Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 3): pp.3059-3069
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.03.735472

Infusion Of Environmental Education In Secondary School Science Curricula In Pakistan

Asma Javed, Department of Environmental Science, International Islamic University, Sector H-10, 44000 Islamabad, Pakistan
Nadia Akhtar, Department of Environmental Science, International Islamic University, Sector H-10, 44000 Islamabad, Pakistan
Kanwar Muhammad Javed Iqbal*, National Institute of Maritime Affairs, Bahria University, Sector E-8, 44000 Islamabad, Pakistan
Hafiz Muhammad Naseer, Department of Environmental Science, International Islamic University, Sector H-10, 44000 Islamabad, Pakistan
Sarah Amir, Department of Environmental Science, International Islamic University, Sector H-10, 44000 Islamabad, Pakistan
Muhammad Irfan Khan, Department of Environmental Science, International Islamic University, Sector H-10, 44000 Islamabad, Pakistan

Abstract. Environmental education (EE) is an important tool for preventingenvironmental problems and sustainable development and is very important for countries where financialresources for addressing environmental issues are limited. In such countries, the role of contentsof school curriculum is crucial in implementingand sustaining environment-based education. As part of the strategy for raising environmental awareness with responsible attitudes amongst the population through the formal school system andto implement its National Education Policy, theFederal government has infused environmental aspects inprimary, elementary and secondary education curricula. Present study aimed at assessing the levels of infusion of the environment related contents inthe textbooks of Biology, Chemistry and Physics developed by Federal Board Intermediate and Secondary Education for class 9th and 10th. The study design was based on review and examinationagainst Bloom's Taxonomy for infusion of environmental component in secondary education's science curricula. The level of infusion is assessed against index score implying 59 attributes divided in three categories of 'environmental knowledge', 'environmental skills' and 'environmental attitude'. Findings indicated that more emphasis is on knowledge (cognitive domain) component about environmental problems than the component of skills (psych motive domain) and very little emphasis is on common attitudes (affective domain) towards environment.The study also identified gaps with reference to developing problem solving skills and environmental appreciation among students. It has been concluded that the integration of environmental aspects is not balanced in the existing science education curricula at secondary level. Thepaper suggestsan assessment of competences of teachers to deliver such component and knowledge of students against infused environmental education contents.

Keywords: Environmental education; environmental knowledge; environmental attitude; environmental skills; curriculum; infusion

INTRODUCTION

We are witnessing unprecedented increase in scale and magnitude of environmental problems. A major cause behind these environmental problems are the ways we live, we eat, we move and we consume and generate waste(Akhtar et al., 2019). Hence, all policies and plans to reduce these environmental problems emphasize the need of environmental education (EE) at all levels(Gündüz & Erdoğuş, 2017; Hassan & Ismail, 2011; Schreuder, 1992). Environmental education is based on providing systematic knowledge using educational technology. It aims at transferring environmental knowledge to individuals at all levels in order to make attitudinal shift through the use of ecological resources reasonably and wisely, as well as having more environmental ethics(Hassan & Ismail, 2011; Sangsongfa & Rawang, 2016). Imparting environmental knowledge and skills to students is not a new phenomenon. The concept of environmental educationwas first reported in the beginning of 1913, at the Balkans Environmental Education in the

Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 3): pp.3059-3069
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.03.735472

Kingdom of Serbs, Croats, and Slavs. At the beginning of each school, a short pledge was made to protect the environment during their stay at school. In 1970, the term 'environmental education' was defined first time by IUCN i.e. "Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelations among man, his culture, and his biophysical surroundings. Environmental education also entails practice in decision making and self-formulation of a code of behavior about issues concerning environmental equality"(IUCN, 1971).

In continuation, United Nations (UN)-Stockholm Conference on Human and Environment, 1972chalked out principles for stimulating and guiding efforts towards public education and awareness to preserve and enhance health care and environment (UNEP, 1972). In 1975, at the International Workshop on Environmental Education in Belgrade, International Environmental Education Programme (IEEP) was initiated. On this occasion, Belgrade Charter was approved which further elaborated aims, objectives, concepts and principles of environmental (UNESCO, 1975). The process of environmental education was further strengthened by 1977 Intergovernmental Conference on Environmental Education in Tbilisi which stresses the need for environmental education in formal and a non-formal educational system and at all age levels (UNESCO, 1977). After these events, most significant documents published regarding environmental education at the global level were World Conservation Strategy which has a separate chapter on environmental education (IUCN, 1980)and Our Common Future report(WCED, 1987)which led to the second major conference, the United Nations Conference on Environment and Development (UNCED). The principal outcome of UNCED, Chapter 36 of the Agenda 21 "Promoting Education, Public Awareness, and Training" directly address environmental education (UNCED, 1992). At international level, ASEAN countries are also emphasizing the need of environmental education by integrating the concepts in basic education. Similarly, Post 2015 South Asia Development Agenda by South Asia Cooperative Environment Programme (SACEP) also emphasized the need to initiate projects for environmental education (SACEP, 2014).

Themain objective of all these efforts was to impart environmental knowledge together with increasing awareness, attitude, behavior, and skills. Awareness and positive attitudes amongst students are imperative as they are the upcoming generation to manage the earth(Hassan & Ismail, 2011). Environmental attitude of individuals change, when their pro-environmental beliefs and norms change(Dietz et al., 2005). Therefore, in imparting environmental education the main goal is to provide environmental awareness and environmental education for all age levels of human societies(Aminrad et al., 2012, 2013). To achieve this goal four broad approaches;infusion, insertion, imposition, and framing are being applied to integrate environmental education into the curriculum at different levels. The infusion is the fusion of environmentalnotions and related activities in existing curricular goals(Kelani, 2015).Imposition is to make environmental topics requirements in the curriculum. Insertion is to add an environmental chapter or a course to the curriculum. Framing refers subjective boundaries of traditional disciplines are removed to create a structure of study that combines subject themes(Kelani, 2015; Kenneth L. Leinbach, 1999). In practice, environmental education in most of the schools is introduced through the cross-curriculum methodology that integrates contents and skills into existing courses without modifying the subject boundaries of the courses themselves.

Environmental Education in Pakistan

At the end of the 20th century, environmental problems elevated(Akhtar et al., 2019; Farooqi & Fatimah, 2010) at much greater pace, while sluggish growth in environmental awareness and initiatives revealed bitter consequences of the environment not only among the developed but also in some developing and under developing countries(Aminrad et al., 2012; Sangsongfa &Rawang, 2016). Pakistan is no exception.Deteriorated situation of the environment is documentedin many of the public sector reports published time to time(GoP, 2005, 2012b, 2012a; IUCN, 1992). Table 1 summarizes the key measures suggested in various policies for environmental education. Almost all of these documents emphasize the need for raising environmental awareness and integrating the environmental component in education.

However, need of environmental education is realized by the government as early as in 1985, through the Coordinate Environmental Education Program (CEEP), environmental concepts were incorporated through infusion approach in existing subjects. Besides many environmental education programs were initiated by non-governmental organizations (NGOs) in the country, for example, the World Wildlife Fund for Nature (WWF) launched many educational and awareness raising programs for

Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 3): pp.3059-3069
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.03.735472

school that includes demonstrations and skill enhancement through activities such as social forestry, solid waste disposal, Green Schools Program etc.(Farooqi & Fatimah, 2010).

In 2009, National Education Policy of Pakistan was approved with following vision for education system: "Our education system must provide quality education to our children and youth to enable them to realize their individual potential and contribute to development of society and nation, creating a sense of Pakistani nationhood, the concepts of tolerance, social justice, democracy, their regional and local culture and history based on the basic ideology enunciated in the Constitution of the Islamic Republic of Pakistan." The policy under its "Section 6.2: Curriculum Reforms" identifies "Environmental Education shall be made an integral part of education" as one of the policy measures(GoP, 2009)

In response to the policy, necessary steps were taken to include the concepts of environmental education in primary, secondary and tertiary level. Textbooks were prepared for different classes especially for the secondary level which includes environmental education in their course content. Departments of environmental science were established in more than 70 universities offering undergraduate, graduate and post-graduateprogram in environmental science(Farooqi & Fatimah, 2010; Khanum, 2019).However, after 18th Amendment in the 1973 Constitution of Pakistan in 2010, education is largely a provincial responsibility. Provinces are now independent and can develop their own curricula and assessment systems. Ten years had passed since the approval of education policy and projects, and it's the right time to analyse the progress on the commitments made in policy.

In this connection, the study aimed atanalysing the extent of infusion of environmental concepts in curriculum of science subjects (Biology, Chemistry and Physics) at secondary school level. In the present study, science curriculum was selected based on preliminary interviews conducted with teachers to help identify the subjects with highest environmental contents.Findings of the preliminary interviews revealed that in opinion of majority of teachers, science curriculum emphasize scientific basis of environmental education(Abdullah et al., 2011). The main topic of the environment is like an umbrella, covering other related topics such as sustainable development, environmental education, and environmental literacy and so on. This study only focuses on one part of this umbrella i.e. environmental education.

Table 1: Key measures proposed in various policies/strategies to promote EE in Pakistan

National Policy/Plan	Strategies/Action Plan/ Statements
National Conservation Strategy of Pakistan, 1992(IUCN, 1992)	Chapter 9, Section 9.2 Education a. Focus on sustainable development in the entire system of formal education and at all levels. b. Adopt a holistic perspective to environmental education in Pakistan. c. Center sustainable development education on practical problems relating to students' immediate environment. d. Aim at instilling ethic of conservation. e. Let education on sustainable development grow from within the existing system rather than be added to it. f. Launch comprehensive non-formal education programs to reach that large
National Environmental Policy of Pakistan, 2005(GoP, 2005)	Policy instrument 5.5 requires a. a national strategy for raising awareness of the general public as well as selected target groups. b. Integration of environmental education into curriculum and syllabi at all levels. c. Establishment environmental education and training institution. d. Establishment of environment clubs in educational institutions.
National Education Policy of Pakistan, 2009(GoP, 2009)	Section 6.2: Curriculum Reforms" identifies "Environmental Education shall be made an integral part of education" as one of the policy measures.
National Climate Change Policy,	a. Develop and introduce climate change curricula highlighting disaster risk reduction into formal education system at all levels.

Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 3): pp.3059-3069
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.03.735472

2012(GoP, 2012a)	b. Advocacy and mass awareness for importance of water, energy conservation, impacts of climate change on various sectors including forest ecosystem, biodiversity etc. using mass media, public-private partnership, students, and community mobilization. c. Climate change as a compulsory subject in forest education system
National Sustainable Development Strategy, 2012(GoP, 2012b)	Section 2.5: Education for Sustainable Development Appraisal of education policies with the overall objective to integrate "Education for Sustainable Development" concept in the curriculum. Try to modify the lifestyle and behavior of citizens through public awareness and functional education using all communication means. Specifically, instill civic awareness and responsibilities in school children from a young age.

METHODOLOGICAL FRAMEWORK

The study implied content analysis based qualitative research approach. For this purpose curriculum contents of the three science-related coursesBiology, Physics, and Chemistry at secondary school level (9th and 10th grade) provided by Federal Board of Intermediate and Secondary Education (FBISE) Islamabad were selected. FBISE has been established under "FBISE Act 1975", is an autonomous body of the Ministry "Federal Ministry of Education and Professional Training". FBISE is responsible to develop and control intermediate and secondary education and conduct examinations in approximately 917 affiliated institutions.

To assess the infusion of environmental concepts, a checklist covering pedagogical domains of Blooms Taxonomy was used. This checklist was first developed by Hungerford et al. (1994)and used in several other studies (Abdullah et al., 2011; UNESCO-UNEP, 1994). For the purpose of present study, the checklist was modified in accordance with the syllabus in Pakistan. The checklist topics were then used to analyze the infusion of environmental education in the existing curriculum contents of science subjects for 9th and 10th grade. The checklistis divided in three basic components of environmental education i.e. knowledge, behavior, and skills(UNESCO-UNEP, 1994).

Infusion of environmental knowledge (41 attributes), Environmental Skills (10 attributes) and environmental attitudes (8 attributes) wereanalyzedusing a scoring approach implying threecategories i.e. completely covered (Score = 1), partially covered (Score=0.5) and not covered (Score= 0) to develop an EE infusion index (EEII). For the scoring purpose, the topics/concepts which were present in both theory and practical are considered as completely covered and scored as one (1), the concepts which were covered only in theory were marked as partially covered and scored as 0.5 and the items which were neither included in the theory nor practical were marked as not covered and scored as zero (0).

The evaluation scores were used to develop an environmental education index using following formula was used to develop index

EE Infusion Index = $\mathbf{A + 0.5B / T}$

Where;

A= number of attributes fully met;

B= number of attributes partially met and

T= total number of attributes (59)

The environmental education index score was tabulated to identify gaps in the existing curriculum.

RESULTS

The education system in Pakistan consists of primary, middle, secondary, higher secondary/intermediate, and tertiary level stages. Secondary School education comprising 9th and 10th grades (IX-XII) is an important stage in the educational career as it offers the middle-levelworkforce for economy and is feeder for the higher levels of education. Secondary education thus provides tremendous prospects to educationists to conceptualize and develop programs for learners to shape their behaviour and attitudes.

Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 3): pp.3059-3069
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.03.735472

The present study examined curriculum of biology, physics, and chemistry for infusion of the environmental concepts. The contents analysis with regard to environmental education in selected science education course books for 9th and 10th grades is presented in Table 2.

Table 2: Environmental education infusion score in science curriculum of 9th and 10th Grade

ENVIRONMENTAL KNOWLEDGE (EK)							
Code	**Environmental Attributes**	**Biology 9th**	**Biology 10th**	**Chemistry 9th**	**Chemistry 10th**	**Physics 9th**	**Physics 10th**
EK 1	**Ecology and the role of ecologists?**	0	**1**	0	0	0	0
EK2	**Individuals, populations, and levels of organization in ecology**	**0**	**1**	**0**	**0**	**0**	**0**
EK3	**Ecosystem**						
EK 3.1	Importance of the concept	0	**1**	0	0	0	0
EK3.2	Components of ecosystems	0	**1**	0	0	0	0
EK 3.3	Ecological niches	0	**1**	0	0	0	0
EK 3.4	Interactions in ecosystem	0	**1**	0	0	0	0
EK 4	**Energy and ecosystems**	0	**1**	0	0	**0.5**	0
EK 5	**Ecological succession**	0	0	0	0	0	0
EK 6	**Population dynamics**	0	0	0	0	0	0
EK 7	**Humans as an ecological factor**						
EK 7.1	Man as powerful variables	**0.5**	0	0	0	0	0
EK 7.2	Humans as an eruptive population	**0.5**	0	0	0	0	0
EK 7.3	Consequences of eruptive human population	**0.5**	0	0	0	0	0
EK 8	**Human history of resource consumption**	0	0	0	0	0	0
EK 9	**Soils and associate problems**	0	0	0	0	0	0
EK 10	**Food production and hunger**						
EK 10.1	The food supplies	**0.5**	0	0	0	0	0
EK 10.2	World food problems	**0.5**	0	0	0	0	0
EK 10.3	Importance of fertilizers and their environmental impacts	**0.5**	**0**	0	0	0	0
EK 11	**Forest resources**						
EK 11.1	Importance/ benefits	**0.5**	**0**	0	0	0	0
EK 11.2	Deforestation	**0.5**	**0**	0	0	0	0
EK 12	**Plant and animal resources**						

Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 3): pp.3059-3069
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.03.735472

ENVIRONMENTAL KNOWLEDGE (EK)							
Code	**Environmental Attributes**	**Biology 9th**	**Biology 10th**	**Chemistry 9th**	**Chemistry 10th**	**Physics 9th**	**Physics 10th**
EK 12.1	preserving ... species	**1**	**0.5**	0	0	0	0
EK 12.2	Extinction/endangered species	**1**	**0.5**	0	0	0	0
EK 12.3	Protecting species	**1**	**0.5**	0	0	0	0
EK 13	**Air Pollution**						
EK 13.1	Sources of air pollution	**0**	**0.5**	0	**1**	0	0
EK 13.2	Major pollutants	**0**	**0.5**	0	**1**	0	0
EK 13.3	Impacts on human health	**0**	**1**	0	**1**	0	0
EK 13.4	Acid precipitation	**0**	**0.5**	0	**1**	0	0
EK 13.5	Ozone depletion	**0**	**0.5**	0	**1**	0	0
EK 13.6	Greenhouse effect and global warming	**0**	**0.5**	0	**1**	0	0
EK 14	**Water pollution**						
EK 14.1	Sources of surface pollution	**0**	**0.5**	0	**0.5**	0	0
EK 14.2	Ground water pollution	**0**	**0.5**	0	**0.5**	0	0
EK 14.3	Wastewater treatment	**0**	**0**	**0**	**0**	**0**	**0**
EK 15	**Noise pollution**	**0**	**0**	**0**	**0**	**0**	**0**
EK 16	**Solid waste disposal**	**0**	**0**	**0**	**0**	**0**	**0**
EK 17	**Hazardous waste**	**0**	**0**	**0**	**0**	**0**	**0**
EK 18	**Human population growth and control**	**0**	**0**	**0**	**0**	**0**	**0**
ENVIRONMENTAL SKILLS (ES)							
ES 1	**Environmental problem solving skills**	**0**	**0**	**0**	**0**	**0**	**0**
ES 2	**Identifying issues and preparing research questions**						
ES 2.1	Identifying environmental issues	**0.5**	**0**	**0**	**0**	**0**	**0**
ES 2.2	Identifying associated variables	**0.5**	**0**	**0**	**0**	**0**	**0**
ES 2.3	Writing research questions	**0.5**	**0**	**0**	**0**	**0**	**0**
ES 3	**Interpreting data from environmental issue investigations**						
ES 3.1	Organizing data in data tables	**0.5**	**0**	**0**	**0**	**0**	**0**

Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 3): pp.3059-3069
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.03.735472

ENVIRONMENTAL KNOWLEDGE (EK)							
Code	**Environmental Attributes**	**Biology 9th**	**Biology 10th**	**Chemistry 9th**	**Chemistry 10th**	**Physics 9th**	**Physics 10th**
ES 3.2	Interpreting data	**0.5**	**0**	**0**	**0**	**0**	**0**
ES 4	**The independent investigation of a student-selected environmental issue**	**0**	0	0	0	0	0
ES 5	**Issue resolution: skills and application**	**0**	0	0	0	0	0
ENVIRONMENTAL ATTITUDE (EA)							
EA 1	**Environmental appreciation and sensitivity**	**0**	**0**	**0**	**0**	**0**	**0**
EA 2	**Environmental attitudes and values**	0	**0**	**0**	**0**	**0**	**0**
EA 3	**Conservation and ecosystem management**	0	**0**	**0**	**0**	**0**	**0**
EA 4	**Consumer and economic action**	0	**0**	**0**	**0**	**0**	**0**
EA 5	**Interpersonal and public persuasion**	0	**0**	**0**	**0**	**0**	**0**
EA 6	**Governmental and public actions**	0	**0**	**0**	**0**	**0**	**0**
EA 7	**Activism for legal actions and law enforcement**	0	**0**	**0**	**0**	**0**	**0**
EA 8	**Citizenship participation**	0	**0**	**0**	**0**	**0**	**0**

It is clear from the above table that all areas of environmental education do not catch equal attention in science subjects. Greater attention has been paid to environmental knowledge (EKII score =0.67), then environmental skills (total ESII score =0.25) and very little consideration have been paid to environmental attitudes (total EAII score= 0). In Environmental Knowledge domain, there are 17 attributes which are covered in theory as well as in the form of practical or field activities while 21 attributes were partially met i.e. only covered in theory. In Environmental Skills domain, none of the attribute was fully met. Some aspects like identification of species mainly comprised of picture based identification without any field visits. The Environmental Attitude domain was not infused in the curriculum, neither in theory not in curriculum. However, few teachers identified some extra-curricular activities initiated by non-governmental sector including painting and quiz competition, plantation drives, and walks that help in developing students' attitude towards environment.Table 3tabulates index score for overall EE infusion in the curriculum.

Table 3: Environmental education infusion index score for three domains of curriculum

Domains	**Total attributes**	**Attributes fully met**	**Attributes partially met**	**Infusion index Score**
Environmental Knowledge	41	17	21	**0.67**
Environmental Skills	10	0	5	**0.25**
Environmental Attitude	7	0	0	**0**
Total	**59**	**17**	**26**	**0.50**

DISCUSSION

The findings revealed that though educational and environmental policies in Pakistan stresses upon the need of integration environmental education in the curriculum at all levels, infusion of environmental concepts in curriculum are still far from desired levels(Malik et al., 2019). Similar results

Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 3): pp.3059-3069
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.03.735472

have been found in studies carried out in Macedonia, Turkey and Bulgaria (Erdoğan et al., 2009; Hart & Nolan, 1999; Srbinovski et al., 2010). The findings also reveal that distribution of environmental concept in all three domains of curriculum is also not same. More focus is paid to theory, while less focus imparted to skill and attitudinal development of the students. The least focused is paid on the contents and activities that can prepare student attitude towards environment(Abdullah et al., 2011; Srbinovski et al., 2010).

The results alsoportrays that biology has most broadly infused environmental knowledge in its curriculum. Different topics related to environmental knowledge and skills have been infused in chapters "Biodiversity", "Nutrition" and "Biological Method". For example, the chapter named "Nutrition" besides discussing components of food, digestion, and balance diet also deliberates environmental knowledge related to food production, hunger, food that feeds the world, world food problems, the importance of fertilizers and environmental hazards related to their use. The chapter on "Biodiversity" covers an aspect of threats and conservation. The areas like "Humans as an Ecological Factor", "Plant and Animal Resources", "Forest Resources" are also covered in this chapter.

In 10th grade Biology curriculum, environmental knowledge is applied through only one chapter named "Man and Environment" which cover aspects of the ecosystem, development and its importance, levels of organization, components of ecosystems, ecological niches, and interactions in ecosystems. All these subtopics are required to be supported by field studies of different types of the ecosystem. This chapter also provides information about the energy and material flow and interaction of living and non-living components. A brief description of 'air pollution' and 'water pollution' through a subtopic "Pollution and its Consequences" has been provided. Environmental behavior and skills components are also not covered in the 10th grade syllabus.

Chemistry

In the subject of Chemistry, environmental knowledge is applied only in the 10th grade syllabus where a separate section of environmental chemistry has been provided. The most extensively covered topics in the syllabus were pollution and its consequences. Besides, the two chapters in the 10th grade syllabus, namely 'The Atmosphere' and 'Water' are intended to mold environmental knowledge in its contents. "The Atmosphere' chapter contains knowledge related to air pollution in the aspects of sources of air pollution, major pollutants, impact on human health, acid precipitation, ozone depletion and the greenhouse effect. These topics are completely covered in theory and practical activities by encouraging students to participate/carry out activities provided with text in textbooks.

Another chapter on "Water" completely covers the topic of surface and ground water pollution, major water pollutants and impact of water pollution on human health. Besides pollution, other knowledge such as food production and hunger and the world food problems are also discussed ordinarily in the chapter "Biotechnology". The subject of chemistry contains no knowledge about the skills and behavior components of environmental education(Erdoğan et al., 2009; Hassan & Ismail, 2011)

Physics

Physics has the least infusion of environmental content in the curriculum. In the 9th grade syllabus, knowledge of energy in terms of its types, conversions and law of thermodynamics have been discussed in a chapter namely 'Work, Power and Energy'. While the other two components of environmental education i.e. 'Environmental Skills' and 'Environmental Behaviour' are not integrated into this subject either theoretically or practically. Atmospheric physics has a major role in Pakistan due to widespread climatic impacts and should be made not only the part of theory but also practical work.

On the basis of finding, gaps in environmental knowledge, skills and attitude domains of the curriculum were identified and condensed in table 4.

Table 4: Gaps identified in the science curriculum

	Biology	**Chemistry**	**Physics Part**
Environmental Knowledge	Ecological succession.	Soil compositionand associated problems,	Meteorology, seasons, air humidity,

Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 3): pp.3059-3069
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.03.735472

	Biology	**Chemistry**	**Physics Part**
	Population and their dynamics Human history of resource consumption. Soils and its allied problems Water and allied problems, wastewater treatment solid waste disposal, hazardous waste Noise pollution	Water and allied problems with special reference to wastewatercharacteristics Solid waste, nature and properties, characteristics of hazardous waste	temperature, and pressure. Climate change Heat pollution Noise pollution. Earthquake and volcanoes Nuclear wastes
Environmental Skills	Environmental problem-solving skills, Independent investigation of environmental problems and Issue resolution skills.	Field studies, Practical aspects of properties of water, air, soil and their implications in real life Problem-solving skills, Issue analysis and interpreting skills, Independent issue investigation and issue resolution skills.	Problem-solving skills Issue analysis and interpreting skills Independent issue investigation and issue resolution skills
Environmental Attitudes	Environmental appreciation, sensitivity, attitudes, and values, Biodiversity conservation and ecosystem management. Consumer and economic action. Interpersonal and public persuasion. Citizenship participation.	Environmental appreciation, sensitivity, attitudes, and values. Interpersonal and public persuasion Citizenship participation	Environmental appreciation, sensitivity, attitudes, and values Energy conservation Interpersonal and public persuasion CitizenshipParticipation

The study alsoshows that environmental skills component is poorly integrated into science education curriculum. Even where documented, those are delivered as theory rather skill based tools. The reason for this may be the low financial resources allocation and the overburden textbooks, therefore; enough school periods for experiments are not available that in turns narrow the boundaries of functional environmental education. Because of its ultimate importance, it is not surprising that many authors put a strong emphasis on environmental skills component and suggest the use of zoos and aquariums in promoting conservation learning, values and skill development(Ballantyne et al., 2007).

For environmental behavior and skill components, it is teachers' duty to develop activities to inculcate values and to conduct discussion or brain storming sessions with students to identify environmental issues from their surroundings which are not covered in the syllabus. To do so, teachers should be trained in the contents, skills, and methodology to deliver contents associated with the

program as it is not easy to deliver concepts which are infused into the overall curriculum. Teachers should be trained to deliver pedagogical content knowledge of the integrated curriculum in line with its objectives(Koehler et al., 2013). Researchers asserted that how effectively teachers deliver environmental education depends on level of environmental knowledge they have(Abdullah et al., 2011; Arslan, 2012; Haron et al., 2005).

CONCLUSION AND RECOMMENDATIONS

There are multitudes of efforts taken to integrate environmental education in the existing education system in Pakistan. However, fruitfulness of these efforts is still questionable. The result of the analysis showed that environmental education has been infused to existing curriculum mainly in the subject of biology covering ecosystem components and its functioning. While very little infusion is found in the subject of physics. The infused contents aremainly in the form of theory which is not supported by activities and mechanism to develop environmental attitudes and behaviours. In curriculum, major consideration is on environmental knowledge and very little towards developing skills and behavior component. The study identifies gaps particularly with reference to developing problem solving skills and environmental appreciation among students. There is also a need to assess teachers' competencies and students' knowledge against infused environmental education contents.

REFERENCES

Abdullah, S. I., Halim, L., & Shahali, E. H. (2011). Integration of environmental knowledge across biology, physics and chemistry subject at secondary school level in Malaysia. Procedia Social and Behavioral Sciences, 15(2011), 1024-1028. doi::10.1016/j.sbspro.2011.03.233

Aminrad, Z., Zakariya, S. Z., Hadi, A. S., & Sakari, M. (2012). Environmental education in Malaysia, progresses and challenges ahead (Review). Life Science Journal, 9(2), 1149-1154. Retrieved November 22, 2016

Aminrad, Z., Zakariya, S. Z., Hadi, A. S., & Sakari, M. (2013). Relationship Between Awareness, Knowledge and Attitudes Towards Environmental Education Among Secondary School Students in Malaysia. World Applied Sciences Journal, 22(9), 1326-1333. doi: 10.5829/idosi.wasj.2013.22.09.275

Arslan, S. (2012). The influence of environment education on critical thinking and environmental attitude. Procedia Social and Behavioral Sciences, 55(2012), 902-909.

Ballantyne, R., Packer, J., Hughes, K., & Dierking, L. (2007). Conservation learning in wildlife tourism settings: lessons from research in zoos and aquariums. Environmental Education Research, 13(3), 367-383. doi: 10.1080/13504620701430604

Dietz, T., Fitzgerald, A., & Shwom, R. (2005). Environmental Values. Annual Review of Environment and Resources, 30, 335-372. doi:10.1146/annurev.energy.30.050504.144444

Environmental Education and Training Partnership. (2004). Advancing Education and Environmental Literacy. U.S. Environmental Protection Agency.

Erdogan, M., Kostova, Z., & Marcinkowski, T. (2009). Components of Environmental Litercy in Elementary Science Education Curriculum in Bulgaria and Turkey. Eurasia Journal of Mathematics, Science and Technology Education, 5(1), 15-26.

Government of Pakistan. (2005). National Environmental Policy of Pakistan. Ministry of Environment, Government of Pakistan.

Government of Pakistan. (2009). National Education Policy of Pakistan. Ministry of Education, Government of Pakistan.

Government of Pakistan. (2012). National Sustainable Development Strategy of Pakistan. Ministry of Environment, Government of Pakistan.

Government of Pakistan. (2013). National Climate Change Policy of Pakistan. Ministry of Climate Change, Government of Pakistan.

Haron, S. A., Paim, L., & Yahaya, N. (2005). Towards sustainable consumption: an examination of environmental knowledge among Malaysians. International Journal of Consumer Studies, 29(5), 426-436.

Hassan, A., & Ismail, Z. M. (2011). The infusion of environmental education in chemistry teaching and student's awareness and attitudes towards environment in Malaysia. Procedia:Social and Behavioral Sciences, 15(2011), 3404-3409. doi:10.1016/j.sbspro.2011.04.309

Institute for Global Environmental Strategies. (2001). Report of the first phase strategic research: Environmental Education. Institute for Global Environmental Strategies.

International Union for Conservation of Nature and Natural Resources. (1970). International workig meeting on environmental education in the school curriculum, final report. Carson City, Nevada: IUCN. Retrieved November 18, 2016, from http://files.eric.ed.gov/fulltext/ED045490.pdf

International Union for Conservation of Nature and Natural Resources. (1980). World Conservation Strategy: Living Resource Conservation for Sustainable Development. IUCN-UNEP-WWF. Retrieved November 22, 2016, from https://portals.iucn.org/library/efiles/documents/WCs-004.pdf

International Union for Conservation of Nature and Natural Resources. (1992). National Conservation Strategy of Pakistan. IUCN, Pakistan.

Kelani, R. R. (2015). Integration of environmental education in science curricula in secondary schools in Benin, West Africa: Teachers' perceptions and challenges. Electronic Journal of Science Education, 19(3). Retrieved November 22, 2016, from http://ejse.southwestern.edu/article/view/14464

Koehler, M. J., & Mishra, P. (2009). What Is Technological Pedagogical Content Knowledge? Contemporary Issues in Technology and Teacher Education, 9(1), 60-70.

Srbinovskia, M., Erdogan, M., & Ismailia, M. (2010). Environmental literacy in the science education curriculum in Macedonia and Turkey. Procedia Social and Behavioral Sciences, 2(2010), 4528-4532. doi:10.1016/j.sbspro.2010.03.725

UNESCO-UNEP International Environmental Education Programme. (1994). A prototype environmental education curriculum the middle school: A discussion guide for UNESCO training seminars on environmental education. Environmental Education Unit, Science and Environmental Education Section, Division for the Renovation of Educational Curricula and Strctures. UNESCO. Retrieved November 22, 2016, from http://www.unesco.org/education/pdf/333_49.pdf

United Nation Division for Sustainable Development. (1992). Agenda 21. Rio de Janerio, Brazil: United Nation Division for Sustainable Development. Retrieved November 18, 2016, from https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

United Nations Educational Scientific and Cultural Organization. (1978). Intergovernmental Conference on Environmental Education. Paris: UNESCO. Retrieved November 22, 2016, from http://www.gdrc.org/uem/ee/EE-Tbilisi_1977.pdf

United Nations Educational Scientific and Cultural Organization. (1990). Environmental education: Selected activities of UNESCO-UNEP International Environmental Education Programme 1975-1990. Paris: UNESCO. Retrieved November 22, 2016, from http://unesdoc.unesco.org/images/0008/000874/087446eo.pdf

United Nations Environment Programme. (1972). Declaration of the United Nations Conferenc on the Human Environment. Stockholm: United Nations Environment Programme. Retrieved November 18, 2016, from http://www.unep.org/documents.multilingual/default.asp?documentid=97&articleid=1503

World Commission on Environment and Development. (1987). Report of the World Commission on Environment and Development: Our Common Future. World Commission on Environment and Development. Retrieved November 22, 2016, from http://www.un-documents.net/our-common-future.pdf