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THE ENVIRONMENTAL LITERACY OF ELEMENTARY SCHOOL TEACHERS BASED IN THE CITY OF MANILA AND NUEVA ECIJA PROVINCE

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ABSTRACT – This is a descriptive, correlational, evaluative study, which focused on the assessment of Environmental Literacy (EL) of randomly selected 1,082 elementary school teachers based in the City of Manila and Nueva Ecija province. The overall aim of this study is to investigate the Elementary School Teachers' EL in order to evaluate their readiness and capacity to implement Philippine RA 9512, i.e., promotion of environmental awareness through environmental education, after a decade of its conception (2008 – 2018). The framework of Hollweg et al. (2011), consisting of environmental knowledge, dispositions, competencies, and environmental responsible behavior, served as the theoretical basis for assessing the teachers' EL. Overall, results revealed the limited readiness and capacity of the teachers to implement environmental education as to comply with RA 9512 due to lack of environmental knowledge and science – based competencies.

Keywords: elementary school teachers, environmental education, environmental literacy, RA 9512, science education

INTRODUCTION

Nowadays, no one can deny the urgency of the major environmental problems such as climate change and biodiversity loss, threatening humanity's existence on this planet. Thus, there is a pressing need to promote environmental literacy through environmental education among its citizens in order for them to mitigate and to be resilient to these threats. This would make them better understand the nature, scale and complexity of these problems and issues; and easily comprehend and develop appropriate dispositions, competencies and behaviors toward the impacts of these concerns on the peoples' lives and livelihoods. Also, there is a need to address continuing conflicts over limited natural resources for sustainability (Hollweg et al. 2011).

In this study, Hollweg et al. (2011) accurately described environmental literacy as:

> *The knowledge of environmental concepts and issues; the attitudinal dispositions, motivation, cognitive abilities, and skills, and the confidence and appropriate behaviors to apply such knowledge in order to make effective decisions in a range of environmental contexts. Individuals demonstrating degrees of environmental literacy are willing to act on goals that improve the well-being of other individuals, societies, and the global environment, and are able to participate in civic life (pp. 5-15 & 5-16).*

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The development of environmental literacy depends robustly on how a person was educated beginning at childhood (Chawla 2007). This could be achieved by environmental education (EE) complemented by science education (SE). EE emphasizes on instilling environmental values, cultivating positive attitudes and eliciting pro-environmental action among the learners; while SE focuses primarily on teaching scientific knowledge and skills through inquiry-based instruction, e.g., the concept of global warming and the means to mitigate it. Thus, EE and SE have their own unique set of epistemologies that should complement one another; and the convergence of these two disciplines in improving citizens' environmental literacy is necessary (Wals et al. 2014). This would lead to a better understanding of the nature, scale and complexity of environmental problems and issues; and to the development of appropriate dispositions, competencies and behaviors to address likewise.

Schoolteachers play important roles in the implementation of EE with SE, supposedly to advance their learners' and future generations' environmental literacy by imparting their own acquired environmental knowledge and competencies; their informed dispositions and actions (World Commission on the Environment and Development 1987). However, inadequate teacher preparation and lack of expertise in the subject matter especially in the field of science are hindering the implementation of EE and SE resulting to pedagogical and pro-environmental action gaps in the Philippines (Savellano 1999; Bernardo et al. 2008; Garcia and Cobar-Garcia 2016; Chang and Pascua 2017)

In spite of the Philippine Government efforts to promote environmental awareness and education through the implementation of Republic Act 9512 since 2008, the country is still lagging behind other nations regarding its Environmental Performance Index in 2015. Thus, the Philippines ranked 114th among 178 countries based on its performance to address high-priority environmental issues, i.e., the protection of human health from environmental hazards, and ecosystems protection (Hsu et al. 2015).

Environmental education (EE) is the means for developing environmental literacy (EL) (Goldman et al. 2014). The UN declarations like the Tbilisi in 1977 (UNESCO-UNEP 1978), and national initiatives in EE e.g. Philippine Council for Sustainable Development in 1992, led to the enactment of Republic Act No. 9512, or the Environmental Awareness and Education Act of 2008. This law mandated leading government agencies such as the Department of Education (DepEd) and the Commission on Higher Education (CHED) for its implementation. The policy mandates teachers to integrate EE in all subject areas in all grade and year levels utilizing diverse teaching and learning strategies. Also, the law declares November as the "Environmental Awareness Month" in order for Filipinos to celebrate and actively participate in nationwide awareness activities and capacity-building programs (Philippine Senate and House of Representatives 2008).

Thus, with the government initiatives mentioned in the foregoing, there is a need to study the elementary teachers' readiness and capacity to execute this environmental education policy after a decade of its implementation.

Objectives

The overall aim of this study is to investigate the Elementary School Teachers' environmental literacy in order to evaluate their readiness and capacity to implement Philippine RA 9512, i.e., promotion of environmental awareness through environmental education, after a decade of its conception (2008 – 2018). In addition, the research would like to attain the following specific objectives, i.e., (1) to determine the teachers' profile, i.e., demographic, professional, and environmental experience which will

be correlated with their environmentally responsible behavior; (2) to determine their scores on the following environmental literacy factors, i.e., environmental knowledge, dispositions, competencies, and responsible behavior; (3) to investigate if there is any significant difference between the teachers' locale of residence, i.e., urban versus rural in terms of environmental literacy factors; (4) to examine the causal relationships using path analysis of the different variables of environmental literacy that would predict environmental responsible behavior (Figure 1); and (5) to determine as to what extent can environmental responsible behavior be further predicted by each of the demographic, professional and environmental experience variables.

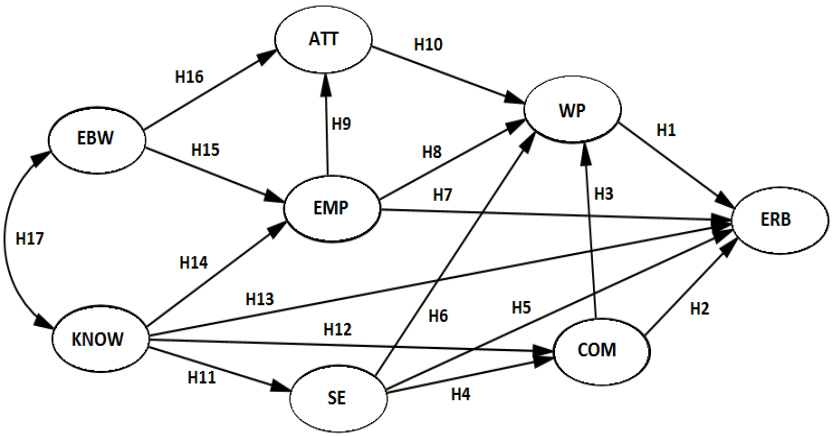

Figure 1. Hypothesized model. Where: KNOW – knowledge; EBW – ecological beliefs and worldviews; ATT – attitude; EMP – empathy; SE – self-efficacy; WP – willingness/intention to participate; COM – competencies; and ERB – environmental responsible behavior.

METHODS

This is a descriptive-correlational, evaluative study participated-in by randomly selected elementary school teachers of the Department of Education (DepEd) Divisions of Manila and Nueva Ecija. Data were gathered using the subscales shown in Table 1; accessed on-line via *Google* forms, as well as fielding printed questionnaires in the study areas. A total of 1,082 respondents completed the questionnaires on both modalities.

The reasons for selecting these localities rest on their urban and rural character respectively. Teachers based in Manila, could be technologically advanced as far as teaching and information gathering are concerned; and teacher training could be well provided – for as compared to Nueva Ecija province. Also, the difference in the built versus natural environment where the teachers lived was considered. These variables might affect the teacher's EL (Hsu and Roth 1998).

The instrument is composed of 11 sub-scales, consisting of 147 items. The 32-item environmental knowledge test assessed the teachers' know-how (knowledge 1) on: earth's physical and ecological systems, environmental issues and problems, solutions and action strategies, and social, cultural and political systems. These four categories were further classified into eight areas of

environmental science concern (knowledge 2), i.e., biodiversity loss, food production, geology and mining, water resources, energy, human health, climate change, and solid waste management (Miller and Spoolman 2013). Correct responses from each of the eight areas of concern were counted; and consolidated scores from the four major areas as well as total and percentage scores were computed.

Table 1. The instrument and its subscales.

Sub-scale	Author	Number of items	Type	Cronbach's alpha
Knowledge (KNOW)	Miller and Spoolman, 2013	32	Test – multiple choice	0.74
Competencies (COM)	Adapted from Middle School Environmental Literacy Survey (MSELS) McBeth, Hungerford and Volk, 2006	16	Test – multiple choice	0.71
Environmental Responsible Behavior (ERB)	Researcher-made	20	6-point survey	0.91
Dispositions				
Ecological Beliefs and Worldviews	Dunlap and Van Liere, 1978 Dunlap R., Van Liere, Mertig and Jones, 2000	15	6-point survey	0.70
Attitude (ATT)	Mayer and Frants, 2004; Clayton and Opotow, 2003	15	6-point survey	0.96
Empathy (EMP)	Davis, 1983; Jollife and Farrington, 2006	10	6-point survey	0.94
Self-efficacy (SE)	Schwarzer and Jerusalem, 1995	10	6-point survey	0.92
Willingness/Intention to Participate (WP)	Researcher-made	15	6-point survey	0.93
Demographic profile	Researcher-made	5	Survey	
Professional profile	Researcher-made	5	Survey	
Environmental experiences profile	Researcher-made		Survey	
	Total	147		

The 16-item adapted competency test assessed the teachers' skills to identify, question or problematize, analyze, and evaluate long – term plans at various levels (local, regional, and global) to resolve environmental issues. There were four actual national environmental issues posed as cases and analyzed. These are: construction of additional coal-fired power plants, gold mining in an area with very high level of biodiversity, construction of a landfill near a marine tourist destination site, and return of illegal logging in a forest reserve area. Correct responses from each of the four skills from the four issues were counted.

Dispositions questionnaire consisted of the following sub-scales: ecological beliefs and worldviews (15 items), attitude towards nature (15), empathy on environmental degradation (10), self-efficacy to perform environmental actions (10), and willingness/intention to participate in environmental advocacies (15). Teachers responded whether they agree or disagree with the posed statements.

Gathered data were descriptively and inferentially analyzed. Effect sizes of the two groups, i.e., urban versus rural teachers, determined the magnitude of significant differences of the above factors. Structural equation modeling (SEM) and path analyses ascertained possible predictors of ERB from the mentioned variables. Moreover, multiple regression using stepwise method was employed to explore other possible predictors of ERB from demographic, professional, and environmental experience profiles of the teachers.

The overall environmental literacy score, i.e., average weighted means of the four factors were computed; thus, an average score of 70% or higher is considered "passing" (Tuncer et al. 2009; NEETF and Roper 2005). The foregoing operations satisfy Thorndike et al.'s (1991) conditions for tests or assessments to function as measures (Hollweg et al. 2011).

RESULTS AND DISCUSSION

Teachers' profile

Demography (Table 2) reveals that majority of the sample is female (88.3%), aged 31-40 years (33.8%) and 41-50 (31.0%), married (75.6%), Catholics (78.2%), and rural dwellers (77.3%). Respondents being predominantly female could influence one or more factors of environmental literacy. As an example is the effect of gender of mostly female samples positively on attitude and concern (Szagun and Pavlov 1995). Roman Catholic teachers dominated the sample at 78%, which could affect the results of this study because of their mastery-over-nature and anthropocentric beliefs, and low level of attitudes toward environmental concern (Hand and Van Liere 1984; Schultz et al. 2000).

Table 2. Demography.

Variables		f	%
Gender	Male	121	11.2
	Female	958	88.3
	LGBT	6	0.6
Age	Under 31	191	17.6
	31-40	367	33.8
	41-50	336	31.0
	51-60	167	15.4
	61+	24	2.2
Religion	Catholic	848	78.2
	Iglesia	72	6.6
	Islam	1	0.1
	Protestant	56	5.2
	Christian	72	6.6
	Others	36	3.3
Marital Status	Single	220	20.3
	Married	820	75.6
	Separated	11	1.0
	Divorced	1	0.1
	Widowed	33	3.0
Locale of Residence	Urban	245	22.7
	Rural	836	77.3

Professionally (Table 3), most teachers have their bachelor's degree (as BEEd, 80.0%) with masterate units (73.0%); cumulatively, years – of - service is between 1-15 years (64.3%), teaching several subjects with no mastery in the domains being taught as to science (50.1%) or non-science (49.9%). That is, several subjects of different disciplines are being taught wherein science is only one of those courses. This situation could probably contribute to the growing problems of implementing environmental education. This argument stemmed from the study of Hsu and Roth (1998), that teachers who finished their graduate studies, and majoring in natural sciences perceived to be more knowledgeable of the environment than did those with majors in other fields like the social sciences, arts, and humanities. But Goldman, Yavetz and Pe'er (2014) argued beyond such relationship, that there is a need to reorient science courses that would contextualize environmental issues and integrate environmental values education in order to attain EL.

Table 3. Professional profile.

Variables		f	%
Educational Attainment	Bachelor's	212	19.5
	Bachelor's + MA Units	792	73.0
	Masterate	65	6.0
	Masterate + PhD Units	11	1.0
	Doctorate	5	0.5
Bachelor's	BEEd	868	80.0
	BSEd	172	15.9
	Others	45	4.1
Years of Service	1-5 years	250	23.0
	6-10 years	231	21.3
	11-15 years	217	20.0
	16-20 years	131	12.1
	21-25 years	136	12.5
	26-30 years	81	7.5
	31+ years	39	3.6
Subjects Taught	Science	544	50.1
	Non-science	541	49.9

The teachers' environmental experience profile (Table 4) indicates that only 4.9% have taken at least a three-unit course in environmental science or other related programs, 7.0% have joined at least one environmental group, and 3.7% regularly read environmental publications or articles in social media and magazines. Also, 26.3% are engaged in environmentally related leisure activities like tree planting and gardening; their perceived environmental literacy has a mean score of 6.1 out of 9 (68%).

Table 4. Environmental experience.

Variables		f	%
Environmental course/s taken	Yes	53	4.9
	No	1032	95.1
Environmental group membership	Yes	76	7.0
	No	1009	93.0
Environmental publications read regularly	Yes	40	3.7
	No	1045	96.3
Environmental leisure activities	Yes	285	26.3
	No	800	73.7

The teachers' environmental experiences reflect their low level of interest or concern about science or the environment in general. This is in spite of government initiatives undertaken to address such gap. Thus, the implementation of environmental education could have been impeded *vis-à-vis* by these variables.

Before the enactment of RA 9512, the Department of Education directed the entire elementary and high school division heads to study the need to establish the Youth for Environment in Schools Organization (YES-O) in 2003. This is a school-based, voluntary, and co - curricular organization that would serve as the conduit for learners' actions toward the protection and conservation of the environment for sustainability. After a decade of its conception, the department formally established the YES-O; requiring the monitoring and evaluation of its student members' activities. A follow-up to the foregoing directive, the department specified the projects of the YES-O classified as ecosystem restoration and conservation (e.g. planting, growing, and caring for trees), disaster risk reduction and management (e.g. fire prevention), and the promotion of local ecotourism sites; wherein teachers should take a lead in these tasks, exhibiting their enthusiasm and concern for the environment (Department of Education 2016).

Teachers' scores on environmental literacy factors

Teachers' different forms of environmental knowledge (Knowledge 1) are presented in Table 5. Although the score is below the passing mark of 70%, the earth's physical and ecological systems obtained the highest average score at 4.47 out of eight points (56%); while environmental issues scored at 3.03 (38%) being the lowest. This could be explained by the former's specific science domain knowledge being asked, while an integration of the different areas of science, i.e., physics, chemistry and biology, plus an understanding of the effects of human activities on these ecological systems are required in the latter. This would suggest compartmentalization of the teachers' knowledge as far as science subjects is concerned.

Table 5. Forms of environmental knowledge.

KNOWLEDGE 1	Mean Score	Std. Dev.	%
Earth's physical and ecological systems	4.47	1.54	56
Environmental issues	3.03	1.47	38
Solutions and action strategies	3.66	1.46	46
Social, cultural, and political systems	4.30	2.26	54

Regarding knowledge on the different environmental science concerns, (Table 6), geology and mining acquired the highest mean score at 2.44 out of four points (61%), while climate change obtained the lowest at 1.16 (29%). This is could be due to the basic obstacles that might hinder meaningful learning of ecology and other environmental science topics by the teachers themselves during their pre-service assignment, i.e., the orientation only to the visible and concrete environmental concepts. This would render the invisible, the abstract and complex scientific ideas not fully understood; leading to the difficulty of connecting or relating such ideas, resulting to misconceptions (Eilam 2000; Sander et al. 2006; Huxter et al. 2015).

Table 6. Knowledge on environmental science concerns.

KNOWLEDGE 2	Mean Score	Std. Dev.	%
Biodiversity	2.34	0.97	58
Food	1.67	0.97	42
Geology and mining	2.44	1.14	61
Water resources	2.07	1.08	52
Energy	1.81	1.05	45
Human health	2.09	0.98	52
Climate change	1.16	0.85	29
Waste management	2.26	0.93	57

Among the disposition factors (Table 7), empathy obtained the highest average score at 5.15 out of six points (86.0%); whereas self-efficacy got the lowest at 4.38 (73.0%). In relation to the latter, when surveyed regarding their perceived environmental literacy, they obtained a mean of 6.1 out of nine (68%). Self-efficacy refers to the teachers' beliefs of their capabilities to organize and execute courses of pro-environmental actions (Bandura 1977, 1986; Schunk 1991); wherein, perception of their environmental literacy more or less supported this finding. Thus, even if self-efficacy and eco-beliefs obtained passing marks, these are considered low compared with other disposition variables.

Table 7. Disposition factors.

DISPOSITION	Mean Score	Std. Dev.	%
Eco-beliefs	4.62	0.61	77
Self-efficacy	4.38	0.72	73
Empathy	5.15	0.71	86
Attitude	4.92	0.69	82
Willingness	5.00	0.72	83

The Filipino value orientation of emotionalism could have influenced the teachers' empathy. Emotionalism, locally referred to as *pagkamaramdamin* which pertains to sensitivity; considered to be the standard how Filipinos think, express, and evaluate the elements that surround them, including destruction of natural environments. This explains why Filipinos are sensitive, wherein, they relate sufferings of other people to themselves. Thus, Filipino rationality and objectivity in looking at the environment are tainted with their own sensitivity (Jocano 1999).

On the types of environmental responsible behavior (ERB) in Table 8, eco-management garnered the highest mean score of 5.11 out of six levels (85.0%); while political-legal action acquired the lowest at 3.82 (64.0%). Overall ERB obtained a mean score of 4.62 (77.0%).

Table 8. Environmentally responsible behavior.

ERB	Mean Score	Std. Dev.	%
Eco-management	5.11	0.79	85
Consumer action	4.81	0.66	80
Persuasion	4.43	0.82	74
Political-legal action	3.82	0.96	64
Overall	4.62	1.29	77

ERB is the expression of environmental literacy based on the teacher's knowledge, dispositions, and competencies within a given context as categorized in Table 8. The first is working

directly with the natural world to prevent or resolve environmental problems or issues e.g., conserving energy by turning-off lights when not being used; second is using financial pressure or boycotting products that tend to harm the environment, e.g., buying products with recyclable, reusable packaging; third is convincing an individual or a group of people to take action, e.g., setting a positive environmental example for students to follow; and fourth is pressuring government or political parties to implement existing laws designed to protect and conserve the environment, e.g., reporting environmental problems or violations observed to proper authorities (Hollweg et al. 2011). Thus, teachers have reported more of the first type of environmental behavior for the past six months, since it is more of a personal, simple, do-it-yourself, non-radical approach; as compared to the fourth type, in conserving the environment.

Results of teachers' competencies in Table 9 revealed the mean score out of four points of the following variables. It shows that teachers lack the appropriate skills in identifying environmental issues (34%); questioning or raising appropriate problems from a case scenario, i.e., to problematize (39%) issues; analyzing probable consequences and factors contributing to a given issue and the long term environmental effects of human actions (51%); and resolving by evaluating which course of action could be most fitting for a given issue (45%) (Hollweg et al. 2011).

Table 9. Forms of competencies.

COMPETENCIES	Mean Score	Std. Dev.	%
Identify issue	1.35	0.87	34
Question issue	1.56	1.06	39
Analyze issue	2.02	1.14	51
Resolve issue	1.81	1.11	45

What they lack the most is environmental issue identification competency. An example is identifying the issue of constructing additional coal-fired power plants that would solve the country's energy crisis. Another is the issue of gold mining for economic growth near a biodiversity hot spot area. Thus, the low level of environmental competencies could probably be due to the lack of teacher training on how to conduct environmental education (EE) where the requirement for environmental competency is science skills, i.e., teaching to do science or the inquiry-based teaching of science (Bernardo et al. 2008).

Furthermore, even after three years of enactment of RA 9512 in 2008, i.e., in 2011, the time when the department urged all elementary and high schools to intensify EE lessons in all science subjects, and teachers were also encouraged to participate in capacity-building activities related to EE; their environmental competency remains very low based on the findings (Department of Education 2016).

Comparing EL of urban versus rural-based teachers

On the four areas of environmental knowledge (knowledge 1), urban teachers scored higher with a small effect size on environmental solutions (t = 2.52, r = 0.12); while rural teachers obtained higher scores with medium-sized effect on social, cultural, and political system (t = -9.25, r = 0.27) (Table 10).

Table 10. Urban vs. rural: Knowledge 1.

	Locality	Mean	%	Std. Dev.	t	df	Effect size
Earth's system	urban	4.51	56	1.59	0.77	1079	0.02
	rural	4.43	55	1.49			
Envi. issues	urban	2.94	37	1.38	-1.84	441	0.09
	rural	3.13	39	1.55			
Envi-solutions	urban	3.79	47	1.38	2.52*	435	0.12
	rural	3.53	44	1.53			
Social, cultural, political system	urban	3.55	44	2.33	-9.25*	1079	0.27
	rural	5.05	63	2.20			

*$p < 0.05$, **$p < 0.001$

Furthermore, rural school teachers exhibited higher scores on knowledge about social, cultural, and political systems, explained by their non-science orientation; and a more focused implementation and teaching of environmental education in the context of social science. On the other hand, urban teachers attained higher scores on environmental solutions, explained by their accessibility towards the material, human, i.e., school leader's capabilities for implementing environmental education perhaps focusing on environmental solutions, and social capital resources; due to the school's proximity to the Department's main office command located within the city (Barton 2007).

In terms of areas of environmental science concerns (knowledge 2), shown in Table 11, rural school teachers scored significantly higher with small to almost medium sized effects on biodiversity (t = -4.01, r = 0.12); food production (t = 3.99, r = 0.12); water resources (t = -5.66, r = 0.17); and energy (t = 4.14, r = 0.12). On the other hand, urban samples obtained higher scores with an almost medium-sized effect on human health (t = 3.94, r = 0.20).

Table 11. Urban vs. rural: Knowledge 2.

	Locality	Mean	%	Std. Dev.	t	df	Effect size
Biodiversity	urban	2.12	53	1.00	-4.01*	1079	0.12
	rural	2.40	60	0.95			
Food	urban	1.45	36	1.00	-3.99*	1079	0.12
	rural	1.73	43	0.95			
Geology	urban	2.38	60	1.12	-1.08	1079	0.03
	rural	2.47	62	1.15			
Water resources	urban	1.73	43	1.04	-5.66*	1079	0.17
	rural	2.17	54	1.07			
Energy	urban	1.57	39	1.03	-4.14*	1079	0.12
	rural	1.88	47	1.05			
Human health	urban	2.31	58	1.03	3.94*	375	0.20
	rural	2.02	51	0.96			
Climate change	urban	1.07	27	0.87	-1.72	1079	0.05
	rural	1.18	30	0.84			
Waste management	urban	2.17	54	0.95	-1.86	1079	0.06
	rural	2.29	57	0.93			

*$p < 0.001$

The results could be explained by the rural school-teachers daily encounter and experiences with the said resources; and attributed to the rural milieu's stronger connections with the community; i.e.,

school science projects are based on the locality's context (Ghose 1982, as cited in Oliver 2007). On the other hand, urban elementary teachers scored higher on human health, which is a primary concern in highly populated urbanized areas through the Essential Health Care Program (EHCP); implemented since 2009 by the Department of Education for elementary school children.

In the case of environmental dispositions (Table 12), urban teachers obtained significantly higher mean scores all with almost medium - sized effects on empathy (t = 5.98, r = 0.28); attitude (t = 4.54, r = 0.22); and willingness (t = 4.97, $p < 0.001$, r = 0.24).

Table 12. Urban vs. rural: Environmental disposition.

	Locality	Mean	%	Std. Dev.	t	df	Effect size
Eco-beliefs	urban	4.53	76	0.64	-2.45	1074	0.07
	rural	4.64	77	0.60			
Self-efficacy	urban	4.43	74	0.66	1.26	426	0.06
	rural	4.36	73	0.74			
Empathy	urban	5.38	90	0.64	5.98*	423	0.28
	rural	5.09	85	0.71			
Attitude	urban	5.09	85	0.66	4.54*	405	0.22
	rural	4.87	81	0.69			
Willingness	urban	5.19	87	0.66	4.97	417	0.24
	rural	4.94	82	0.72			

$p < 0.001$

Empathy towards degradation, attitude towards nature, and willingness to participate in environmental action emerged as the rallying points of urban elementary school teachers' dispositions. The Filipino character of being emotional or sensitive coupled with the urban teachers' exposure to dire environmental situations where many city dwellers endure and suffer, account for their higher environmental disposition scores (Jocano 1999; Hsu and Roth 1998).

Regarding environmental responsible behavior (Table 13), rural teachers acquired significantly higher scores with medium to large effect sizes on all variables: eco-management (t = -7.47, r = 0.37); consumer action (t = -9.89, r = 0.48); persuasion (t = -14.28, r = 0.61); political-legal action (t = -20.40, r = 0.53); and overall (t = 14.95, r = 0.63).

Table 13. Urban vs. rural: Environmental responsible behavior.

	Locality	Mean	%	Std. Dev.	t	df	Effect size
Eco-management	urban	4.81	80	0.72	-7.47*	346	0.37
	rural	5.19	87	0.62			
Consumer action	urban	4.31	72	0.95	-9.89*	321	0.48
	rural	4.96	83	0.72			
Persuasion	urban	3.65	61	1.00	-14.28*	339	0.61
	rural	4.66	78	0.82			
Political-legal action	urban	2.55	43	1.15	-20.40*	1074	0.53
	rural	4.19	70	1.08			
Overall	urban	3.97	66	0.79	-14.95*	347	0.63
	rural	4.81	80	0.68			

$p < 0.001$

This could be attributed to the Philippine rural milieu's preserved Filipino value orientation; considered as the instigator of the locals' behavior. These are emotionalism, relationalism, and moralism**.** First, emotionalism as discussed earlier, is locally referred to as *pagkamaramdamin* (sensitivity), considered to be the standard how Filipinos think, express, and evaluate the elements that surround them, including destruction of natural environments. Second, relationalism or *pagkamapagkapwa* focuses on the importance of personal interaction in group relations, also pertaining to "sense of community"; and third, moralism or *pagkamarangal* denotes personal dignity and honor, commitment to principles, and familial reputation (Jocano 1999).

Thus, behavior is anchored within the context of culture and location (Hsu and Roth 1998). Contextualizing, these three value orientations encompassed the four categories of ERB mentioned earlier such as the rural teachers' high regard for the environment.

However, the results of Hsu and Roth (1998) revealed otherwise, where urban high school teachers scored significantly higher in their ERB than their rural counterparts. Such difference exists because of the urban teachers' more often exposure to environmental degradation; where they consider social solutions, i.e., human effort, would address such problems.

For environmental competencies in Table 14, urban teachers significantly obtained higher scores on resolving environmental issues with a somewhat medium – sized effect (t = 8.53, r = 0.25). This could be attributed to their accessibility towards the material, human, and social capital resources which was mentioned earlier.

Table 14. Urban vs. rural: Environmental competencies.

	Locality	Mean	%	Std. Dev.	t	df	Effect size
Question issue	urban	1.54	39	1.06	-0.50	1074	0.02
	rural	1.58	40	1.06			
Analyze issue	urban	2.13	53	1.17	2.72	1074	0.08
	rural	1.91	48	1.11			
Identify issue	urban	1.40	35	0.90	1.68	364	0.09
	rural	1.29	32	0.83			
Resolve issue	urban	2.15	54	1.13	8.53**	1074	0.25
	rural	1.46	37	1.08			

$*p < 0.001$

Overall, the low level of environmental competencies could be due to the lack of training of both urban and rural elementary teachers on how to conduct environmental education (EE); as well as facilitating students to "learn to do science" rather than just "learn about science" (Archie 2003; The National Environmental Education and Training Foundation 2000). This was one of the directives of the department of tapping science teachers to implement EE. One of the requirements of operational literacy, the ultimate level of environmental literacy (EL), is the use of process skills of scientific inquiry (Roth 1992). Thus, there is a need to merge EE with science education in order to attain this ultimate level of EL.

On overall average percentage scores in Table 15, urban teachers acquired significant higher scores with small effect sizes on dispositions (t = 3.67, r = 0.17); and competency (t = 5.51, r = 0.17). On the other hand, rural teachers obtained significant higher scores on knowledge with a small - sized effect (t = -4.09, r = 0.12), environmental responsible behavior with a large – sized effect (t = -14.67, r = 0.61).

Overall, rural-based teachers scored higher than their urban counterparts but with a small sized-effect (t = -4.32, r = 0.13).

Table 15. Urban vs. rural: Overall environmental literacy.

Environmental literacy component	Locality	Mean	Std. Dev.	t	df	Effect size
Knowledge	urban	46.21	14.18	-4.09*	1079	0.12
	rural	50.45	14.38			
Disposition	urban	82.04	8.73	3.67*	443	00.17
	rural	79.67	9.61			
Competency	urban	44.98	15.68	5.51*	1079	0.17
	rural	38.98	14.88			
Behavior	urban	66.53	13.27	-14.67*	363	0.61
	rural	80.15	11.36			
Overall Score	urban	59.93	7.08	-4.32	1079	0.13
	rural	62.31	7.77			

*$p < 0.001$

Table 16 presents the overall environmental literacy score of elementary school teachers at an average of 62%; with 185 obtaining passing scores of 70 and above, out of 1082 participants i.e., 17% passing rate.

Table 16. Urban vs. rural: Overall environmental literacy scores and rate

Environmental Literacy Factors	
Knowledge	49%
Disposition	80%
Behavior	77%
Competencies	40%
Average	62%
Environmental Literacy Rate	
Average scores above or equal to 70%	185
Number of respondents	1082
Passing rate	17%

Overall, the EL classification of elementary teachers is more or less within the nominally, environmentally literate; where they have satisfactory disposition (82%), and moderately satisfactory behavior towards the environment (77%). The former referred to as entry-level variables (Hungerford and Volk, 1990). This is the stage where their awareness, sensitivity and attitude towards the environment are starting to develop. However, they have very rudimentary knowledge (49%) and competencies (40%) about how the natural and social systems function; based on Roth's (1992) description. Thus, their average EL considering the four factors described by Hollweg et al. (2011) is 62%. Since the passing score is 70% based on Tuncer et al. (2009); NEETF and Roper (2005), only 185 out of 1,082 elementary teacher – participants obtained 70% and above percentage scores, for a passing rate of 17%. Therefore, elementary teachers have to undergo retooling or training in order to improve and enhance their capacities and capabilities especially in the environmental knowledge and competencies or skills domains, to completely immerse themselves in teaching environmental education.

Results of SEM model-fit measures revealed chi-square (x^2) = 6455.18, degree of freedom (*df*) = 3142, x^2/df = 2.05; the overall model fit measure - root-mean-square error of approximation (RMSEA) = 0.036 are within acceptable range (Schermelleh-Engel et al. 2003). Path analysis identified possible predictors of environmental responsible behavior and its immediate antecedent, willingness to participate or intention to act.

As shown in Figure 2, path analysis revealed the teachers' environmentally responsible behavior are influenced profoundly by their willingness to participate in environmental conservation, WP ($\beta = 0.31$, $p < 0.01$); followed by self-efficacy SE ($\beta = 0.12$, $p < 0.05$). Thus, H_1 and H_5 are supported respectively.

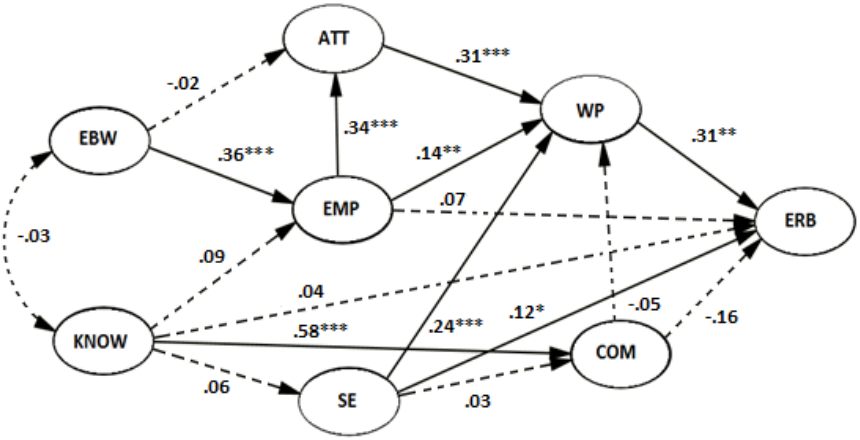

Figure 2. Path diagram with corresponding standardized regression weights. Note: Solid lines in the model indicate significant path as *p < 0.05, **p < 0.01, ***p < 0.001; KNOW – environmental knowledge, EBW – ecological beliefs and worldviews, ATT – attitude towards nature, EMP – empathy, SE – self-efficacy, COM – competencies, WP – willingness/intention, ERB – environmental responsible behavior.

Competency was predicted by knowledge ($\beta = 0.58$, $p < 0.001$), while EMP predicted ATT ($\beta = 0.34$, $p < 0.001$), and ecological beliefs and worldviews, EBW influenced EMP ($\beta = 0.36$, $p < 0.001$); H_{12}, H_9, and H_{15} correspondingly receive support given the significant path coefficients. Likewise, ATT mediated the effects of EMP toward WP. There was no covariance relationship between KNOW and EBW; and other remaining hypotheses are not supported.

ERB is considered as the ultimate outcome of EL where environmental problems and issues require citizen action. Since there is a large effect size between the correlation of these two variables, it would be practical to consider willingness/intention as the next dependent variable (Armitage and Conner 2001; Ajzen 1991). Disposition variables i.e., willingness (WP) and self-efficacy (SE) are direct predictors of environmental responsible behavior (ERB), while attitude (ATT), empathy (EMP), and SE are direct predictors of WP. Furthermore, WP mediated the effects of EMP towards ERB; while EMP likewise mediated the effects of ecological beliefs and worldviews (EBW) towards ATT, and ATT mediated the effects of EMP toward WP. In other words, the disposition variables played vital roles in

influencing the ERB of elementary schoolteachers, i.e., the ones developed to influence positively ERB in contrast with the knowledge and competency factors. It only shows that both competencies (COM) or skills and knowledge (KNOW) have to be further developed among the teachers, because it influenced neither ERB nor WP. This was also evident in the previous results.

Teacher profile variables as predictors of ERB

Multiple regression using stepwise method, Table 17 revealed highest educational attainment (β =0.11; $p < 0.001$) and subjects taught, i.e., science versus non-science (β = 0.090; $p < 0.01$) as weak predictors of ERB. As the teachers' educational attainment increases by one standard deviation (0.572), ERB increases by 0.11, where, SD for ERB is 13.138; thus a change of 1.45 (13.138*0.11). Therefore, for every 0.572 increase in educational attainment, an increase of 1.45% is expected in ERB; which means, the higher the teacher's educational attainment, the more ERB would be manifested.

Table 17. Multiple regression of educational attainment and subjects taught with ERB.

Model		B	Std. Error	β
1	(Constant)	72.24	1.38	
	Highest education	2.56	0.70	0.11**
2	(Constant)	71.25	1.42	
	Highest education	2.42	0.69	0.11**
	Subjects taught	2.31	0.73	0.090*

Model 1: $R^2 = 0.012$, $\Delta R^2 = 0.011$, SD = 0.572;
Model 1: $R^2 = 0.020$, $\Delta R^2 = 0.018$, SD = 0.500;
*$p < 0.01$; ** $p < 0.001$*

In the case of subjects taught, as more schoolteachers teach science subjects by an SD = 0.500, ERB increases by 0.09 standard deviations, which constitutes a change of 1.18% (0.09*13.138). Therefore, for every 0.500 (or 1.00 teacher) teachers engaged in teaching science, there is an increase of 1.18% in ERB. Meaning, if elementary teachers teach science, they are expected to exhibit ERB. Moreover, the teaching of science, i.e., its method and the question of "how" such phenomenon occur will eventually change the behavior of teachers because of a deeper understanding of the environment. Thus, encouraging pre-service and in-service teachers to take post graduate programs in line with environmental science or science education will change their behavior pro-environmentally.

CONCLUSION AND RECOMMENDATIONS

The present study investigated the environmental literacy (EL) of elementary school teachers based in the city of Manila and province of Nueva Ecija. Very few teachers have taken at least one environmental science course as part of their graduate studies, have joined at least one environmental group, and regularly read publications pertaining to the environment. Thus, it is highly recommended that the department should encourage or motivate their teachers by providing incentives, e.g., promotion, to involve themselves in these endeavors for environmental conservation. Environmental knowledge could also be acquired in this recommended situation which would address one of the issues in the proceeding.

Environmental knowledge in general garnered below seventy percentage scores on most areas and concerns; teachers scored very low on environmental issues and climate change. Likewise, teachers' environmental competency appeared to be the lowest among the EL factors wherein environmental issue identification obtained a very poor score. However, both disposition and ERB variables obtained more

than seventy percentage points except for self-efficacy and political-legal action respectively which exhibited lower than the previously mentioned score of 70%. Thus, it is highly recommended that a series of teacher training or capacity building activities on developing environmental knowledge, i.e., concept of climate change, and competencies shall be conducted. The latter is through the enhancement of their process skills of scientific inquiry, i.e., the skills to be utilized in evaluating problems and issues based on available facts. Thus, sound science education is necessary in developing this particular competency. If possible, there is a need for curriculum development of pre-service teacher education leaning toward the pedagogy to improve the teaching of science, i.e., science process skills; on the assumption that RA 9512 is strictly implemented.

Urban teachers exhibited significantly higher mean scores on knowledge about environmental solutions and human health; dispositions concerning empathy on environmental destruction, attitude towards nature, and willingness to participate in environmental actions; and skills in resolving environmental issues. On the other hand, rural-based teachers displayed significantly higher mean scores on knowledge about social, cultural, and political systems; and on biodiversity, food production, water resources, and energy concepts. Also, highly significant scores were obtained by these teachers on ERB variables. Clearly, rural teachers have the slight edge in EL brought about by the natural environment where they impart EE to their students; and the significant ERB they have claimed. Thus, it is recommended that young, single teachers be assigned by the department to rural areas for them to experience the preserved culture of the community and its natural physical environment. If not possible, part of the teacher trainings must include field visits to these areas and cultural immersion with the community.

The disposition variables self-efficacy and willingness to participate both influenced teachers' ERB according to SEM and path analysis, with the latter, being a better predictor than the former. Likewise, WP is a mediator of EMP towards ERB. However, both knowledge and competencies failed to influence ERB directly which complemented the low scores of these two factors mentioned earlier. Mild predictors of ERB from the teachers' profile include educational attainment and subjects taught leaning towards science. Self-efficacy could be further developed if the teachers perceived that they have already acquired the necessary skills in imparting EE. This would further strengthen their capacity to perform ERB. Therefore, as what was mentioned earlier, it is highly recommended to implement teacher trainings to boost their morale and capacity to impart EE. In addition, the department should continuously require teachers to take their post-graduate programs preferably in line with environmental science or science education because of the reasons stated previously.

Lastly, a qualitative research has to be conducted to further validate and triangulate currently analyzed quantitative data.

Elementary School Teachers' environmental literacy is below the set passing mark of 70%, attributed to their low knowledge and competency scores. Thus, they have limited or inadequate readiness and capacity to impart or teach environmental education according to RA 9512, i.e., after a decade of its implementation in spite of government initiatives.

STATEMENT OF AUTHORSHIP

Both authors conceptualized, identified the framework, gathered materials for literature review, identified the study sites, coordinated with the Department of Education, and collected data from target population. The first author performed the stats and analyzed the data; and wrote the introduction, and results and discussions section. The second author formulated and wrote the method, the conclusion and recommendations sections; and reviewed the manuscript.

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