Research Paper

Naturalistic Intelligence (NI) : Nature and Nurture

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Abstract

Howard Gardener's Multiple Intelligence theory includes Naturalistic intelligence, a cognitive potential to process information regarding nature. The individuals with high NI are likely to do well in diverse nature related careers and can contribute towards sustainable management and conservation of nature.

Studies of NI in Indian context lack any insights into NI that can help to identify and nurture NI. We assessed NI in school children and its expression in naturalists. Correlation of NI with other intelligences and its use were explored.

NI had highly significant but moderate correlations with other seven intelligences. Interview results showed that expert naturalists are highly sensitive towards variety, relationships and patterns found in natural objects and make use of multiple senses, including visual, auditory, olfactory, tactile and gustatory while experiencing their surroundings. The results of both studies are used in conjunction with NI studies abroad to list characteristics that can help identify children with high NI. Activities that can help nurture NI are recommended.

Keywords: Multiple Intelligence, Naturalistic Intelligence, naturalist, education

Introduction

All species require knowledge of their natural surroundings to survive in this world. For several thousand years, humans learnt and passed on the knowledge about nature in various ways. Organized forms of this knowledge are included in life sciences and natural history. Knowledge of nature is also expressed and shared through cultural practices, art forms, songs, dance, music and literature. Hunters, farmers, shepherds, fishermen, biologists, bird-watchers, botanists are some examples of people who generate knowledge about nature through their observations of flora, fauna and natural phenomena. The knowledge is based on information through keen observations of individuals who can distinguish and find relations between plants, animals and other components in nature. The ability of certain individuals to observe and detect patterns in nature has been treated as a separate intelligence, termed, "Naturalistic Intelligence."

Identification of intelligence and its nurture have

practical implications for an individual as well as for the society in which s/he resides. Psychometric approach led to creation of various tests for intelligence which led to popular term "Intelligence Quotient" (IQ) that describes scores on the tests of intelligence (Neisser et al. 1996). Spearman (1927) emphasized the importance of a general factor, *g*, which represents all that the psychometric tests have in common; others (e.g., Thurstone, 1938) focus on more specific group factors such as Memory, Verbal ability, Number Ability, etc.

Howard Gardener took an interdisciplinary and culturally sensitive approach to intelligence. Gardner, (1993), defined intelligence as an "ability to solve problems or fashion products that are of consequence in a particular cultural setting or community". Later, in his book, *Intelligence Reframed*, Gardner (1999) listed Multiple Intelligence (MI), each oriented to a specific type of information: linguistic, logical-mathematical, musical, spatial, bodily kinaesthetic, naturalistic, interpersonal, and intrapersonal, etc. He states that intelligence can be seen as a potential – not as something

that is fixed—and this potential is either stimulated or diminished by the cultural, environmental, and social settings a person experiences.

Naturalistic Intelligence (NI), first described by Gardner, has been comparatively less well studied than the other intelligences. NI is defined as “the potential to process information that is exhibited by naturalists” (Hayes, 2009). Gardner (1999:49) believes “the naturalist’s intelligence (is) as firmly entrenched as the other intelligences” and that “(t)here are. . .core capacities to recognize instances as members of a group (more formally, a species); to distinguish among members of a species; to recognize the existence of other, neighbouring species; and to chart the relations, formally or informally, among the several species.” He has explained the concept by quoting many examples of botanists, zoologists, evolution theorists, environmentalists, entomologists, etc. Poets and authors writing about nature, wildlife photographers, film-makers are some other examples who display high sensitivity towards nature, but they may not be always be able to distinguish between species and therefore may or may not be showing NI as defined by Gardner.

The MI theory of Gardner has been used to formulate variety of educational and experiential learning programmes to identify inclinations, develop intelligence profiles of individuals and to design programmes that cater to individual’s personality development (Gardener and Hatch 1989; Chen, 1993; Bas, 2016). It has been seen that it leads to successful student outcomes including more interest and motivation, better recall, deeper understanding, higher attainment and improved self-esteem (Hanafin, 2014). Hayes (2009) has discussed how learning from MI theory and practice can be applied to naturalistic education and supporting (environment and biodiversity) conservation. Some MI studies that include NI are by Razmjoo (2008), Almeida et al. (2010) and Karamustafaoglu (2010).

Indian schools, with some exceptions, do not incorporate activities that can support development of diverse intelligences of an individual. Tamilselvi and Geetha (2015) have noted the importance of integrating MI activities in the teaching to aid students’ learning. But only a few basic assessments of MI (including NI) have been conducted in Indian settings. Kaur and Chhikara (2008) assessed multiple intelligence levels among young adolescents and found gender related differences in the levels. Watve (2010) tested the relations among eight intelligences in MI in school children and found significant correla-

tion. Baskaran and Babu (2014) investigated NI in Master’s level students of library science and discuss need for nurture.

A very recent study from neighbouring Nepal (Neupane, et al. 2018) has shown that NI ranks first among the MI in school children in Kailali district. Other studies (Sener and Çokçaliskan 2018, Zebari et al. 2018) have assessed and ranked NI with respect to other intelligences in school and University students. The studies above have tested for presence of NI but have not described its characteristics in details. Our understanding of NI characters is mainly from studies in Europe and America such as by Armstrong (2009).

Understanding the nature of NI can help its nurture from early age. NI enhancement can help the individuals perform better in tasks that require understanding of flora, fauna and nature in general.

Aim of the present study was to understand NI, its relationship to other intelligences and its use by expert naturalists. The specific research questions posed were :

1. What is the relation between NI and other intelligences?
2. What are the ways in which nature related information is gathered and processed by individual with high NI (viz. Naturalists)?

The findings are used to describe characteristics of individuals with high NI and ways of creating supportive environment for the nurture of NI.

Biodiversity documentation, sustainable management and environmental conservation are considered national priorities in India (NBAP, 2008). Environmental education has been a compulsory component of school and university curriculum since 2003 (Almeida, and Cutter-Mackenzie, 2011). This is considered necessary to create awareness and sensitivity towards nature from early ages. Based on our study we suggest NI nurturing activities that can be incorporated in formal and informal nature education and help raise environmental awareness in the society.

Methodology

An exploratory correlational study was conducted using MI test for the eight intelligences. Data was collected using MI assessment tool, which is a behavioural checklist based on Gardner’s theory of multiple intelligence developed and tested by Jnana Prabodhini Institute of Psychology (Watve, 2010). The checklist consists of 80 statements, 10 for each of the intelligences. Each statement describes behaviours (ex. Recognizes and discriminates between different textures) rated on a 5-point scale (1-5). The composite

checklist was in English and also translated in Marathi.

One hundred self-nominated students between age 11-15yrs from Pune city and suburbs were administered this checklist during the period 2005 to 2006. It included 42 girls and 58 boys. In order to check inter-rater reliability, the checklist given to students was also given to one of their parents. The scores attained by students and parents were found to be matching. Item total correlation was tested and found significantly high (ranging from 0.60- to 0.80) which indicated satisfactory internal consistency. Correlations amongst the raw scores of the sampled students were calculated.

Naturalists were identified using Gardener's definition (Gardener, 1999) of naturalists as "(person who)... demonstrates expertise in the recognition and classification of the numerous species-the flora and fauna- of his or her environment. Eight naturalists (demonstrating skills for identifying plant and animal species and working full time in natural science studies) were interviewed using a semi-structured open-end interview schedule. It included questions regarding ways in which they distinguish plant and animal species, how they integrate the information about natural elements and use it in their chosen career. They were also queried regarding childhood experiences mainly to understand their interests, inclinations and influencing factors that helped them in taking up natural science studies. It helped to understand the actual process by which naturalistic individuals use their faculties in navigating through life. Information from two more naturalists was gathered through analysis of radio interviews and their own writings.

The study has limitations that the sample is culturally restricted and the nature of the tests limits analysis. But the sample is from a culturally homogenous group and showed concurrent validity. Considering this, results are fairly reliable, and can be used for further research.

Results

The raw scores on NI test were used to draw a frequency diagram (Graph 1). NI scores were normally distributed. Table 1 shows descriptive statistics of the NI scores. The sample is negatively skewed indicating more number of students are on higher end of the scores. Table 2 shows correlation of each intelligence score with the total scores on MI test. High correlations indicate high internal consistency.

The results of MI scores were used to find correla-

tions of NI with each of the intelligences. Table 3 shows highly significant correlation between NI and other intelligences at 0.01 significance level. The values ranged from moderate to high. Most students with high NI also displayed higher scores for other intelligences. Highest correlation among the pairs is between NI and Bodily-Kinaesthetic intelligence. They are likely to have some factors more in common than the rest, perhaps related to physical and biological capacities of the individual.

Graph 1 : Distribution of NI scores

Table 1 : Naturalistic Intelligence Descriptive Statistics

Intelligences	MEAN	S.D	Skewness	Kurtosis
NATURALISTIC	34.86	8.17	-0.43	0.16

Table 2 : Area total correlation

Area of intelligence	Correlation
LINGUISTIC	0.60
INTERPERSONAL	0.71
INTRAPERSONAL	0.72
VISUO-SPATIAL	0.76
BODILY-KINESTHETIC	0.75
MUSICAL	0.76
LOGICO-MATHEMATICAL	0.65
Naturalistic	0.80

Table 3 : Correlation of NI with other intelligences for N-100

Area of intelligence	Correlation	
LINGUISTIC	0.43	Moderate
INTERPERSONAL	0.51	Moderate
INTRAPERSONAL	0.48	Moderate
VISUO-SPATIAL	0.53	Moderate
BODILY-KINESTHETIC	0.63	High
MUSICAL	0.53	Moderate
LOGICO-MATHEMATICAL	0.45	Moderate

In some individuals, NI raw scores were high (45 and above) but scores on some other intelligences were lower than 30, one as low as 17 (See Graph 2). There were also students who were high on logico-mathematical, intrapersonal, visuo-spatial or linguistic intelligences but low on naturalistic intelligence. (See Graph 3). Two tailed t test revealed no significant difference in NI scores of boys and girls.

Use of NI by naturalists

Table 4 describes naturalists interviewed for understanding their use of NI in practice. The sample

included 7 males and 3 females between ages 25 and 70 at the time of interviews. They all had experience of working in wilderness areas and were mainly from two fields, taxonomy and ecological research involving plants or animals, areas which are primarily used to define naturalistic intelligence.

A psychologist measures intelligence as a 'performance' in response to the external stimuli. It was our effort to understand what kind of stimuli are received by the naturalists from the surroundings and how they perceive them. Naturalists were questioned about their childhood activities, how they identified different species or other components in the natural world, environment at home and school environment and its impact on their interests etc.

While describing how they experience nature, the naturalists described their use of multiple senses. They talked about observing patterns and shapes in examining natural elements. For example the botanists noted differences in leaf shapes, remembered the growth patterns of trees or shrubs. The zoologists noted the shapes, shades of colours, patterns of movement for ex. flight of birds or butterflies. These indicate towards the use of visual sense. The individuals also talked about use of auditory senses. They described a very high sensitivity to sounds. The expert bird watchers could hear and remember diverse bird calls, discern the different notes and some could even imitate the bird calls with high precision. Apart from the audio-visual senses, the individuals described us-

Graph 2 : Other intelligence scores of 12 individuals with NI scores above 45 (each line for one individual)

Graph 3 : Other intelligence scores of 6 individuals with NI scores 20 or less (each line for one individual)

Table 4 : Description of naturalists

Code	Qualification	Research field	Field of work
A	PhD	Plant taxonomy, Ecology	Ecology research, environment education, teaching, conservation
B	Diploma	Animal taxonomy, Wildlife biology	Wildlife studies, environment education, teaching, conservation
C	PhD	Plant taxonomy, Ecology	Ecology research, environment education,
D	MSc	Wildlife biologist Biodiversity studies	Farmer, Ecology research
E	MSc	Plant taxonomy, Ecology	Environment education, teaching, science communicator
F	MSc	Biodiversity studies	Wildlife studies, Science communicator
G	MSc	Biodiversity studies	Wildlife studies, Farmer, entrepreneur
H	MCom, Diploma	Wildlife biology, ornithology	Environment educator, science communicator, conservation
I	PhD	Microbial taxonomy, Biosciences	Biological research, teaching, science communicator
J	PhD	Wildlife biologist	Wildlife studies, teaching

ing olfactory and tactile senses. They talked about different smells as an aid to identification of species. The natural world was described as full of various smells that become part of memory which is useful in identification of species. Some described detecting the presence of certain animals, (as diverse as ants and tigers) through their characteristic smells. Texture of natural things was also considered very important. Different barks, leaves, flowers, fruits have distinctive textures which are imprinted in a naturalists' memory and useful in remembering the species. The touch of animal and sensing its response to touch are important in handling animals, such as snakes. Although taste is an equally important sense, it is used with discretion in experiencing nature as it can be potentially dangerous to taste unknown things. But for some plants or fruits, taste was considered a very important quality to remember the species. Most respondents showed keen interest in food and testing diversity of foods which could be related to the high sensitivity to taste.

Although the naturalists described individual senses and how they use it to identify specific plants or animals, they all emphasized that, in practice, it is an 'integrated experience', where they remember plants or animals or natural phenomenon as a com-

posite of different sensory experiences. There are no fixed or pre-determined categories in which these experiences can be categorized. However, for the purpose of documentation, the plant and animal taxonomy disciplines have created several technical terms that describe colour, texture and smell etc. which are not part of colloquial language. For ex. the terms scabrid, coriaceous, hirsute describe texture of a leaf. Those who undergo formal training in the discipline learn to apply the terms in describing their sensory perceptions.

Interestingly, three of the naturalists, formally trained in the science of taxonomy said that their ability to discern types and patterns was limited to natural entities alone. Gardener (1999) supposes that "naturalists' capacity is brought to bear on artificial items", such that a child that can discriminate among plants and animals is using the same skills when she classifies sneakers, cars, marbles etc. But the respondents said that they never observe or remember the types of man-made objects like cars because they are not at all interested in them. However, on further probing, half of the naturalists remembered collecting natural as well as man-made things as children. They had collected stamps, coins, matchboxes, candy wrappers, bottle caps in childhood along with feathers,

rocks, leaves and shells. Perhaps it's not the skill set but interest that made some prefer remembering natural objects rather than man-made objects.

Apart from the sensory aspects, the individuals described seeing relations among the different components in nature. They described observing interdependence among the naturally occurring living and nonliving things. E.g. finding a certain group of plants near moist areas in a forest, listening to the alarm calls of different animals and birds to deduce movement of a large predator, seasonal cycles in habitats.

All the individuals had started observing nature since childhood. They had experienced nature in unstructured manner initially, observing nature around their homes, visiting natural areas like forest, rivers, farms in rural areas etc. But this was also followed by partially structured experience of nature through environment education programmes, environmental camps, trekking etc. Collecting different natural and non natural things (stamps, leaves, coins, stones etc.) was commonly practiced. Eight of them had followed this with formal training in natural sciences as part of graduate and post-graduate studies. One had practiced farming and livestock rearing, while one has chosen to be into agri-horticulture as a full-time profession. They had acquired their information on nature through direct experience as well as indirectly through books, audio-visual media (mainly television and films before the internet era) and expert talks on nature. Most of them remembered influence of other accomplished naturalists who directly or indirectly helped them in observing and documenting natural phenomenon.

According to Gardener and Moran (2006) "Naturalist(ic) intelligence processes information related to distinguishing among natural and manmade objects, which is evolutionarily derived from the hominid capacity to recognize, group, and label distinctions among natural phenomena". This is supported by the responses of the naturalists in present study. It was seen that they perceive and categorize information related to flora, fauna and also abiotic components of nature such as temperature, moisture, wind, light etc. and can recognize patterns and relations between them. They use all five senses which aids in receiving information that is not gained by simple observations or listening.

In the case of high NI individuals, their mind is processing over the Content 'Nature', gathered through sensory organs and then processed to abstract form. In other intelligences stated by Gardener the content of thinking are different. Language in

Linguistic intelligence, sound in Musical intelligence, Visual matter in Visuo-spatial intelligence, symbolic material in Logico-mathematical intelligence, bodily and kinesthetic sensations in Bodily-kinesthetic intelligence, relations in Interpersonal intelligence and within self experiences in Intrapersonal intelligence. Likewise sensory-motor experiences seem to be material to be processed in Naturalistic intelligence (NI).

Some of the common processes that emerged through the discussion are as follows :

The individuals displayed **curiosity about nature** as indicated by questions, seeking information from various sources, experimenting on natural phenomena.

They had **selective attention** towards things in nature, comparatively extended attention span and successful concentration towards living and nonliving things in nature in their natural form.

They **grasped various aspects** of natural things, their sizes, shapes, contours, designs, patterns, colours, texture, temperature and vibrations, odors and taste through audio-visual, tactile, olfactory senses and occasionally through taste.

They had a **rich memory of past experiences** regarding natural things, as an integrated experience of in the form of visual, auditory, tactile and olfactory representations, could note distinction amongst them, their interconnections, their naturally occurring patterns, alterations and forecasting further variations.

They showed **divergent thinking patterns** on the gathered information. Continuous processing over the acquired information to see relations amongst them and find out causal relationships is generally done.

They **logically compiled** and did **critical evaluation** of the data to give meaning to this linking and deductive as well as inductive reasoning

Though naturalistic intelligence was dominant and common in this chosen group, they differed with respect to other potentials and performed activities related to linguistic intelligence (writing, reading literature), musical intelligence (singing, mimicking), logico-mathematical intelligence (conducting research), spatial (drawing), bodily-kinesthetic (outdoor sports, trekking) etc. Interestingly, all of them had ability to communicate this knowledge to others, but had chosen various forms of expressions that included giving talks, formal teaching, informal outdoor communication, writing and in case of two individuals by writing poetry and through drawings. Some had chosen to express their learning of nature through scientific papers, while others through more popular writings and talks. Their academic performance in

school had varied from moderate to poor and at least three expressed difficulties in adjusting to the standard schooling and education.

Discussion

The study revealed many facts about NI, its relationship with other intelligences and processes involved in use of NI. Moderate correlation shown by NI with remaining Intelligences indicates that some intelligence factor is common to all. But the fact that the correlation is not perfect, in any pair, supports the idea of Gardener that NI is a separate intelligence. The adolescents in the sample varied with respect to NI and other intelligences. Home and school environment could be responsible for these variations in addition to hereditary factors.

MI theory states that all intelligences are needed by an individual to productively function in society. Karamustafaoglu (2010) has shown that individuals with different levels of intelligence have different learning characteristics and each student can learn and succeed when the teaching activities are organized by taking the students' intelligence types into consideration. Kornhaber, Fierros and Veenema (2004) studied 41 schools that had used MI-inspired practices for several years. They document numerous ways in which these schools and their students have benefited. MI approach offers suggestions for providing a more reasonable and practical approach to schooling.

School education especially in India, does not address needs for nurture of multiple intelligences. Considering the variation in the intelligence profiles, a standard educational content, as delivered in Indian schools may not benefit all in the same way. For ex. Some of the students in the sample had high scores in Linguistic or Logico-mathematical intelligence (Graph 3). They would do well in languages, logical and mathematical tasks, which are valued potentials in Indian education system. But the same students had low levels of naturalistic intelligence which could lead to poor understanding of subjects such as life sciences and biology. One of the students, who had high NI score, had lower scores on Linguistics and Intrapersonal intelligence (Graph 2). Linguistic intelligence is useful in communicating while Intrapersonal intelligence can help in knowing and learning about own self. Teaching activities based on MI can help such individuals overcome their weaknesses and use their potential to the fullest. Understanding intelligence profile of a student can then be followed by developing skills that are required in adult life, for ex.

in choosing a career based on his/her dominant intelligence/s.

According to Gardener and Moran (2006) Intelligence and skill are separate. Intelligence is an individual's biopsychological information processing capacity, while skill is a cognitive performance that includes the supports and the constraints of the environment (See Fischer, 1980). In many fields people with skills for identification of natural elements, or understanding of natural phenomenon are needed. For ex. the field of organismal and conservation biology does need "scientific naturalists" (Futuyma 1998:2) to study or learn about nature. Fostering of NI is also required for undergraduate biology students (Hayes, 2009).

The intelligence profile of individual is a potential which can develop into a skill in later years if supportive environment is available. The school children in this study displayed NI as a potential, while the naturalists showed necessary skills for making a career in nature related subjects.

Adult naturalists in our study listed many activities they had engaged in at young age, which match those listed in the MI test used in this survey. This suggests that they had displayed NI characteristics at young age. However, at least half of them felt that school environment was not very supportive to their potential. The schools had focused on more conventional skills such as reading, writing, calculations etc. and had not included outdoor activities or experimentation that enhance nature related skills (identifying species, handling animals etc.) . Their skills grew through their interactions at home with family, and outside of home, with friends having similar interests and by interactions with experienced naturalists. These individuals developed into adult naturalists due to the support through various means. But it is possible that for several others naturalistic potential remained underdeveloped and underutilized due to various social, cultural, physical constraints. To avoid this, early identification of NI, followed by nurturing through activities in home, schools and outside of school can prove beneficial. Armstrong (2009) lists activities that indicate high Naturalistic Intelligence and suggests that children with high NI think through nature and natural forms and need access to nature and opportunities and tools for investigating nature. Thinking through nature and natural forms could be used innovatively in teaching methodology as well, especially so if the individual shows less interest in some subjects. Gerald Durrell, a renowned wildlife biologist, has described early education by his tutor,

George, who incorporated natural history, (Durrell's favourite subject) into teaching of all subjects, including mathematics, history and geography which were otherwise taxing for the young naturalist (Durrell, 2006).

We suggest following characteristics that can help parents and educators to assess NI levels in children, adding to those suggested by Armstrong (2009)

- Perceiving and distinguishing different tastes, textures and smells in addition to audio-visual memory
- Urge to handle, smell, taste unfamiliar objects
- Interest in playing with sand, mud, water and other natural objects
- Good memory of experiences in nature and with plants and animals
- Talking a lot about favourite pets and animals,
- Interest in tasting diversity of foods and cooking
- Liking field trips in nature, zoo, natural history museums
- Enthusiastic participation in activities that involve natural objects (mehendi, rangoli, decorations etc.) even when NOT proficient in it
- Keenly observing nature (clouds, water, hills) etc., getting excited about nature
- Keenly observing plants and animals in zoos, aquariums, terrariums, gardens
- Collecting various natural objects (rocks, leaves, feathers, insects etc.)
- Effortless understanding of animal and plant classification, evolution etc.
- Easily grasping the natural groups of animals and plants (ex. sharks, whales, mosses etc.)
- Interest in knowing about nature through films, internet, books etc.

Assessment can then be followed up by efforts to nurture the intelligence. This should not be limited to only ranking high on NI assessment. It is necessary to remember cautioning by Armstrong (2009) and many others against pigeonholing a student into one intelligence, as each can have many strengths. Overcoming weaknesses in a certain intelligence aspects is equally important.

NI enhancing activities need not be limited to children alone. Many adults, from all walks of life, are now seen participating in nature related activities, environment information collection, conservation action etc. Growing participation in taught courses in Ecological Restoration, Field Botany, Ornithology, Herpetology, Entomology, Wildlife photography, Animal psychology indicates that people are interested in learning about nature. Career options for

individuals with dominant NI have become available in horticulture, environmental restoration, field biology, tourism, sustainable agriculture. The NI skills might be useful even in other fields such as food industry. Very recently Government of India has launched green skill development courses which train individuals in practical nature related services, such as garden maintenance, documenting biodiversity, bird watching. Individuals in such courses can benefit through activities that can nurture NI.

We suggest following division of NI nurturing activities

- a. those encouraging use of multiple senses
- b. those providing information about diversity of natural elements
- c. those encouraging organization of information

a. those encouraging use of multiple senses

Vardin (2003) has compared the human development theories proposed by Maria Montessori and Gardener, showing how both emphasize importance of environment (used in a sense broader than natural environment) on human development. Montessori curriculum, especially the sensorial exercises (For details See Vardin 2003) are a good way for encouraging use of various senses.

In recent years, schools encourage activities such as nature visits, plantations, vermiculture as part of environment education. This can provide an opportunity for children to interact with nature. Nature education courses can give similar opportunities to adults. But for development of NI, special efforts will be required to ensure that the individuals actually use all their senses with hands-on experience of nature rather than just seeing a natural area, listening to talks, demonstrations, presentations or through taking photographs. Walking through a natural area, touching, smelling different things on the way, camping, building and maintaining a compost pit provide an enriching sensory experience.

In the past, elements of nature could be easily experienced in immediate surroundings even in a city. Most cities had hills, gardens, wetlands and parks which were easily accessible and safe for exploring. With growing urbanization, many of the natural elements are lost or are inaccessible. Public gardens are limited to a few cities and are changing towards visually appealing gardens rather than stimulating senses. In most gardens, wading in pools, touching or cutting flowers, digging in the sand is not allowed or is frowned upon by parents or garden authorities. Zoos are good places to see wild animals, but cannot

allow hands-on experience of wild animals. These rules are required for safety of the plants and animals but they do deprive visitors from sensory stimuli. The exposure to nature is definitely much more in rural areas as compared to city. But considering the rapid urbanization of villages, it is possible that rural population is also deprived or will be deprived of nature experience, unless actually engaged in farming, live-stock rearing etc.

Developing and/or maintaining public wilderness areas such as town forests, riversides, natural ponds, wild gardens etc. are some actions that society can take for nurturing Naturalistic Intelligence in the citizens.

b. those providing information about diversity of natural elements

Formal school curricula of state and central boards include biology and environmental sciences. Since 2003, Environment Education has also become a compulsory subject at undergraduate level for all faculties. Both include information about flora, fauna and natural phenomena, but mainly as text or figures. Teaching of these subjects in class does not require actually engaging with natural objects/phenomenon and using various senses. Biology teaching in school and college includes detailed information about plants and animals, but it needs to be accompanied by practical lessons in interacting with the species in natural state, not only in laboratories. Knowing the characters of a taxon (for ex. An insect/ plants) from text is possible but inadequate for being able to actually identify it. A naturalist is not only required to learn and apply whatever is already documented, but to detect new patterns and linkages. For this s/he requires opportunities to explore natural objects and formulate her /his own concepts and patterns.

Information on nature is now easily available through books, TV, Films and Internet. But it is entirely targeted at visual and auditory senses. The other senses described, emphasized by naturalists, are not used while gaining information on nature from media alone. Outdoor exposure through visits to parks, field trips to diverse natural areas are by far the best way of experiencing nature, especially so if it includes opportunities to explore nature through multiple senses.

c. those encouraging organization of information

Organizing observed information is an important part of developing NI. Keeping a field diary, notes, recordings, sharing and comparing with observations of others, conducting experiments, developing

projects are also important part of NI nurture. Observing and drawing natural objects can be taken up as part of recording.

In the table 5 we have listed different activities that can be part of NI nurturing at home and school. But maintaining natural areas which allow outdoor activities is equally important and needs to be ensured by nature-aware society. These expand on suggestions by Hammerman (2006) and Armstrong (2009). Though divided into three groups the activities have many overlapping features.

NI and environmental conservation

Morris (2004) had criticized Gardener's idea of naturalistic intelligence and had argued that considering large scale environmental degradation, sensitivity (rather than intelligence) towards environment is required. Tirri and Nokelainen (2008) included "Environmental intelligence" in their Multiple Intelligences Profiling Questionnaire rather than Naturalistic Intelligence. They based this on Environmental Sensitivity Scale (EnSS) influenced by the work of Gardner (1999), Morris (2004) and Wilson (1998). It included following three categories: 1) Love for nature; 2) Nature conservation; 3) Environment-friendly consumer habits.

These are different objectives than the nurture of NI. Gardener and Moran (2006) have clearly asserted that naturalist intelligence does not include empathy for natural things. They consider empathy as an emotional capacity whereas NI is an information processing capacity. Thus, individuals may have high NI, but not have sensitivity towards nature or participate in nature conservation and vice versa. For ex. a plant or animal taxonomist may not wish to involve in conserving plant or animal species. Animal or plant collection, taxidermy are integral part of natural science studies but are considered environmentally unfriendly and insensitive by many.

Nature conservation requires much information from natural science fields, and hence nurturing NI will indirectly help in conservation. However, for involving naturalists in nature conservation, NI enhancing activities need to be coupled with those that create empathy and sensitivity towards nature. Recent studies by Priyankara and Fan (2017) indicate that NI can be a predictor of eco-initiatives, eco-civic engagement in managers and executives of an industry. Further research can focus on assessment of NI and Environmental Sensitivity as separate but linked factors. The insights from these studies can provide valuable help in developing a nature sensitive society.

Table 5 : Activities to encourage nurture of NI

	Exploring with senses	Collecting information on nature	Organizing information through projects
Home	Free play with natural objects (mud, soil, grains, leaves etc.) Kitchen exploration Interacting with pets	Collections of various objects Exposure to books, media on natural science	Raising caterpillars, butterflies, maintaining garden, terrarium or aquarium Cooking, experimenting with different food items Making photo-video documentation
Schools	Use of sensorial exercises Making smelling boxes, sets of ringing bells/chimes Exploratory for natural textures, smells. (ex. collection of natural perfumes/ ittar bottles, collections of different fabrics etc.).	Collective learning- seed/leaf collections, School fieldtrips to different habitats in different seasons, visit to bioscience laboratories, interactions with biologists Use of TV, Internet, Films etc.	Developing school garden, pet section Using microscopes, binoculars, telescope leaf/ seed rangoli, jewellery making, nature poetry, reading nature literature, nature quests Project activity such as monitoring biodiversity, seasonal changes etc.
Outdoor	Development of sensory gardens (garden of fragrant flowers, food plants, aromatic plants and butterfly gardens, etc.) Experiencing of public natural spaces, wilderness areas, natural ponds, natural riverbanks, etc. Nature camps with hands-on activities	Nature information centres Visit to different ecosystems Botanical gardens, zoos, etc. Interactions with expert naturalists	Working in animal rescue centres, Community farms, gardens, nature parks and butterfly gardens Experience in natural science projects Report writing and scientific documentation exercises

Finally, it is the responsibility all, citizens, civil society organizations, schools and government agencies to ensure natural as well as social environment that encourages nurture of Naturalistic Intelligence.

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