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URBAN AND RURAL MIDDLE SCHOOL TEACHERS ON ENVIRONMENTAL LITERACY: MANILA AND NUEVA ECIJA IN CONTEXT

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ABSTRACT – This is a descriptive, correlational, evaluative study, which focused on the assessment of Environmental Literacy (EL) of 966 randomly selected middle school teachers from the City of Manila and in the province of Nueva Ecija. The research aimed to assess the teachers' readiness and capacity in implementing RA 9512, i.e., the promotion of environmental awareness and education after more than a decade of its enactment. The framework of Hollweg, et. al. (2011), served as the theoretical basis for assessing the teachers' EL, encompassing the areas of environmental knowledge, dispositions, competencies, and environmental responsible behavior. Results have shown that the teachers have limited readiness and capacity to implement environmental education in compliance with the Philippine Republic Act 9512 due to their low levels of environmental knowledge and inquiry- based, scientific competencies.

Keywords: environmental education, environmental literacy, RA 9512, science education, urban and rural middle school teachers

INTRODUCTION

The threats of major environmental problems such as global warming and climate change need humanity's immediate attention and action. In order for global citizens to mitigate and exhibit resiliency against these hazards, the promotion of environmental literacy (EL) through environmental education is needed. With this, they will not only easily comprehend the nature, scale, and complexity of these problems and issues; but also learn to acquire environmental knowledge and develop appropriate dispositions, competencies, and behaviors toward the impacts of the said problems on human lives and livelihood. Furthermore, continuing conflicts over the limited amount of natural resources must be addressed (Hollweg, Taylor, Bybee, Marcinkowski, McBeth & Zoido, 2011). Environmental literacy is described 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*" (Hollweg, et. al., 2011, pp. 5-15 & 5-16).

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There is a significant epistemological convergence between environmental education (EE) and science education (SE). EE is designed to instill environmental values, cultivating positive attitudes and eliciting pro-environmental action among the learners; on the other hand, SE focuses primarily on teaching scientific knowledge and skills through inquiry-based instruction, e.g., the concept of climate change and the means to mitigate it. Thus, the complementary epistemologies of EE and SE require convergence in order to improve the environmental literacy of global citizens (Wals, Brody, Dillon, & Stevenson, 2014).

Schoolteachers play important roles in implementing EE with SE; very vital in advancing the environmental literacy of the present set of learners and of future generations, by imparting their own acquired environmental knowledge and competencies, their informed dispositions and actions (World Commission on the Environment and Development, 1987). However, insufficient teacher preparation and experience especially in the field of science could be hindrances in the implementation of EE and SE (Savellano, 1999; Bernardo, Limjap, Prudente, & Roleda, 2008; Garcia & Cobar-Garcia, 2016; Chang & Pascua, 2017). This regrettable situation was revealed in the Environmental Performance Index in 2015, where the Philippines, ranked 114th out of 178 countries (Hsu et al., 2015). This is in spite of the Philippine Government's efforts to promote environmental awareness and education through the implementation of Republic Act 9512 since 2008, i.e., more than a decade of its enactment.

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), Commission on Higher Education (CHEd), Technical Education and Skills Development Authority (TESDA), Department of Environment and Natural Resources (DENR), and Department of Science and Technology (DOST) for its implementation. Furthermore, the policy mandated teachers to integrate EE in all subject areas utilizing diverse teaching and learning strategies; which would suit the cognitive levels of students at different year levels. Also, to celebrate and promote active participation in nationwide capacity-building programs, the law declares the month of November as the "Environmental Awareness Month" (Philippine Senate and House of Representatives, 2008).

Objectives

The overall aim of the research was to investigate the middle school teachers' environmental literacy as to assess their readiness and capacity to implement RA 9512, after more than a decade of its enactment, i.e., 2008-2019. Specifically, the study would like to attain the following objectives, i.e., *(i)* to ascertain the teachers' demographic, professional, and environmental experience profiles; *(ii)* to determine the teachers' scores on the following EL measures which include environmental knowledge, dispositions, competencies, and environmental responsible behavior; *(iii)* to investigate if there is any significant difference between the middle school teachers' locale of residence, i.e., urban versus rural in terms of environmental literacy variables; *(iv)* to examine the causal relationships through path analysis the different variables of environmental literacy that would possibly predict environmental responsible behavior of these teachers (Figure 1); and *(v)* to determine as to what extent can environmental responsible behavior be further predicted by each of the demographic, professional and environmental experience variables.

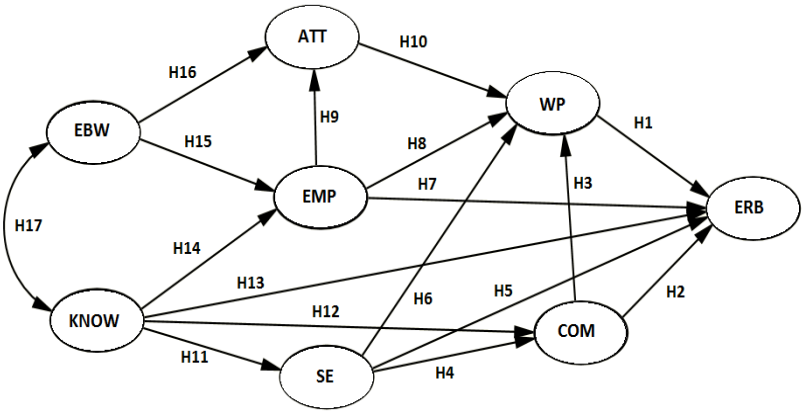

Figure 1. Hypothesized Model. Where: KNOW - knowledge; EBW - ecological beliefs & worldviews; ATT - attitude; EMP - empathy; SE - self-efficacy; WP - willingness/intention to participate; COM - competencies; and ERB - environmental responsible behavior.

METHODS

The participants of this descriptive-correlational, evaluative study were randomly selected 966 middle school teachers of the Department of Education (DepEd) Divisions of Manila and Nueva Ecija province in the island of Luzon, Philippines shown in Figure 2. Data were gathered using the instrument presented in Table 1, by accessing it on-line; and/or distributing printed questionnaires in the study areas.

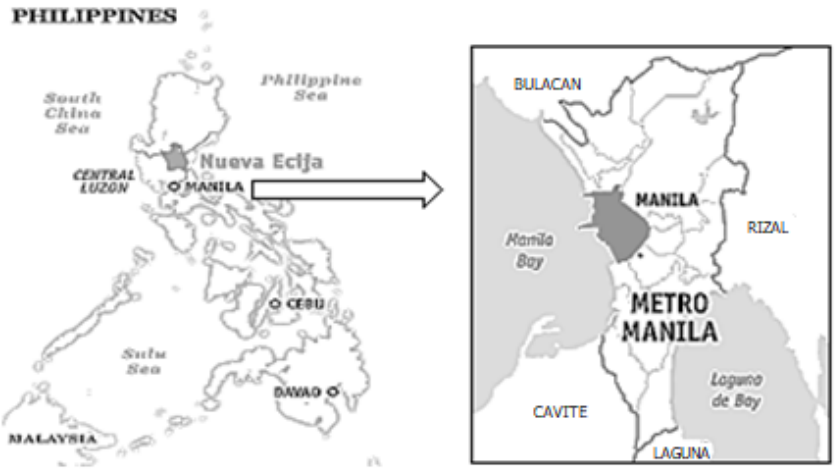

Figure 2. Location map of Manila and Nueva Ecija province (adapted from *Google* maps).

Middle or secondary school teachers have their respective majors as science and non-science, upon finishing their bachelor's degree as BSEd; as compared to Elementary school teachers who are "generalist" upon finishing their BEEd program. The selection of the urban (Manila) and rural (Nueva Ecija) localities in the study exemplified the following attributes: aside from the proponents' accessibility and familiarity with the two sites, teachers in urban settings could be considered technologically advanced as far as teaching and information gathering are concerned; also, teacher training could be well provided – for in urban as compared to rural settings; and finally the obvious differences in the built versus natural environment where the teacher is assigned. These factors might affect the teacher's EL (Hsu & Roth, 1998).

The instrument is composed of 11 sub-scales, consisting of 147 items. The 32-item environmental knowledge test assessed the teachers' comprehension (knowledge 1) on four themes: (1) earth's physical and ecological systems, (2) environmental issues & problems, (3) solutions and action strategies, and (4) social, cultural and political systems. Range of scores is from 0 to 8. These themes were further categorized into eight areas of environmental concerns (knowledge 2), i.e., biodiversity loss, food production, geology and mining, water resources, energy, human health, climate change, and waste management (Miller & Spoolman, 2013); score ranges from 0 to 4. Correct responses from each of the eight areas of concern were counted. Accumulated scores from the four major areas and its equivalent percentage scores were computed.

Table 1. The instrument and its subscales.

Sub-scale	Author/s	Number of items	Type	Cronbach's alpha
Knowledge (KNOW)	Miller & Spoolman, 2013	32	Test - multiple choice	.74
Competencies (COM)	Adapted from Middle School Environmental Literacy Survey (MSELS) McBeth, Hungerford & Volk, 2006	16	Test - Multiple Choice	.71
Environmental Responsible Behavior (ERB) Dispositions	Researcher - made	20	6-point survey	.91
Ecological Beliefs & Worldviews (EBW)	Dunlap & Van Liere, 1978; Dunlap R. , Van Liere, Mertig, & Jones, 2000	15	6-point survey	.70
Attitude (ATT)	Mayer & Frantz, 2004; Clayton & Opotow, 2003	15	6-point survey	.96
Empathy (EMP)	Davis, 1983; Jollife & Farrington, 2006	10	6-point survey	.94
Self-efficacy (SE)	Schwarzer & Jerusalem, 1995	10	6-point survey	.92
Willingness/Intention to participate (WP)	Researcher – made	15	6-point survey	.93
Demographic profile	Researcher - made	5	Survey	
Professional profile	Researcher - made	5	Survey	
Environmental experiences profile	Researcher - made	4	Survey	
	total	147		

The 16-item adapted competency test likewise assessed the teachers' skills to identify, question or problematized, analyze, and evaluate long – term plans to resolve environmental issues. There were four actual, national environmental issues posed as cases: 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 protected area. Correct responses from each of the four issues were counted.

The 20-item, environmental responsible behavior (ERB) sub-scale is further elaborated into eco-management (7 items), consumer action (4), persuasion (5), and political-legal action (4). The teachers responded as to they agree or disagree with the posed statements.

The dispositions questionnaire consisted of the following subscales on: ecological beliefs and worldviews (15 items), attitude towards nature (15), empathy on degradation (10), self-efficacy to act pro-environmentally (10), and willingness/intention to participate in environmental advocacies (15). The teachers responded whether they agree or disagree with the given statements.

Descriptively and inferentially, gathered data were analyzed. Effect sizes of the rural versus urban groups were also computed to determine the magnitude of significant differences of the above factors. Structural equation modeling (SEM) and path analysis investigated possible predictors of ERB from the mentioned variables. In addition, multiple regression using step-wise method was utilized to explore other possible predictors of ERB from the teachers' demographic, professional, and environmental experiences profiles.

This study is also suggesting for the computation of the overall environmental literacy score; wherein weighted means of the four EL main factors, i.e., knowledge, competency, disposition, and behavior were calculated. Equal percentage weight distribution is applied, i.e., at 25% each factor for a total of 100%. With this parameter, an average score of 70% or higher for each factor is considered "passing" (Tuncer, et al., 2009; NEETF & 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

Teachers' profile

Tables 2 & 3 present the demography of the respondents. It revealed that the majority of the middle school teachers were females (78.4%), aged 31-40 years (31.6%) and age at under 30 years (29.5%). They are mostly married (64.2%), Catholics (70.1%), and rural dwellers (62.9%).

Table 2. Demographic profile.

Variables		f	%
Gender	Male	207	20.7
	Female	785	78.4
	LGBT	9	0.9
Age	Under 31	295	29.5
	31-40	316	31.6
	41-50	230	23.0
	51-60	141	14.1
	61+	19	1.9

Table 2 (Continued). Demographic profile.

Variables		f	%
Religion	Catholic	702	70.1
	Iglesia	73	7.3
	Islam	2	0.2
	Protestant	80	8.0
	Christian	82	8.2
	Others	62	6.2
Marital Status	Single	321	32.1
	Married	643	64.2
	Separated	11	1.1
	Divorced	1	0.1
	Widowed	25	2.5
Locale of Residence	Urban	366	37.1
	Rural	620	62.9

Professionally, as shown in Table 3, most teachers have their bachelor's degree (as BSEd, 93.7%; non-science majors, 68.8%) with masterate units (68.5%); years of service cumulatively is between 1-10 years (57.1%), teaching non-science subjects (72.9%).

Table 3. Professional profile.

Variables		f	%
Educational Attainment	Bachelor's	197	19.7
	Bachelor's +MA Units	686	68.5
	Masterate	84	8.4
	Masterate + PhD Units	26	2.6
	Doctorate	8	0.8
Bachelor's	BEEd	4	0.4
	BSEd	938	93.7
	Others	59	5.9
BSEd Major	Science	312	31.2
	Non-science	689	68.8
Years of Service	1-5 years	325	32.5
	6-10 years	246	24.6
	11-15 years	122	12.2
	16-20 years	93	9.3
	21-25 years	96	9.6
	26-30 years	47	4.7
	31+ years	72	7.2
Subjects Taught	Science	271	27.1
	Non-science	730	72.9

The teachers' environmental experience profile as shown in Table 4 indicates that only 15.7% of the respondents have taken at least a three-unit course on environmental science or other related programs; 12.3% have joined at least one environmental group, 4% read environmental publications regularly, and 35.8% are engaged in environmentally-related leisure activities (i.e., tree planning and gardening).

Table 4. Environmental experience profile.

Variables		f	%
Environmental course/s taken	Yes	157	15.7
	No	844	84.3
Environmental group membership	Yes	123	12.3
	No	878	87.7
Environmental publications read regularly	Yes	40	4.0
	No	961	96.0
Environmentally related leisure activities	Yes	358	35.8
	No	643	64.2

Teachers' scores on environmental literacy factors

Table 5 presents the teachers' four forms of environmental knowledge (Knowledge 1); earth's physical & ecological systems obtained the highest average score at 4.49 out of eight points (56%); while environmental issues scored at 3.02 (38%) as the lowest.

Table 5. Forms of environmental knowledge.

KNOWLEDGE 1	Mean Score	Std. Dev.	%
Earth's system	4.49	1.68	56
Environmental issues	3.02	1.45	38
Solutions	3.84	1.55	48
Social, cultural, and political systems	3.66	2.29	46

Regarding Knowledge 2 (Table 6), geology and mining acquired the highest mean score at 2.34 (58%), while climate change obtained the lowest at 1.20 (30%).

Table 6. Knowledge on environmental science concerns.

KNOWLEDGE 2	Mean Score	Std. Dev.	%
Biodiversity	2.23	1.05	56
Food	1.58	0.95	40
Geology and mining	2.34	1.15	58
Water resources	1.78	1.02	45
Energy	1.69	1.11	42
Human health	2.11	1.02	53
Climate change	1.20	0.93	30
Waste management	2.18	1.05	54

On dispositions (Table 7), empathy obtained the highest average score at 5.29 (88.0%); whereas self-efficacy got the lowest at 4.43 (74.0%). Moreover, in relation to the latter, their perceived

environmental literacy has a mean score of 6.03 out of 9 (67%). Self-efficacy in this study pertains to the beliefs of the teachers on their capacities in organizing and executing courses of pro-environmental actions (Bandura, 1977, 1986; Schunk, 1991); where their perceived EL more or less substantiated this finding.

Table 7. Disposition factors.

DISPOSITION	Mean Score	Std. Dev.	%
Eco-beliefs	4.62	0.54	77
Self-efficacy	4.43	0.67	74
Empathy	5.29	0.61	88
Attitude	5.04	0.64	84
Willingness	5.11	0.61	85

The teachers' environmental responsible behavior (ERB) in Table 8 shows eco-management garnering the highest mean score of 4.94 (82.0%). On the other hand, political-legal action acquired the lowest at 3.19 (53.0%); obtaining an overall mean score of 4.28 (71.0%).

Table 8. Environmentally responsible behavior.

ERB	Mean Score	Std. Dev.	%
Eco-management	4.94	0.73	82
Consumer action	4.53	0.94	75
Persuasion	4.02	1.08	67
Political-legal action	3.19	1.38	53
Overall	4.28	0.88	71

Regarding teachers' competencies, Table 9 revealed the mean scores (out of four points) of the four variables. It shows that teachers lack the appropriate skills in identifying environmental issues (36%); questioning or raising appropriate problems from a case scenario, i.e., to problematize issues (38%); analyzing probable consequences and factors contributing to a given issue and the long term environmental effects of human actions (53%); and resolving by evaluating which course of action could be most fitting for a given issue (46%) (Hollweg, et al., 2011).

Table 9. Forms of competencies.

COMPETENCIES	Mean Score	Std. Dev.	%
Identify issue	1.45	0.92	36
Question issue	1.51	1.05	38
Analyze issue	2.12	1.15	53
Resolve issue	1.83	1.17	46

Comparing EL of urban versus rural-based teachers

Involving the four areas of environmental knowledge (Knowledge 1) in Table 10, rural teachers obtained significant higher scores with small-sized effect on social, cultural, and political systems (t = -4.04, r = .13).

Table 10. Urban vs. rural: Knowledge 1.

KNOWLEDGE 1	Locality	Mean	%	Std. Dev	t	df	Effect size
Earth's system	urban	4.38	55	1.80	-1.89	678	.07
	rural	4.60	58	1.56			
Environmental issues	urban	3.02	38	1.43	-.06	1008	.00
	rural	3.02	38	1.47			
Solutions	urban	3.91	49	1.64	1.22	688	.04
	rural	3.78	47	1.45			
Social system	urban	3.35	42	2.30	-4.04*	1008	.13
	rural	3.96	50	2.28			

*$p < .001$

No significant difference exists between urban and rural localities in terms of areas of environmental science concerns (Knowledge 2) except for one. As shown in Table 11, rural teachers scored significantly higher with a small - sized effect only on water resources (t = -4.63, r = .14).

Table 11. Urban vs. rural: Knowledge 2.

KNOWLEDGE 2	Locality	Mean	%	Std. Dev	t	df	Effect size
Biodiversity	urban	2.16	54	1.09	-1.67	1008	.05
	rural	2.27	57	1.03			
Food	urban	1.59	40	.96	.071	1008	.00
	rural	1.58	40	.95			
Geology	urban	2.26	57	1.15	-1.64	1008	.05
	rural	2.38	60	1.16			
Water resources	urban	1.59	40	1.01	-4.63*	1008	.14
	rural	1.90	48	1.01			
Energy	urban	1.65	41	1.11	-.73	1008	.02
	rural	1.71	43	1.11			
Health	urban	2.14	54	1.13	.69	671	.03
	rural	2.09	52	.96			
Climate change	urban	1.18	30	1.01	-.46	679	.02
	rural	1.21	30	.88			
Waste management	urban	2.10	53	1.11	-1.73	706	.07
	rural	2.22	56	1.01			

*$p < .001$

On environmental dispositions, urban teachers obtained significantly higher mean scores on empathy towards degradation, and attitude towards nature, but only with small- sized effects (t = 3.18, r = .10; t = 2.83, r = .10) respectively (Table 12).

Table 12. Urban vs. rural: Environmental disposition.

DISPOSITIONS	Locality	Mean	%	Std. Dev	t	df	Effect size
Eco beliefs	urban	4.62	77	.52	-.14	806	.00
	rural	4.62	77	.55			
Self-efficacy	urban	4.43	74	.63	.04	984	.00
	rural	4.43	74	.70			
Empathy	urban	5.37	90	.57	3.18*	984	.10
	rural	5.24	87	.62			
Attitude	urban	5.11	85	.61	2.83*	984	.10
	rural	4.99	83	.66			
Willingness	urban	5.16	86	.56	1.98	847	.07
	rural	5.08	85	.64			

*$p < .01$

Significantly higher scores were obtained by rural-based teachers regarding environmental responsible behavior (ERB) presented in Table 13. Small to almost medium - sized effects were acquired on eco-management (t = -4.64, r = .14); consumer action (t = -4.76, r = .15); persuasion (t = -5.00, r = .16); political-legal action (t = -6.48, r = .22); and the overall (t = -5.91, r = .19).

Table 13. Urban vs Rural: Environmental Responsible Behavior.

BEHAVIOR	locality	Mean	%	Std. Dev	t	df	Effect size
Eco-management	urban	4.80	80	.75	-4.64*	984	.14
	rural	5.02	84	.70			
Consumer action	urban	4.34	72	.94	-4.76*	984	.15
	rural	4.64	77	.93			
Persuasion	urban	3.80	63	1.05	-5.00*	984	.16
	rural	4.15	69	1.08			
Political-legal action	urban	2.83	47	1.25	-6.48*	841	.22
	rural	3.40	57	1.42			
Overall	urban	4.06	68	.83	-5.91*	984	.19

*$p < .001$

Urban teachers obtained significantly higher scores for environmental competencies (Table 14), specifically on resolving environmental issues, but only with a small – sized effect (t = 5.01, r = .16). This could be attributed to their accessibility towards the material, human, and social capital resources; e.g., division capacity building, where the department's head office is located, i.e., Manila.

Table 14. Urban vs Rural: Environmental Competencies.

COMPETENCIES	Locality	Mean	%	Std. Dev	t	df	Effect size
Question issue	urban	1.46	37	1.03	-1.44	982	.05
	rural	1.56	39	1.07			
Analyze issue	urban	2.14	54	1.19	.62	982	.02
	rural	2.09	52	1.11			
Identify issue	urban	1.47	37	.92	.59	982	.02
	rural	1.43	36	.91			
Resolve issue	urban	2.02	51	1.23	5.01*	982	.16
	rural	1.64	41	1.10			

*$p < .001$

The overall average percentage scores in Table 15 shows urban teachers acquiring significantly higher scores with small - sized effects on dispositions ($t = 2.80$, $r = .10$); and competency ($t = 2.90$, $r = .11$). On the other hand, rural teachers obtained significant higher scores on environmental responsible behavior only with a small – sized effect ($t = -4.66$, $r = .16$). Overall, there is no significant difference between the two groups.

Table 15. Urban vs Rural: Overall Environmental Literacy.

EL component	Locality	Mean%	Std. Dev.	t	df	Effect size
Knowledge	urban	47.35	16.82	0.24	719	.01
	rural	47.11	14.30			
Disposition	urban	82.49	6.91	2.80*	914	.10
	rural	81.09	8.42			
Competency	urban	44.75	17.61	2.90*	750	.11
	rural	41.52	15.82			
Behavior	urban	68.66	13.81	-4.66**	853	.16
	rural	73.03	14.85			
Overall Score	urban	60.80	7.76	0.26	963	.01
	rural	60.67	7.83			

*$p < .01$, **$p < .001$

Table 16 presents the overall environmental literacy score of middle school teachers at an average of 61%; with 122 obtaining passing scores of 70 and above, out of 966 participants i.e., 13% passing rate.

Overall, middle school teachers' EL is more or less categorized as nominal, wherein they have satisfactory disposition (82%), and moderately satisfactory behavior towards the environment (71%). Dispositions are considered entry-level variables; thus, in this category of EL, the teachers' awareness, sensitivity and attitude towards the environment are just starting to develop (Hungerford & Volk, 1990). On the other hand, teachers have low environmental knowledge (47%) and competencies (43%). Thus, their average EL considering the four factors is 61%.

Table 16. Overall environmental literacy scores and EL rate.

Environmental Literacy Factors	
Knowledge	47%
Disposition	82%
Behavior	71%
Competencies	43%
Average	61%
Environmental Literacy Rate	
Average scores above or equal to 70%	122
Number of respondents	966
Literacy rate	13%

Since the passing score is 70% based on Tuncer, et al., (2009); and NEETF & Roper (2005), only 122 out of 966 middle school teachers attained 70% and above percentage scores for a passing rate of 13%. Therefore, 1 out of ten middle school teachers is suggestive of being environmentally literate.

Predictors of environmental responsible behavior

SEM model fit indices disclosed chi-square (x^2) = 9372.85, degree of freedom (*df*) = 3142, x^2/df = 2.98; the root-mean-square error of approximation (RMSEA) = .057. Thus, the overall model fit measure is within acceptable range (Schermelleh-Engel, Moosbrugger, & Muller, 2003). Path analysis identified possible predictors of environmental responsible behavior (ERB) and its immediate antecedent, willingness to participate (WP) or intention to act.

Path analysis (Figure 3) revealed Middle School teachers' willingness to participate WP (β = .30); self-efficacy SE (β = .26); and KNOW (β = .16) influenced their environmental responsible behavior (ERB), Thus, H_1, H_5, H_{13} are supported, respectively.

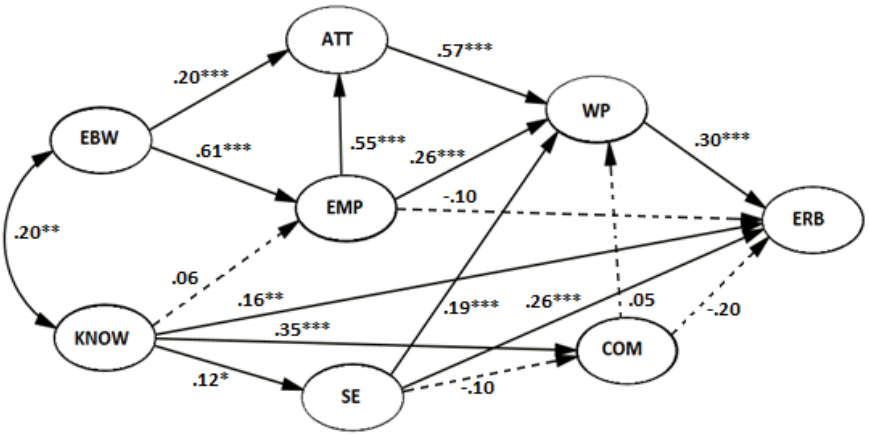

Figure 3. Path diagram with corresponding standardized regression weights. Note: Solid lines in the model indicate significant path as *p < .05, ** p < .01, ***p < .001; KNOW - environmental knowledge, EBW – ecological beliefs and worldviews, ATT – attitude towards nature, EMP – empathy, SE – self-efficacy, COM – competencies, WP – willingness/intention, ERB – environmental responsible behavior.

COM is predicted solely by KNOW (β = .35); both EMP and EBW predicted ATT (β = .55, β = .20 respectively); EBW influenced EMP (β = .61); and KNOW predicted SE (β = .12). Therefore, H_{12}, H_9, H_{16}, H_{15}, and H_{11} correspondingly received support given the significant path coefficients. A covariance relationship exists between KNOW and EBW (β = .20); thus, H_{17} is supported. Likewise, teachers' WP were influenced by their ATT (β = .57), EMP (β = .26); and SE (β = .19). Therefore, H_{10}, H_8, and H_6 are also supported respectively. In other words, both disposition and knowledge variables operate toward the manifestation of ERB. However, it shows that COM influenced neither ERB nor WP; but KNOW predicted COM, wherein, both factors are cognitive-based.

ERB is the dependent variable of EL, where environmental problems and issues require citizen action. Likewise, it would be practical to consider willingness/intention as the next dependent variable; since there is a large effect size between the correlations of these two variables, (Armitage & Conner, 2001; Ajzen, 1991). In order of decreasing magnitude of regression weights, disposition variables i.e., WP, SE, and KNOW are direct predictors of ERB, while ATT, EMP, and SE are direct predictors of WP.

Furthermore, a mediator (variable B) is said to facilitate the effects of one (variable A) to the other/next (variable C), if B causes an increase in the path regression index from A to C; i.e., A → B →C. The opposite applies in moderation.

In this case, WP mediated the effects of EMP; while it (WP) moderated the effects of ATT towards ERB. ATT likewise mediated the effects of EBW towards WP, while EMP moderated EBW effects towards WP. Remarkably, SE mediated the effects of KNOW towards ERB; which means, both affective and cognitive factors (except for COM) played vital roles in influencing ERB of middle schoolteachers.

Teacher profile variables as predictor of ERB

In Table 17, multiple regression using stepwise method revealed perceived EL (β = .07; $p < .05$) as a weak predictor of environmental responsible behavior (ERB). That is, as the teachers' perceived EL increases by one standard deviation (1.31), ERB increases by 0.07, where, SD for ERB is 14.60; thus a change in 1.022 (14.6*0.07). Therefore, for every 1.31 increase in perceived EL, an increase of 1.022% is expected of ERB.

Table 17. Multiple Regression of perceived EL with ERB.

	Model	B	Std. Error	β
1	(Constant)	66.93	2.22	
	perceived EL level	0.72	0.36	0.07*

Model 1: $R^2 = .004$, $\Delta R^2 = .003$; perceived EL SD = 1.31;
***p* < .05

DISCUSSION

Based on the results, middle schoolteachers' demographic profile could affect some of the outcomes of the study. Examples are the positive effect of mostly female samples on environmental attitudes and concern (Szagun & Pavlov, 1995). In contrast with Catholic teachers' "mastery-over-nature" beliefs, this could lead to their negative attitudes toward environmental concern (Hand & Van Liere, 1984; Schultz, Zelezney, & Dalrymple, 2000).

For the teachers' professional profile, Hsu and Roth (1998) argued, that those who finished their graduate studies and majored in the natural sciences, are perceived to be more knowledgeable of the environment as compared with those who majored in other fields like the social sciences, humanities, and the arts. However, beyond such relationship, in order to attain environmental literacy, it is necessary to reorient science courses in such a way that it should contextualize environmental issues and at the same time, integrate environmental values education (Goldman, Yavetz, & Pe'er, 2014).

The findings on the teachers' environmental experience profile reflected their low levels of interest and concern about the environment. This is in spite of government initiatives undertaken supposedly to address this gap, such as the conceptualization and creation of the Youth for Environment in Schools Organization (YES-O) in 2003 and 2013, respectively. The teachers were directed to take a lead in the following tasks of ecosystem restoration and conservation, disaster risk reduction and management and the promotion of local tourism sites (Department of Education, 2016).

Knowledge 1 results could be explained by the teachers' specific science domain cognition regarding the earth's physical and ecological systems. While environmental issues would require an understanding of the effects of human activities on the earth's ecological systems only; an integration of the different disciplines of science, i.e., biology, chemistry, and physics, is a requisite. Also, the teachers' non-science orientation and a more focused implementation and teaching of environmental education in the context of social science, could be contributing factors. Under Knowledge 2, the teachers' low level of understanding of climate change could be due to the basic obstacles hindering the meaningful learning of Ecology, and other environmental science topics during their pre-service stint, i.e., the orientation of the learners only to the visible and concrete environmental concepts, like in this case, geology and mining. As a result would render the invisible as abstract; leading to the complex scientific concepts not fully understood. Thus, the learner would have difficulty in connecting scientific ideas, resulting to misconceptions (Eilam, 2002; Sander, Jelemenska, & Kattmann, 2006; Huxter, Uribe-Zarain, & Kempton, 2015).

Moreover, the rural teachers' higher scores on water resources could probably be due to their daily encounter and experiences with this natural resource. These findings could be attributed to the rural milieu's stronger connections with the community, where school science projects are based on the locality's context (Ghose, 1982 as cited in Oliver, 2007).

On the teachers' dispositions, in general, empathy emerged as the predominant factor. Jocano (1999) described the Filipino value orientation of emotionalism, which could have influenced the teachers' empathy. Emotionalism pertains to sensitivity and is considered to be the standard of how Filipinos think, express, and evaluate the elements that surround them, including the destruction of natural environments. Thus, Filipinos are sensitive, relating sufferings of other people to themselves; and their rationality and objectivity in looking at, and perceiving the environment being tainted with their own sensitivity. Furthermore, both empathy and attitude emerged as the strong points of urban middle school teachers' dispositions. The emotional or sensitive Filipino character, coupled with the urban teachers' exposure to appalling environmental situations, where many city dwellers endure and suffer; account for their higher environmental disposition scores (Jocano, 1999; Hsu & Roth, 1998).

Environmental responsible behavior (ERB) is the expression of environmental literacy based on the teachers' knowledge, dispositions, and competencies within a given context. Eco-management is working directly with the natural world to address environmental problems or issues, e.g., conserving water by having shorter shower time; consumer action is using financial pressure or boycotting products that tend

to harm the environment, e.g., patronizing products with less or eco-friendly packaging; persuasion is by encouraging or convincing an individual or a group of people to take action, e.g., using social media for environmental campaigning; and political-legal action is pressuring government or political parties to implement existing policies crafted to protect and conserve the environment, e.g., reporting to proper authorities violations committed by certain individuals against proper solid waste management (Hollweg, et al., 2011). Thus, teachers have reported more of eco-management behavior for the past six months, since it is more of a personal, simple, practical, and non-radical approach as compared to the other types of behavior.

These behavioral findings could be attributed to Jocano's (1999) rural context's preserved Filipino value orientation; which prompted the rural teachers' actions. These are emotionalism, relationalism, and moralism. As discussed earlier, emotionalism is locally referred to as *pagka-maramdamin* (sensitivity), it is the standard how Filipinos think, express, and evaluate the elements that surround them, including destruction of natural environments. Next, relationalism or *pagka-mapagkapwa* centers on the importance of personal interaction in group relations, also known as "sense of community"; lastly, moralism or *pagka-marangal* denotes personal dignity and honor, commitment to principles, and familial reputation. Thus, behavior is anchored within the context of culture and location (Hsu & 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 study of Hsu & Roth (1998) have shown otherwise, where urban middle school teachers scored significantly higher ERB than their rural counterpart. Such difference exists because of the former's more frequent exposure to environmental degradation; where they consider social solutions, i.e., human effort, could address such problems.

With the findings on competencies, teachers lack the skills in identifying and problematizing environmental issues in these posed cases, such as, constructing additional coal-fired power plants to solve the nation's energy crisis; and the issue of gold mining for economic growth near a biodiversity hot spot area. In these situations, issues need to be identified and problematized to fully address such environmental dilemmas. Thus, the low level of environmental competencies is also a reflection of their lack of scientific inquiry teaching skills (Bernardo, *et.al*., 2008). This is in spite of the education department issuing an order, i.e., in 2011, urging all elementary and middle schools in the Philippines to intensify environmental education (EE) in all science subjects, and encouraging the teachers to participate in capacity-building activities related to EE; their environmental competency remains at a low level (Department of Education, 2016).

The teachers' low level of competencies could be further explained by the lack of trainings of both urban and rural elementary teachers on how to conduct EE in relation to science education (SE); i.e., facilitating their 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, by commissioning science teachers to implement EE. Operational literacy, being the ultimate level of environmental literacy (EL), requires the use of process skills of scientific inquiry (Roth, 1992). Thus, there is a need to merge EE with SE in order to attain this ultimate level of EL.

The disposition variables, i.e., self-efficacy (SE) and willingness to participate (WP); and environmental knowledge (KNOW) predicted the teachers' ERB based on structural equation modeling (SEM) and path analysis. SE has the greatest influence on ERB than the two variables. Although KNOW has a weak influence on ERB, the descriptive results of KNOW revealed low percentage mean scores.

Moreover, WP mediated EMP towards ERB; which supported the studies conducted by Batson, Chang, Orr, and Rowland (2002); and Ajzen & Fishbein (1980). Also, SE mediated KNOW towards ERB, indicating that KNOW and SE work in agreement with the attainment of ERB (Zimmerman, 2000).

Competency (COM) failed to influence ERB directly as exhibited by the low scores of this factor mentioned earlier. But, it was noted that the teachers' profile of perceived environmental literacy (EL) weakly predicted teachers' ERB. Therefore, except for competency, both cognitive and affective factors of EL, influenced middle school teachers' ERB.

CONCLUSION

The present study investigated the environmental literacy (EL) of middle school teachers based in the city of Manila and province of Nueva Ecija. Their profile generally indicated a low level of interest in science, and engagement in environmental endeavors. Concerning the four factors of EL, environmental knowledge and competency obtained below seventy percentage scores. Albeit, both disposition and environmental responsible behavior factors obtained more than seventy percentage points. Urban-based teachers garnered significantly higher scores on dispositions regarding empathy on environmental destruction and attitude towards nature. On the other hand, rural teachers exhibited significantly higher mean scores on knowledge about social systems and water resources. Also, higher significant scores were obtained by these teachers on all ERB variables. Other than those mentioned, there were no significant differences noted between the two groups. In addition, except for competency, both cognitive and affective factors of EL influenced middle school teachers' ERB.

Both urban and rural Middle School Teachers' environmental literacy is below the set passing mark of 70%, due to their low knowledge and competency scores; where one out of ten middle school teachers is suggestive of being environmentally literate. Thus, they have limited readiness and capacity to impart or teach environmental education as mandated by RA 9512, after more than a decade of its implementation in spite of government initiatives.

RECOMMENDATIONS

The Department of Education must highly encourage or motivate their teachers by providing incentives, e.g., promotion, to involve themselves in environmental activities in order to improve their EL. Moreover, the department should continuously encourage teachers to take their post-graduate programs preferably in line with environmental science or science education to effectively impart EL to their students.

It is also recommended that a series of teacher training or capacity - building activities on developing environmental knowledge, e.g., concept of climate change; and competencies anchored on the scientific process should be conducted, that is, by enhancing their process skills of scientific inquiry. Thus, sound science education is necessary in developing this particular competency particularly in curriculum development of pre-service teacher education.

Young and single teachers could be assigned to rural areas in order for them to experience the preserved culture of the community and its natural environment. Also, part of the teacher trainings must include field visits to these areas and cultural immersion with the community (Garcia & Cobar-Garcia, 2018).

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

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 formulated and wrote the method, the conclusion and recommendations sections; and reviewed the manuscript. The second author performed the stats and analyzed the data; and wrote the introduction, and the results and discussion sections.

DECLARATION OF ORIGINALITY

We, hereby, declare that this research article with its data set is our own intellectual work. To the best of our knowledge, it contains no materials previously published or written by another individual or institution; and is free from any ethical issues.

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