

ECOLOGICAL LITERACY AMONG TECHNICAL AND NON-TECHICAL STUDENTS OF NEPAL

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ABSTRACT

Ecological literacy creates foundation towards betterment of environment and reducing negative externalities of human activity. A study was done to evaluate the level of ecological literacy among students pursuing technical and non-technical education in Nepal. Structured questionnaire was designed, pilot tested and administered to different students all over Nepal through Google form. Altogether 375 responses were obtained. Gender, type of education and ethnicity significantly affected ecological literacy. Female students, technical students and elite groups' students were 2.4%, 4.92% and 2.19% more ecologically literate than male students, non-technical students and marginalized group students respectively. Technical students have basic level and non-technical students have low level of ecological literacy. Though these groups of students are acquiring information from various courses they are studying, they were unable to relate what they learnt in class with their surroundings. Urgent and effective amendments and action is needed in developing sound scientific information about ecosystem, skills for critical thinking, positive attitude, creative and strategic problem solving to increase the rational action among the students to sustain the environment.

Keywords: Ecological literacy, environment, attitude, critical thinking

INTRODUCTION

A person's ecological understanding, thinking, habits and general knowledge about environment is termed as ecological literacy. Paul Risser used the term "ecological literacy" for the first time in 1986 while addressing the Ecological Society of America (Risser, 1986). Ecological literacy has been defined as "the ability to use ecological understanding, thinking and habits of mind for living in, enjoying, and/or studying the environment" (Berkowitz et al., 2005) and as focusing on the "key ecological knowledge necessary for informed decision-

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making, acquired through scientific inquiry and systems thinking” (McBride et al., 2013). (Meena & Alison, 2009) referred student’s understanding about ecological concept as well as his/her place in the ecosystem as ecological literacy. Various factors impact personal environmental knowledge, attitudes, uses and concern. The widespread public awareness of and concern about environmental issues at that time is often attributed to the work of the distinguished naturalist and nature writer, Rachel Carson (Rothman, 1988).

Students are future of tomorrow. The way we shape them today will help them will affect the sustainability of future. For this, the entry point is to make them ecologically literate. It will change their dimension of attitude, behavior and concern as well as basic knowledge on ecosystem. However, there is limitation of such study in context of Nepal. In this regard, the present study was done to record the perception of students about general environmental issues as well to assess the level of ecological literacy among technical and non-technical students of Nepal and factors affecting it.

THEORETICAL FRAMEWORK

The vision for assessing ecological literacy in this study was crafted by overcoming the challenges of balancing brevity with comprehensiveness. An inclusive and adaptive analytical approach was needed to examine the perspectives of students was essential. Frameworks for ecological literacy generally prioritize that the knowledge about the environment is necessary for informed decision-making and they also emphasize systems thinking as they involve the identification of various biophysical and social components in the contextual environment. In this regard, the theoretical framework for the study was adapted and synthesized from numerous alternate frameworks previously used for ecological literacy as shown in table 1 as because , a widely accepted framework was not found which was also supported by (Knapp and D’Avanzo, 2010) and (Jordan et al., 2009).

In the study done by (Cherrett, 1989), ecological literacy was assessed by top twenty ecological concepts in rank order viz; 1) the ecosystem, 2) succession, 3) energy flow, 4) conservation of resources, 5) competition, 6) niche, 7) materials cycling, 8) the community; 9) life history strategies, 10) ecosystem fragility, 11) food webs, 12) ecological adaptation, 13) environmental heterogeneity, 14) species diversity, 15) density dependent regulation, 16) limiting factors, 17) carrying capacity, 18) maximum sustainable yield, 19) population cycles, 20) predator-prey interactions.

(Klwmow, 1991) used eleven basic concepts for assessing ecological literacy which included the nature of ecological science, nature of ecological science, influences of physical and biological factors on organisms, species distribution, populations, communities, organism interactions, ecosystem

concept, energy flow through ecosystems, nutrient cycling in ecosystems, constant change in ecosystems and human impacts on ecosystems.

(Berkowitz et al.,2005) gave three overlapping components of ecological literacy; knowledge of key ecological systems, ecological thinking toolkit and understanding of the nature of ecological science and its interface with society. Similarly, (Jordan et al., 2009) formulated the three overlapping components of ecological literacy; ecological connectivity and key concepts of ecosystem, ecological scientific habits of mind for modeling and dealing with environmental uncertainty and lastly, links between human actions and their subsequent effects on ecosystems. The present study has used the framework stated above with some modifications. The modifications were with respect to attitude of concerns, behavior and actions, view towards sustainability of campus and general knowledge about environment and important issues in Nepalese context.

Based on the theoretical framework, concept of work was put forth for assessment of ecological literacy. The concept for analysis was based on the fact mentioned here under; an ecologically literate individual understands environmental realities by specifically identifying their cause and effect relationships. As such, the ecologically literate individual has a clear perception and understanding of an ecosystem dynamic, as well as its past and future outcomes. He or she understands the complexity of studied objects and phenomena, allowing for more enlightened decision-making and is also up to date about various issues taking place.

METHODOLOGY

After rigorous setting of appropriate questions structured survey method was followed. The survey questions were in part drawn from survey studies conducted in the past (Davidson, 2010; Morrone, et al., 2001; Bruyere, 2008) and were in part crafted by the principal author. The first section in the questionnaire included the basic and socioeconomic information about the respondents whereas, the second section reflected attitude of concern which included 16 statements each with five point Likert scale as suggested by Awadia and Esa (2013) showing various degrees of agreement to gauge the student's level of care about environmental issues. The statements used are given in appendix 1. The third section included five statements reflecting behavior and action of students towards certain environmental issues to judge student's practical competency. The fourth section was loaded with six statements to record their view for improving the sustainability in their campus whereas the last section was designed to access the general knowledge of students about various ongoing environmental issues. After the questions were devised, they were pilot tested for checking the length of

questions and clarity of statements. These questions were then loaded in Google form after subsequent corrections. The questionnaire was sent to students through Facebook and Google group. Snowballing was done so as to reach much of targeted group. 375 responses were obtained, out of which, 152 were non-technical and 223 were technical students. The responses thus obtained which were then coded and subsequently analyzed in Statistical Package of Social Science (SPSS) version 25.

Both descriptive and inferential analysis was done. Chi square test was done to test the level of significance for perception on ecological literacy, responsibility towards environment and activities to reduce the impact on environment with respect to gender, type of education and level of education. Independent sample t test was done to triangulate the score with gender, type of education and type of college. Moreover, ordinary linear regression was done to assess the role of gender, type of education, level of education, ethnicity and type of institution on ecological literacy percentage. The percentage grading was created as shown in appendix 2 by assigning percentage to each response in each heading. For general knowledge section the correct answer obtained full marks whereas wrong was assigned 0 marks. The grading scheme required at least 60% to be ecologically literate. This rating scale is based on the rating given by (Mcginn, 2014). From 60 percent to 100 percent the levels were broken up into 10 percent ranges just like a standard grading rubric as shown in Table 1. The reason of choosing this method was because of easiness in easy understanding not by only academia but also other personals.

Table 1: Standard grading rubric for ecological literacy

Percentage	Grade	Level of ecological literacy
60-70%	D	Low
70-80%	C	Basic
80-90%	B	Standard
90-100%	A	High

RESULTS AND DISCUSSION

GENERAL INFORMATION

Out of 370 respondents, 60.8% were male and 39.2% were female. Majority of the participants (71.2%) were pursuing bachelor's level of education, followed by intermediate (14.7%) and masters or above (14.1%). Moreover, 59.5% were from technical education, mostly agriculture. The detail is shown in table 1 below:

Table 2: Gender, education level and type of education of respondents

Variables	Percentage
Gender	
Male	60.8
Female	39.20
Education	
Intermediate	14.7
Bachelors	71.2
Masters and above	14.1
Type of education	
Technical	59.5
Non-technical	40.5

PERCEPTION ON ENVIRONMENTAL ISSUE AND SPECIES EXTINCTION

33.2% respondents perceived pollution as the most important environmental issue in their locality followed by deforestation (31.2%). Moreover, habitat loss was perceived to be the major cause of species extinction in the natural habitat followed by climate change, over harvesting and predation as shown in the table 3. (Sodhi et al., 2009) stated that habitat loss causes extinctions directly by removing all individuals and indirectly by facilitating the establishment of an invasive species or disease agent, improving access to human hunters, or altering biophysical conditions. They also suggested that the deforestation is currently, and is projected to continue to be, the prime direct and indirect cause of reported extirpations.

Table 3: Perception on Important environmental issues (left) and causes of species extinction (right)

Important environment issues		Causes of species extinction	
Particulars	Percentage	Reasons	Percentage
Climate change	11.5	Habitat loss	55.1
Pollution	33.3	Over harvesting	10
Over harvesting	11.4	Climate change	21.2
Deforestation	31.2	Predation	13.7
Others	12.6		

PERCEPTION ON THE LEVEL OF ECOLOGICAL LITERACY

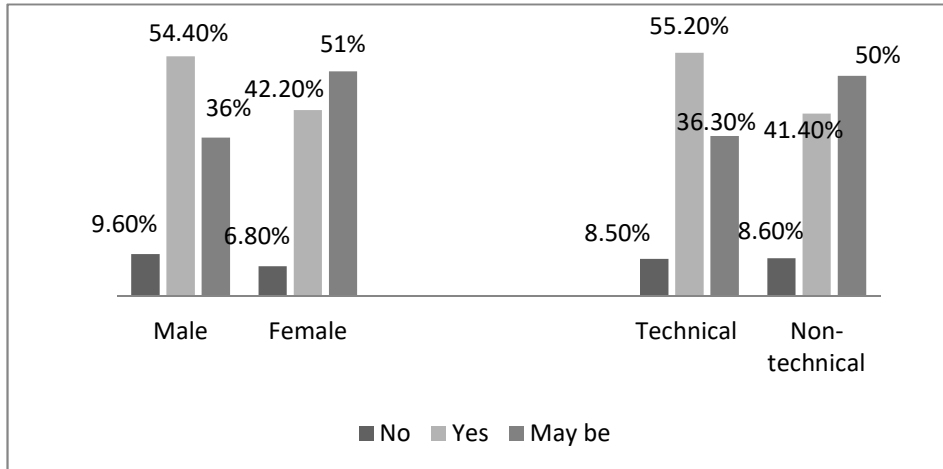


Figure 1: Ecological literacy with respect to gender (left) and type of education (right)

Significant difference was observed in the perceived level of ecological literacy with respect to gender ($\chi^2=8.37, P<0.05$) and type of education ($\chi^2=6.66, P<0.05$). 54.4% of male and 42.2% female said that they were ecologically literate. Similarly, 55.2% of technical students and 41.4% % of non-technical students said to be literate ecologically. The detail is shown in the Figure 1.

PERCEPTION ON RESPONSIBILITY

Technical students were found to be significantly more self-responsible than non-technical students in reducing waste generation in the environment ($\chi^2=8.01, P<0.05$), whereas no significant difference was noted with respect to education in this regard. Detail is shown in Figure 2.

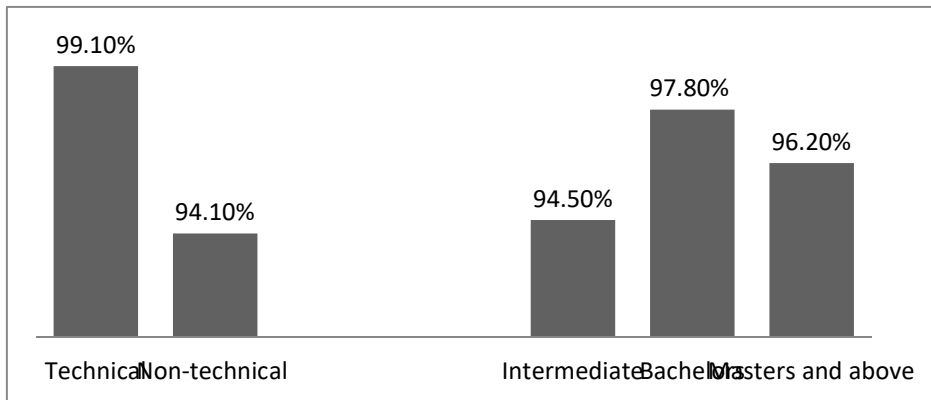


Figure 2: Responsibility to reduce waste with respect to type of education (left) and level of education (right)

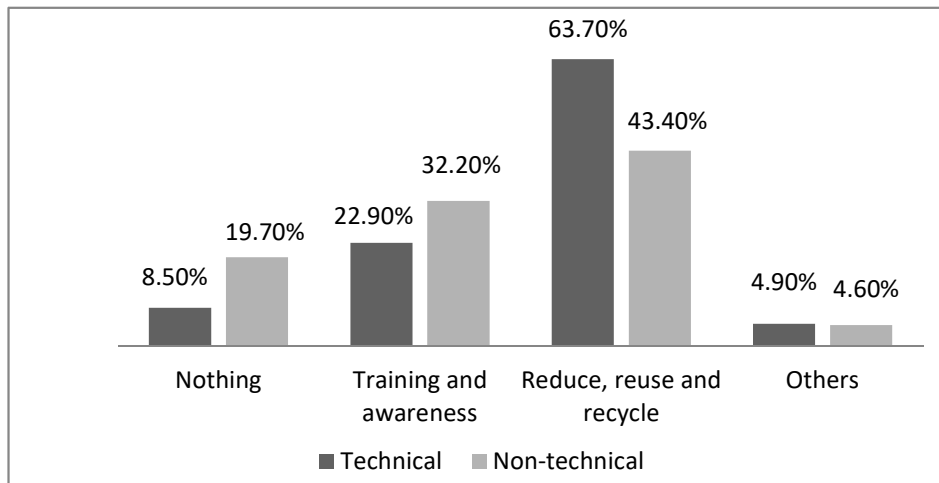


Figure 3: Activities doing by respondents to reduce the impact on environment

8.5% of technical students and 19.7% of non-technical students are not doing anything to reduce the impact on environment. Detail is shown in Figure 3. Both of these groups are focusing on reduce, reuse and recycle. Non-technical students are focusing more on training and awareness as compared to technical students because they are less acquainted with the impact of human activities on environment and the ways to reduce the impact. The finding is statistically significant ($\chi^2 = 18.38, P < 0.001$).

Moreover, when reasons of not doing any such activities, it was found that non-technical students focused on lack of idea and knowledge whereas technical students stressed on some other unseen factors. Also, intermediate students had least idea or knowledge in this regard. Detail is shown in Figure 4.

Table 4: Reasons of not doing environment conservation and awareness activities with respect to type of education and level of education

	Type of education (%)		Level of education (%)		
	Technical	non-technical	Intermediate	bachelors	masters and above
It's not my duty	1.40	13.30	6.10	5.80	22.20
lack of idea and knowledge	23.60	42.20	48.50	29.80	27.80
I am not capable	11.10	16.90	12.10	12.50	27.80
others	63.90	27.70	33.30	51.90	22.20
Chi square value	23.20***		15.19*		

Note: *= $P < 0.05$ & ***= $P < 0.001$

FACTORS AFFECTING ECOLOGICAL LITERACY

Female were 2.4% more ecologically literate than male students. Moreover, non-technical students of Nepal are 4.92% less ecologically literate than technical students. The percentage obtained was not significantly different with respect to the level of education. Moreover, elite groups were 2.19 %more ecologically literate than marginal groups, probably due to more access to technical education. The model was also statistically significant. Detail is shown in the Table 5. (Tikka et al., 2000) found the significant variation in students' environmental knowledge, attitudes and activity levels respect to gender and education level.

Table 5: Simple linear regression estimates predicting the level of ecological literacy by characteristics of students (n= 375)

Independent variables	Regression coefficient
Gender (1=female)	2.40**
Education type (1=nontechnical)	-4.92***
Education level (1=intermediate)	2.26ns
Ethnicity (1=elite)	2.19*
Type of institution (1=governmental)	1.57ns
Intercept	68.12***
Model F	9.82***
Regression degree of freedom	5
Residual degree of freedom	365
Adjusted R square	0.107

Note: *=P<0.05, **=P<0.01, ***=P<0.001, ns=not significant (P>0.05)

LEVEL OF ECOLOGICAL LITERACY

The score obtained by female is significantly higher than male in terms of behavior, work towards campus sustainability and overall ecological literacy. Similarly, the type of education significantly affects their activities, attitude, behavior, work toward campus sustainability, general knowledge about environment and overall ecological literacy (Table 6). The score of students from private college was significantly higher than public college in terms of behavior and work towards campus sustainability. The detail about the level of scores in individual areas and overall ecological literacy is shown in Table 6.

Table 6: Independent sample t test showing the score obtained on different aspects of ecological literacy with respect to gender, education type and type of college

	Activities	Attitude	Behavior	Campus sustainability	GK	Total
Gender	Ns	Ns	**	*	Ns	*
Male	91.37 ±1.115	77.02 ±0.89	73.15 ±1.20	80.55 ±1.23	42.12 ±1.42	67.5 ±0.60
Female	93.45 ±1.295	78.42 ±1.19	78.15	84.09 ±1.31	43.48 ±2.04	69.42 ±0.75
Education type	***	*	Ns	*	***	***
Technical	96.04 ±0.71	78.96 ±0.76	76.02 ±1.20	83.67 ±1.20	45.88 ±1.33	70.40 ±0.48
Non-technical	86.5 ±1.71	75.5 ±1.34	73.76 ±1.50	79.38 ±1.38	37.88 ±2.09	65.08 ±0.87
Type of college	Ns	Ns	*	*	Ns	NS
Governmental	92.60 ±1.07	77.61 ±0.89	73.62 ±1.18	80.64 ±1.24	41.41 ±1.36	67.88 ±0.61
Private	91.41 ±1.37	77.5 ±1.20	77.83 ±1.51	84.3 ±1.19	44.92 ±2.20	68.91 ±0.75

Note: *=P<0.05, **=P<0.01, ***=P<0.001, ns=not significant (P>0.05)

Based on the score secured by the participated students their level of ecological literacy was calculated based on criteria given by McGinn (2014). Both male and female students have basic literacy with respect to attitude, behavior and work towards campus sustainability. They were however considered as illiterate with respect to their scores obtained in general information about environment and its allied problems. Technical students have only basic level of ecological literacy. Moreover, the level of ecological literacy of students both from government and private college is low. Detail is shown in the Table 7.

Table 7: Level of ecological literacy among students with respect to gender, education type and type of college

	Attitude	Behavior	Campus sustainability	GK	Total
Gender					
Male	Basic	Basic	Basic	Illiterate	Low
Female	Basic	Basic	Basic	Illiterate	Low
Education type					
Technical	Basic	Basic	Standard	Illiterate	Basic
Non-technical	Basic	Basic	Basic	Illiterate	Low
Type of college					
Governmental	Basic	Basic	Standard	Illiterate	Low
Nongovernmental	Basic	Basic	Standard	Illiterate	Low

Note: Illiterate<low<Basic<Standard<high (As given by rating of McGinn, 2014)

This supports the study of (Goldman et al., 2006) and (Negev et al., 2008) which was carried out at Israeli academic institutions. Several other studies have found that women show more positive attitude towards environment. Previous studies have found that women and girls show more positive attitudes towards the environment than men (Yavetz, and Pe'er 2006; Engels and Jacobson 2007). However, all the sections seem to possess poor general knowledge with respect to environment. An ecologically literate person must have positive attitude, reflect it in behavior, thinks about campus sustainability and have sound general information about environment. The result is shocking in the sense that though the students have been getting acquainted with environmental education since their primary level but are unable to reflect it in their responses. The results suggested that the institutions have failed to attract students with a higher level of ecological literacy and highlighted the need of significant task to be done in this regard. This baseline data shows that there is significant work to be done to increase ecological literacy both for technical and non-technical students. This is a barrier to sustainability work in communities, across states, and at the federal level because if people do not know, care, or take sustainable actions, then issues such as climate change are more difficult to adequately address. (Orr, 2004) states that it is unacceptable that the students leave college without a strong concept of each aspect of ecological literacy.

CONCLUSION

The concept of ecological literacy is of great significance in today's world where numerous environmental hazards are kicking its way due to anthropogenic activities. However, the findings revealed that even technical students have only basic level of ecological literacy whereas non-technical students' ecological literacy is too poor. They were unable to relate what they learnt in class with their surroundings. There was difference in the student's attitude, behavior and knowhow of general issues which signified that there was limitation in scientific understanding and awareness the students are getting in the colleges. Gender and technical seem to have more effect on ecological literacy. Until and unless, the gap with respect to attitude, behavior, action and general knowledge between technical vs non-technical, male vs female or governmental vs private college is reduced, the sustainability will only reflect in words.

In the wake of climate change and other growing environmental concern, students are not been able to reflect the actions with the knowledge they are gaining. In this context, an ecologically literate person will make wise decisions and take perfect actions to solve environmental issues which is an essential skill given the environmental issues facing the world today. Practical oriented and student friendly efforts are needed in enhancing the ecological literacy of students. Efforts to increase ecological literacy should be done because it incorporates not only a person's knowledge, but also their caring and the actions they take. The curriculum should be updated

accordingly giving more emphasis to citizen science and environmental ethics in order to increase the rational action among the students to sustain the environment, Amendments and actions are to be utmost identified and implemented to develop base of scientific information about ecosystem as well as skills for critical thinking, positive attitude, creative and strategic problem solving and prompt decision making. The study is to be replicated to wider section of society and to identify effective interventions for increasing the ecological literacy of students and other individuals of society. In addition to it, the government should focus on the ecological literacy of policy makers and decision makers because it will enable them to think about the environmental consequences of their decisions as well as for developing the aspects of ecological literacy as a culture and also for reflecting it in our education system.

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