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Long Paper  
**Effects of Learning Action Cells among Elementary Teachers' Level of Awareness on Climate Change Education**

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## Abstract

Climate change from a global perspective unequivocally accepts that humans are the primary cause of this phenomenon. A professional development program or learning action cell (LAC) must be designed and implemented to promote programs and practices vis-à-vis climate change. Hence, learning action cells (LAC) followed the theory of experiential learning as modeled by Kolb (1984) with a novel perspective conducted among elementary teachers at the Schools Division Office-City of San Pedro. It described the level of agreement regarding global warming and climate change; the level of knowledge on related issues of climate change; the level of agreement and disagreement on climate actions; the significant effect of learning action cells; and the role of education in addressing climate change. The study was a concurrent triangulation design, using a descriptive-survey and a narrative approach. Convenient sampling was employed with twenty-one teacher-respondents. Descriptive and inferential statistics were used to analyze quantitative data and a narrative approach for qualitative data. A paired t-test was used to test the significant effect of LAC using IBM SPSS Statistics version 20. The results indicated that LAC on climate change has a significant effect on the level of agreement on global warming and climate change, the level of knowledge on related issues of climate change, and the level of agreement and disagreement on climate actions. The role of education includes the following themes: (a) from integrating climate change to integrating climate change towards application; (b) empowering and engaging learners to lead, train, and emphasize climate change to learners; and (c) educating people to act for better results.

Keywords – awareness, climate change, curriculum, learning action cell

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## INTRODUCTION

Climate change from a global perspective unequivocally accepts that humans are the primary cause of this phenomenon (Henderson et al., 2017). Cross and Congreve (2021) linked other challenges to climate change, such as mass migration, biodiversity loss, and a

threat to food security. The problem was across levels, particularly in basic education. Nonetheless, Fortner (2001) articulated that climate change is a topic that teachers believe all learners should be familiar with. Teachers, on the other hand, lack the necessary knowledge and abilities to teach it.

To address teachers' professional needs, Shea, Mouza, and Drewes (2016) established the Climate Academy as a professional development program, which they designed and implemented to promote science standards that have been benchmarked. Furthermore, Drewes, Henderson, and Mouza (2018) studied the influence of a climate change professional development (PD) model for science professionals on student learning.

In the Philippines, understanding can modify behavior, raising awareness of the anthropogenic causes of climate change, which may affect self-efficacy in decreasing the impact of human activity (Hoffmann & Muttarak, 2020). Likewise, Valencia (2018) assumed that the Education for Sustainable Development (ESD) position is a fundamental topic for educational institutions in the Philippines.

As regards professional development, the Department of Education issued DepEd order 35, series 2016 entitled "The Learning Action Cell (LAC) as a K to 12 Basic Education Program School-Based Continuing Professional Development Strategy for the Improvement of Teaching and Learning," in consonance with professional development. This policy, which is based on the principle of lifelong learning and the DepEd's commitment to the development of teachers' capacity for professional accomplishment, actively promotes the continuous professional development of its teaching professionals. School-based LAC is a professional learning community for teachers to improve practice and student achievement. This particularly addresses the content and pedagogy of the K–12 Basic Education Program.

Various studies have revealed that developing knowledge, skills, attitudes, and values are critical in teaching about climate change, though there has been a shift toward a constructivist approach in which various techniques and strategies are developed (Fortner, 2001; Rule & Meyer, 2009). Pro-environmental behavior and awareness of the anthropogenic causes of climate change must be a target of education, as well as education for sustainable development. Sustainability encompasses development policy in basic education (Hoffmann & Muttarak, 2020; Valencia, 2018; Ocampo & Buenviaje, 2022). Professional development is highlighted in ensuring responsive education on climate change issues (Shea et al., 2016; Drewes, Henderson, & Mouza, 2018; Department Order 35, Series 2016).

Furthermore, teachers are expected to be prepared for lessons and more confident when implementing lesson plans in the K–12 curricula that address sustainability. Likewise, it can provide age-and developmentally-appropriate strategies for learners. Similarly, when teachers are more methodical and contextualize the learners'

learning requirements, student learning improves. As part of the professional development of teachers in the Schools Division Office-City of San Pedro, elementary teachers conducted learning action cells on climate change. The study answered the following questions:

1. What is the elementary teachers' level of agreement on the teaching of global warming and climate change?
2. How do teachers describe their level of knowledge on the related issues of climate change?
3. What is the teachers' level of agreement on the teaching about climate actions?
4. What is the teachers' agreement on the teaching of climate change education, in terms of?
  - a. Curriculum
  - b. School?
5. Do learning action cells have a significant effect on teachers in terms of?
  - a. level of agreement regarding the teaching of global warming and climate change
  - b. level of knowledge on the related issues about climate change
  - c. level of agreement of teachers about the teaching of climate actions?
6. What is the present role of education in addressing climate change?
7. Probing Questions:
  - a. How can teachers promote education about climate change?
  - b. What can be done more to make an effective and efficient climate change education?
  - c. Is there an urgency now to address climate change and did the situation get any better now?

## **NULL HYPOTHESIS (H<sub>0</sub>)**

Learning action cells have no significant effect on teachers' level of climate change awareness as shown by the pre-test and post-test means which are the same.

## **LITERATURE REVIEW**

### ***Experiential Learning***

The learning action cells followed the theory of experiential learning as modeled by Kolb (1984). The experiential learning cycle includes learning from concrete experiences (feeling), learning from reflective observation (watching), learning from abstract conceptualization (thinking), and learning from active experimentation (doing). Morris (2020) proposed a novel perspective on experiential learning that consists of contextually rich concrete experience, critical reflective observation, contextual-specific abstract conceptualization, and pragmatic active experimentation. The same theory was

utilized in the learning action cells conducted among elementary teachers teaching climate change.

Furthermore, Heinrich and Green (2020) opined that process learning theory with a practice-driven paradigm is crucial given the shortcomings of experiential learning. Likewise, by paying attention to holistic design, instruction, evaluation, and learners. This study investigates the effect of learning action cells among elementary teachers in terms of awareness of content, attitude, and agreement on climate change and climate action, and agreement about climate change education in terms of curriculum and school share.

### ***Teachers' Knowledge and Attitude on Agreement with Climate Change and Climate Action***

In K-12 science lessons, climate change is a big issue. Whatever the case, it is a human problem that demands social, technological, and scientific answers (Siegner & Stapert, 2020). Climate change mitigation requires future environmental harm mitigation and adaptation to changing conditions, and education is crucial (Bevins, 2020). Understanding teachers' perceptions of climate change have a significant role in how and to what extent institutions address the need to educate learners on this subject, specifically, and participate in other climate change mitigation strategies, in general (Chowdhury, Ahmed, Ahmed, & Haq, 2021).

Several studies on education for sustainable development have identified efforts in higher education, but large-scale programs involving primary and secondary learners are limited (Scheie & Stromholt, 2019). Climate change curriculum developers, researchers, and educators should investigate if they want to include an interdisciplinary, socio-scientific approach to climate change education (Siegner & Stapert, 2020).

Moreover, teachers have knowledge gaps, especially in terms of climate change's consequences, as well as misunderstandings concerning climate change's causes (Seroussi et al., 2019). Sukma, Ramadhan, and Indriyani (2020) studied how primary school teachers feel about including environmental education in the curriculum. Science is the most commonly paired topic in elementary school with environmental education. Chowdhury, Ahmed, Ahmed, and Haq (2021) investigated teachers' perceptions of climate change in terms of relevance, causes, effects, and mitigation. Teachers in public and private schools understand climate change's importance, causes, ramifications, and mitigation. Sociodemographic and intellectual factors impact teachers' attitudes toward climate change.

### ***Professional Development in Climate Change***

Professional development is a planned, methodical process that helps professionals acquire, use, and retain information, skills, and expertise. Formal and

informal education, vocational, specialized, or skill-based training, and advanced professional learning are all examples of professional development (Havea & Mohanty, 2020). Professional development is required for teachers to have the skills and information necessary to educate children about current environmental and societal challenges (Li et al., 2021).

Teachers working in K-12 schools play a critical part in this process (Redman, Wiek, & Redman, 2018). Bascopé, Perasso, and Reiss (2019) discussed some common challenges and the need for educational systems to promote science-based citizenship education toward sustainable development. There is a gap between teachers' epistemologies regarding science in general and climate science (Liu & Roehrig, 2019). Li et al. (2021), examined and assessed improvements in teacher efficacy on climate change using an innovative professional development paradigm.

Strategies for strengthening a learning, educator support, and knowledge co-creation by encouraging higher levels of thinking and more meaningful social relationships are fulfilled through professional development (DuBois, Krasny, & Russ, 2019). Professional development programs can help environmental educators innovate or improve their techniques by supporting seminars and continuous networks for sharing ideas (Li & Krasny, 2019). Martins-Loução et al. (2020) examined if teachers developed innovative methods for teaching biodiversity and climate change in the classroom via scientific inquiry.

Innovative and engaging professional development helps teachers enhance their expertise and confidence in teaching sustainability (Murphy et al., 2020). Johnson et al. (2008) discussed the value of inquiry-based curriculum activities, the importance of an opportunity to "learn by doing," and the necessity of expressing their thoughts with others (Li & Krasny, 2020).

According to the Intentional Network Design (IND) model, applying intervention qualities to a teacher education program or school design typically results in gains in three outcomes: teacher agency (and its antecedent, self-efficacy), trust, and instructional capacity (Baker-Doyle & Yoon, 2020). Due to evolving learning objectives and a continually changing student demographic, teachers are expected to have higher standards. Meanwhile, there are concerns that teachers are becoming younger and more inexperienced (Floden, Stephens, & Scherer, 2020).

### ***Climate Change in MELCs***

These are some of the most essential learning competencies (MELCs, 2020) across the curriculum at the elementary level. For the 3rd quarter of Grade 2 Araling Panlipunan or Social Studies, there are the MELCs; Natatalakay ang mga pakinabang na naibibigay ng kapaligiran sa komunidad (Discusses the benefits that the environment provides to the community). While for Grade 3 English, 4th quarter, the MELCs are "Restate facts from

informational texts (climate change, children’s rights, traffic safety, etc.) listened to". Climate change in Grade 4 is concentrated on Edukasyon sa Pagpapakatao or values education. For Grade 5, climate change is evident in values education with three competencies for the 3rd quarter. Finally, for Grade 6, the MELCs are evident in the 3rd quarter of values education and the 4th quarter of social studies.

## **METHODOLOGY**

### ***Research Design***

This study used the mixed method, also called the concurrent triangulation design. A mixed-method study involves collecting quantitative and qualitative data concurrently or sequentially, with the quantitative data taking precedence, and combining the data at one or more phases of the research process (Boru, 2018). In this approach, the researchers begin with a quantitative method and then use a qualitative method to follow up on and enhance the quantitative results. The qualitative and quantitative data are analyzed separately, with the qualitative findings being utilized to enhance the quantitative findings. All data is gathered at the same time, and quantitative and qualitative methods are equally weighted (Fraenkel & Wallen, 2009). The concurrent triangulation design of investigating teachers’ levels of awareness is new in the Schools Division of San Pedro, as it is a newly established school division office. Moreover, no data is available to measure and present the effect of learning action cells on climate change among elementary school teachers in the said division.

This study also employed a descriptive survey. According to Salaria (2012), it is a disciplined inquiry technique to collect and evaluate empirical data. The objective of descriptive research is to acquire knowledge about teachers’ awareness of climate change and the effect of learning action cells. The researchers developed a survey question from the existing literature and studies. Three experts validated the survey questions.

### ***Sample of the Study***

In this study, convenience sampling was employed. Since this is a concurrent triangulation design, convenience sampling is appropriate as this study includes both qualitative and quantitative investigations. Generalizability is prioritized by convenience sampling techniques to guarantee that the information acquired is typical of the population from which the sample was taken (Etikan, Musa, & Alkassim, 2016). As part of the research technique known as convenience sampling, researchers gather information from a group of respondents who are conveniently located. It is the most commonly used sample method since it is so rapid, easy, and economical (Adlit & Ida, 2022). Since there are twenty-one elementary teachers teaching climate change and twenty-one attendees of the school learning action cell, all of them are considered the sample of the study.



## Data Gathering Procedure

The researchers used Google Form to survey teachers to collect both quantitative and qualitative data. The survey instrument was validated by master teachers and head teachers. The survey used the 5-point Likert scale, where positive statements are described in the following (Table 1).

Table 1. 5- Point Likert Scale for Positive Statements

Score	Range	Description
5	4.20-5.00	Strongly Agree
4	3.49-4.19	Agree
3	2.60-3.39	Neutral
2	1.80-2.59	Disagree
1	1.00-1.79	Strongly Disagree

The survey used the 5-point Likert scale, where statements are described in the following (Table 2).

Table 2. 5- Point Likert Scale for Negative Statements

Score	Range	Description
5	4.20-5.00	Strongly Disagree
4	3.49-4.19	Disagree
3	2.60-3.39	Neutral
2	1.80-2.59	Agree
1	1.00-1.79	Strongly Agree

These data also require correct analysis, interpretation, comparisons, and trend and relationship analysis.

## Data Analysis

Both descriptive and inferential statistics are used. Frequency, percentage, mean, and standard deviation are used for descriptive statistics, while a paired t-test is used for inferential statistics to test significance. Further, when the objects in one sample are all measured twice, which is common in "before and after" comparisons, when the objects are related in some way, or when the objects are deliberately matched and have similar characteristics, the samples are paired (Xu et al., 2017). The researchers used IBM SPSS Statistics version 20.0 to test the difference.

Additionally, the narrative approach is also utilized as a qualitative approach. The narrative approach relies on people's written or spoken words or visual representations. Individual lives are frequently the focus of these strategies, as seen by their stories (Adlit

& Ida, 2022). Narrative analysis is utilized in stories that include how teachers promote education about climate change effectively and efficiently as well as the urgency to address climate change and the present situation and whether it gets better.

## RESULTS AND DISCUSSION

### **Q1. What is the elementary teachers' level of agreement on the teaching of global warming and climate change?**

Table 3 shows the elementary teachers' level of agreement on the teaching of global warming and climate change. The mean for the pre-test totaled 4.46, or the verbal description of strongly agree. The mean for the post-test totaled 4.72 and a verbal description of strongly agree. The level of agreement of teachers regarding global warming and climate change are both rated as "strongly agree". This is affirmed by Chowdhury, Ahmed, Ahmed, and Haq (2021), who stated that for institutions to address the need to educate learners specifically about climate change mitigation efforts, it is crucial to understand teachers' perspectives on climate change. Sociodemographic and intellectual factors impact teachers' attitudes toward climate change. Similarly, the topic of "climate change" was introduced through teacher preparation, according to Da Rocha, Brandli, and Kalil (2020). The usefulness of this strategy is shown by the findings that instructors struggle to understand and apply CCE in the classroom.

Table 3. Elementary Teachers' Level of Agreement on the Teaching of Global Warming and Climate Change

Level of agreement regarding global warming/climate change.	Pre-Test	Verbal Description	Post-Test	Verbal Description
1. It poses a serious threat to people around the world.	4.76	Strongly Agree	4.90	Strongly Agree
2. It poses a serious threat to you and your family.	4.85	Strongly Agree	4.90	Strongly Agree
3. It is caused by human activities.	4.45	Strongly Agree	4.71	Strongly Agree
4. Problems and their impact are underestimated in the news.	3.90	Agree	4.52	Strongly Agree
5. Climate change is happening right now.	4.52	Strongly Agree	4.80	Strongly Agree
6. I am ready to reduce my energy usage to tackle climate change	4.19	Agree	4.55	Strongly Agree
7. You completely understand what climate change means.	4.38	Strongly Agree	4.70	Strongly Agree
8. global temperatures have changed compared to the previous decade.	4.62	Strongly Agree	4.70	Strongly Agree
<b>Mean</b>	<b>4.46</b>	<b>Strongly Agree</b>	<b>4.72</b>	<b>Strongly Agree</b>

## **Q2. How do teachers describe their level of knowledge on the related issues of climate change?**

Table 4 reveals the elementary teachers' level of knowledge on the related issues of climate change. The pre-test totaled a mean of 3.71 or a verbal description of "agree." The post-test totaled a mean of 4.36 with a verbal description of "strongly agree." The results affirmed that users get consistent information in climate change communication via congruent messages, such as concise and helpful guidance or more comprehensive background information (Ngo, Poortvliet, & Feindt, 2020). Likewise, teachers lack basic knowledge and have misconceptions about the causes of climate change and its effects. Compared to the number of teachers who comprehend it, fewer are motivated to mitigate climate change. Knowledge of climate change is significantly correlated with concern and preparedness to act (Seroussi et al., 2019). Further, the teachers all concur that teaching children about climate change is crucial, and they all want to learn more so they can educate their learners (Bevins, 2020).

Table 4. Elementary Teachers' Level of Knowledge on the Related Issues of Climate Change

<b>Level of knowledge about climate change and its effects</b>	<b>Pre-Test</b>	<b>Verbal Description</b>	<b>Post-Test</b>	<b>Verbal Description</b>
1. Greenhouse gases	3.67	Agree	4.50	Strongly Agree
2. Aerosols	3.62	Agree	4.20	Strongly Agree
3. Currents in the sea/ocean	3.57	Agree	4.25	Strongly Agree
4. Melting of ice or volcanic eruptions	3.62	Agree	4.35	Strongly Agree
5. El Niño	3.71	Agree	4.35	Strongly Agree
6. Deforestation	3.93	Agree	4.50	Strongly Agree
7. Overall, climate change	3.86	Agree	4.35	Strongly Agree
<b>Mean</b>	<b>3.71</b>	<b>Agree</b>	<b>4.36</b>	<b>Strongly Agree</b>

## **Q3. What is the level of agreement of teachers on the teaching of climate actions?**

Table 5 conveys the elementary teachers' level of agreement among teachers on the teaching of climate actions. The pre-test totaled a mean of 4.01 or a verbal description of "agree. The post-test totaled a mean of 4.49 and a verbal description of strongly agree. Further, professional development is required for teachers to have the skills and information necessary to educate children about current environmental and societal challenges (Li et al., 2021). Moreover, if education for sustainable development is taught and learned throughout the educational sector, the future generation will be better prepared to deal with the enormous sustainability concerns. Teachers working in K-12 schools play a critical part in this process (Redman et al., 2018).

Table 5. Elementary Teachers' Level of Agreement on the Teaching of Climate Actions

Level of the agreement for the following statements about climate action.	Pre-Test	Verbal Description	Post-Test	Verbal Description
<b>Positive Statement</b>				
1. Each one of us can reduce the effects of climate change	4.52	Strongly Agree	4.75	Strongly Agree
2. It should be mandatory to reduce energy usage if it reduces climate change	4.28	Strongly Agree	4.50	Strongly Agree
3. Climate change is bound to happen because of the current modern society	4.23	Strongly Agree	4.60	Strongly Agree
5. The government should increase the incentives for people who try to reduce climate change	3.95	Agree	4.10	Agree
6. I will promote a greener environment and participate in initiatives to reduce climate change	4.37	Strongly Agree	4.75	Strongly Agree
8. Recent global disasters are because of climate change	3.14	Neutral	4.15	Agree
9. Media has a role in addressing climate change.	3.57	Neutral	4.60	Strongly Agree
<b>Mean</b>	<b>4.01</b>	Agree	<b>4.49</b>	Strongly Agree

Table 6 shows the elementary teachers' level of disagreement on the teaching of climate change actions. The pre-test totaled a mean of 3.36 or a verbal description of neutral. The post-test totaled a mean of 4.32 or a verbal description of strongly disagreeing. For instance, related studies suggest strategies for improving online professional development by strengthening learner support and knowledge co-creation by encouraging higher levels of thinking and more meaningful social relationships (DuBois, Krasny, & Russ, 2019). Professional development programs can help environmental educators innovate or improve their techniques by supporting seminars and continuous networks for sharing ideas (Li & Krasny, 2019). Martins-Louço et al. (2020) examined if teachers who participated in a CPD program knew more about inquiry-based scientific education (IBSE). They developed innovative methods for teaching biodiversity and climate change in the classroom via scientific inquiry.

Table 6. Elementary Teachers' Level of Disagreement on the Teaching of Climate Actions

<b>Level of disagreement for the following statements about climate action.</b>	<b>Pre-test</b>	<b>Verbal Description</b>	<b>Post-test</b>	<b>Verbal Description</b>
4. Climate change is a natural phenomenon; we can't do anything about it	3.17	Neutral	4.24	Strongly Disagree
7. Climate change is only because of the pollution from industries	2.95	Neutral	4.24	Strongly Disagree
10. There are more important matters than climate change	3.59	Disagree	4.29	Strongly Disagree
11. Cutting down trees to build infrastructure is not a bad thing	3.71	Strongly Disagree	4.62	Strongly Disagree
<b>Mean</b>	<b>3.36</b>	<b>Neutral</b>	<b>4.32</b>	<b>Strongly Disagree</b>

#### **Q4. What is the teachers' agreement on the teaching of climate change education, in terms of?**

##### **Sufficiency in K to 12 Curriculum**

Table 7 presents the pre-test on the sufficiency of climate change education in the K-12 curricula where 11 or 52% agree that it is sufficient while 10 or 48% disagree. The data in Table 8 shows an increase and a change in teachers' agreement on the sufficiency of climate change education in K-12 curricula. A total of 16 teachers, or 76%, agree that it is sufficient, while 5 teachers, or 24%, disagree.

Table 7. Sufficiency of Climate Change Education in K to 12 Curriculum (Pre-Test)

<b>Pre-Test</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Agree</b>	11	52
<b>Disagree</b>	10	48
<b>Total</b>	<b>21</b>	<b>100</b>

Table 8. Sufficiency of Climate Change Education in K to 12 Curriculum (Post-Test)

<b>Post-Test</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Agree</b>	16	76
<b>Disagree</b>	5	24
<b>Total</b>	<b>21</b>	<b>100</b>

Learning action cells also presented the various essential learning competencies (MELCs, 2020). The percentage from the pre-and post-survey shows that teachers realized the sufficiency of climate change education in the elementary curriculum.

### **Schools' Share in Addressing Climate Change**

The records in Table 9 show the frequency and percentage of the teachers who agree and disagree on the school's share in addressing climate change. The pre-test shows that there are 15 teachers, or 71%, who agree that the school should share in addressing climate change, while 6 teachers, or 29%, disagree.

Table 9. School Share in Addressing Climate Change (Pre-Test)

<b>Pre-Test</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Agree</b>	15	71
<b>Disagree</b>	6	29
<b>Total</b>	<b>21</b>	<b>100</b>

The data in Table 10 suggests that there is an increase in the number of teachers who agree that the school should address climate change with 19 teachers, or 90%, while there are 2 teachers, or 10%, who disagree.

Table 10. School Share in Addressing Climate Change (Post-Test)

<b>Post-Test</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Agree</b>	19	90
<b>Disagree</b>	2	10
<b>Total</b>	<b>21</b>	<b>100</b>

Professional development, or the learning action cell, is critical in the classroom because teaching and learning processes, such as teacher agency, trust, and instructional capacity, require further improvement (Baker-Doyle & Yoon, 2020). Teachers must meet higher requirements due to changing learning objectives and student demographics (Floden, Stephens, & Scherer, 2020), and acquire the knowledge and abilities required to teach learners about environmental and societal issues (Li et al., 2021). Moreover, future generations will be better equipped to address the tremendous sustainability challenges if ESD is taught and learned throughout educational sectors, and participation in the program enhances sustainability knowledge, behavior, and the capacity to connect the information to action (Redman et al., 2018).

### **Q5. Do learning action cells have a significant effect on teachers in terms of?**

#### **Level of Agreement Regarding the Teaching of Global Warming and Climate Change**

Table 11 shows the t-test for Paired Samples' result on the level of agreement on the teaching of global warming and climate change. There is a significant difference between the pretest and post-test scores of the respondents based on the t-value of -4.077 with a corresponding probability value of 0.005, which is less than alpha (0.05). The null hypothesis is rejected. Hence, learning action cells on climate change have a

significant effect on the teachers' level of agreement on global warming and climate change. This significant change in the level of agreement affirms that in addressing teachers' perspectives on climate change, it is vital to understand teachers' knowledge and attitudes (Chowdhury, Ahmed, Ahmed, & Haq, 2021) as well as become part of teacher preparation (Da Rocha, Brandli, & Kalil, 2020).

Table 11. t-test for Paired Samples (Pretest and Post Test) on Level of agreement on the teaching of global warming and climate change

Test Type	Mean	Standard Deviation	t-value (df = 7)	Sig.	Interpretation	Decision to Ho
Pretest	4.4587	.30806	-4.077	0.005	Significant	Reject
Posttest	4.7225	.14190				

$\alpha = 0.05$  Level of Significance

### ***Level of Knowledge on the Related Issues about Climate Change***

Table 12 shows the t-test for Paired Samples' result on the level of knowledge on the related issues of climate change. There is a significant difference between the pretest and post-test scores of the respondents based on the t-value of -4.077 with the corresponding probability value of 0.0001, which is less than alpha (0.05). The null hypothesis is rejected. Hence, learning action cells on climate change has a significant effect on the teachers' level of knowledge on the related issues of climate change. LAC is a necessary activity that provides comprehensive background information (Ngo et al., 2020). This also affirms that it is significantly correlated with knowledge and attitude to teach climate change (Seroussi et al., 2019) and that teachers become effective in educating learners (Bevins, 2020).

Table 12. t-test for Paired Samples (Pretest and Post Test) on Level of knowledge on the related issues about climate change

Test Type	Mean	Standard Deviation	t-value (df = 7)	Sig.	Interpretation	Decision to Ho
Pretest	3.7114	.13434	-15.123	0.000	Significant	Reject
Posttest	4.3571	.11339				

$\alpha = 0.05$  Level of Significance

### ***Level of Agreement of Teachers about Teaching Climate Actions***

Table 13 shows the T-test for Paired Samples' results on the level of agreement of teachers about climate actions. There is a significant difference between the pretest and post-test scores of the respondents based on the t-value of -3.416 with the corresponding probability value of 0.014 which is less than alpha (0.05). The null hypothesis is rejected. Hence, learning action cells on climate change has a significant effect on the teachers' level of agreement of teachers about climate actions. The results further affirm that

professional development enables teachers to educate learners about current environmental and societal challenges (Li et al., 2021) as teachers play a critical role (Redman et al., 2018). Participation in the LAC program improved sustainability knowledge, behavior, and the ability to link action to information (Redman et al., 2018).

Table 13. t-test for Paired Samples (Pretest and Post Test) on Level of agreement of teachers about climate actions

Test Type	Mean	Standard Deviation	t-Value	Sig.	Interpretation	Decision to Ho
Pretest	4.0086	.49415	-3.416	.014	Significant	Reject
Posttest	4.4929	.26682				

$\alpha = 0.05$  Level of Significance

### ***Level of Disagreement of Teachers about the Teaching of Climate Actions***

Table 14 shows the t-test for Paired Samples results on the level of disagreement of teachers about the teaching of climate actions. There is a significant difference between the pretest and post-test scores of the respondents based on the t-value of -7.953 with the corresponding probability value of 0.004 which is less than alpha (0.05). The null hypothesis is rejected. Hence, learning action cells on climate change has a significant effect on the teachers' level of disagreement of teachers about climate actions. The result reveals that professional development encourages higher levels of thinking and more meaningful social relationships (DuBois, Krasny, & Russ, 2019), and helps educators to innovate or improve techniques by supporting seminars and continuous networks for sharing ideas (Li, & Krasny, 2019) and develop innovative methods for teaching biodiversity and climate change in the classroom via scientific inquiry (Martins-Loução et al., 2020).

Table 14. t-test for Paired Samples (Pretest and Post Test) on Level of disagreement of teachers about the teaching of climate actions

Test Type	Mean	Standard Deviation	t-Value	Sig.	Interpretation	Decision to Ho
Pretest	3.3550	.35567	-7.953	.004	Significant	Reject
Posttest	4.3475	.18319				

$\alpha = 0.05$  Level of Significance

## ***Q6. What is the present role of education in addressing climate change?***

### ***How Can You Promote Education about Climate Change?***

#### **a. Integrating Climate Change (Pre)**



Climate change education must be integrated into different learning areas to increase learners' knowledge and awareness about taking care of the environment and promote activities such as awareness campaigns, to reduce, reuse, recycle, and plant trees; promote proper waste disposal; and activities starting at home with family, to think globally and act locally. Increase young minds' understanding of climate change by allowing them to practice at home with documentation to be submitted. Provide policy guidelines and share knowledge; encourage them with innovative approaches through media or partnerships.

#### **b. Integrating Climate Change towards Application (Post)**

With the integration of climate change, emphasis on promoting the 5Rs, efficient use of energy and water, and planting more trees is highlighted. Learning by doing and setting awareness for learners to take care of and preserve the environment through proper waste management, propaganda, and advocacy Educating about climate change and its effects is crucial to promoting climate action. We empower learners with the knowledge, skills, values, and attitudes needed to act as agents of change, work together, and be involved.

#### ***What Can Be Done More to Make an Effective and Efficient Climate Change Education?***

##### **a. Empowering and Engaging Learners (Pre)**

Empowering learners with knowledge, skills, and values to act as agents of change. Encourage learners to be informed, involved, and more responsible. Engage learners in activities such as learning by doing or applications such as energy use reduction and more "earth hour" activities. Strengthen environmental education to have compassion for the environment. Develop videos about the ill effects of climate change and advocate actions to model a good example for learners and the community.

##### **b. Leading, Training, and Emphasizing Climate Change to Learners (Post)**

Teachers should serve as a model for leading and doing the right things to show the right attitude and mindset about climate change. Encourage learners and the community to participate in various activities that are suggested, such as planting more trees, being responsible and maintaining a greener environment, and practicing proper waste disposal. Attend seminars and do re-echoes to learners with their parents to understand their environment and combat climate change. By attending seminars from experts, conducting research, and probably practicing and putting into reality what has been learned from a series of seminars. Incorporate climate change lessons and provide additional examples of the importance of caring for Mother Earth. I will emphasize the cause and effect of climate change with the learners for them to realize the importance of contributing to solving the issue. Encourage students to change their behavior and assist them in making informed decisions. increase the level of awareness among our

learners. enrich their learning experiences through the application. Engaging learners in community and classroom projects to increase awareness of climate change.

### ***Is There an Urgency Now to Address Climate Change and Did The Situation Get Any Better Now?***

#### **a. Educating People (Pre)**

The implementation of education for climate change is still weak. We are already experiencing the effects of climate change, and the situation is getting worse. It is not too late if we act today by educating people. Though it is not easy to make the situation better for a short period, it will take a longer time. Most of the support is from private organizations and private individuals.

#### **b. Acting for Better Results (Post)**

We need to love and value our environment. If people continue polluting and destroying our environment, it will affect our lives and livelihoods. The situation will not get better if we do not do our part. It is a serious problem, and we should act now before it gets worse. We need to act and do something to reduce climate change. It worsens the situation because of continued illegal human activities like illegal logging, improper waste management, and others. Though we cannot control it, it will still get better if we continue to include it in the curriculum for better results.

## **CONCLUSIONS AND RECOMMENDATIONS**

The teacher's level of agreement regarding global warming and climate change for the pretest and posttest is described as strongly agree. Elementary teachers' level of knowledge on the related issues of climate change in the pre-test is described as "agree," while in the post-test it is described as "strongly agree." Elementary teachers' levels of agreement about climate actions based on the pre-test show that teachers agree, while the post-test shows that they strongly agree.

Teachers' agreement about climate change education, in terms of curriculum and school. It reveals that there is an increase in agreement from 52% to 76% on the sufficiency of learning competencies about climate change, which is present in the elementary curriculum as evident in Araling Panlipunan, English, and Values Education. Schools' share in addressing climate change also increased from 71 to 90%. These include professional development or learning action cells; meeting higher professional requirements, knowledge, and abilities; equipping; and participation in programs for sustainability.

The results indicated that LAC on climate change has a significant effect on the level of agreement on global warming and climate change ( $t(7) = -4.077, p < 0.05$ ), level of knowledge on related issues of climate change ( $t(7) = -4.077, p < 0.05$ ), and level of

agreement ( $t(7) = -3.416, p < 0.05$ ), and disagreement on climate actions ( $t(7) = -7.953, p < 0.05$ ). The role of education includes the following themes: (a) from integrating climate change to integrating climate change towards application, (b) empowering and engaging learners to lead, train, and emphasize climate change to learners, and (c) educating people to act for better results.

## **RECOMMENDATIONS**

Learning action cells on climate change education must be continued for a longer period. It must be able to provide also tangible outputs or evidence such as teachers' portfolios to monitor the development of teachers in terms of content, delivery and instructions, and assessment. Assessing elementary and secondary teachers' knowledge, attitude, and behavior about climate change to plan, execute and monitor programs/ actions in a large-scale setting such as at the Division or Regional level for impact.

Continuous efforts by school heads to streamline the curriculum and school programs to address climate change education and tapping local government units and non-governmental organizations to promote community action plans for sustainability.

A more comprehensive study must be conducted to measure different variables beyond the knowledge, skills, attitudes, and values of teachers in connection with climate change. Correlational as well as experimental studies of climate change are also recommended. A qualitative study could be conducted to formulate theories of sustainability that are culturally embedded among Filipinos. It allows future researchers to further explore themes arising from this study, such as integrating climate change towards application, leading, training, and emphasizing climate change to learners and acting for better results.

## **PRACTICAL IMPLICATION**

The study about learning action cells on climate change education contributes positively and significantly to the various educational practices at the school level and towards the Division and Regional programs and policies about reiterating action and sustainability. It is also emphasized in the paper that the school, through the teachers, has a critical role in addressing the pressing issues related to climate change and action. The learning action cell presents not only the teachers' level of agreement regarding the teaching of global warming and climate change, but also their level of knowledge on the related issues of climate change, their level of agreement about the teaching of climate action, and their level of agreement about the teaching of climate change education, in terms of curriculum and school. The study on the impact of learning action cells on climate change must also allow teachers to reflect on personal, communal, national, and even digital efforts to translate practices and behaviors addressing immediate environmental and climate issues.

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