



## Environmental literacy and epistemological beliefs of Filipino pre-service teachers: A search for congruency

Gilbert C. Magulod Jr.

*College of Teacher Education, Cagayan State University at Lasam, Lasam, Cagayan, Philippines*

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### Abstract

Future teachers must have to be environmentally literate and competent enough in producing informed learners who can make environmentally responsible decisions and exhibits environmental responsible behavior. The study investigated the relationship between the environmental literacy and epistemological beliefs of pre-service teachers. It employed descriptive correlational research design. The participants were the sixty pre-service teachers of Cagayan State University randomly selected. Findings revealed that there is a high level of environmental literacy among the pre-service teachers. Likewise, they exhibit positive personal epistemological on the five dimensions. Significantly, the test of difference showed that sex is the single variable showing a significant difference in the environmental literacy while parents' education attainment also spelled significant differences on the epistemological beliefs of the pre-service teachers. The study also found out that there is a significant relationship between the environmental literacy and epistemological beliefs of the pre-service teachers indicating that the higher the environmental literacy of the respondents the more they likely to exhibit sophisticated belief about environmental knowledge. Results of the study further suggest that there is a congruency between the environmental literacy and epistemological beliefs of the pre-service Filipino teachers. The higher they perceived themselves to possess the ability to learn the higher they manifest environmental literacy. Therefore, epistemological beliefs of the pre-service teachers should be taken into consideration in the teacher education training program to develop future educators who are environmentally literate.

\*Corresponding Author: Gilbert C. Magulod Jr. ✉ [gilbertmagulod\\_rdecsulasam28@yahoo.com](mailto:gilbertmagulod_rdecsulasam28@yahoo.com)

## Introduction

Education on the environment is considered the key to reducing environmental problems. Prevention of any kind of human damage to the environment can be realized by promoting responsible citizenship. As the world is faced with critical environmental problems, educational systems must produce environmentally literate citizens who care about the environment and have sufficient knowledge about environmental issues to behave responsibly (Tuncer *et al.*, 2009).

One of the most important and ultimate goals of environmental education is to raise environmental literacy among individuals (Roth, 1992). Environmental literacy primarily involves knowledge, attitudes and active participation in a sustainable environment. There is an increasingly urgent need to develop a culture of participation among young people who in turn may become future leaders. Future teachers are the most important factor in promoting environmental literacy. Therefore, they must be well prepared to manifest such. In addition, they must have a good grasp and understanding of environmental issues and problems affecting the society every day. Teachers' role is crucial in promoting environmental literacy in schools and society. The adequate preparation of teacher education students in environmental education is a prerequisite for their future ability to design and implement effective environmental education (Yavets, Goldman & Pe'er, 2009).

This paper explores the congruity between the environmental literacy and epistemological beliefs of the pre-service teachers. It is argued that when pre-service teachers have the positive beliefs on the structure and nature of knowledge the higher environmental literacy they exhibit. Teacher education programs are a good place to end such neglect. Teachers need to be life-long learners who are scientifically and environmentally literate. Environmental literacy and epistemological beliefs are thought to be related in different reasons. In the previous studies conducted, Hsu (2004) found out that there is a linear model of lines up with the idea

that getting more knowledgeable makes individuals more aware and motivated through the environment. In like manner, Diets *et al* (2005) confirmed that individual values and view of expert authority which are components of epistemological beliefs affect individuals' reasoning and environmental behaviors. It can be synthesized from the previous studies that epistemological beliefs affect environmental literacy. Since no study has been conducted among Philippine Teacher Education Institutions investigating how these variables correlated, no conclusive results would still claim that such relationship exists among pre-service teachers. Hence, this study was conducted.

The study investigated the relationship between the environmental literacy and epistemological beliefs of pre-service teachers. It specifically assessed the: (a) level of environmental literacy of the respondents along with environmental knowledge, environmental attitudes, environmental uses and environmental concern; (b) level of epistemological belief along with speed of knowledge acquisition, structure of knowledge, sources of Knowledge, control of knowledge acquisition, and stability of knowledge; (c) ascertain the difference on the environmental literacy of pre-service teachers when grouped according to their profile variables; (d) ascertain the difference on the personal epistemological beliefs of pre-service teachers when grouped according to their profile variables; (e) Test the significant relationship between Domains of Epistemological beliefs and domains of Environmental Literacy. Determination of the relationship between environmental literacy and epistemological beliefs of Filipino pre-service teachers makes study significant in attaining the goals of environmentally literate citizens.

## Materials and methods

### Research Tools

This study utilized three-part questionnaire. The first part was a self-made questionnaire for the profile of the pre-service elementary teachers. For the second part is the Epistemological Beliefs Survey by Wood and Kardash (2002) measures different epistemological beliefs.

It consists of 38 items and it measures five (5) factors namely: speed of knowledge acquisition; the structure of knowledge; sources of knowledge; control of knowledge acquisition; and stability of knowledge. For the third part, it assessed the environmental literacy of the pre-service teachers developed by Kaplowitz & Levine (2005) consisting of four dimensions as environmental knowledge (11 items), environmental attitudes (9 items), environmental uses (19 items) and environmental concerns (9 items).

*Method*

This study employed the descriptive correlational method. The descriptive component of the study revolved around the investigation of the pre-service teachers' environmental literacy and epistemological beliefs. On the other hand, the correlational component is centered on the relationship between environmental literacy and epistemological beliefs of the pre-service teachers.

*Participants*

The participants of the study were the sixty (60) pre-service teachers randomly sampled from the College of Teacher Education of Cagayan State University at Lasam, Philippines.

*Data Analysis*

To analyze the data, the study used mean, weighted mean and standard deviation were used to determine the average scores of the respondents on their environmental literacy and epistemological beliefs, meanwhile, Independent Sample T-test and One-Way Analysis of Variance were used to determine if there exists a significant difference on the environmental literacy and epistemological beliefs when grouped according to their profile variables. Finally, the test for the relationship was computed using the Pearson Product Moment Correlation. The hypotheses investigated in the study were tested at 0.05 level of significance. The scale of interpretation for the variables being measured to assess the environmental literacy and epistemological beliefs of the respondents followed this range: 4.20-5.00: Very High; 3.40-4.19: High; 2.60-3.39: Moderate; 1.80-2.59: Low; 1.79: Very Low.

**Results and discussion**

*Environmental Literacy of the Pre-service Teachers*

The pre-service teachers have a high level of environmental literacy as attributed to the overall mean of 3.79 (SD= 0.30). A closer look at the table, it further reveals that the pre-service teachers have "high" rating along with the four dimensions of environmental literacy: environmental knowledge with the mean of 3.77 (high), environmental attitude with the mean of 3.41 (high), perceptions of environmental uses with the mean of 3.80 (high), and environmental concern with the mean of 4.19 (high).

**Table 1.** Environmental Literacy.

Environmental Literacy	Mean	Std.Dev.	D.I.
Environmental Knowledge	3.77	0.36	High
Environmental Attitudes	3.41	0.53	High
Environmental Uses	3.80	0.43	High
Environmental Concern	4.19	0.48	High
Over-all Mean	3.79	0.30	High

The high level of the pre-service teachers' environmental knowledge implies that they acknowledge themselves to have deep environmental knowledge manifested in their understanding of the different environment and environment-related issues on biodiversity, solid waste management, extinction of animal species etc. the positive understanding of the pre-service teachers on environment is attributed to the learning outcomes of their subjects biological science (Bio 11), environmental education (ST 103), and general ecology (Bio 62). De Chano (2006) defines environmental knowledge referring to the information enables somebody to study and reach about physical, social, cultural conditions that affect the development of organisms.

In like manner, the pre-service teachers also showed high positive rating on their environmental attitude implying that they have acquired values and concern for motivation in protecting the environment. The pre-service teachers founded their environmental attitude on the anthropocentric, ecocentric and biocentric point of views.

They have the beliefs that human beings are responsible for protecting the environment while animals and other living creatures have the equal rights to be protected.

The pre-service teachers also manifest a high level of environmental concerns. They exhibit high environmental concern on smoke pollution, hazardous waste, ozone layer depletion, global warming, air pollution, and industrial pollution. For them, most of the reasons for environmental problems were caused by human activities. The finding also implies that the pre-service teachers show sensitivity toward environmental problems and issues.

Finally, analysis of the dimensions, it also indicates that the pre-service teachers have a high level of awareness of environmental uses. Their high level of awareness on the uses of environmental resources implies that plants, animals, and other natural resources have their importance to human survival and at the same time for the natural functioning of the ecosystem. For them, plants are sources of foods and goods for humans; they can also be used for medicines. Trees, for example, have an important role as abatement of climate change as well as provide shade and protection for animal and humans.

*Epistemological Beliefs of the Pre-service Teachers*

Table 2 presents the personal epistemologies of the pre-service elementary teachers. It can be seen that the pre-service teachers have “high” rating along the five dimensions of epistemological beliefs namely a) sources of knowledge with a category mean of 3.87 (high); b) structures of knowledge with a category mean of 3.80 (high); c) speed of knowledge acquisition with a category mean of 3.77 (high); d) control of knowledge acquisition with a category mean of 3.66 (high); and lastly, e) stability of knowledge with a category mean of 3.58 (high). The high rating of the pre-service elementary teachers to the five dimensions of personal epistemologies implies that they exhibit high positive personal epistemologies. This explains their stand on the dynamics of knowledge, how they decide with the contending knowledge assumptions and claims, and their attitude and ability to judge new

information that could affect their lives as future elementary teachers.

**Table 2.** Epistemological Beliefs.

	Mean	Std. Dev.	D.I.
A speed of Knowledge Acquisition	3.77	0.35	High
Structure of Knowledge	3.80	0.50	High
Sources of Knowledge	3.87	0.34	High
Control of Knowledge Acquisition	3.66	0.39	High
Stability of knowledge	3.58	0.47	High
Over-all Mean	3.74	0.32	High

The highest mean among the epistemological beliefs of the pre-service teachers is along with the belief on the sources of knowledge (3.76- high). The assessment on the source of knowledge measures the pre-service teachers' belief regarding where knowledge comes from. The "high" positive epistemological belief on this dimension shows that the pre-service teachers believe that environmental knowledge is tentative and dynamic. The search for environmental knowledge is unending. For them, to become an environmentalist, they must be able to rely on what scientist, researchers or authorities tell about the different environmental issues. They believed that organization of their environmental knowledge must come from omniscient authority and other different sources such as school, mass media, and results of investigations.

On the other hand, there is a high positive epistemological belief of the pre-service elementary teachers with respect to structures of knowledge (3.71- high). This assessed their belief on how knowledge about the environment is arranged whether it is a fact being represented from simple to complex manner. The finding implies that pre-service elementary teacher holds the belief that it is imperative for environmental information to learn effectively when it is broken down into small parts. This somehow shows that to be possessing the positive environmental knowledge, it should start from knowing the basic issues about the environment before moving to complex environmental issues. As to control of knowledge acquisition (3.51- high), the positive high belief of the pre-service teachers in this

dimension implies that no one has the monopoly of environmental knowledge. They believe that environmental knowledge is an individual encounter with the problem. The creation of such knowledge is a collective endeavor and not just a product of one or a single individual. This also indicates that as pre-service elementary teachers do not just believe in environmental knowledge presented to them but rather they exert effort to be critical about them.

Relative to the speed of knowledge acquisition (3.60-high), the high assessment of the pre-service elementary teachers in this dimension showed that they believe that environmental knowledge is dependent on how quickly they can absorb the concepts. This indeed implies that, as future teachers, they claim that knowing the basic facts about environmental issues is important to them to better understand how these issues affect the lives of people.

Along with stability of knowledge (3.40- high), the finding reveals that these pre-service elementary teachers believe that environmental knowledge should be understood holistically because of its ultimate purpose is to help human beings understand their role in the protection and conservation of the environment.

The finding generally implies that the pre-service teachers founded their epistemological beliefs on the view that nature of knowledge is being developed based on the personal capacity of an individual to process information, active involvement, reliance to omniscient sources, and hands-on experience.

This suggests that for the pre-service teachers, knowledge about the environment is the product of their experience, dependent on empirical investigations, and personal encounters about environmental issues and problems.

**Table 3.** Test of Difference on the environmental literacy of pre-service teachers when grouped according to their profile variables.

Profile Variables	Environmenta l Knowledge	Environmental Attitude	Perception of Environmental Uses	Environmental Concern
Sex	0.366 ns	0.036 *	0.192 ns	0.853 ns
Type of HS Graduated from	0.411 ns	0.330 ns	0.703 ns	0.079 ns
Father's Occupation	0.285ns	0.429 ns	0.429 ns	0.213ns
Mother's Occupation	0.143ns	0.672 ns	0.110ns	0.459 ns
Birth Order	0.427 ns	0.525 ns	0.123 ns	0.099 ns
Father's Education	0.285 ns	0.429 ns	0.213 ns	0.086 ns
Mother's Education	0.651 ns	0.126 ns	0.752 ns	0.677 ns
Family Monthly Income	0.734 ns	0.086 ns	0.322 ns	0.887 ns

\*= significant at 0.05 level (2-tailed)

ns= not significant at 0.05 level

Note: all other variables are not significant.

Table 5 shows that there also exists a significant difference on the environmental literacy of the pre-service teachers particularly on environmental attitude when grouped according to their sex (p value= 0.036). This shows that sex is the only profile variable which spells significant difference on the environmental literacy of the pre-service teachers. Results of the post hoc Tukey Test showed that female pre-service teachers have higher environmental attitude compare to male pre-service teachers. This finding construes with Tikka *et al* (2010) stated that

females have environmental attitude and responsibility towards the environment that they live in. this is attributed to the caring attitude of females.

In like manner, this study contradicts the finding of this study also reveals that profile variables such as the type of high school graduated from, parents' occupation, birth order, parents' education, and family monthly income do not spell the significant difference in terms of the pre-service teachers' environmental literacy.

**Table 4.** Test of Difference on the personal epistemological beliefs of pre-service teachers when grouped according to their profile variables.

Profile Variables	A speed of knowledge acquisition	Structure of knowledge	Sources of knowledge	Control of knowledge acquisition	Stability of knowledge
Sex	0.903ns	0.7129 ns	0.301 ns	0.633 ns	0.552ns
Type of HS Graduated from	0.623 ns	0.158 ns	0.807 ns	0.648 ns	0.667 ns
Father's Occupation	0.912 ns	0.250 ns	0.555 ns	0.502 ns	0.479 ns
Mother's Occupation	0.350 ns	0.0561 ns	0.908 ns	0.895 ns	0.366 ns
Birth Order	0.490 ns	0.850 ns	0.894 ns	0.494ns	0.867ns
Father's Education	0.003 **	0.207 ns	0.134 ns	0.505 ns	0.182 ns
Mother's Education	0.948 ns	0.631 ns	0.043*	0.091 ns	0.620 ns
Family Monthly Income	0.403 ns	0.293 ns	0.427ns	0.263 ns	0.164 ns

\*= significant at 0.05 level (2-tailed)

ns= not significant at 0.05 level

Note: all other variables are not significant.

Table 3 shows that there is a significant difference on the personal epistemologies of pre-service elementary teachers when grouped according to their profile variable. Significant differences are seen along the speed of knowledge acquisition and sources of knowledge when grouped according to fathers' educational attainment (p value=0.003) and mothers' educational attainment (p value=0.043). Based on Post-Hoc Test, it showed that the significant difference on personal epistemologies is seen on the pre-service teachers whose parents are college undergraduate. This affirms the finding of Schommer et. al (2006) study revealed that the more educated parents have and the more they expect their children

to take responsibilities in the home and for their own thinking, the more likely children to develop a sophisticated system of epistemological beliefs. In the same manner, in the latest study of Topcu & Tuzun (2009), they found out that the higher the educational attainment of the mother the better students developed knowledge of cognition skills and epistemology. Also, in the previous study of Magulod (2017) investigating the epistemological beliefs of pre-service teachers, he also found out that no significant difference existed along sex, type of HS graduated from, parents' occupation, birth order, and family monthly income do not spell significant difference on their personal epistemologies.

**Table 6.** Test of Relationship between Domains of Epistemological beliefs and domains of Environmental Literacy.

Variables		A speed of Knowledge Acquisition	Structure of Knowledge	Sources of Knowledge	Control of Knowledge Acquisition	Stability of Knowledge
Environmental Knowledge	r	.3944	.0236	.3049	.1371	.0832
	p value	p=.023*	p=.896	p=.084	p=.447	p=.645
Environmental Attitudes	r	.5334	.2872	.2925	.6182	.5463
	p value	p=.001**	p=.105	p=.099	p=.000**	p=.001**
Environmental Uses	r	.1591	.2364	.3799	.1170	.3508
	p value	p=.376	p=.185	p=.029*	p=.517	p=.045*
Environmental Concern	r	.0538	.5362	.1078	.1934	.2904
	p value	p=.766	p=.001**	p=.550	p=.281	p=.101

Table 5 shows that there is a significant relationship between the epistemological beliefs and environmental literacy of the pre-service teachers. Significant relationships are found between environmental knowledge and speed of knowledge acquisition (r=0.399 and p value=0.023), environmental attitude

and speed of knowledge acquisition (r=0.5334 or p value= 0.001), environmental concern and structure of knowledge (r=0.5362 or p value= 0.001), awareness on environmental uses and sources of knowledge (r=0.3799 or p value =0.029), control of knowledge acquisition and environmental attitudes (r=0.6182 or p

value- 0.000), environmental attitudes and stability of knowledge (  $r$  value= 0.5463 or  $p$  value= 0.001), and lastly, awareness on environmental uses and stability of knowledge ( $r$  value= 0.3508 or  $p$  value= 0.045). Generally, the positive relationship between epistemological beliefs and environmental literacy had been confirmed from the previous study of Ozturk (2009) finding that epistemological belief components, innate ability, and quick learning were significantly related with the behavior component of environmental literacy.

The positive relationship between environmental knowledge and speed of knowledge acquisition shows that the higher environmental knowledge of the pre-service teachers the better they learn quickly about environmental issues and problems. Likewise, the stronger the pre-service teachers exhibit positive environmental attitude the faster they acquire environmental knowledge. This can be simply explained that pre-service teachers tend to act as an environmentalist if they believe they can learn how to solve environmental problems quickly.

In like manner, the higher the belief of the pre-service teachers on the structure of knowledge they tend to have a higher environmental concern. This implies that when pre-service teachers understand better the nature and structure of environmental problems and issue the more they show positive environmental concerns.

Likewise, the higher the pre-service teachers cling to authoritative sources of knowledge about the environment, the stronger they manifest awareness on the uses of environmental resources. It can be explained that relying on an omniscient source of environmental knowledge will make the pre-service teachers becomes environmentally literate.

Meanwhile, the stronger the pre-service teachers' belief on the control of knowledge the stronger they manifest positive environmental attitude. This implies that relying on what they read about environmental issues and problems is not enough to become environmentally literate hence they should be

validated from different sources or based on their own personal experiences. This also indicates that as pre-service elementary teachers become more critical about environmental issues they tend to exhibit positive environmental attitude.

Finally, the stability of knowledge is significantly correlated to the environmental attitude and awareness to environmental uses among the pre-service teachers. This can be practically explained that the pre-service teachers adhered to the belief that learning about environmental issues requires the continual development of one's skills, knowledge, and approaches to fully understand it. Hence, they likely to display more environmental behaviors when they believe they possess the potential ability to deal with environmental problems.

Previous studies also contradict the relationship between environmental attitude and knowledge, Alp *et al* (2008) reported that a sample of elementary students of Ankara indicated a low level of knowledge, but a high level of environmental attitude. Consequently, Alp *et al.* (2006) studied with a sample consisting of students from urban schools and proposed that environmental knowledge does not have a direct influence on responsible environmental behaviors of students but mediated by behavioral intentions and environmental effect.

### Conclusion

The study investigated the relationship between the environmental literacy and epistemological beliefs of pre-service teachers. Findings revealed that there is a high level of environmental literacy among the among the pre-service teachers along with environmental knowledge, environmental attitude, awareness of environmental uses, and environmental concern. Likewise, the pre-service teachers exhibit positive personal epistemological on the five dimensions namely speed of knowledge acquisition, the structure of knowledge, sources of knowledge, control of knowledge acquisition, and stability of knowledge. Significantly, the test of difference showed that sex is the single variable showing the significant difference

in the environmental literacy while parents' education attainment also spelled significant differences on the epistemological beliefs of the pre-service teachers. The study also found out that there is a significant relationship between the environmental literacy and epistemological beliefs of the pre-service teachers indicating that the higher the environmental literacy of the respondents the more they likely to exhibit sophisticated belief about environmental knowledge.

Results of the study further suggest that the environmental literacy of the pre-service teachers is affected by their epistemological beliefs. The higher they perceived themselves to possess the ability to learn the higher they manifest environmental literacy. Therefore, epistemological beliefs of the pre-service teachers should be taken into consideration in the Teacher education training program to develop future educators who are environmentally literate.

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