very Poor

The result implies that the teachers can demonstrate correct science facts, the flexibility of explanations, sequential presentation of facts, and hierarchical presentations. They can prepare a lesson that reflects knowledge of the subject matter including the concept of the topic. They know how to apply a range of teaching to develop critical and creative thinking, as well as higher-order thinking skills because of the teachers continuing professional growth. The result also indicated that teachers recognize the multicultural background of learners when providing learning opportunities. The respondents' experiences enhance their capabilities in teaching and the ability to recognize and understand learner's way of thinking.

Furthermore, the result implies that the SHS Science Teachers were knowledgeable enough in terms of subject matter, instructional strategy and learners' conception.

The result of this study conforms to what Rohaan, *et.al.* (2009) stated that teachers should know teaching strategies that incorporate appropriate conceptual representations to address learner difficulties and misconceptions and to foster meaningful understanding.

6.4A measure of the Relationship between Pedagogical Content Knowledge and Teaching Competence of Science Teachers

The relationship between pedagogical content knowledge and teaching competence of Science Teachers is reflected in Table 4. The result of the Pearson r product-moment correlation revealed a highly significant relationship, r= 0.502 with p=0.000 between pedagogical content knowledge and teaching competency of SHS Science Teachers.

Table 4. Spearman rho between Pedagogical Content Knowledge and Teaching Competence of Science Teachers

VARIABLE	rho	SIG
Pedagogical Content Knowledge and Teaching Competence	.5027	.000

* p<0.05 significant @ 5% alpha level

The result implies that teaching competence is significantly related to the pedagogical content knowledge of Science Teachers. This result indicates that the more knowledgeable and skillful the teachers are, the more they are competent in their profession. Teachers that teach based on their specialization were thoroughly grounded in the subject matter of Science well beyond any material which they are expected to teach that makes teacher deliver the lesson clearly with appropriate methods and strategy suited to the needs of the learners.

Moreover, the result implies that teachers possess a variety of skills. Competent and outstanding teachers know what and how to teach, thus, help students enhance their skills and cognition that helps them strengthen their ability to receive and comprehend information in Science subjects.

The result conforms to the study of Jeofry (2011) that the teachers need to be competent skillful, and knowledgeable to provide an effective and efficient way of teaching to meet every student's needs.

Furthermore, it conforms to the study of Kilic (2011) that having strong subject matter knowledge is essential to becoming a good teacher, but it is not sufficient for effective teaching; teachers should know how to teach a particular concept to particular learners, how to represent a particular idea, how to respond to learners' questions, and what curriculum materials and tasks to use to engage students in a new topic.

Thus, the null hypothesis which states that there is no significant relationship between teaching competence and pedagogical content knowledge of SHS Science Teachers in the First District of Capiz is hereby rejected.

7.CONCLUSION AND RECOMMENDATION

A. CONCLUSION

Given the foregoing, findings, the following conclusions are formulated:

1. The highly competent level of personal and instructional competencies of SHS Science Teachers indicates that the teacher has a strong belief about their capability, positive behavior, and capacity to teach effectively. Teachers' high teaching personal competence attributed that teachers show a harmonious relationship with students and can always be a person who is easy to approach and be with which enable the students to participate and keeps them attentive, and stimulate their interest in learning. They have already built a personal solid foundation, with self-knowledge, and self-confidence that influence them to maintain and perform well in teaching. The high-level teachers' instructional competence attributed that the teachers yield the greatest results in instructional delivery which leads the students increased their mastery of the lesson, teachers know how to teach and what to teach that ensure students understand what has been taught. Moreover, teachers can meet the needs of the learners in a highly competent way of teaching. Thus, produces skillful and knowledgeable students.

2. The outstanding level of pedagogical content knowledge of SHS Science Teachers may be attributed to the fact that the teachers were knowledgeable enough on the different science facts that help their students learn better. Teachers' expertise in the subject matter maximizes students learning. Teachers provide appropriate methods and strategies of learning for the students to attain the necessary knowledge that they should have. This is a strong indication that the teachers are competent and highly capable of teaching Science and can effectively demonstrate the skills and processes needed in delivering quality teaching to students. Their outstanding pedagogical content knowledge is a reflection of their professional qualities as teachers. Teachers inculcate learning and values to students that mold them to become better and globally competitive individuals. As a result, it provides better instructions for the students to achieve academic success such as enhancing higher-order thinking skills and performance inside and outside the classroom.

3. The significant relationship between the pedagogical content knowledge and teaching competence of SHS Science Teachers attributed that the teachers are knowledgeable enough and become highly competent. Teachers with outstanding pedagogical content knowledge combined with a high level of teaching competency build a strong foundation of education and producing highly competent and knowledgeable students. It also contributes to the well-organized learning environment, conducive learning for everyone, and thus provides effective learning.

B. RECOMMENDATION

In light of the findings and conclusions, the following recommendations are requested.

1. Since the level of personal and instructional competencies of teachers were highly competent, the researchers recommend that the teachers need to participate in continuing trainings/seminars for their personal and instructional development and to be updated on the latest content and teaching strategy to be integrated with their teaching. Science Teachers may continue practicing, and evaluating their personal and instructional competence and

efficiency in the teaching and learning process. Teachers may pursue a higher level of education to upgrade their professional competence and become more confident and inspired in maintaining a high personal and instructional competence. Teachers may improve their aesthetic competence by attending training workshops on arts and computer literacy. In the absence of funds, the teachers need to be more resourceful and may use indigenous material.

The Science Head Teachers or Coordinators shall observe the teachers and check their daily lesson guide weekly to motivate teachers to maintain their outstanding performance. They may maintain regular staff conferences or meetings to update the teachers on the latest approach for 21st-century students.

The School Administrators may continue to motivate to possess high personal and instructional competence to deliver quality education to the students. School Administrators shall send teachers to seminars related to personal and instructional competence or conduct seminars or in-service trainings where personal and instructional competence will be given emphasis. Furthermore, School Administrators may provide funds for classroom structuring and in making instructional materials and teacher made learning resources to improve teachers aesthetic competence.

2. Since the level of the pedagogical content knowledge is outstanding, the researchers recommend that the teachers will strive harder to achieve outstanding performances in every situation. Teachers may contextualize their strategies and methods that will suit the needs and readiness of the students. Science Teachers may handle their specialized subject to maintain mastery of the subject matter and deliver the lesson clearly to the students. Teachers may attend seminars and workshops to enhance their knowledge of the subject matter and instructional strategies to meet the needs of the students and to offer quality education.

The Science Head Teachers and Coordinators shall maintain the class observation using the DepEd COT-RPMS rating sheet every quarter to assist Science Teachers knowledge of content within and across the curriculum, and teaching strategies appropriate to learners.

3. Since, there is a significant relationship between the pedagogical content knowledge and competencies of teachers, the researchers recommend that the teachers may continue their professional development by pursuing masters and doctorate degrees that will make them knowledgeable, skillful and highly competent teachers. Also, the involvement of the school, teachers, and students need to strengthen through the integration of love in Science in every activity of the students. Teachers may teach based on their specialization to show knowledge and mastery of the subject matter to be a highly competent Science Teacher.

The school administrators shall monitor teachers' performance constantly to maintain teachers' high-level competence and outstanding pedagogical content knowledge.

4. It is recommended to use the researcher proposed sustainable instructional program during In-service Enhancement Training (INSET) every October, and use the proposed Learning Action Cell (LAC) session guide to develop teacher pedagogically and teaching competency, specifically in their aesthetic, planning, and knowledge in the subject matter.

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