

Biology Learners' Conception of Ecology of a Wetland Ecosystem

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Abstract

Wetlands ecosystems play an important role and are relevant to biotic and abiotic factors including survival of humans. Therefore, it is imperative that learners in Lesotho become sensitized to the knowledge about the ecology of wetland ecosystems. Few studies investigated Lesotho students' ecological literacy of wetlands hence this study explored biology learners' knowledge of that topic. The research was conducted using a mixed research approach and data was collected using observation and close-ended questionnaires. This research approach neutralized the weaknesses of data and strengthened the validity of the research findings. The ecological literacy has been adopted as a theoretical framework. The research findings revealed that most participants had moderate ecological knowledge of a wetland ecosystem and students' conceptions were mostly based on their cultural background not much from class teaching. Findings also revealed that boys were more ecologically literate than girls. For further research, higher order levels of Bloom's taxonomy could be tested by using other different research tools and teachers' approaches in teaching of ecological concepts.

Keywords: ecological literacy, conception, wetlands ecosystems, gender

Introduction

A wetland is defined as an area of land saturated with water, either permanently or seasonally. Wetlands form an important ecosystems worldwide (Olalekan et al., 2014) occupying seven percent of the land surface (Cassidy, 2019). Lesotho has approximately 1.3 percent of its total land covered by different types of wetlands (Mokuku & Taylor, 2015). United Nations Educational Scientific and Cultural Organization (UNESCO) (2021) recommends that schools' engagement with environmental issues should go beyond teaching and involve actions within schools. Lesotho government has a strong support for protection of wetlands and as such Lesotho Education Quality for Equality Project (LEQEP) (2019), through Ministry of

Education and Training (MOET) (2019) and Water Act No. 15 (2008) provide for protection of wetlands Training ecosystems.

Williams (2018) stated that although wetlands are beneficial and provide a range of functions, they are one of the most threatened ecosystems globally due to human activities such as farming, urban developments and limited knowledge. The environment is degrading at an alarming rate and the effects of climate change are negatively impacting the environment, and as such, an effective environmental education is urgent for students (Houponen, 2023; Heasly et al., 2024; Salite et al., 2024). The importance of wetlands knowledge in Lesotho is now well recognized and this fact is emphasized by the involvement of Ministry of environment through different projects as in Semonkong wetlands and restoration and conservation project (UNDP, 2016). A similar study was determined for the Tlokoeng valley community's conceptions concerning wetlands (Mokuku and Taylor, 2012).

The government of Lesotho has taken some initiatives especially to conserve wetlands and to promote environmental conservation. The United Nations (UN) Programme (2004) reported that the commitment of the country to conserve wetlands ecosystems was shown by Lesotho's accession to relevant programmes, both globally and regionally. Such programmes include the Convention on Wetlands of International Importance known as RAMSAR Convention; Southern African Development Community (SADC); Orange Senqu River Commission (ORASECOM); ReNOKA also known as 'We are the river'; and Lesotho Department of Water Affairs project (2018) which stress the proper management and better use of wetlands and the recognition of International World Wetland Day (IWWD) (UN Programme Report, 2004).

Gender is considered as a crucial factor of culture that shapes life even in the context of sustainable ecological education and gender relations significantly determine daily life of a person, family, workplace and wider community. Gender is also important as it ensures that males and females are both favoured by development activities, thus enhancing sustainability, and effectiveness of activities and initiatives. Gender also builds and promotes quality and equity (Badjanova et al., 2017).

Studies of Heinzle et al. (2010) and Zelezny et al. (2000) as cited by Badjanova et al. (2017) are among studies which revealed that females display stronger environmental factors and are more concerned about environment and reflect pro-environmental attitudes and behaviour than males. In addition, Olsson & Gerricke (2017) as cited by Badjanova et al. (2017) emphasized that females have stronger sustainability consciousness. In a similar way, Badjanova et al. (2017) cited the study of Eisler et al. (2003) as one of the few studies which found that males showed no differences nor stronger engagement in environmental behaviour than females. However, Badjanova et al. (2017) recommended that studies concerning gender should be subjected to a given culture with specified measures. Kark (2017) suggested that the discussion of gender should focus on instrumental and expressive traits rather than only on stereotypes with time in a specific culture. The Ramsar Convention on Wetlands (2022) illustrated that male and female learners may not demonstrate similar perceptions with respect to the degree to which they express the conception of the ecology of a wetland ecosystem.

Lesotho learners are expected to have basic background knowledge on the importance of ecosystems originating from Lesotho General Certificate of Secondary Education (LGCSE) Biology (0180) curriculum (NCDC 2020) topic 18. This topic reads as '*Relationships of organisms with each other and the environment*' and the learning

outcome which states that learners should be able to: *"Define an ecosystem as a unit containing all of the organisms and their environment, interacting together, in a given area."* This curriculum lacks wetland ecosystem integration and students may lack awareness of the importance of a wetland ecosystem. Science teachers on the other hand may not view wetlands in the vicinity of their school as a suitable and available ecosystem for the teaching and learning of some ecological concepts. Therefore the current research investigates high school biology learners' conception on the ecology of a wetland, based on a local wetland ecosystem in Pitseng. The environmental education learning for secondary school learners should include community or local based learning as it helps learners to develop an understanding of the quality of both life and environment in their local ecosystems (Wanchana et al, 2020).

Literature Review

It can be argued that biology learners' conception of a wetland ecosystem ecology is crucial for solving the problems related to wetlands. Learners have been found unquestionably contributing to the high rate of extinction of species such as rhinos either directly through hunting and selling parts of animals and indirectly through destruction of habitats (Khumalo, 2010). A study focused on wetland habitat (Anderson and Moss, 2011), showed that learners' perception of certain types of wetlands was more positive at a younger age. The knowledge did not change with sex but it was concluded that conditioning coming from literature, televisions or orally led to learners' negative conception of a wetland ecosystem.

In a study on bird tourism literacy, or avitourism literacy, in South Africa, learners obtained a rate of 43.66% and this marked passive behavior of learners towards birds, bird's habitats and avitourism activities (Tustin & Conradile, 2016). Elsewhere learners' level of knowledge about species diversity conservation techniques, was found to be above mastery level in their knowledge among grade 12 learners and had shown high level regarding biodiversity conservation, whereas grade 10 learners were not aware of many plants and animals in one area (Fenetahum & Estheu, 2014).

A climate change study found that learners understood more about basic concepts of global climate change such as the greenhouse effect, gases and human activities such as burning and deforestation. Yet they lacked knowledge about the effects of mitigations and adaptations. On alternative knowledge such as media, home and community, learners had poor knowledge and comprehension on the aspects of the climate change (Pitpitunge, 2013).

The Grade 11 learners were measured on their science, technology, engineering, Arts and Mathematics (STEAM) knowledge on global climate change (Lekgeu & Davis, 2017). Findings indicated that learners who participated in global climate change monitoring activities reported gains and improvement in their knowledge in STEAM subjects. The improvement was more pronounced in female than male learners.

In another study, the middle students were tested on the knowledge of the climate system, causes, consequences and solutions to the global warming (Dewi & Khoirunisa, 2018). The results showed that learners who attended schools in urban area had a higher understanding of the climate change than students who attended school in the rural area.

Based on gender difference, Brederberg (2015) study indicated that males and females seemed to demonstrate many similar attitudes with respect to the ecology of wetlands. Also, both males and females seemed to express similar level of hopefulness that environmental problems in future could be solved. Munishili et al. (2013) illustrated that although girls believed that government had the biggest role to play in protecting the environment, they had somewhat less faith in government to make a difference than did boys.

Nevertheless, boys expressed the understanding that environmental and political issues were very closely related by larger margins than girls. This is similar to a study conducted by Sarah et al., (2020) to assess the influence of biology education on the ecology and maintenance of wetlands' resources using Pece Wetland in Uganda. To achieve this purpose, the study investigated whether what was learnt in biology lessons at school and what is being applied by the school leavers played any role in the knowledge on functions of wetlands and maintenance of wetlands. The results showed that the content from biology learnt from secondary schools had no significant influence on knowledge of biology learners in better understanding of functions of wetlands even after completing school. Therefore, the current study explores the knowledge of learners on the ecology of a wetland ecosystem.

Wanchana et al. (2020) conducted a research which investigated how teachers should improve their environmental education competency in relation to environmental education using mixed research methods and the instruments which were employed were questionnaires and interviews. The findings revealed that the environmental education in schools is dependent on teachers because they create learning platforms for their classrooms.

Houponen (2023) carried out a study which explored the teachers' perceptions of their students' environmental literacy. The study employed voluntary group interviews with 48 participants across the globe. The key finding was that teachers had a feeling that students failed to achieve applicable or operational environmental literacy because of a number of factors, including Environmental Education (EE) teaching that lacked behavioral literacy methods. The study further revealed that the curriculum was too strict leaving a little room for EE activities and that the more focus is on exams and grades. Also, students did not show any interest in EE due to peer pressure, weak parents' and society support as well as superficial knowledge. Teachers concluded their students' knowledge to be on nominal literacy level.

Badjanova et al. (2017) conducted a quantitative study which explored gender identity of students among three age groups of students and teachers as an implications for a sustainable future. The results revealed that masculinity or femininity in different social conditions could change in line with the demands from the environment and revealed that gender difference is significant across the ages.

Theoretical Framework

Ecological literacy is used as a theoretical framework underpinning this study. The Theory of ecological literacy provides an understanding of how people should learn the ecology of the earth and ecosystems and live in a sustainable manner (Orr, 1990). Jones (2020) stated that ecological literacy enables better understanding of the natural systems such as the ecology. The concept of ecological literacy has been developed to provide a basis for understanding ecological functions and developing new capacities

and critical skills (Boehnert, 2015). In the light of the above, the learners' key competencies of ecological literacy are that they should:

- Have knowledge of nature, and human's place in it;
- Explain ecological functions of wetlands;
- Identify species diversity in local wetland ecosystem;
- Describe importance of habitats within ecosystem;
- Demonstrate causes and effects of ecosystem realities like global warming and how wetlands regulate climate;
- State negative human impacts in ecosystems.

In a related manner, an environmentally literate student could be described as someone who demonstrates awareness, concern, understanding and takes action to enhance the situation (Moseley, 2000) as cited by Houponen, (2023).

Methodology

The methodological approach that was used in this study was mixed method (Cohen, Mannion & Morrison, 2017), Observation and a closed ended questionnaires were used for collection of data from the sample of population comprising of 30 purposively selected Form E biology learners, (n=15 girls and n= 15 boys) from one school in Pitseng area. Questionnaires were directly administered to participants and respondents selected; Yes/ No/ Not sure questionnaires were also retrieved directly from learners by researchers for data analysis. Results were presented in tables for each Ecological Literacy tenet, analyzed and discussed. The statistical package for social science (SPSS) version 26 was used for the analysis of individual questions based on ecological competencies. The generated data were also analysed using mixed method approach which neutralized the weaknesses of data but strengthened collected data.

Research Finding

This section focused on the results that were obtained from data analysis, and the results were based on the following two research questions:-

1. What is the nature of the conceptions of Form E biology learners on the ecology of a wetland ecosystem?
2. What are the differences in the conceptions of high school boys and girls on the ecology of wetlands ecosystems, if any?

The research questions were analyzed based on Ecological Literacy tenets.

The Nature of the Conception of Learners about the Ecology of a Wetland Ecosystem

In this section, the results of the nature of the conception of learners in relation to the ecology of a wetland are presented with focus on the the following ecological literacy tenets: Knowledge of wetland ecosystem and human place in it; beneficial services provided by wetland ecosystem to people and livestock; species found in a local wetland ecosystem; comprehension on causes and effects of ecosystem realities like global warming and how wetlands regulate climate change; and negative human impacts in a wetland ecosystem.

Table 1*The Nature of the Conception of Learners on the Ecology of a Wetland Ecosystem*

Content knowledge:	Statements based on themes/tenets	Respondents n=30		
		YES	NO	NOT SURE
The knowledge of learners about the ecology of a wetland ecosystem and humans' place in it.	Ecosystem is a unit or group of living organisms that live and interact with each other in a specific environment.	28 (93.3%)	1 (3.3%)	1 (3.3%)
	Wetland in Pitseng area is an ecosystem like forests and rivers and affects local people.	15 (50.0%)	7 (23.3%)	8 (26.7%)
	Local teachers can use local wetland to teach some concepts in biology.	28 (93.3%)	1 (6.7%)	-
Content Knowledge: Services provided by a local wetland ecosystem to local people and livestock	Wetland in Pitseng provides local people with water used for drinking, domestic use and farming.	25 (83.3%)	3 (10.0%)	2 (6.74%)
	Local wetland provides food for livestock.	14 (46.7%)	5 (16.7%)	8 (36.7%)
Identification of plants and animals found in a wetland ecosystem and their habitats	Local wetland is also a habitat for animals like frogs and birds such as cattle egret.	24 (80.0%)	3 (10.0%)	3 (10.0%)
	Different grasses and reeds used for different cultural purposes are also found in local wetland.	20 (66.7%)	3 (10.0%)	7 (23.3%)
	Animals in a wetlands have special habitats and breeding areas.	14 (46.7%)	3 (10.0%)	13 (43.3%)
Knowledge on about causes and effects of wetland ecosystem realities like global warming and regulation of climate change	A lot of carbon dioxide is used in photosynthesis by many plants in a wetland ecosystem to regulate climate.	7 (23.3%)	6 (20.00%)	17 (56.7%)
	Water in a wetlands flows slowly and sediments in water drop out thus purifying water.	17 (56.7%)	6 (20.0%)	7 (23.3%)

	Local wetland maintains the flow of Mphenyeke river in most seasons.	19 (63.3%)	2 (6.7%)	9 (30.0%)
Adverse impacts on wetland ecosystem	Livestock grazing on a local wetland can damage habitats, destroy plants and animals and cause soil erosion.	20 (66.7%)	6 (20.0%)	4 (13.3%)
	Humans' and animals' trampling reduces infiltration and affects habitats leading to loss of plants and animals in local wetland.	10 (33.3%)	4 (13.3%)	16 (53.3%)
	Increased runoff can affect ability of wetland to support aquatic habitats leading to death of animals.	16 (53.3%)	5 (16.7%)	9 (30.0%)
	Runoff with fertilizers from nearby fields can cause water pollution and can be toxic to plants and animals in wetlands.	24 (80.0%)	2 (6.7%)	4 (13.3%)

The Knowledge of Learners' on a Wetland and the Teachers' Place in It

Majority of learners, 28(93 %) agreed with the general definition of an ecosystem as per the Biology syllabus. When relating to the knowledge of a wetland as an ecosystem like a forest and a river, only half of the class 15(50%) thought a wetland is an ecosystem, while 7(23.3%) of the participants said no and 8(26.7%) of learners were not sure. Many learners, 28(93.3%), had a view that local teachers could use the local wetland to teach some concepts in biology while 1(6.7%) of learners did not agree.

The Services Provided by Wetland Ecosystem to People and Livestock

Regarding the content knowledge on the Pitseng wetland ecosystem services to the local people, 25(83.3%) of learners thought it provided water for various uses, whereas 3(10 %) said no and 2(6.7%) of learners were unsure. Concerning provision of food for livestock, only 14(46.5%) of learners thought the wetland provided the service, while 5(16.7%) of learners said it did not provide such a service; and 8(36.7%) of learners were not sure.

The Knowledge of Species in Local Wetland Ecosystem

In relation to species that inhabit the local wetland ecosystem, the majority of respondent 24(80.0%) had knowledge that local wetland provides habitats for animals such as frogs and birds such as Cattle egret. Few of the learners 3(10%) indicated that such species did not inhabit the wetland, and an equal number were not sure.

Furthermore, 20(66.7%) of the participants indicated that different grasses and reeds used for different cultural purposes are also found in a wetland ecosystem while 3(10%) said such species did not exist and were not used by the community and 7(23.3%) participants were not sure. Fourteen (46.7%) of participants agreed that animals in wetlands have special habitats and breeding areas and almost same number of learners, 13(43.3%), were not sure about the existence of such habitats and breeding areas. Three (10%) did not have the knowledge.

Knowledge on Causes and Effects of Ecosystem Realities like Global Warming and Regulation of Climate Change on a Wetland

Only 7(23.3 %) of the participants knew that carbon dioxide used in photosynthesis in a wetland can regulate climate change. Six (20%) of the learners could not interconnect carbon dioxide with climate regulation and 17(56.7%) of the respondents were not sure. Considering purification of water by wetlands, the majority of learners, at 17(56.7%), had the knowledge of the process while 6(20.0%) of the learners lacked the knowledge about the process and 7(23.3%) of the learners were unsure. A considerable number of the learners, 19(63.3%), had the knowledge that Pitseng wetland maintains flow of the local river whereas only 2(6.7%) of the learners did not know, and 9(30.0%) of the learners were not sure.

Adverse Impacts on Wetland Ecosystem

Majority of learners, 20(66.7%), had the knowledge that habitats in a wetland ecosystem can be damaged by overgrazing, followed by 6(20.0%) and 4(13.3%) of learners without the knowledge and those who were unsure respectively. Reduction of infiltration due to humans and animals' trampling a wetland was known by 10(33.3%) of learners whereas 4(13.3%) of the learners did not have the knowledge. A Considerable number of the learners, 16(53.3%), were not sure. Sixteen (53.3%) of the participants agreed that the increased runoff can affect the ability of a wetland to support habitats leading to death of animals. Five (16.7 %) of the learners lacked knowledge about runoff effects and 9(30.0%) were not sure. Majority of the learners, 24(80.0 %) had the knowledge that runoff with fertilizers from nearby fields can cause water pollution and can be toxic to plants and animals in wetlands. Least number of learners, 2(6.7%) lacked this knowledge while 4(13.3%) of the learners were not sure.

In conclusion, the majority of learners held a sound knowledge on the ecology of a wetland ecosystem, yet many also reflected a limited understanding of the wetland ecosystem.

The Differences Between Boys' and Girls' Conception on the Ecology of Wetlands Ecosystems

In this section, the results of the students' knowledge in relation to the ecology of a wetland based on gender are presented with focus on the following themes: Knowledge of a wetland ecosystem and human place in it; beneficial services provided by wetland ecosystem to people and livestock; species found in a local wetland ecosystem; comprehension on causes and effects of ecosystem realities like global

warming and how wetlands regulate climate change; and state negative human impacts interpretations in a wetland ecosystem.

Table 2

The Differences between Boys' and Girls' Conception on the Ecology of Wetlands Ecosystem

Content Knowledge:	Statements based on themes/tenets	Respondents n=30					
		Male n = 15			Female n = 15		
		Yes	No	Not sure	Yes	No	Not sure
The knowledge of learners on the ecology of a wetland ecosystem and humans' place in it.	Ecosystem is a unit or group of living organisms that live and interact with each other in a specific environment.	13 (86.7%)	1 (6.7%)	1 (6.7%)	15 (100%)	-	-
	Wetland in Pitseng area is an ecosystem like forests, rivers, decomposing logs and affects local people.	13 (86.7%)	6 (40.0%)	3 (20.0%)	9 (60.0%)	1 (6.7%)	5 (33.3%)
	Local teachers can use local wetland to teach some concepts in biology.	14 (93.3%)	1 (6.7%)	-	14 (93.3%)	1 (6.7%)	-
Gender differences in the services provided by wetland ecosystem to people and livestock	Wetland in Pitseng Provides local people with water used for drinking, domestic use and farming.	13 (86.7%)	1 (6.7%)	1 (6.7%)	12 (80.0%)	2 (13.3%)	1 (6.7%)
	Local wetland provides food for livestock.	7 (46.7%)	2 (13.3%)	6 (40.0%)	7 (46.7%)	3 (20.0%)	5 (33.3%)
3 Knowledge of different species found on the local wetland ecosystem	Local wetland is also a habitat for animals like frogs and water birds such as cattle egret.	13 (86.7%)	1 (6.7%)	1 (6.7%)	11 (73.3%)	2 (13.3%)	5 (33.3%)
	Different grasses and reeds used for cultural purposes are also found in local wetland.	12 (80.0%)	1 (6.7%)	2 (13.3%)	8 (53.3%)	2 (13.3%)	2 (33.3%)
	Animals in	8	1	6	6	2	7

	wetlands have special habitats even for breeding.	(53.3%)	(6.7%)	(40.0%)	(40.0%)	(13.3%)	(46.7%)
The knowledge of boys and girls on how a wetland ecosystem regulates climate change	Lot of carbon dioxide used in photosynthesis by many plants in wetlands regulate climate.	2 (13.3%)	4 (26.7%)	9 (60.0%)	2 (33.3%)	2 (13.3%)	8 (53.3%)
	Water in wetlands flows slowly and sediments in water drop out thus purifying water.	8 (53.3%)	5 (33.3%)	2 (13.3%)	9 (60.0%)	1 (6.7%)	5 (33.3%)
	Local wetland maintains the flow of Mphenyeke river in most seasons.	12 (80.0%)	3 (20.0%)	-	7 (46.7%)	2 (13.3%)	6 (40.0%)
Boys' and girls' adverse impacts on wetland ecosystem.	Water in wetlands flows slowly and sediments in water drop out thus purifying water.	8 (53.3%)	5 (33.3%)	2 (13.3%)	9 (60.0%)	1 (6.7%)	5 (33.3%)
	Local wetland maintains the flow of Mphenyeke river in most seasons.	12 (80.0%)	3 (20.0%)	-	7 (46.7%)	2 (13.3%)	6 (40.0%)
Boys' and girls' adverse impacts on wetland ecosystem.	Livestock grazing on local wetland can damage habitats, destroy plants and animals.	12 (80.0%)	2 (13.3%)	1 (6.7%)	8 (53.3%)	4 (26.7%)	3 (20.0%)
	Humans and animals" trampling reduces infiltration and affects habitats leading to loss of plants and animals in local wetland.	6 (40.0%)	2 (13.3%)	7 (46.7%)	4 (26.7%)	2 (13.3%)	9 (60.0%)
	Increased runoff can affect ability of wetland to support aquatic	6 (40.0%)	4 (26.7%)	5 (33.3%)	10 (66.7%)	1 (6.7%)	4 (26.7%)

	habitats leading to death of animal.						
	Runoff with fertilizers from nearby fields can cause water pollution and can be toxic to plants and animals in a wetland.	12 (80.0%)	2 (13.3%)	1 (6.7%)	12 (80.0%)	3 (20.0%)	-

Gender Differences in the Knowledge of Learners' on a Wetland and the Teachers' Place in It

Majority of boys, 13(86.7%), and all girls 15(100%) had the knowledge that an ecosystem is a unit or group of living organisms that live and interact with each other in a specific environment. Two (6.7%) of the boys lacked this knowledge and equal numbers were not sure. The concept that a wetland in Pitseng area is an ecosystem like forests and rivers and affects local people was known by 13(86.7%) of boys and 9(60%) of girls. Six (40%) of boys and 2(6.7%) of girls did know this concept and 3(20%) of boys and 5(33.3%) of girls were not sure. A considerable number, 14(93.3 %) of both boys and girls thought local teachers could use a local wetland to teach some concepts in biology whereas the same number of 1(6.7%) of boys and girls did not think so.

Girls responded better on definition statements and the implication is that girls have knowledge of content from biology class. Boys were better on the statements which demanded practical experience on the wetland ecosystem as they mentioned animals and plants in a wetland ecosystem with a higher percentage of yes responses than girls. Both boys and girls could not relate photosynthesis to climate change.

Gender Differences in the Services Provided by Wetland Ecosystem to People and Livestock

Thirteen (86.7 %) of boys and 12(80%) of girls had the knowledge that wetland in Pitseng provides local people with water used for drinking; domestic use and farming. One (6.7%) of boys did not think so, and equal number was unsure. Two (13.3%) of girls disagreed that the wetland provided the stated ecosystem services and 1(6.7%) were not sure. On the other hand, the same number of 7(46.7%) boys and girls held a view that a local wetland provides food for livestock. Two (13.3%) boys did not think that the wetland provided this kind of service as compared to three (20%) girls who also lacked the knowledge. The rest of the boys 6(40%) and 5(33.3%) girls were unsure.

Gender Differences in the Knowledge of Species in Local Wetland Ecosystem

More boys, 13(86.7%), as compared to girls, 11(73.3%), had the knowledge that a local wetland is also a habitat for animals like frogs and birds such as cattle egret. Boys who disagreed with this statement were equal to girls who were not sure, at 1(6.7%). On the other hand, relatively more girls disagreed with 2(13.3%) and were unsure 5(33.3%) of the stated concept. A large number of boys, 12(80%), held a view that different grasses and reeds are used for different purposes as compared to just more than half of the girls 8(53.3%). One (6.7%) of boys and 13.3% of girls lacked this knowledge and 2(13.3%) of the boys and 5(33.3%) of the girls were not sure.

Gender Differences in the Knowledge on Causes and Effects of Ecosystem Realities Like Global Warming and Regulation of Climate Change on a Wetland

Few boys, 2(13.3%) and relatively more girls 5(33.3%) had the knowledge that a lot of carbon dioxide is used in photosynthesis by many plants in a wetland to regulate climate. More than half of the boys 9(60%) and 8(53%) girls were not sure about the scientific fact. There were twice as many boys 4(26.7%) than girls 2(13.3%) without this knowledge. Eight (53.3%) of male and 9(60%) of females knew that water in a wetlands flows slowly and sediments in water drop out thus purifying water. More boys 5(33.3%) than girls 1(6.7%) lacked this, and fewer boys 2(13.3%) than girls 5(33.3%) were not sure.

Almost double number of male learners at 12(80.0%) as compared to 7(46.7%) of female respondents knew that a local wetland maintains the flow of Mphenyeke River in most seasons. Three (20%) of boys did not know this compared to 2(13.3%) of girls and many of the girls, 40%, of girls were unsure.

Gender Differences in Adverse Impacts on Wetland Ecosystem

The fact that livestock grazing on a local wetland can damage habitats, destroy plants and animals and cause soil erosion was known to 12(80.0%) of male and 8(53.3%) of female respondents. More boys, 6(40%), indicated that humans and animals' trampling reduces infiltration and affects habitats leading to loss of plants and animals in a local wetland than girls with 4(26.7%). On the other hand, 7(46.7%) of boys and 9(60%) of girls were not sure whereas equal number, 2(13.3%) for boys and girls disagreed with the statement. Several males, 6(40.0%) and males and females at 4(26.7%) were not sure. Ten (66.7%) had the knowledge that increased runoff can affect ability of a wetland to support aquatic habitats leading to death of animals. A very high percentage, 12(80%) for both sexes, knew the fact that runoff with fertilizers from nearby fields can cause water pollution and can be toxic to plants and animals in a wetland ecosystem. Two (13.3%) of boys and 3(20%) of girls did not possess this knowledge.

In conclusion, the findings established that there is a significance difference between knowledge of boys and girls on the ecology of a wetland ecosystem. Girls responded better on definition statements and the implication is that girls comprehend content from biology class better than boys on the statements which demanded practical experience on the wetland ecosystem as they mentioned animals and plants in a wetland ecosystem with a higher percentage of yes responses than girls. Both boys and girls could not relate photosynthesis to climate change.

Conception of High School Biology Learners on the Ecology of Wetlands Ecosystems

In general, the study has found that there were variations in knowledge among learners based on different EL tenets. From the study it has been found that most of the learners held a scientific conception of nature as most of them knew the meaning of an ecosystem. Aminudim et al. (2010) and Ibrahim et al. (2010) found in their studies that there is much sound knowledge of a wetland ecosystem in young people. Few of the learners, however, could understand the wetland involved in this study which pointed out that the knowledge of youth on wetlands was very low and this is in line with other studies (Brederberg, 2015; Munishi et al., 2012)

Learners also had the knowledge that their local wetland provides different ecosystem services to the local people such as water which is in agreement with the

study of Thlakola and Mokuku (2021) whose findings showed that learners mentioned variety of uses of wetland. Few learners, however, knew about provision of food for livestock. Majority of learners also identified some plants and animal species in a local wetland namely grasses, reeds, frogs and cattle egret. Most learners in this study could not comprehend the biological processes such as photosynthesis and climate change. This Finding correlates with Pitpitunge (2013) research which stated that learners had poor comprehension on the aspects of the climate change.

Learners had the knowledge that human activities like overgrazing, trampling and pollution have impacts on the ecology of a wetland ecosystem. Similarly, Pitpitunge (2013) found that learners were aware of basic concept that human activities such as burning and deforestation have negative impacts on environment.

By close ended questionnaire, the findings of the present study show that, most learners were ecologically literate to some extent and that they had some knowledge variations on different concepts of ecological literacy tenets.

Differences in the Knowledge of High School Biology Boys and Girls on the Ecology of a Local Wetland Ecosystem

The knowledge about the ecology of wetlands may vary due to some demographic variables such as gender, age and education. Girls had more knowledge compared to boys on defining an ecosystem. The educational human-ecosystem relation of the teacher's use of a wetland for teaching was indicated by most boys than girls (Glass et al., 2021) who argued that the wetland ecosystem can be used by teachers to teach young people about many different topics including food chains, nutrient cycles, importance of habitats and human impacts in wetlands.

For ecological literacy tenet showing services provided by a wetland, the knowledge of both boys and girls was similar and this correlates with findings of Khumalo (2010) who indicated that knowledge on the services provided by wetland ecosystem did not change with sex but changes with other factors such as exposure to literature and television.

The differences in the knowledge of plant and animal species between male and female learners were slightly higher for male learners; which can be ascribed to practical experience. This result also parallels the findings of Munishili et al., (2013) who established that males were more inclined than girls in the knowledge of ecology and protection of a wetland ecosystem. Male respondents in the present study had more knowledge of animals, including birds and plants with their habitats but held limited knowledge, compared to girls, about breeding areas in a wetland.

Gender appears to be more influential as boys had little knowledge, relative to girls, on regulating processes namely climate change and purification of water. The findings are related to Pitman et al. (2018). In the present study, some boys lacked the knowledge that carbon dioxide is used in photosynthesis by plants in a wetland and thus regulate climate than girls. However, all learners showed more knowledge in relation to pollution of a wetland ecosystem by fertilizers regardless of gender.

Gender also influenced perceptions of learners in relation to the negative human impacts on a wetland ecosystem, as more boys than girls had knowledge that grazing and trampling destroy habitats on a wetland ecosystem. This result could be attributable to the fact that boys in this context look after animals in a wetland ecosystem. The result is further in agreement with a study of Tesfai (2016) who established that gender influences the knowledge of a wetland ecosystem; Munishili et

al. (2015) study concluded that male participants better comprehended aspect that a wetland ecosystem degrades due to negative human activities than female participants.

It can then be concluded that there is a difference in the knowledge of boys and girls about the ecology of a wetland ecosystem, based on the different ecological literacy tenets. Brederberg (2015) similarly illustrated that males and females may not demonstrate similar knowledge on their expressed understanding in wetland ecology. Ecological literacy is correlated with gender among others (Pitman et al., 2018).

In view of the above findings, it is recommended that an enhanced learner centered approach with field work is needed in order to develop learners' ecological literacy. The recommendation correlates with Sarah et al., (2020) idea that teachers should use more learner-centered approaches and make students aware about the importance of local wetland ecosystems. Knowledge from home or community is related to lack of learners' knowledge on the ecology of a wetland ecosystem as learners cannot explain concepts in a detailed scientific way.

Although learners showed some knowledge on some ecological aspects of a wetland ecosystem, learners' knowledge was rather narrow, as the type of instrument used largely tested only level 1 of Bloom's taxonomy, while ecological literacy demands higher order levels of Bloom's taxonomy and more complex assessment methods. Thus, in terms of the theoretical framework of the study, the learners' ecological literacy was tested to a limited extent. Also, the study has some limitations in that, it focused on learners only and not on best use of stated approaches from the syllabus by teachers. Curriculum developers have specified clearly that every topic on environmental values, should be practically done and project work be developed within the curriculum to enhance the use of local ecosystems such as a wetland in and environmental related issues in general

For further research, higher order levels of Bloom's taxonomy could be tested by using other different research tools and teachers' approaches in teaching of ecological concepts should be investigated. Data was also collected from the learners in one school in the vicinity of the local wetland and the study focused on one demographic variable, gender. Thus it is further recommended that, data should be collected from the learners in more than one school chosen randomly and be analyzed in terms of other demographic variables, such as age and home background.

Conclusions

The study explored biology learners' conception on wetland ecosystem, where wetlands in Lesotho face challenges related to pressures like overgrazing and burning. The study employed Ecological Literacy as the theoretical framework. The research was conducted using mixed research approach and data was collected using observation and a close-ended questionnaires. The generated data were analysed using mixed method approach which strengthened data and enhanced the validity of findings. The research findings revealed that most participants had sound ecological knowledge of a wetland ecosystem and students' conceptions seemed to be mostly based on their social and cultural background and not much from biology class teaching. Findings also revealed that boys were more ecologically literate than girls. The recommendation is that data should be collected from the learners in many schools chosen randomly and data analysis should include other demographic variables, such as age and home background.

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