USING A FIELD TRIP TO INVESTIGATE THE DEVELOPMENT OF BIOLOGY STUDENTS' KNOWLEDGE ON LOCAL WETLAND ECOSYSTEM BIRDS: AN ACTION RESEARCH CASE STUDY

BY

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DECLARATION

I, the undersigned Makabelo Tenane, hereby declare that to the best of my knowledge, this thesis has been composed solely by me and that it has not been submitted, in whole or in part, in any previous application for degree. Except where states otherwise by reference or acknowledgement, the work presented is entirely my own.

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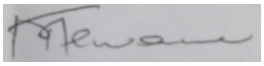

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ABSTRACT

This study investigated the development of Grade 11 biology students' knowledge of wetland birds with the use of a field trip. The three research questions guiding the study were: "What is the conception of Grade 11 biology students' knowledge on birds found in Pitseng wetland ecosystem?"; "How does Grade 11 students' knowledge of birds in Pitseng wetland develop with the use of field trip approach overtime?" and "What is the difference between the conception of male and female students on wetland birds if any?" The research involved 34 participants, and the research instruments for generating data were observation and open-ended questionnaire and a students' field worksheet. The students' knowledge was assessed within the ecological literacy framework. The analysis of data was both qualitative and quantitative descriptive. The findings revealed that students' knowledge on wetland birds increased with the use of field trip overtime. The study concludes that field trip is an effective strategy for studying birds in the local ecosystem, and for developing students' ecological literacy. It is recommended that the method should be used widely in the teaching of biology and that further research should explore its use in the study of birds, with focus on students' ecological conceptions in schools located in different regions of the country, and the data be analysed in terms of other demographic variables, such as age and home background.

Keywords: birds, conception, ecological literacy, wetland ecosystem, field trip.

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LIST OF ACRONYMS

AR -Action Research

CAR- Critical Action Research

CBD -Convention on Biological Diversity

EAR -Emancipatory action research

ECOL- Examinations Council of Lesotho

EL- Ecological Literacy

IWWD- International World Wetland Day

LO- Learning Outcome

LGCSE- Lesotho General Certificate for Secondary Education

LNDC- Lesotho National Development Curricula

NUL- National University of Lesotho

ORASECOM- Orange Senqu River Commission)

PAR- Participatory Action Research

ReNOKA- 'We are the River

SADC -Southern African Development Community

TAC -Technical Action Research

UN- United Nations

UNCBD -United Nations Convention on Biological Diversity

WWD-World Wetland Day

CHAPTER 1

1.1 Introduction

This study investigates the development of biology students' knowledge of wetland birds with the use of a field trip. This chapter introduces the research by giving the background to the study and a statement of the problem. These are followed by the purpose of the study. The research questions and objectives guiding the study are presented followed by the significance of the study.

1.2 Background to the Study

Alfred (2016) indicates that global biodiversity in an ecosystem is a crucial factor for the performance of an ecosystem, but biodiversity is diminishing at a very high rate around the world and the knowledge about biodiversity declines in a similar way. Mekonen (2019) adds that birds are excellent bio indicators of health of biodiversity in an ecosystem, and similarly birds are important components of the world's many ecosystems such as a wetland (Sekercioglu et al., 2016). In the context of biology education, of significance to the study of local biodiversity is the instructional strategies and the human impact on the biodiversity (Heydari et al., 2020).

Birds are integral parts of food chains and food webs in an ecosystem and they play a vital role in keeping balance of nature (Mahendrian & Azeez, 2018). Birds feed on the insects and act as the natural pest controllers; birds are pollinators of the plants and they are agents of seeds dispersal (Hardwood, 2022). One of the known functions of a wetland ecosystem is to provide a habitat for the birds and the birds use wetlands for breeding, nesting and rearing young ones. The birds also use a wetland ecosystem as a source of drinking water and for feeding, resting and social interactions (Steward, 2016).

Use of field trip can be an effective instructional strategy as field trip approach is believed to correlate Bloom's taxonomy in that it moves the task beyond the cognitive level as the teacher shifts from passive education to student-centred education ((O'Neal, 2023). Moreover, the engagement of students in the learning process by use of student-centred approach helps them to conceptualise birds-related concepts on a wetland ecosystem better (Adawiah & Jiwa, 2014). In order to achieve improved teaching and learning in a biology classroom, Udeani et al. (2016)

emphasise that teachers must move away from lecture-based teaching to more participative approaches that include real–life applications for learning such as increased involvement of students' experimental designs and activities. Hence, the focus of this research is to investigate the development of biology students' knowledge of wetland birds with the use of a field trip.

1.3. Science Curriculum and Wetlands Conservation

Wetlands of Lesotho play a critical role in providing ecosystem services which include rich and unique biodiversity, habitats and breeding areas for a variety of different species (Cavallito, 2022). Lesotho wetlands may be grouped into five main types which are as follows: the mires, marshes, natural lakes, rivers and artificial reservoirs (Mokuku et al., 2015); similarly, United Nations (UN) Environment Programme (2013) states that Lesotho is well endowed with wetlands of varying types, palustrine, lacustrine, and riverine systems with palustrine being the most dominant. Palustrine wetlands are vegetated, non-riverine or non-channel system and they include billabongs, swamp and mires (Chatanga et al., 2019).

Several studies have been conducted to assess people's knowledge on local wetland ecosystem. Mokuku & Taylor et al. (2015) conducted a study in this context that demonstrates that communities might hold limited sound knowledge about wetlands. Specifically, their study revealed that a peri-urban community had limited ecological knowledge of a wetland and that they were very much aware of the degradation of the wetland but had no conservation measures in place. While this study did not investigate the community knowledge on wetland biodiversity, it pointed to a potential threat to Lesotho wetlands ecosystems that are a home to rich biodiversity, including birds. Another local study (Tlhakola & Mokuku, 2021) found that students' knowledge on wetland fauna was much better as compared to flora and among studied animals, birds were better known by many participants.

The present study focused on Palustrine (mires) wetland in Pitseng which is situated within a rangeland that is facing threads such as overgrazing, burning of grass and pollution by fertilizers. This wetland is also showing signs of degradation, but still has abundant flora and fauna diversity. The Grade 11 biology students, who participated in the study, as part of community might be aware of the biodiversity of this wetland, but have not previously been taught biology in relation to the wetland.

Ministry of Education (NCDC) (2020). Topic 5 which states, "*Describe Relationships of organisms with one another and with the environment,"* suggests that students should be able to "*discuss an ecosystem as a unit containing all organisms (fauna and flora) and their environment (water, air, soil, climate, light,) interacting together in a given area."* The syllabus further states that, *"Ecosystem can be as small as a tree, or as large as a wetland*". The syllabus learning outcome (LO) also states that students should also be able to "*Discuss conservation of resources",* and the assessment of this LO is that students should be able to *"describe the need for conservation of natural resources (limited to water and non-renewable materials including fossil fuels).* This syllabus also indicates that local natural resources should be incorporated in learners-centred teaching.

The government of Lesotho has taken some initiatives to conserve wetlands and the commitment of the government to environmental conservation, especially the wetlands is beyond doubt. 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 global and at regional. Such programmes include the Conversion on Wetlands of International Importace known as RAMSAR Conversion; Southern African Development Community (SADC); Orange Senqu River Commission (ORASECOM); ReNOKA also known as 'We are the river' and the recognition of International World Wetland Day (IWWD) (UN Programme Report, 2004).

ORASECOM was established by governments of Botswana, Lesotho, Namibia and South Africa to act as a technical advisor to the member states on matters related to promotion of among others utilization, conservation and management of the resources of the Orange-Senqu River System by all stakeholders including students (Ministry of Natural Resources (ORASECOM), (2004). It has a responsibility to scale up the efforts towards the protection of wetlands by communities including youth for the sustainable provision of the benefits obtained from them (Ministry of Natural Resources: (ORASECOM), (2004) with the assistance of (SADC) Regional Unit and the Department of Water Affairs (2003), formulated a National Wetlands Management Programme in 2005. ORASECOM main concern is the establishment of a programme that would address conservation, rehabilitation and protection of degraded wetlands by different activities carried out by communities including students or whereby communities will be participants to address local government structures (ORASECOM, 2008). ORASECOM plan is to engage all members of the community, and schools through

curriculum, teachers and students. Although ORASECOM has good plans about conservation of wetlands, up to now there are no clear measures of how students are engaged through school curricula.

ReNOKA is another national programme and active citizenry movement that aims to engage unity and inspire all communities including students living and working within the Orange Senqu River Basin to act together to protect and restore land and water for the shared prosperity of the catchment and its people (Fanana, 2022). ReNOKA calls on Basotho to collaborate in the protection of wetland ecosystems. One of the once off measures taken by ReNOKA to address the status of wetlands in Lesotho, was to raise an awareness about the urgency of reversing the acceleration of loss of wetlands, by organising an open webinar among seventy (70) participants of which youth were also represented (UN Environmental Programme, 2023). However, the School Biology curriculum does not cover wetlands. Such an integration would be a more sustainable way of creating generation of citizens that are aware of the importance of wetlands. There is currently no evidence that schools are actively involved in the ReNOKA initiative in terms of reorienting curricula to focus on wetlands conservation.

The other initiative of raising awareness on importance of wetlands is the celebration of World Wetland Day (WWD) which is recognised as a United Nations International Day of importance celebrated around the world each year on 2nd February. This day is celebrated in order to globally support the conservation and sustainable management of the wetlands (UN Environmental Programme, 2023). The celebration makes the public aware and to discuss the value of wetlands. The event celebration plays a great role in promoting healthy wetlands in order to deliver the associated ecosystem services for the benefit of communities. During the celebration, the focus is also on the demand for water required for various needs. The celebration aims at drawing attention to the relevance of biodiversity conservation and sustainable use of natural resources. Not only are wetlands a habitat to a wide range of species of plants and animals they also sustain the livelihoods of people living around them (UN Environmental Programme, 2023).

Lesotho held its first WWD at the National Convention Centre on the 2nd February 2004 (Ministry of Natural Resources, 2004). The 2nd of February each year is World Wetland Day marking the date of the adoption of Ramsar Convention on Wetlands on 2 February 1971.WWD can be used as an educational strategy to remind students of the importance of wetlands. It is a day to reinforce the importance of wetlands for world biodiversity, its climate

and human livelihoods (IUCN, 2021). Both ReNOKA and ORASECOM commemorate the WWD on 2 February annually joining the global community in raising awareness and increasing the understanding of the critical importance of the wetlands (re NOKA, 2023). In 2023, the commemoration was held under the theme "*It's time for Wetland Restoration",* and this was a call for people to take action to protect wetlands. Although WWD celebration in Lesotho is an important educational approach tool to remind students of the importance of wetlands, the secondary school biology curricula in Lesotho does not specifically cover wetlands as unique ecosystems that should be conserved. The researcher's view is that the current state of involvement of schools, both teachers and students in this annual event is minimal.

The second State of Environmental Report (2002) reports about some wetlands conservation initiatives that occurred in the past, but which seemingly did not have much impact (Ministry of Tourism, Environment and Culture -Lesotho (2002. One such initiative is the SADC programme for conservation and sustainable use of wetlands. The second phase of SADC focused on training to capacitate resource manager in the sub-region with skills for conservation and sustainable use of wetlands. The other one is the Lesotho Highlands Development Authority (LHDA) restoration of wetlands by providing advice on the monitoring of the system and rehabilitation activities**.** State of Environment Report is more than two decades ago, in 2002, yet the wetlands are still being degraded, and there are now more recent wetlands conservation initiatives, ORASECOM and ReNOKA. It can be argued that the integration of school curricula in such initiatives could help develop generations of citizens that are environmentally literate about wetlands.

The Lesotho National Development Curricula (NCDC, 2020) advocates learner-centred activity-based approaches such as field trips. Even though various environmental laws and policies are in place, to conserve and protect natural resources, only through effective environmental education will the students' behaviour change towards biodiversity conservation (Alexandar, 2014). When ecological concepts are taught in schools, it is important that the students not only understand ecology, but also experience it in nature, in a local ecosystem, so field trips have always been an important means of teaching as they are used as part of laboratory in Biological science (Behrendt, 2014). Obadiora (2016) states that learning can take place everywhere not only in classroom or in the school environment, and therefore a field trip serves as an appropriate strategy. Lesotho General Certificate for Secondary

Education **(**LGCSE) Biology examiner's report stated that performance of Lesotho students on ecological concepts was extremely poor and one recommendation stated the use of learner centred-approaches which expose students to the environment (Examinations Council of Lesotho (ECOL), 2018). The under-performance of secondary students on ecological concepts, for the years 2013 and 2017, is also cited by Tlhakola and Mokuku (2021) in their case study. It is therefore concluded that the initiatives taken by ORASECOM, ReNOKA and WWD, could somehow be related to biology curriculum, with a view to improve students' comprehension and conservation of their local wetlands.

1.4. Local Curriculum Reforms in Science

Concerned educational bodies such as NCDC in collaboration with ECOL, National Task teams or subject panels, teachers' training institutions, teachers' associations, policy makers and educators in Lesotho identified the need to shift from the old science curriculum to the integrated Basic Education curriculum (NCDC, 2020). Integrated basic education curriculum is described as a curriculum that cuts across subjects and is doing away with boarders and respond to the changing demands of the education system **(**Dillion & Boyd, 2022). One of the reasons why curriculum can change is if students could not acquire knowledge, skills, attitudes and values that addressed contemporary issues which may be social, environmental or economical (Drew, 2023).

NCDC (2020) stated that the present Lesotho curriculum for secondary schools properly addresses the environmental management and wetlands protection and was not the case in the previous curriculum. The positive aspects of the integrated curriculum in relation to integrated science including biology are as follows: it considers the environment as a multi-dimensional concept and it is therefore concerned that learners should understand scientific and environmental phenomenon in terms of physical, economic, social, political, and technological development; it seeks to promote knowledge skills and values relevant to biology and technology; it aims to develop relevancy attitudes and values such as awareness and caring for the environment (NCDC, 2020). The current study also aims at developing and improving students' understanding of their local ecosystems, related ecological concepts and their conservation.

1.5. The United Nations Conventions on Wetlands and Biodiversity

Field trips that expose students to the biodiversity of a local wetland ecosystem connect them with nature both inside and outside the classroom (Gibbons & Gregory, 2013). The United Nations Convention on Biological Diversity (UNCBD) (Mauverney, 2023) sought to provide a legal framework for protection of biodiversity. In the year 1995, Lesotho gave a formal consent to the Convention on Biological Diversity (CBD) (Decade on Biodiversity, (2021-2030) as an acknowledgement of the observation that biological diversity is lost at an alarming rate (Mauverney, 2023).

The objectives of the convention to be achieved were the "*conservation of biological diversity; the sustainable use of its components; access and the fair and equitable sharing of the benefits arising out of the utilization of generic resources"* (Secretariat of CBD report, 2021-2030). The other objective of the convention is to reduce biodiversity loss and there is an implied commitment by Lesotho to comply and undertake activities towards achievement of biological diversity. CBD considers biodiversity components such as birds and states that according to various scholars, birds of Lesotho are recorded as three hundred and forty (340) species (Secretariat of CBD, 2021 -2030). This implies an increase of birds' species as compared to 318 species reported by the National Environment Secretariat (2000). The threads included degradation of habitats negatively (Secretariat of CBD report, 2021-2030).

However, the habitat loss has been addressed by conservation efforts such as forestry interventions and new bird species were attracted as a result (Secretariat of CBD report, 2021-2030) and it is concluded that the trend of decline in bird's populations and diversity is somehow stabilised. Ambrose (2020) report states that species of birds in Lesotho increase in intervals (Ambrose, 2020). The current study is important as it might have an educational input in relation to the knowledge and study of wetland birds in their local areas. It is expected that some species of birds which can be identified at Pitseng might be similar to the ones mentioned by Ambrose and CBD report.

The convention on biological diversity covers biodiversity at all levels; ecosystems, species and genetic resources. It also covers biotechnology and generally covers all possible issues that are directly or indirectly related to biodiversity. The convention report is important as students can acquire that knowledge and be involved in conservation measures. The report also shows that the International Day for Biological Diversity is celebrated on 22 May annually

(Secretariat of CBD report, 2021-2030). It is also important for students to observe this day so as to protect biodiversity of birds for instance and ecosystem in their areas.

1.6. The State of Environment and Local Environmental Policy Framework

In 1996 Lesotho government adopted policy designed to protect and enhance environment of Lesotho for the benefit of both present and future generations (Ministry of Environment Lesotho government, 1998). The goal of the National Environmental Policy is to address a broad range of environmental problems facing Lesotho with a view of achieving sustainable development for Lesotho (Lesotho government, 1998). The objectives of the policy include the conservation and maintenance of ecosystems and ecological processes essential for the functioning of the biosphere and to preserve biological diversity; to encourage and facilitate NGO's, individuals and academic and research institutions and business community participation in environmental management; promote understanding of essential casual linkages between development and the environment; and ensure that environmental awareness is treated as an integral part of education at all levels including schools; and encourage and facilitate the participation of individuals, non-governmental organisations communities, religious organisations and business community in environmental management.

Participation would be promoted through activities in the following programmes: gender equity, equality, development of science and technology and environmental education and public awareness **(**Ministry of Environment Lesotho government, 1998). The environmental policy relates directly to the current study as its objective is to facilitate schools' participation in conservation of biodiversity with birds included and ecosystems. However, the participation of students is determined by the strategies used in classroom and curriculum. With the current situation**,** the students are less engaged they cannot retain information more effectively than just a typical classroom experience. The expectation was that the objectives would be included in curriculum.

The report from the National Environment Secretary (2000) stated that Lesotho was a home of 318 species and this was based on data in Ambrose et al. (2000). However, Ambrose (2020) report showed that in the third edition of his bibliography, after a longer interval, the number of species of birds in Lesotho has risen from three hundred to three hundred and sixty-two (362) (Ambrose, 2020). In the second edition of his bibliography (March, 2005) the number of species of birds had risen to three hundred and forty-nine (349) (Ambrose, 2020). In November

1998, the number of species of birds was three hundred and forty (340) and the number of species of birds in 1997 was three hundred and twenty-two (322) while in 1993, there were three hundred (300) species of birds. These figures show that the number of species of birds in Lesotho discovered increased over time and this is important to the present study in that more species could be discovered.

National Environment Policy and some principles that apply in the context of the report include the following: ensure that sustainable development is of the environment; encourage participation by the people of Lesotho in the development of policies, plans and processes for the management of the environment; ensure that environmental awareness is threatened as an integral part of education at all levels even at schools. In addition to the Policy, there is an Environment Act of 2008 (Ministry of Environment Lesotho Government, 2008). This Act defines the biological diversity as the variability among living organisms from all sources including terrestrial ecosystems and aquatic ecosystems and the ecological habitants.

Lesotho Government (2008) makes provision for the protection and management of the environment and sustainable utilization of natural resources of concerning conservation of biological diversity. Even in this regard, the policy does not however reflect any participation of schools, students and teachers and this may hinder a broad based engagement of the schools and students in biodiversity conservation activities. Lesotho has also a constitution which supports issues related to the environment. The mandate for the Department of the Environment is always aligned with section 36 of the constitution (1993) which states that "*Lesotho shall adopt policies designed to protect and enhance the natural and cultural environment of Lesotho for the benefit of both present and future generations."* However, the involvement of students in abiding by constitutions and observing natural and cultural environment is low as the curriculum does not include the importance of wetlands ecosystem and Lesotho birds.

The study is also based on gender, boys and girls whose views and participation may differ in relation to environmental issues. Khanyane et al. (2016) study investigated perceived gender differences in performance in Science and underlying reasons on causes of the difference at Lesotho secondary schools. Principals, teachers and students from six purposively selected schools were participants and collection of data was through Focus group discussion as well as a questionnaire. Findings revealed that principals had one view that boys perform best in sciences while teachers and students had mixed views on which gender performs best in sciences as it was indicated that performance depends on students and classroom factors.

Teachers and students perceived beliefs on possible underlying factors that impact negatively on girls' performance in science included attitudes towards science, home experience, language proficiency, socio-economic challenges and gendered thinking aptitude. The present study will therefore investigate the students' development of knowledge of wetlands birds, in the context of outdoor learning experience, through a field trip.

1.7. Statement of a Problem

Teachers lack time to make use of local environmental resources and fail to research and prepare for outdoor classrooms due to tightly controlled class schedules (Ruether, 2018). This study therefore investigates the development of biology students' knowledge of wetland birds with the use of a field trip in a local wetland ecosystem, in one secondary school. Application of activities that develop higher order cognitive abilities, such as student-centred will be applied in the process of the students' teaching (Reed & Bergemann, 2011).

Birds are some of the most important species that can help to maintain biodiversity in wetland ecosystems. Although birds are important organisms in ecosystems and biodiversity and for human existence, there is limited research in Lesotho that has investigated the diversity of birds among secondary school students using a field trip. Available research however, indicates that students had some cultural or local knowledge related to birds, as they were able to name birds in their home environment, and new birds better than any other wetlands animals (Tlhakola & Mokuku, 2021).

1.8. Purpose

The purpose of this study was to investigate the development of biology students' knowledge of wetland birds with the use of a field trip over time.

1.9. Research Questions

1. What is the conception of Grade 11 biology students' knowledge of birds in Pitseng wetland ecosystem?
2. How does Grade 11 students' knowledge of birds in Pitseng wetland develop with the use of field trip approach overtime?
3. What are the differences between male and female students on the conception of wetland birds, if any?

1.9.1 Research Objectives

The objectives of the present study are to:

1. Investigate the conception of biology students' knowledge of birds in a wetland ecosystem
2. Assess how knowledge of students develop with the use of fieldtrip approach overtime
3. Investigate how the conception of male and female students differ?

1.10 Significance of the study

The study might broaden participating students' wetland biodiversity knowledge, based on their local environment. The findings of the study would be useful to biology teachers by providing insights on appropriate teaching strategies to develop students' ecological literacy, based on a local wetland ecosystem. In addition, the study could be useful to curriculum planners, in terms of guiding them to structure the biology curriculum to bring out required ecological literacy in biology students.

1.11 Conclusion

This chapter presented the importance of wetland ecosystems birds and the state of wetlands in Lesotho. This chapter further focused on effectiveness of field trip in relation to strategies advocated in the national curriculum policy documents and changes that have occurred in Lesotho. . The initiatives taken by Lesotho government in raising awareness of the importance of wetlands ecosystems were also outlined, and it is argued that the involvement of students by government' programmes such as ORASECOM and Re NOKA is minimal, and this forms the basis of the statement of the problem and research questions. The chapter also presented the purpose of study, which is mainly informed by the discussed Government of Lesotho policy framework, on protection and enhancement of environmental management.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review focuses on the students' knowledge of birds in a wetland ecosystem; how field trip approach improves students' knowledge of birds in a local wetland ecosystem; birding and bird identification and citizen science and the school curriculum. This chapter will also discuss the theoretical framework underpinning this study.

2.2 Students' Knowledge of a Wetland Ecosystem Birds

Animals like birds surround our daily life and children have different opinions about their characteristics and it is difficult for children to observe both biological and ecological concepts (Ahi, 2016). Hummel et al. (2015) investigated students' knowledge level of birds and their attitudes towards birds in countries at different level of economic development. To collect data, a Bird Knowledge Questionnaire and a Bird Attitude Questionnaire were developed and used in the Colombia, Germany, Turkey and Slovakia by the researchers in the study. The results obtained, showed that Colombian students had the highest interest in birds. Girls had consistently higher interest in birds than boys in all countries but there were no gender differences in the cognitive domain. It was concluded that animal-related activities such as monitoring life cycles of birds show strong associations with an interest in birds.

The functioning of ecosystems and services provided by them are greatly dependent on biodiversity to a large extent, so loss of biodiversity is a major concern as it is a threat to human beings globally (Lasien et al., 2023). In a research which was conducted in nine different secondary schools with students aged 12 to 15 years of age, a questionnaire was used to assess the students' knowledge of birds and attitudes towards conservation after participating in environment Education Program (Lasien et al., 2023). Participating schools had previously participated in the Environment Education Programme at the Urdabai Bird Centre (UBC). The findings showed that secondary students' factual knowledge regarding birds' migration was limited and particularly that their birds' identification skills were scarce and knowledge and conservation measures were affected by sociocultural background. In the current study

participants never participated in any particular environmental programme, other than the learning of ecological related content in Biology.

Students should be interested in birds because they develop observation skills; reinforce content areas and improve self-control (Magpiong, 2015). Other bird related studies showed the predictors of birds' species knowledge on different groups including students (Radler & Heil, 2021). In Germany for instance, data was collected via online questionnaire, containing demographic data and engagement in bird watching, activity and images of 28 bird species native to Germany. Data was collected from students, lecturers and administrative staff. Males identified more species of birds than females. Employees scored higher than students, implying that students were less ecologically literate about birds than adults. However, it was found that birding specialization was the most important predictor of species knowledge.

Elementary schools were adopted to improve environmental and conservation education and develop respect of environment students live in and raise awareness about biodiversity especially birds' observation (Vielliard, 2000). A total of 515 children participated in the study which investigated and named the birds known by Brazilian children aged 3 to 16 (Bartoszeck et al., 2018). Only 206 students were interviewed and the instrument used was semi-structured interviews who were asked to draw and name birds they knew and where each bird was seen. Results revealed that everyday observation is more important to pupils as compared to classroom formal education in the children' knowledge.

Similar studies were also conducted by Tunnicliffe (2011) and Dogru (2022) whereby children ranging between the ages of 6 to 15 participated in a study conducted to investigate specific birds such as a pigeons and owls in their area and instruments used to collect data. Findings were similar to the study of Bartoszeck et al. (2018) in that lower grade students were found to have more limited information and less biological literacy than the ones in upper grades. Older children in secondary school had more specific knowledge of birds' characteristics even though biological information provided by children was not accurate. Sampling method was used to select a working group which consisted of only pre-school pupils to collect data in south-West Turkey (Ahi, 2016). Instruments used to collect data were also interviews and children drew birds and the results revealed that children's mental model about birds does not have biological basis but is adequate for their age.

Students learn to recognise animals such as birds from their earliest years through actual sighting in their own observations of their world and also from different media. Yli-Panula & Matikainen (2014**)** conducted a study involving lower and upper secondary education students focused on knowledge of animals and the respondents were aware of animals living in ecosystems, especially mammals and birds. The invertebrates, however, were nearly forgotten from all ecosystems, although they are an essential part of biodiversity and the food chain/web.

If the society is expected to have an interest in global environmental crisis, the society should first be motivated with an experience in their own environment (O'Neal, 2023). Sarah (2014) carried out a study whose purpose was to assess the influence of secondary school biology education on the use of wetland resources. The findings revealed that the knowledge from biology education had no significant influence on the use of wetland resources after school. Thus, Sarah's students' knowledge about the ecology of wetland birds may also not have been improved by biology education. The results also implied that little was really done by biology education for conservation and protection of the wetland resources. Little effort to conserve and protect wetland ecosystem could be lack of awareness of the need to protect this source of livelihood**.** Sarah's (2014) findings also revealed that Biology teachers do not use field trip method and alludes to the main difficulty as failure of biology teachers to use the immediate natural environment, and their perception of field work as expensive to conduct, takes plenty of time, and that large numbers of learners hinder carrying out fieldwork.

2.3 The use of a Field Trip Approach to Study Birds

When students learn through a project-based approach, they gain a better understanding of what they learn, they retain it longer and they become in charge of changing the world (Alexandar & Poyyamoli, 2014). The freshwater wetland education programme was conducted using a field trip that involved 180 students from two schools, with the aim to investigate the existing students' knowledge on flora and fauna of wetland ecosystem such as birds (Alexandar & Poyyamoli, 2014). Students from each school were divided into two groups; one group was kept as a control while the other one was an experimental group. Both groups were pre and post tested before and after the intervention with a programme. The findings revealed that the freshwater wetland based experiences improved students' attitudes and perceptions about birds and changed their conservation behaviour on wetland ecosystem.

Through education, hopefully, wetlands could be saved and students' attitudes and knowledge could be developed and these would be conducive to save the global environment (O'Neal, 2023). Students' field trip was taken to the Mangrove forest and freshwater marsh wetland to be taught about ecology and environmental awareness in general biology (O'Neal, 2023). Students observed different plants and animals including birds and recorded their observations on data sheet and answer guiding questions. The study concluded that students found field trips to be the best laboratory experiences; they gained some understanding of structure and function of the wetlands. Environmental education emphasises comparative learning, critical thinking and discussion, hands-on activities and a focus on action strategies with real world application (Hallman, 2015). In a small-scale research, Mokuku and Robert (2011), investigated appropriate Environmental Education (EE) pedagogy to respond to intensifying environmental problems in Lesotho. The findings of the study revealed that outdoor learning in Lesotho is currently not well established as part of teaching and learning culture and that the implementation of outdoor learning in Lesotho would be a shift from traditional teaching to a child-centred approach which could lead to action competence. The use of outdoor learning is still a challenge with many biology teachers hence why the current study investigates the use of field trip in development of students' ecological literacy.

Udeani (2016) states that one of the ways of improving teaching and learning processes in biology classrooms is to move away from teacher-centred approaches to more participative approaches that include real-life applications for learning such as the increased involvement of students' experimental designs and activities. Furthermore, in addition to the cognitive and psycho motor development of students, outdoor ecological exercises combining place-based education and experimental learning can stimulate the affective domain of the learning process (Sukhontapatipak & Srikosamatara, 2011). It can also be argued that students' experience of the natural environment, allows them to witness the reality rather than studying from secondary information sources such as textbooks and televisions.

The effects of field trip experiences on students' knowledge on biology achievement was determined in one study (Patric, 2010). The major findings of this study included significant differences in students' comprehension of the scientific process test scores between students exposed to field trip and those who were not exposed; a significant difference in students' biology achievement test scores between students exposed to field trip experiences and those who were not; and a strong correlation between process of science score and biology

achievement score. It was concluded that field experiences enhanced students' understanding of process of science, improved their attitudes towards biology and significantly influenced their biology achievement.

It could be argued that students' ability to recognise birds may be best developed through field work based learning. In one study (Massy & Roskaft, 2013) residents living adjacent to a park seemed to know birds better based on their interaction with the environment. The men, older people and Maasai tribe showed good or perfect ability to recognise the photos of 8 selected bird species. Unexpectedly, people with little or no education had greater ability of recognising birds than those who received secondary and/ or higher education.

Similarly, Adawiah and Jiwa (2014**)** explored ecological literacy among secondary school students with an instrument that used several pictures about plants and animals found in the environment around them. The findings showed that students' ecological literacy was limited due to their classroom-based learning that did not seem to relate to their surroundings. The recommendation was that future studies should be directed towards enhancing students' ecological literacy hence the current study explores students' development of knowledge of wetlands birds over time, using field trip.

Larsen et al. (2017) present a case study where in real and virtual field trips that involved 211 Grade 8 learners were conducted and compared, in Maribor Island. The emphasis was on determining the levels of knowledge gains on biology and ecology with respect to the two teaching strategies. A fore-existing natural trail in the protected area was chosen and digitized for the purposes of the study. During the development of the virtual trail, the real field trip was stimulated in order to ensure a valid comparison. The results generally showed minute effectiveness differences between levels of knowledge acquisition between both field trips. However, the students participating in the real field trip were generally more successful in their performance regarding the exercises they had been assigned, which included the real objects serving as tools supporting the students in their observation and investigation endeavours. On the other hand, the students participating in the virtual field trip were more successful with regard to computerized exercises, where they were able to access additional information on more complex processes. The present study aims to try out a real field trip, rather than a virtual one.

Ezechi (2018) investigated the influence of field trip in the teaching and learning of biology among 100 senior secondary students in Egypt and Nigeria respectively. The findings revealed that teachers used field trips once a year and that some teachers did not use it at all in the teaching and learning of biology. The findings also revealed, among others, that a field trip is an effective method of teaching since it helped students acquire useful knowledge while having fun and relaxation at the same time. A similar study was conducted in Indonesia whereby field trip was used to investigate senior high school students' environmental literacy on biodiversity (Rijal et al., 2018). The results showed that more than 79% of students gave a positive view for each field trip activity. The students' interest in biodiversity after field trip activity increased (85% - 100%); they gained knowledge on a diversity of vertebrates' characteristics, the status and condition of birds and other animals.

Collating these related studies, it can be seen that there are a number of pedagogical benefits associated with a field trip in science teaching, yet there are a few studies outdoor learning studies in Lesotho, focused on students' learning of birds in a wetland ecosystem, hence the reason for conducting this study in the Pitseng wetland ecosystem.

2.4 Birding and Bird Identification

Birding is being outside following animals, either as a recreational activity or as a form of citizen science, and this is dependent on weather and time of the day and birding can be improved by use of technology like use of binoculars to bring birds closer (Rosen, 2011). Similarly, birding is defined as observing, listening, pursuing or admiring birds and it is for everyone, no matter age, race, financial situation or physical ability (Bloss, 2023). A bird watcher may observe birds by using their naked eyes, as is in the current study, by using visual enhancement device like binoculars or a telescope, by listening for birds' sound or voices and by watching webcams (Rosen, 2011). The researcher's current teaching of Biology, and many of the other biology teachers that the researcher is aware of in this context, does not involve much of field trips, yet literature shows that this strategy can benefit students a lot and improve their performance in a related subject.

Starrison (2022) states that birds are identified basically based on shape, size, colouring, unique field marks such as wing marks, feathers and tail size. Other features include behaviour, habitat, sound, food, season and range as well as geographical location. The bird watcher can probably hear more birds than seeing them and the shape and size can be compared to something already

known (Wilkinson, 2014). Starrison (2022) further illustrated that identifying birds gives rise to awareness of the local environment and the biodiversity all around the specific place and that the use of these distinguishing features helps one to quickly identify different birds. Other than visiting the place, birds can be attracted by providing variety of food types at a certain place (Pennington, 2023). In the current study, features which were used to identify birds were those that the students could think of, based on their knowledge of the birds.

Birding is important for students as they cannot stop noticing birds once they realise how many different kinds of birds are living where they live (Bloss, 2023). Going to the same spot on a regular basis allows one to become more familiar with the birds and this increases chances of bird conservation and this can even help to identify migrant birds (Bloss, 2023). The best time of the day to go for bird watching depends on what kinds of birds to be seen, for instance, mornings tend to be better for songbirds (Bloss, 2023). The best birding hours for people looking to find most birds ranges between 7 and 10 a.m. (Schneider, 2023),

Practices of bird watching are always much more than categorising species of birds. Students match birds with the place where birds were identified as "home" (Wilkinson et al., 2014). It can be concluded that bird watching practice is therefore reflected as the effective strategy for teaching biology and this makes students to recall identified birds from their local environment easily.

As a way of responding to great loss of birds and their habitats, Utami and Amberwani (2022) conducted a research with grade ten students. E-Atlas Avifauna was developed as an identification tool of birds and to train environmental care character whereby 71% was declared as a practical percentage for Avifauna E-Atlas. After identification of birds from pictures with their natural habitats and their description, the findings revealed that students' practical response percentage was 95.2%, which was slightly lower than teachers' practical response percentage of 97.7%. Both percentages were very practical according to set character. And it was concluded that E-Atlas Avifauna is an interesting learning resource and can help students identify birds and train environmental care characters. The research' aim was similar to the current study which exposes students to identify birds in a natural environment

An effective environmental education will change the students' behaviour towards biodiversity (Alexandar, 2014). In one research project, a lesson plan was created for middle school students to learn about birds and raise awareness about threats to natural ecosystem (Kahnet et al., 2020).

To make bird watching easy for students, the team constructed a bird watching field guide with a comprehensive list of bird species including photos, description and frequency data. The field guide was to be used by students to identify bird species during their outdoor lesson. The aim of the project was to raise awareness about declining bird population and also to increase students' interest in biodiversity. The expectation was that the lesson plans would engage students in a way that they would retain information more effectively than a typical classroom experience. This knowledge retention would in turn, make students more environmentally conscious towards their surroundings and local wildlife. The lesson covered bird identification, among others, as well as challenges faced by bird population and was accompanied by an outdoor bird watching activity. The findings of this study revealed that students could easily identify birds using some photos and they discovered that many species of birds suffered greatest losses.

In a study that involved 345 students from public and private schools in the selected communities surrounding five ranges of the park, few of the students could correctly name 10-14 birds (Oyebamiji & Odewumi, 2020). Specifically, knowledge of ecosystem was based on communities surrounding five ranges of the park**.** The students seemed to better known ecosystem related knowledge such as bird's role in pollination of plants' flowers and as agents of seed dispersal. The study concluded that students' ability to adequately identify common birds in their environment and their food resources is low but they had a good understanding of ecosystem services provided by birds.

Species identification is essential to biology, conservation and management (Hallman et al., 2015). Three classes of students participated in birds' identification using twitter and each class had a class twitter account (Hallman et al., 2015). Students had access to internet and identified birds from instructor-provided list or from their field guides in their devices. They wrote short description of birds to identify the chosen species and the description were sent to a single tweet on twitter. Results revealed that vast majority of students, participating in the study, actively improved their description of birds through twitter device.

2.5 Citizen Science and the School Curriculum

One of the ways of increasing scientific knowledge and engaging people in learning more about the world or linking school curriculum with community is by the use of Citizen Science which is defined as the practice of public participation and collaboration in a conducted research

(Cerrato, 2022). The participants, who conduct the scientific research, do so voluntarily. Citizen scientists may be engaged in different activities such as designing experiments, collecting data, analysing results and solving problems and dissemination of results (Cerrato, 2022). The current study could be described as reflective of some aspects of citizen science as it plans to engage students in a voluntarily data collection activity in their local wetland ecosystem and to collect scientific data and gain more knowledge about aspects of their local wetland ecosystem.

Roche et al. (2022) describe citizen science as a growing field of research and practice, generating new knowledge and understanding through the collaboration of citizens in scientific research and the recommendation is to align educational learning outcomes from the curriculum with citizen science. The main benefit of citizen science is the fact that people become more aware of scientific concepts and phenomena and there is a direct participants' involvement and more concern on scientific issues (European Commission, 2023). Citizen science is mostly connected with the environmental domain, because it provides an opportunity to expand the knowledge base through local involvement and increase citizen awareness. (European Commission, 2023).

Bopardikar et al. (2023) indicate that one powerful way of engaging students in environmental education can be a school-based citizen-science whereby science curricula can be developed around citizen science activities. Bopardikar et al. (2023) conducted a case study aimed as supporting middle school students to learn about climate change. Data were collected using interviews, observations and document analysis. Findings revealed that the activities evolved through various measures, including appraisal by external advisers, inspiring examples, surveys of teachers' implementation and written pre-post assessment of students learning throughout phases of analysis, developmental and evaluation of the curriculum. Four key considerations for designing school based citizen science emerged from data as: creating the learning environment around the fieldwork; tackling concern about data quality and utility; making scientists-designed fieldwork and engaging to students.

Youth participation in citizen science is a growing topic of interest for educators (Harris, 2017). In yet another study that involved youth, the students scanned the area of their campus and investigated their local environment phenomena on campus at a local pond and wetland site for birds (Bird et al., 2020). The students' aim was to do what actual scientists do in real life, and not just learn about it, but live it. They wanted to experience real outdoor science learning

through field trips (Bird et al., 2020). The study was conducted by students who engaged in their research and collected data on bird species diversity. The main findings of this study were that students gained a broader understanding of birds in their local ecosystem and the components within it. The conclusion was that community and citizen science-based outdoor learning experiences, have potential to connect campus investigation to a broader community context, and to deepen real-life science learning.

Ortiz et al. (2018) investigated a problem that students lacked a positive outdoor experience which could lead to students growing up not appreciating the significance of the natural world, local wildlife and natural resource careers. The problem was addressed in the following ways: a wild bird conservation curriculum that required students to be proficient in science practices was developed and was aligned with state standard for use in k-12 classrooms; and a Student-Teacher-Scientist-Partnership was initiated to enhance students towards birds in South Texas (Ortiz et al., 2020). The research was conducted with grades 6 and 7 students whereby students were assessed on their affinity, perceptions, and attitudes towards wildlife, birds, science, and nature prior to and after the program using a mixed method of open-ended questions and Likert-type statements. Findings showed that both grades levels had a positive attitude towards wildlife and working with a scientist. Their perceptions towards habitats destructions and its effect improved as well as their perceived knowledge of birds, especially grade 7 students. During the study, students had the opportunity to be outdoors and to integrate hands-on, kid based wildlife science activities into the classroom to enhance their appreciation of wildlife. Ortiz et al. (2018) research is similar to current study as students will have the opportunity to experience outdoor learning, but just focusing on local wetland birds.

2.6 Theoretical Framework

Ecological literacy (EL) has been adopted as the theoretical framework underpinning this study and this theory will be used as a framework for data collection and analysis. Orr (1989) is the first to introduce the term ecological literacy. EL enables better understanding of the natural systems such as the ecology of wetlands and assists learners and adults to understand nature and their place in it (Boehnert, 2015). Furthermore, Jones (2014) emphasises that EL teaches about how nature works in terms of biodiversity changes, interconnections and relationships of living things and interaction of biotic and abiotic factors.

Hammarsten et al. (2019) assert that children spend less time outdoors and this condition creates health problems and nonexistence of ecological literacy. To be ecologically literate means understanding the principles of organization of ecological communities such as ecosystems and using those principles for creating sustainable human communities. EL can be integrated into the science curriculum and be demonstrated in the classroom and that can be achieved by taking students for field trips to local natural ecosystems such as a wetland and teaching them to identify animals such as birds (Hack, 2015).

The knowledge and understanding about relationships between humanity and nature is fundamental to the health and survival of many species, and forms a basis for EL and EL is correlated with gender among others (Pitman et al., 2018). Ecologically literate learners understand environmental realities by specifically identifying their cause, effects and relationships (Smitsman, 2014). Orr (1989) emphasized that EL does not only require mastery of the subject matter but understanding the principles for creating sustainable management of environment.

Ecologically literate learners learn and act on their knowledge, experience and belief in relation to environment (Orr, 1989). Adawiah (2014) further states that the ecologically literate learners have clear knowledge and understanding of ecosystem dynamics as well as its past and future outcomes. Boehnert (2015) asserts that ecologically literate students respond to severe environmental problems based on ecological knowledge.

EL emphasises that knowledge about the environment is necessary for informed decision making (Cherett, 1989). Several factors may influence personal EL: knowledge, gender, subject matter expertise and attitude (Turner et al., 2009). Ecological literacy equips students with the knowledge and competencies necessary to address solution of environmental issues in an integrated way (Jiwa & Esa, 2014).

Based on this reviewed literature on Ecological Literacy, it can be argued that its key tenets are that students should:

- Describe biodiversity changes;
- Identify organisms in an ecosystem;
- Describe the natural systems better;
- Illustrate the acquired knowledge and competencies necessary to address solution of environmental issues in an integrated way;

- Describe and respond to severe environmental problems based on ecological knowledge; Relate the principles of organization of ecological communities such as ecosystems
  and use those principles for creating sustainable human communities;
- Identify environmental realities by specifically identifying their cause, effects and relationship;
- Relate relationships between humanity and nature as fundamental to the health and survival of many species;
- Describe the principles of organization of ecological communities such as ecosystems and using those principles for creating sustainable human communities;
- Explain how nature works based on changes such as biodiversity changes;
- List interconnections and relationships of living things and interaction of biotic and abiotic factors.

For the purposes of this study, the focus will be mainly on two tenets, namely: Describe changes in nature such as biodiversity changes; and identify organisms in an ecosystem.

2.7 Conclusion

In this chapter, the reviewed literature was related to students' knowledge of wetlands birds, and it mainly reveals that students had limited knowledge of birds as few of them could identify birds and provide plausible descriptions of birds' features. In addition, studies concerning effectiveness of use of field trip were reviewed, and these show that field trip is an effective strategy for teaching biology and can enhance students' ability to recall birds observed in their local environment easily. The literature review also highlighted citizen science as an importance discourse in science education that creates an opportunity to expand knowledge of students by conducting or being participants in a real life scientific research. The importance of birding, as outdoor approach for studying birds was also discussed in relation to science education.

The chapter concludes by discussing ecological literacy as a theoretical framework that underpins the study. The theoretical framework is justified in relation to its importance for data collection and analysis. Based on reviewed literature and ecological literacy, the following two tenets of the theoretical framework were identified as key to the present study: "Changes in nature such as biodiversity" and "Identification of organisms in an ecosystem".

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter focuses on the research methodology employed in carrying out this study. It comprises, research design, the type of research method used, study population sampling technique, instrumentation, data collection procedures, data analysis, validity and reliability as well as ethical considerations

3.1.1 Research design

The research design is defined as a plan or strategy that is drawn up for organising or sharpening the research in making it practicable so that research questions can be answered Bouchrika (2023). The research design identifies the evidence needed to address the logic that underpins the connections between the research purposes, objectives, questions, data, and conclusion drawn (Cohen et al., 2011). The current study used observation method and a questionnaire so as to bring about completeness and diversity of information

3.1.2 Research methodology

The research method of the present study was a mixed-method case study design (Ary et al., 2010). Mixed-method design involves qualitative and quantitative approaches in a single study (Cohen et al., 2007). Validation of data involves triangulation which allows the researcher to collect separate forms of data at separate times using more than one method (Burns, 2015). In this study, the mixed method approach is important as the logic of mixing two methods will complement each other and strengthen collected data. A case study concerns in-depth learning about the problem and also that the findings can be transferred to many.

3.1.3 Action Research Methodology

An action research in the field of education is defined as a method that focuses on solving problems in social systems such as schools and other organisations (Johnson, 2019). Action

research is typically a process which goes in cycles that moves through the four phases This study investigates the development of biology students' knowledge of wetland birds with the use of a field trip. The research employed mixed-method approach data collection methods which are as follows: planning of action, action taking, observation or analysis of evidence and reflection; and one cycle is linked to the next, through the reflection phase (Burns, 2015). The four stages are explained in detail below:

Planning Phase: the researcher prepares for taking action and for gathering information and data in order to observe and monitor the practice. In planning phase research questions and methods are explained in detail (Cohen et al., 2007).

Action Phase: in this phase, the researcher implements the plan or changes a practice and collects data from one or variety of sources (Cohen et al., 2007).

Observation Phase: Collected data is analysed, synthesised and interpreted and key issues related to the problem are identified and this leads to reflection phase (Cohen et al., 2007).

Reflection phase: An area of focus is identified based on a problem. The information which is already known is used to learn more about the problem. Then actions are taken and a new area of focus is identified (Cohen et al., 2007)

AR is representing the term for a set of approaches to research which, at the same time, systematically investigate a given social situation and focuses on promotion of democratic change and collaborative participation (Burns, 2015). Different types of AR include Participatory action research (PAR), emancipatory action research (EAR), technical action research (TAC), critical action research (CAR), action learning, participant inquiry, practitioner inquiry and cooperative inquiry are all terms broadly underpinned by the assumptions and approaches embodied in AR (Burns, 2015). These types of AR share the common characteristics and are the following: undertake research to bring about positive change and improvement in the participants' social situation; generate theoretical as well as practical knowledge about the situation; enhance collaboration and involvement of participants who are actors in the situation and most likely to be affected by changes; and to establish an attitudinal stance of continual change, self-development and growth (Burns, 2015).

PAR emphasizes that participants should be members of the community being studied using their life experience. The research should empower those who are directly affected by

outcomes which originate from research participants as co-researchers (Burns, 2015) and this is the case with the current study

CAR is the research which validates or extends PAR as it seeks to change the existing power structures and inequalities within the community under study and encourages continued learning and professional growth (Given, 2009). EAR is about participation: all people involved come together as co-participants in a process of education for a practice change. EAR respects diversity in values, traditions and practices and integrates thinking and doing (Ledwith, 2016).

TAC is the use of an experiment that is not naturally present or well developed but occurs as a result of investigation so as to help a client and to learn about the experiment which is still under development and its effects (Wieringa, 2014).

Sullivan et al. (2021) indicated that practitioner inquiry is characterised by the systemic study of practice. It is about teachers work and teachers themselves as a basis of research, helping them to develop themselves through carrying out an action research in their practice. Teachers can experience a sense of empowerment and this may help them to appreciate the extent to which they are in control of their own professional development.

In light of the above, the type of action research employed in the present study is PAR. The action research had been undertaken so as to bring about positive change and improvement in the students' theoretical as well as practical knowledge about the local wetland birds. PAR enhances a joint effort and engagement of participants who are actors in the situation. In the area of education, an action research is defined as a systematic type of research conducted by the teacher to improve practice, and involves data gathering regarding the activities they carry out at their own schools (Unlu et al., 2015). In the current study participants' collected data so as to address the outlined research questions.

3.1.4. Population and Sample

In research study population means the entire group of participants about which some information and data is required to be ascertained and draw the conclusion about and this group can be people, or can be a group of elements of anything under study such as objects and events (Bhandari, 2020).

The target population in this study was Grade 11 biology students because they are the most senior biology students who may relate a local wetland as an ecosystem even though wetlands are not infused in Biology curriculum. LGCSE Biology (0180) curriculum topic 5 emphasises the Relationships of organisms with their environment which includes biodiversity in ecosystems. However, wetlands are not specified like other ecosystems. The wetland ecosystem existing in students' local area acted as a base for knowledge of wetland birds.

3.1.4. Sampling Method

The sampling method in research study is the selection of a subset of the population of interest and sampling technique allows data to be collected faster and at a lower cost and to make inferences (Turner, 2020). The sampling technique that was used in this study was purposive sampling as an intact class participated in the current study (Cohen et al., 2007).

This technique is well suited for an action research case study since it seeks cases where researcher can get rich information and the purposive sampling is the better matching of the sample to the aims and objectives of the research (Nurs, 2020). In Purposive sampling the findings are not generalised (Cohen et al., 2007) as was the case in this study. Ary et al. (2010) further illustrates that in purposive sampling technique subjects are selected based on knowledge and experience, their accessibility and proximity to the researcher as in this current study. In this study, one high school was chosen in the Pitseng area close to the researcher's place of work and to the wetland ecosystem. The sample of population for study comprised of 34 students (24 females and 10 males) in an intact class and as the only grade 11 biology class in the school. Pitseng is located in the foothills, and is small town situated in a largely subsistence rural community.

3.1.5. Instrumentation

The function of data collection instruments in research is to help a researcher to achieve his or her purpose, address the research questions and helps the researcher to consider the ethical and practical implications of data collection (Simplilearn, 2023). Simplilearn (2023) categorises data collection instruments into primary and secondary methods whereby primary methods involve the collection of original data or first-hand information directly from respondents. Primary techniques include surveys and questionnaires, interviews, observations, experiments and focus groups. Secondary data collection involves using existing data collected by someone

and this data can be obtained from published sources, on-line database, government and institutional records and past research studies.

The instruments that were utilized in this study for data collection was the primary data collection method students' questionnaires, observation of birds and use of worksheets. Questionnaires were in the form of open ended questions and worksheet which is a media in the form of sheets containing tasks and activities that students must carry out during the observation of wetland birds (Merry et al., 2023). Questionnaires were intended to seek the background knowledge of students in relation to wetland ecosystem birds and reflect on collected data after research cycles. Worksheets were intended to support the learning process which was in the form of lists of names of some birds expected to be found in a local wetland ecosystem, so that students can be active in the learning process. In addition, students were free to add birds and describe birds freely and thus reveal what is important about the phenomenon of concern (Cohen et al, 2007). In addition, a camera was to be used to capture pictures of some birds where possible**.**

3.1.6. Data Collection Method

The research method for the present study is action research. The method was conducted in two cycles and each cycle consisted of four stages namely, planning phase, action implementation, observation phase and reflection phase (Burns, 2010). The aim of the action research is to expand scientific knowledge generally and enhance competencies of participants (Cohen et al., 2011; Rogers et al. 2013).

The action research was carried out as a case study design of one secondary school to gather data on knowledge of students on local wetland birds and a field trip was tried out to develop the knowledge of students' overtime. The research meets requirements of a case study as it is time bound and defined in a local wetland and the study is content-based on the phenomena rather than a study conducted in a lab. A case study is concerned with in-depth understanding of a phenomena as it is from subjective experiences of individuals (Cohen et al., 2007 & Ary et al., 2010). The case study enabled participants to discuss their knowledge on wetland birds and arrive at the best possible responses to the research questions. Furthermore, collected data from the study afforded the researcher the opportunity to analyse deeply learners' knowledge and factors influencing that knowledge at they emerge from the responses.

The four phases of the AR were conducted as follows:

3.1.6.1. Planning Phases for Cycles 1 and 2

Action research planning phase is the stage where by the researcher prepares for taking action and for gathering information and data in order to observe and monitor the practice and planning phase research questions and methods are explained in detail (Cohen et al., 2007).

In preparation for the 'action phase' the researcher prepared the following instruments:

1. An open-ended questionnaire to establish students' background knowledge of the Pitseng wetland ecosystem (see Appendix A). The questionnaire was intended to help the researcher to collect a broad qualitative and quantitative data. It covered the broad content areas such as the background knowledge of students on wetlands ecosystem and the current situation in a local wetland ecosystem.

2. A lesson plan as a guide for both the activities of the teacher and the students (see Appendix B). The plan was structure to reflect knowledge, skills, attitudes and values that are meant to be taught and learnt by students from the wetland ecosystem (Padayichie, 2022)

3. A worksheet to be filled by students during their observation of a wetland birds. The students and the researcher prepared the list of birds that they thought were found in Pitseng wetland and developed the associated worksheet (see Appendix C). The worksheet was intended to give students clues regarding what to observe and focus on during the field trip and to increase the learning effectiveness on targeted concepts (Myers & Jones, 2021), and it was structured in the following broad areas: Name of an identified bird and its general and unique description.

The whole class of 34 students, participated in all cycles' activities.

3.1.6.2. Action Phase for two cycles

The Action Phase of Action research involves the implementation of the plan or changes a practice and collects data from one or variety of sources (Villiegas, 2023). The action of two cycles was on different dates and times of the day, and Cycle 2 was conducted based on the weaknesses and strengths of Cycle 1, in order to improve the results. For instance, the visit in the first cycle was at noon but the time was changed to 8 a.m. in the second cycle. The wetland is about twenty minutes-walk from the school, and 34 students in intact class were arranged to

work in 17 sex-based pairs: 12 pairs of girls, and 5 pairs of boys. Each pair was required to observe, share their observations of wetland birds and record them on the worksheet.

When students arrived in a wetland, worksheets were administered directly by the researcher to 34 participants (n = 34). Each pair found a suitable place to stand and observe birds, but pairs were not close to any of the classmates. Observations of birds were made with the naked eye from a distance to avoid disturbing the birds; students used their senses of sight and hearing to observe and identify and then used their worksheets to describe birds seen in the Pitseng wetland.

Students were asked to make a tick against a bird observed in the Pitseng wetland choosing from the list of birds provided on the worksheet and to describe it. Students were also allowed to record and describe any other bird which was not on the given list of birds using either Sesotho or English names.

The researcher went around checking on the students. They were allowed to capture photos for the wetland and wetland birds as part of data. Capturing of photos in a research becomes observational data and photos are accurate and reliable sources of data (Cleland & MacLeod, 2021). The researcher kept her own diary about the field trip.

Worksheets were also retrieved directly from learners after completion of all the cycles by the researcher for data analysis. Results were presented in tables and figures for each wetland bird. The results were then analysed based on the tenets of Ecological learning (EL).

3.1.6.3 Observation Phases for the two cycles

Observation in Action Research involves analysis, synthesis and interpretation of collected data and key issues related to the problem are identified and this leads to reflection phase (Villegas, 2023). In this study, observation in the two phases involved the mixed-method approach presentation of students' findings of conception on birds and related concepts in relation to Pitseng wetland. The researcher reflected on the analysed data and on her own diary to make own assessment of the impact of the field trip on the students' knowledge of wetlands birds and related concepts in preparation for the next cycle.

3.1.6.4 Reflection Phase for all cycles

Reflection Phase is about identifying an area of focus based on a problem. The information which is already known is used to learn more about the problem. Then actions are taken and a new area of focus is identified (Cohen et al., 2007)

In this study, the researcher prepared the reflection questions and students answered in their pairs and noted the answers down, which were then generally discussed by the whole class in preparation for the next cycle. The current study conducted only two cycles.

3.1.7 Data Analysis

The significance of data analysis in research is to summarise and simplify collected data and makes data more accurate as it involves the interpretation of gathered data to determine patterns, relationships and trends (Amadebai, 2023). In the present study, the generated data were analysed using mixed method approach which neutralised the weaknesses of data but strengthen collected data. The qualitative analysis involved Thematic Analysis and Theoretical framework underpinning the current study. Thematic Analysis is a foundation qualitative research method that can be used for identifying, analysing, describing, and reporting themes within a data set (Braun et al., 2022**).** This technique was used to categorise textual data generated from the pairs of students. The main advantage of thematic analysis is to identify patterns that provide an answer to research questions being addressed. Patterns are derived through process of data familiarisation and differences and similarities in textual information derived from data will also be identified (Ary et al. 2010).

The quantitative analysis of data involved the use of statistical method, numeric values and software gain and focuses on mathematical or numerical analysis of data and this data is gained from instruments such as surveys and questionnaires (Eteng, 2023) as it is the case in the current study. The main advantage of quantitative data is that it can provide objective, reliable and generalizable results and this reduces the risk of bias, error and subjectivity in data collection and interpretation (Eteng, 2023).

3.1.8 Validity and Reliability

According to Ary et al. (2010), validity, in the context of this study refers to how accurately a method measures what it is intended to measure. Validity describes the degree to which the

results actually measure what they are intended to measure and it is important because it measures the accuracy of the study (Ary et al., 2010). The instruments used were face-validated and this was done by relying on the views and guidance of experts with the technical knowledge on validation of instrument. The instruments were face-validated by two experts; the supervisor and a biology teacher with more than 10 years' experience in teaching.

Reliability refers to how consistency a method measures what it is intended to measure and it describes that the result of a given study can be repeated or replicated under the same conditions and have consistent results (Ary et al., 2010). Reliability is important because it measures the quality of the research. This study achieved this by explaining the assumptions and theory behind the study and by explaining in detail how data will be collected to allow for an audit trail if necessary. Reliability states that auditing for reliability requires that data and descriptions of the research should be elaborate and rich may also be enhanced by altering the research design as new findings emerge during data collection (Cohen et al., 2007**)**.

3.1.9 Ethical Considerations

Cohen et al. (2007), emphasizes that the researcher should be in compliance with the principle of informed consent which maintain that the research participants should consent to participation in a research study. Burns (2015) illustrated that ethical considerations are tied up with the quality, value and democratic worth of the AR in changing and enhancing social situations for the participants. As such the researcher formally asked for permission to conduct the research from one participating school' principal as the head of the school. The Principal, concerned biology teacher, parents (of minors) and participating students were all informed about the study so as to ascertain their voluntary involvement in the study. (Appendix I). A letter from the University's ethical committee was not attached as the University did not have the systems for ethical clearance of students' research proposals in place yet.

All involved parties were assured that the data and information collected for the purpose of the study would be kept confidential and real names of participating school and respondents will not be mentioned but instead pseudonyms would be used. This was done in line with the principle of anonymity and confidentiality which affirms that research information should not reveal the identity of the participants (Cohen et al., 2007).

Furthermore, Burns (2015) states that even when written consent is not required, all stakeholders and participants have a right to information about the purpose, procedures, possible effects and how the research will be used, as well as assurances of anonymity, voluntary participation and withdrawal from the research without penalty. This is particularly important in an approach where researchers could be accused of 'experimenting' on their students and 'threatening' their educational achievement. In addition, the participants were assured that data collected for the study would be used solely for research purposes. The community Chief was asked to grant permission prior to the visit to the local wetland ecosystem, after being informed and provided with full details about the purpose of the visit by the researcher.

3.2 Conclusion

This chapter outlined the research methodology employed in this study, namely the action research. Participatory Action Research, is specifically described as the type of action research method used in this study to bring about positive change and improvement in the students' theoretical and practical knowledge about local wetland birds. The chapter further presented how the population of the study, sampling method, and how data was generated, validated and analysed. The researcher's ethical considerations were also discussed.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter entails the results that were obtained from collected data and the results are based on the following research questions:

1. What is the conception of students on wetland birds and their related concepts?
2. How does the knowledge of students develop with the use of field trip over time?
3. What is the difference between the conception of male and female students' knowledge of wetland birds and their related concepts if any?

The generated data was analysed to determine students' competency on the following tenets of Ecological Literacy.

- Description of biodiversity changes;
- Identification of organisms in an ecosystem.

4.2 THE FIRST CYCLE

The whole class, of 34 students, participated in the first action research cycle activities of planning, action, monitoring/observation and reflection, as outlined below.

4.2.1 Planning Phase

In preparation for the 'action phase,' the researcher prepared the following instruments:

1. Questionnaire to establish students' background knowledge of the Pitseng wetland ecosystem (see Appendix A).
2. A lesson plan as a guide for both the activities of the teacher and the students (see Appendix B).

3. A worksheet to be filled by students during their exploration of a wetland. The students and the researcher prepared the list of birds that they thought were found in the Pitseng wetland and developed the worksheet (see Appendix C).

4.2.2 Action Phase

A pre-field trip questionnaire with **7** open-ended questions, was developed and administered to 34 students. The questionnaire was administered directly by the researcher to 34 participants; 10 males and 24 females in an intact class. The completed 34 questionnaires were retrieved directly from the learners by the researcher for data analysis.

On the 16 February 2023 at twelve noon, the researcher took the class for a field trip to Pitseng wetland. The wetland is about twenty minutes-walk from the school. All students were present, and were arranged to work in 17 sex-based pairs: 12 pairs of girls, and 5 pairs of boys. Each pair was required to observe, share their observations of wetland birds and record them on the worksheet. Observations were made with the naked eye from a distance to avoid disturbance of the birds, and students used their senses of sight and hearing to identify them.

The researcher, on the other hand, observed students as they spread out at the wetland to work in pairs, with the guidance of the worksheet. Students were asked to make a tick against a bird observed in the Pitseng wetland, choosing from the list of twenty birds provided on the worksheet, and describe it. They were also allowed to record and describe any other bird which was not on the given list of birds using either Sesotho or English names.

The researcher moved around to the different areas in Pitseng wetland so as to observe and record as many birds as possible and to check on all pairs of students making sure that students maintained a good distance between the pairs and also ensuring that students discussed in their pairs only. They submitted the worksheets to the researcher after completion.

Students were also allowed to use cell phones to capture pictures of the wetland birds. They used the worksheet to identify observed birds, discussed in pairs and recorded the description. For the birds which were not on the list, students recorded, named and described them. The researcher recorded her own field notes based on her observations and insights during the field trip. The session lasted for an hour and students submitted 17 worksheets to the researcher after completion.

Below are the findings on students' conception of birds, based on their submitted field worksheet records (see Appendix D). The students' mentioned the Sesotho names of the birds which are also presented in their common English name, as per Ambrose (2020).

4.2.3. Observation Phase: Students' Background Knowledge of Birds

As mentioned above, students' knowledge of the Pitseng wetland was established in terms of birds found in the wetland**.** The results show that of the 34 students who participated in the study, 18 (53%) had never been to the Pitseng wetland or any other wetland, and less than half of students, 14 (41%), had once been to the wetland. Two students (6%) did not respond to the question.

When asked to mention at least six birds found in the Pitseng wetland, only 6 students (18%) were able to mention a maximum of three birds correctly, that are found in a wetland, such as a Cattle Egret (Leholosiane), a Heron (Kokolofitoe) and a Long-tailed Widowbird (Molepe). Some students' listed birds including a vulture and an eagle which do not exist in Pitseng wetland.

Hadeda Ibis (**Lengangane)**

Eleven pairs out of 17 [65%] pairs of students indicated to have observed Lengangane (Hadeda Ibis) during the field trip: four male pairs out of 17 pairs 4[24% of males] and seven female pairs out of 17 pairs 7[41% of the females] recorded the bird. Only five pairs of students 5[(29%) of the total 17] provided a plausible description of the bird, either in terms of colour, features or behaviour as follows: two pairs out of seventeen pairs of students 2 [12%] named it as a dark grey bird ("*E grey bo dark, e kholo*"), one pair 1[(6%] said it is a silver and a black bird; the other pair 1[9%] described it as a big bird and has a long beak, and one pair 1[6%]:- described it as a bird which is always in a pair or in a group.

Six pairs 6[35%] who identified the bird, described it as a black bird, indicating a stark mismatch between the bird name and its appearance. The other six pairs of students 6 [35%] did not identify the bird on the checklist nor describe it. The researcher did observe the occurrence of Hadeda Ibis, in the visited wetland, and noted the bird as a dark grey bird with a long beak.

Table 1: Identification of Hadeda Ibis

Students' Field Observations	**Frequency of Student Pairs (N=17 pairs)**	**Male Pairs (N=17) pairs)**	**Female Pairs N=17 pairs**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	11(65%)	4(24%)	7(41%)	A dark grey bird It is a bigger bird that can fly and has a long beak The birds are always in pairs or in a group A silver and black bird	A black bird
Bird not Recorded, but Described					
Bird neither Recorded nor Described	6(35%)	1(6%)	5(29%)		

Red Winged Starling (Lets'oemila)

Six pairs of students 6[35%] indicated to have spotted the Red Winged Starling: two male pairs 2[12%] of males) and four female pairs 4[24% of females]. Of these students, four pairs 4[24%] gave a plausible description of it: two pairs 2 [12%] described the bird as black with orange

feathers on the wings as in one pairs' response: "*E ntso masiba a mapheo a orange*," and the other two pairs of students 2[12%] described the bird as a black and red bird. Two pairs of students 2[12%] described a Red Winged Starling as black with yellow tail and the other eleven pairs of students 11[65%] did not mention the bird. The researcher too did identify the bird in the wetland and noted that "*The bird is black with orange feathers on the wings and tail."*

Table 2: Identification of Red Winged Starling

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male pairs N =17 Pairs**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	6 (35%)	2(12%)	4(24%)	Black body with orange feathers on the wings A black and red bird	Black with yellow tail
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	11(65%)	3(18%)	8 (47%)		

Long-tailed Widowbird (Molepe)

The majority of students, 11 pairs out of 17[65%] pairs of students, indicated to have observed the Long-tailed Widowbird: four male pairs 4[24% of males] and seven female pairs 7[41% of females]. All 11[65%] pairs who identified the bird gave a plausible and accurate description of the bird as black and a long-tailed: *"E ntso e mohatla omo motelele."* However, six pairs of

students 6[35%] did not record the bird. The researchers observed the bird in the field and recorded it as *"a black bird characterised by a long tail."*

Table 3: Identification of Long-tailed Widowbird

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	11 (65%)	4 (24%)	7 (41%)	A black and a long-tailed bird	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	6(35%)	1(6%)	5(29%)		

Reed Bunting (Tsoere)

Nine pairs out of 17 [53%] pairs of students indicated to have spotted the Reed Bunting, at the Pitseng wetland: three male pairs 3[18% of males] and six female pairs 6[35% of the females]. Reed Bunting was plausibly described as a brown and a small bird by seven pairs of students 7 [41%]. Other descriptions were rather inaccurate: two pairs of students 2[12%] expressed that these types of birds are black and many inside the reeds: - "*It is black and many birds inside the reeds."* The other eight pairs of students 8[47%] did not mention the bird. The researcher's field notes about the birds stated: "*The birds are abundant in the area of the wetland where there are reeds and these birds are brown with black strips and grey on the chest."*

Table 4: Identification of Reed Bunting

Students' Field Observations	Frequency of Student Pairs N=17	Male Pairs N=17	Female Pairs N=17	Plausible Description of the Bird	Implausible Description of the Bird
Bird Recorded	9 (53%)	3(18%)	6(35%)	A brown and a small bird Many inside the reeds	Birds are black
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	8(47%)	2(12%)	6(35%)		

Rock Dove (Leeba)

Seven pairs out of 17[41%] indicated to have observed the Rock Dove: three male pairs 3[18% of males] and four female pairs 4[24% of females]. The bird was accurately described by only five pairs 5[29%]: one pair of students 1[6%] described it as grey bird whereas 4[24%] pairs described it as a grey and white bird. The other two pairs 2(12%) provided descriptions that did not match the bird: one pair 1[6%] described it as a purple and white bird and the other pair 1[6%] as a blue and brown bird. Ten pairs 10[59%] neither recorded nor described the bird. The researcher observed the bird in the wetland, and described it as a light grey bird with white colour at the end of the tail' feathers and the wings.

Table 5: Identification of Rock Dove

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	7 (41%)	3 (18%)	4 (24%)	A grey and a white bird	A purple and white bird A blue and brown bird
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	10(59%)	2(12%)	8(47%)		

Barn Swallow (Lefokotsane)

Four of the 17 pairs 4[24%] of students indicated to have identified the Barn Swallow (Lefokotsane), and they were all female. All four provided a plausible description of the bird, either in terms of colour and behaviour: two pairs 2[12%] described it as a dark grey bird and the other two pairs 2[12%] described it as a bird that has a fish tail made by its feathers and flies fast. Majority of pairs of students, thirteen pairs, 13[76%] neither recorded nor described the bird. The researcher observed the bird and described it as "a *small bird with a dark grey colour and a fish like tail."*

Table 6: Identification of Barn Swallow

Students' Field Observations	Frequency of Student Pairs N=17	Male Pairs N=17	Female Pairs N=17	Plausible Description of the Bird	Implausible Description of the Bird
Bird Recorded	4 (24%)	0(0%)	4(24%)	A dark grey bird. A fish tail made by its feathers. It flies fast.	
Bird not Recorded, but Described					
Bird neither Recorded nor Described	13(76%)	5(29%)	8(67%)		

Heron (Kokolofitoe)

Majority of students, fourteen pairs 14[82%], indicated to have observed Heron: four male pairs 4[24% of males] and ten female pairs 10[59% of the females]. A total of twelve pairs 12[71%] provided a plausible description of the bird, either in terms of colour or features: eight pairs 8[47%] mentioned it as a tall grey and a white bird: - two pairs 2[18%] described it as a white and silver black bird with a long neck. Two pairs out of 17[12%] pairs of students described heron as a bird with long legs and a long neck: "*It has long neck, it is grey in colour and it has another white colour."*

Only one pair, 1(6%) that listed the bird, incorrectly mentioned that it is black. One pair 1[6%] marked the bird on the check-list without a description. Three pairs 3[18%] of students did not indicate seeing the bird. The researcher recorded the heron in the field and described it thus:

"*A tall bird with a long neck, a long beak and long legs. It is light grey with white and black colour at the tips of the wings."*

Table 7: Identification of a Heron

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	14 (82%)	4 (24%)	10 (59%)	A grey and white bird Tall bird Long beak Long neck and long legs	A white and black bird
Bird not Recorded, but Described	1(6%)	0(0%)	1(6%)		
Bird neither Recorded nor Described	2(12%)	1(6%)	1(12%)		

Cape Turtle Dove (Lekunkuroane)

Ten pairs of students out of 17[59%] indicated to have observed the Cape Turtle Dove: two male pairs 2[40% of males] and eight pairs of females 8[47% of females]. A total of seven

pairs 7 [42%] students gave a plausible description of the bird as follows: one pair of students 1[6%] stated that the bird is grey, one pair 2[12%] described it as a greyish fat red bird; while four pairs 4[24%] described it as a silver grey bird. Three pairs of students 3[18%] inaccurately recorded the bird as follows: 4[24%] described that it is blue purple: *"Blue purple"*; one pair 1[6%] mentioned that it is a blue and white bird; Seven pairs of students 7[41%] did not identify the bird in the field. The researcher recorded Cape Turtle Dove as a reddish grey bird and bigger than the rock dove.

Table 8: Identification of Cape Turtle Dove

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird recorded	10(59%)	2 (12%)	8 (47%)	The bird is grey A silver greyish red and a fat bird.	It is blue purple. A blue and white bird
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	7(41%)	3(18%)	4(24%)		

African Yellow Warbler (Motintinyane)

Five out of 17[29%] pairs of students indicated to have observed the African Yellow Warbler: two male pairs 2[40% of males] and three female pairs 3[18% of females]. Five pairs of students 5[29%] gave a plausible description in terms of its colour as follows: Three pairs 3[18%] described it as a yellow and a black bird while the other pair 1[6%] of students

described it as a yellow bird with black stripes. One pair of students 1[6%] described the bird in terms of size and stated that it is a small bird. African Yellow Warbler was not mentioned by twelve pairs of students 12 [71%]. The researcher's field notes in relation to the bird stated that "*It is a small yellowish bird."*

Table 9: Identification of African Yellow Warbler

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	5 (29%)	2 (12%)	3 (18%)	It is a yellow and a black bird It is a small bird It is yellow with black stripes	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	12(71%)	3(18%)	9(53%)		

Cattle Egret (Leholosiane)

Cattle Egret was recorded by seven pairs 7[41%] and a slightly higher percentage of male pairs 4[24%] of males] as compared to three female pairs 3[18% of females] reported identifying it. All the seven pairs, 7[41%] accurately described Cattle Egret as a tall and a thin bird with the white body or white feathers. One pair of the seven pairs further also described it behaviourally as a bird that herds the cattle, "*E tšoeu e alosa liphoofolo tse pela mokhoabo,*" due to its occurrence around livestock. Cattle Egret was not identified by ten pairs of students 10[59%]. The researcher also recorded that it is a white middle-sized bird.

Table 10: Identification of the Cattle Egret

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	7(41%)	4(24%)	3(18%)	Has a white body or white feathers The bird is tall A thin bird	.
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	10 (59%)	1(6%)	9(53%)		

Barn Swallow (Lenkabelane)

Most students, ten pairs out of 17[59%], indicated observing the Barn Swallow. Of the 10 pairs, four were male pairs 4[24% of males] and six female pairs 6[35% of females]. A total of six pairs 6[35%] provided a plausible description as follows: four pairs 4[24%] mentioned that it is a dark grey bird, and two pairs 2[12%] stated that it is as a thin and silver bird. Other descriptions were rather inaccurate: four pairs 4[24%] described it as a black bird and two pairs of students 2[12%] as a black and white bird. The other seven pairs 7[41%] did not identify the bird in the field. The researcher recorded it behaviourally as a "*fast flying dark grey bird."*

Table 11: Identification of Barn Swallow

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	10(59%)	4(24%)	6(35%)	A dark grey bird The bird is thin and silver	• A black and white bird
Bird not Recorded, but Described OR birds recorded but not described	1(6%)	1(6%)	0(0%)		
Bird neither Recorded nor Described	6(35%)	0(0%)	6(35%)		

White-necked Raven (Lekhoaba)

Less than half of the pairs of students 6[35%] claimed to have observed the White-necked Raven: five male pairs 5[29% of males] and one female pair 1[6% of females]. Of these six pairs, four pairs 4[24%] gave a plausible description of the bird as follows: All four pairs 4[24%] described the bird as a black and a white-necked bird. Two pairs inaccurately or vaguely described it as: one pair of students 1[6%] described it as black bird. *"E ntšo hohle,*" and the other pair of students 1(6%) described the bird as a tall. More than half of the pairs of

students 11(65%) did not mention White-necked Raven. The researcher observed the bird in the field, and recorded it as a black and white necked bird and white in the chest.

Table 12: Identification of White-necked Raven

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	6(35%)	5(29%)	1(6%)	Black bird with a white colour on the neck A black and white bird	The bird is just black A tall bird
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	11(65%)	0(0%)	11(59%)		

Southern Masked Weaver (Letolonche)

Only one pair of students 1[6%] identified the Southern Masked Weaver, and this was a male pair. The bird was accurately described as a black and a yellow coloured bird. All the other sixteen pairs, 16[94%] did not record the bird. The bird was also not identified by the researcher.

Table 13: Identification of Southern Masked Weaver

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	1(6%)	1(6%)	0(0%)	Is a black and yellow coloured bird	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	16 (94%)	4 (24%)	12(71%)		

Cape Crow (Mokhoabane)

Four pairs of students 4(24%) recorded to have observed the Cape Crow: two male pairs 2[12% of males] and two female pairs 2[12% of females]. All pairs, 4[24%], accurately described the bird as a pure black bird. Thirteen pairs 13(76%) of students did not mention nor describe the bird. The researcher observed the bird and recorded: "*The bird is black.*"

Table 14: Identification of Cape Crow

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	4(24%)	2(12%)	2(12%)	A black bird	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	12(71%)	2(12%)	10(59%)		

House Sparrow (Seroebele-sa-matlo)

Seven pairs of students 7[41%] out of 17 pairs listed the House Sparrow: one male pair 1[6% of males] and six female pairs 6[35% of females]. All seven pairs, 7[41%], gave a plausible description of the bird as follows: three pairs 3[18%] described the bird as light brown in colour, one pair of students 1[6%] described it as small in size, and three pairs 3[43%] stated that it has brown, black and white patches. The House Sparrow was neither mentioned nor described by more than half of the pairs of students 10[59%]. The researcher reported that it is a brown bird with black stripes and grey or white chest.

Table 15: Identification of House Sparrow

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	7(41%)	1(6%)	6(35%)	• Small in size • It has brown, black and white patches • As a light brown bird in colour	
0(0%)	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	10(59%)	4(24%)	6(35%)		

African Pied Starling (Leholi)

Only one male pair of students 1(6%) indicated seeing the African Pied Starling (Leholi) in the wetland, and this pair described the bird as a black bird with white feathers on wings and under its neck. All other sixteen pairs of students 16(94%) did not mention the bird. The bird was observed and recorded by the researcher as black with white chest.

Table 16: Identification of African Pied Starling

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	1(6%)	1 (6%)	0(0%)	A black bird with white feathers on wings and under its neck	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	16(94%)	4(24%)	12(71%)		

Black-and-white Shrike (Ts'emeli)

Black-and-white Shrike was reported by 6 pairs out of 17(35%) pairs of students, whereby 2[12%] were male pairs; while four 4(24%) were female pairs. Five [29%] gave a plausible description of the bird as a black and white bird. One pair of students, 1[6%], was less accurate and described it as a short bird that has a deep voice. The researcher observed and mentioned the bird as a black and white.

Table 17 Identification of Black-and-white Shrike

Students' Field Observations	Frequency of Student Pairs N=17	Male Pairs N=17	Female Pairs N=17	Plausible Description of the Bird	Implausible Description of the Bird
Bird Recorded	6 (35%)	2(12%)	4(24%)	It is a black and white bird	Deep voice and a short bird
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	11(65%)	3(18%)	8(47%)		

Rock Kestrel (Seotsanyane)

Only one male pair of students 1 (6%) recorded observing Rock Kestrel. The pair further described the bird accurately in terms of colour and behaviour, as a black and white bird, that can hover: "*Ke nonyana e ntšo le bosoeu, e ea binela."* The rest of students, sixteen pairs 16(94%), did not record the bird. The researcher too did not spot this bird.

Table 18: Identification of Rock Kestrel

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	1 (6%)	1 (6%)	0(0%)	A black and white bird that can hover	
Bird not Recorded, but Described	0(0%)	0(0%)	1(6%)		
Bird neither Recorded nor Described	15(88%)	4(24%)	11(65%)		

Lanner Falcon (Phakoe)

Seven pairs of students, 7[41%], indicated observing Lanner Falcon: three male pairs 3[18% of males] and four female pairs 4[24% of females]. Six pairs 6[35%] gave a plausible description of the bird as follows: three pairs 3[18%] described it as a grey bird with sharp nails: "*E 'mala o mothokoa, e manala a matelele,"* and the other three pairs 3[18%] described it as a silver or dark grey bird. One pair, 1[6%], inaccurately identified it as a black bird. Ten

pairs of students, 10[59%], did not record this bird. The researcher observed the bird and stated:

"The bird is greyish in colour."

Table 19: Identification of Lanner Falcon

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	7(41%)	3(18%)	4(24%)	It has sharp nails A dark or silver grey	A black bird
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	10(59%)	2(12%)	8(47%)		

Hamerkop (Mamasianoke)

Hamerkop was reported being observed by only one pair of students 1(6%) and this was a male pair. The student provided a plausible description of the bird as brown in colour. The majority of students, 16(94%) pairs, did not record the bird. The researcher did not see and record this bird as well.

Table 20: Identification of Hamerkop

Students' Field Observations	Frequency of Student Pairs N=17	Male Pairs N=17	Female Pairs N=17	Plausible Description of the Bird	Implausible Description of the Bird
Bird Recorded	1(6%).	1(6%).	0(0%)	A brown bird	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	16(94%)	4(24%)	12(71%)		

Unknown (Fotha)

Fotha was added as another bird to the provided list by only one pair of students, 1(6%), and this was a male pair who described it as a brown small bird with black and grey colours. The bird was neither recorded nor described by the rest of sixteen pairs 16(94%). The recorded bird is not known by the researcher.

Table 21: Identification of Fotha

Students' Field Observations	Frequency of Student Pairs N=17	Male Pairs N=17	Female Pairs N=17	Plausible Description of the Bird	Implausible Description of the Bird
Bird Recorded	1(6%)	1(6%)	0(0%)	A brown bird	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	16(94%)	4(24%)	12(71%)		

4.2.4 Reflection phase

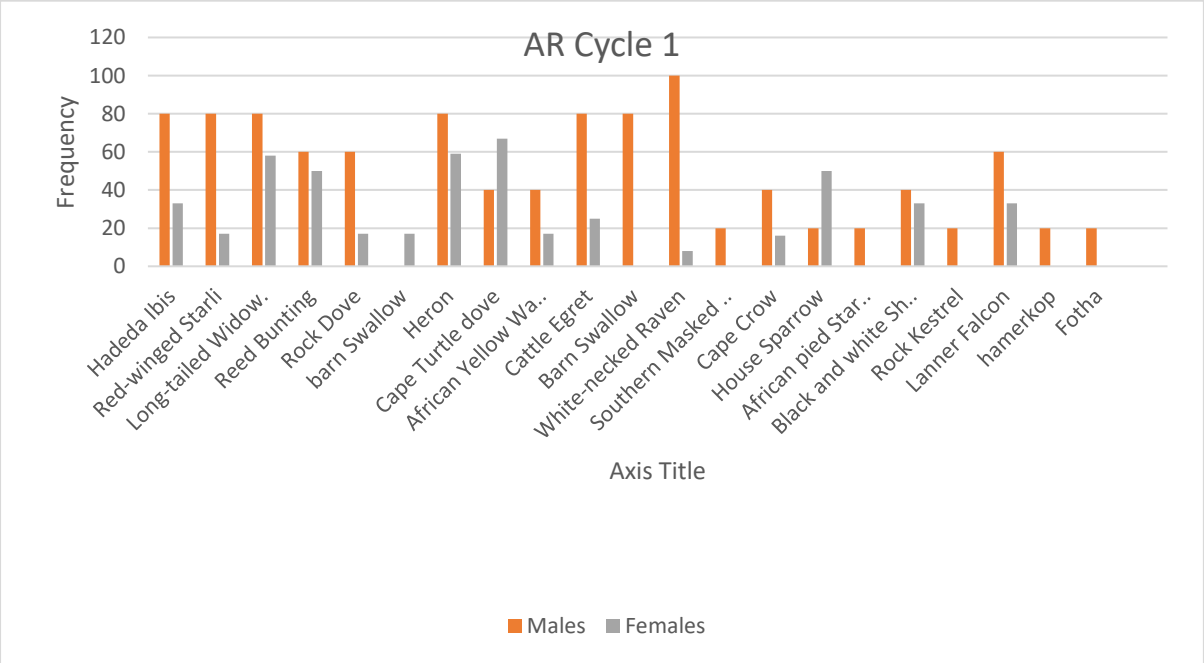
Following the field trip, the researcher prepared a set of questions for students to answer and reflect on their experience (see Appendix E). The reflection questions were answered by students in their pairs in writing. They then presented their responses which were noted on the board for the whole class discussion. The formulated reflection questions covered the following areas: most frequently identified and recorded birds; description of birds and how the next trip could be improved with regard to ecological literacy.

The reflection session revealed that the total number of birds that the students purported to have observed in the Pitseng wetland were 21. Of these birds, the six most frequently mentioned were: Kokolofitoe (Heron) by 82%, with plausible description by 71%; Lengangane (Hadeda Ibis) by 65%, with a plausible description by 29%; Molepe (Long-tailed Widowbird) by 65% with a plausible description by 65%; Lenkabelane (Barn Swallow) by 59% with a plausible description by 24%; Lekunkuroane (Cape Turtle Dove) by 59% with a plausible description by 29% and Tsoere (Reed Bunting) by 53% with a plausible description by 41%.

Five new birds, 5(24%), were reported to have been identified in this cycle and these were: Lekunkuroane (Cape Turtle Dove) by 59%), with a plausible description by 29%; Motintinyane (African Yellow Warbler) by 29%, with a plausible description by 29%; Letoloptje (South masked Weaver) by 6%, with a plausible description by 6%; Seotsanyane (Rock Kestrel) by 6%, with a plausible description by 6% and Fotha (Unknown) by 6%.

Gender-based findings (see Appendix I on page 46) revealed that a higher number of male pairs tended to provide more plausible descriptions of birds than female pairs, and examples of such birds include: White-necked Raven (60%), Cattle Egret (80%), Long-tailed Widowbird (80%) and Hadeda Ibis (100%). Male students also identified and gave more plausible descriptions of 4 (24%) birds which were not recorded by female pairs, and the birds are as follows: Hamerkop, Rock Kestrel, African Pied Starling and Southern Masked Weaver; all by 6%. The bird descriptions among the students were as follows: 6 (35%) birds had plausible descriptions of at least 50% of the females, and 10(59%) birds had plausible descriptions of a minimum of 50% males.

Figure 1: Identified wetland birds by males and females in Cycle1



The reflection session revealed that students frequently recorded six birds and the bird identified with the highest percentage, (82%), was Heron. This became apparent when students answered the question "*How has your knowledge been changed by the birds you have learned from the wetland"* - and the typical plausible responses by 71% and were as follows:

Many pairs of students (47%) described its colour and other features as a tall, grey and a white bird; 18% described it as a white and silver black bird with a long neck and 12% pairs of students described heron by its size as a bird with long legs and a long neck. Only one pair of students, (6%), stated incorrectly that the bird is black.

In addition to the guidance of birds provided on the worksheet, the discussion revealed that students used different Sesotho names for some of the same birds that were observed during the fieldwork and that, in some cases, they might not have made a distinction in their identification of different bird species of the same family. For instance, the students seemed to use the names Lenkabelane and Lefokotsane interchangeably for Swallow species, whereas these can be different species for Greater Striped Swallow and Red Breasted Swallow or White Throated Swallow (Ambrose, 2020) respectively. The description of Fotha, mentioned by a pair of boys, (6%), which the researcher stated as unknown, seemed to fit the House Sparrow, suggesting that the former is a rarely used name for a House Sparrow.

The students' descriptions of their listed birds, on the other hand, were not clear enough in many cases to clearly depict the bird and it is possible that they did not care to provide the required details to make a clear distinction between similar birds. Colour descriptions used for some birds were implausible; for example, blue, purple and silver birds for grey colour. It is also noteworthy that some birds which were recorded by students were not observed by the researcher, and that the students could have observed these birds far from where the researcher was during their wetland exploration.

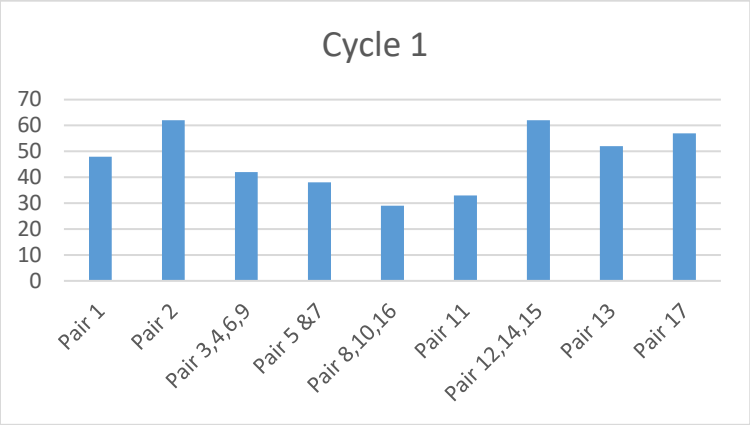
Students had insightful views on the field trip itself, suggesting a sound appreciation of the behaviour of birds. They also suggested that the next field trip to the wetland could be improved by visiting it late in the afternoon around 16hr00 when more birds, which left the wetland during the day, are back. They also suggested that the visit should be early in the morning around eight o'clock when the birds are not hiding from the heat inside the long grass or reeds, and when many birds have not yet left the wetland. They further suggested that photos should be captured if possible for reference and more clarification during the reflection phase.

Summary for Cycle 1

The students recorded a total of 21 birds during the first cycle field trip, but the number of birds recorded by individual pairs varied. Methods used to collect data and to address research questions were students' open ended questionnaires, observation of birds and use of

worksheets**.** The record was as follows: pair 1 recorded 10 (48%) birds; pair 2 recorded 13 (62%) birds; pairs 3, 4, 6 and 9 recorded 9 (42%) birds; pairs 5 and 7 recorded 8 (38%) birds; pairs 8, 10 and 16 identified 6 (29%); pair 11 recorded 7 (33%) birds; pairs 12, 14 and 15 recorded the highest number of birds with 13 (62%); pair 13 recorded 11 (52%) and pair 17 recorded 12 (57%) birds. Pairs 1 to 12 were female pairs while pairs 13 to 18 were male pairs.

Figure 2: Number of birds identified by pairs of students



Many of the students' recorded birds, however, the birds did not match well with the descriptions the students provided for them. It became apparent that the number of birds seen and recorded may also depend on the time of the day the field trip was taken. The discussion and corrections made in class, as part of reflection, indicated that there was a need to conduct the second cycle and such field trip was to be improved by visiting the same wetland at a different time of the day. Students seemed to be more interested and ready to visit the wetland after the reflection exercise.

4.3 THE SECOND CYCLE

The whole class, of 34 students, participated in the second cycle activities and all students were present.

4.3.1 Planning Phase

In preparation for the 'action phase,' the researcher prepared the same worksheet that was used in the first cycle to be filled by students during their exploration of the wetland.

4.3.2 Action Phase

The action of the second cycle was taken on the 9th March 2023. Based on the reflection, the time for the visit to the wetland for Cycle 2 was changed from twelve noon to four o'clock in the afternoon. Students worked in the same pairs as in Cycle 1 and followed the same observation procedures as in Cycle 1.

The researcher went around checking on the students. Photos of the wetland and some wetland birds were captured as part of data (see Appendix F). Capturing of photos in a research becomes an observational data and photos are accurate and reliable sources of data (Cleland & MacLeod, 2021). The researcher kept her own journal on the experiences about the field trip.

Figure 3: 34 participants in Pitseng wetland

Figure 4: Pitseng wetland ecosystem

Figure 5: Pairs of students

4.3.3 Observation Phase

This section presents the findings (see appendix G) on students' conceptions of birds, based on their submitted field worksheet records in relation to the Pitseng wetland.

Long-tailed Widowbird (Molepe)

All pairs of students, 17(100%), indicated to have observed the Long-tailed Widowbird: five male pairs 5(29% of males) and twelve female pairs 12(71% of females). All seventeen pairs 17(100%) who identified the bird gave a plausible and accurate description of the bird as a black and a long-tailed bird. The researcher observed the bird and recorded it as a black bird with a long tail. Figure 5 below is the picture of the bird, and was captured by a student in the wetland.

Figure 6: Long-tailed Widowbird in Pitseng wetland

Table 22: Identification of Long-tailed Widowbird

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	17(100%)	5(29%)	12(71%)	A black bird with a long tail	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	0(0%)	0(0%)	0(0%)		

Heron (Kokolofitoe)

All seventeen pairs, 17(100%), indicated observation of Heron (Kokolofitoe): Five male pairs 5(29% of male pairs) and twelve female pairs 12(71% of female pairs). A total of seventeen pairs 17(100%) provided a plausible description as follows: eight pairs 8(47%) recorded it as a tall bird with a long neck: "*Nonyana e kholo e maoto a matelele le molala oa teng omo telele haholo*"; seven pairs of students 7(41%) described it as a grey, a black and a white coloured bird "*E thokoa e ntšo mapheong, e tšoeu ka limpeng"* and two 2 (12%) stated that it is black and grey. The researcher recorded it as a tall bird with long feet and neck, with grey, white and black colours. Figure 6 below shows the pictures of the bird, captured by students at the wetland during the field trip.

Figure 7: Heron in Pitseng wetland

Table 23: Identification of Heron

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	17(100%)	5(100%)	12(100%)	A tall bird with a long neck This bird has a grey, a black and a white colour A black and a grey bird	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	0(0%)	0(0%)	0(0%)		

Hadeda Ibis (Lengangane)

The majority of pairs of students, 16(94%), indicated observation of Hadeda Ibis: four male pairs 4(24% of males) and twelve female pairs 12(71% of females). A total of sixteen pairs 16 [94%] provided a plausible description as follows: thirteen pairs 13(76%) of students recorded it as a dark grey bird: *"A mathokoa bo tebileng*; three pairs 3(18%) as a bigger bird with a long beak "e *kholo le molomo o motelele.*" One pair 1(6%) did not identify the bird. The researcher recorded it as a dark grey bird with a black colour at the ends of the wings and tail. The researcher further recorded that it has a long beak. The picture below (Figure 8) shows a pair of Hadeda Ibis, shot during the field trip by one male student at the wetlands.

Figure 8: Pair of Hadeda Ibis in Pitseng wetland ecosystem

Table 24: Identification of Hadeda Ibis

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	16(94%)	4(24%)	12(71%)	A dark grey bird A bigger bird with a long beak	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	1(6%)	1(6%)	0(0%)		

Reed Bunting (Tsoere)

All pairs of students, 17(100%), indicated to have observed the Reed Bunting: five male pairs 5(29% of males) and 12 female pairs 12(71% of females). Eleven pairs 11(82%) gave a plausible and accurate description as follows: eight pairs 11(65%) described it as a small bird and most of the time found inside the reeds: "*Ke nonyana e nyane e sootho, e ipata kahara lehlaka*"; and three pairs 3(18%) stated that it is a brown bird. However, a total of six pairs 6(35%) inaccurately recorded the bird as follows: three pairs 3(18%) described it as a black bird found in wetland trees and three pairs 3(18%) described it as a grey bird. The researcher observed the bird in the field and recorded it as a small brown bird with black stripes and a grey chest.

Table 25: Identification of Reed Bunting

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=5**	**Female Pairs N=12**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	17(100%)	5(100%)	12(100%)	It is a small bird and most of the time found inside the reeds. It is a brown bird.	Found inside wetland trees It is black. A grey bird
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	0(0%)	0(0%)	0(0%)		

House Sparrow (Seroebele-sa-matlo)

Fourteen pairs, 14(82%), of students indicated to have observed the House Sparrow: three male pairs 3(8% of males) and eleven female pairs 11(65% of females). The bird was accurately described by eleven pairs 11(65%) as follows: seven pairs 7(41%) stated that it is a brown, white and black bird: "*Se light brown, se setšo le bosoeu*"; two pairs 2(12%) described it as light brown and two pairs of students 2(12%) described it as a small bird. Three pairs provided an implausible description of the bird: two pairs 2 (12%) stated that it is a black bird and one pair 1(6%) recorded it as a grey and black bird *"E black and grey."* Three pairs 3(18%) did not record nor describe the bird. The researcher further observed and described it as a small light brown bird with white and black patches and a grey chest.

Table 26: Identification of House Sparrow

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	14(82%)	3(18%)	11(65%)		
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	3(18%)	2(12%)	1(6%)		

Black-and-white Shrike (Ts'emeli)

Black-and-white Shrike was indicated to have been observed by thirteen pairs of students 13(76%): three male pairs 3(18% of males) and ten female pairs, 10(59% of females). All pairs, 13(76%), described it plausibly correctly as a black and white bird "*Ke nonyana e ntšo e tšoeu."* One pair 1(6%) simply described it as a middle-sized bird. The bird was neither recorded nor described by three pairs 3(18%). The researcher observed the bird and recorded it as a black and white bird.

Table 27: Identification Black-and-white Shrike

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	13(76%)	3(18%)	10 (59%)	A black and white bird	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	4(24%)	2(12%)17	2(12%)		

African Pipit (Ts'ase)

African Pipit (Ts'ase) was indicated to have been observed by twelve pairs out of seventeen 12(71%) pairs: five male pairs 5(29% of males) seven female pairs 7(41% of females). Nine pairs 9(53%) gave a plausible and accurate description of the bird as follows: six pairs 6(35%) recorded it as a light brown bird, and three pairs 3(18%) as a brown small bird; "*e sootho, e tsesane.*" However, a total of three pairs 3(18%) inaccurately recorded the bird as a grey bird; *"it is thin and grey."* African Pipit was not recorded nor described by five pairs 5(29%). The researcher observed the bird in the field and recorded it as a small brown bird.

Table 28: Identification of African Pipit

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	12(70%)	5(29%)	7(41%)	A light brown bird. A small bird.	A grey bird.

Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	5(30%)	0(0%)	5(29%)		

Pied Kingfisher (Seinoli)

Thirteen pairs of students, 13(76%), claimed to have observed Pied Kingfisher: four male pairs 4(24%) and nine female pairs 9(53%). All thirteen pairs 13(76%) plausibly described the bird as follows: three pairs 3(18%) described it as a medium-sized black and white bird; nine pairs 9(53%) emphasised that it is black, "*ke nonyana e ntšo*"; and one pair 1(6%) mentioned that the bird is thin and long. The bird was not recorded nor described by four pairs 4(24%). The researcher observed and recorded the bird as a black bird with white patches and a long beak.

Table 29: Identification of Pied Kingfisher

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17 N=17**	**Female Pairs N=17 N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	13 (76%)	4(24%)	9(53%)	A medium sized black and white bird	It is black and it
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	4(24%)	1(6%)	3(18%)		

White-necked Raven (Lekhoaba)

Ten pairs, 10(41%), claimed to have observed the White-necked Raven: five male pairs 5(29% of males) and five female pairs 5(29% of females). Eight pairs 8(47%) described it plausibly as a black bird with a white colour on the neck and on the chest *"E ntšo e tšoeu molaleng le ka limpeng."* Only two pairs of students 2(12%) inaccurately mentioned that it as a black bird, *"ke nonyana e ntšo."* the bird was neither recorded nor described by seven pairs 7(41%). The researcher recorded that the White-necked Raven as a black bird with white collar and a white chest.

Table 30: Identification of White-necked Raven

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	10(59%)	5(29%)	5(29%)	A black bird with a white colour on the neck and on the chest	A black bird
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	7(41%)	0(0%)	7(419%)		

Cattle Egret (Leholosiane)

Eleven pairs of students, 11(65%), indicated to have observed the Cattle Egret: four male pairs 4(24% of males) and seven female pairs 7(41% of females). All eleven pairs 11(65%) gave a plausible description of the bird as follows: seven pairs 7(41%) described it, either by colour and behaviour, as a white bird that it is found near the cattle in a wetland, "*e tšoeu, e alosa liphoofolo tse pela mokhoabo"*; two pairs 2(18%) said that it is a thin and a tall bird and two

pairs 2(18%) further recorded that it has yellow feet. Six pairs did not identify the bird. The researcher also observed the white bird near cattle in the wetland.

Table 31: Identification of Cattle Egret

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	11(65%)	4(24%)	7(41%)	Has a white body or white feathers The bird is tall and thin The bird has yellow feet	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	6 (35%)	1(6%)	5(29%)		

Cape Crow (Mokhoabane)

The Cape Crow was claimed to have been observed by nine pairs, 9(53%), of students: five male pairs 5(29% of males) and four female pairs 4(24% of females). Eight pairs 8(47%) provided a plausible description that it is a black bird *"Ke nonyana e ntšo."* One pair 1(6%) provided descriptions that did not match the bird, and stated that it is black and white, "*ke nonyana e ntšo e nang le bosoeu molaleng.*" The bird was neither recorded nor described by eight pairs 8(47%). The researcher also observed the bird in a wetland and recorded it as a black bird.

Table 32: Identification of Cape Crow

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	9(53%)	5(29%)	4(24%)	A black bird	It is a black and white
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	8 (47%)	0(0%)	8(47%)		

African Yellow Warbler (Motintinyane)

Two female pairs of students, 2(12%), indicated identifying the African Yellow Warbler, and both of the two pairs 2(12%) gave a plausible description of the bird as a small yellow bird, "*a small bird with yellow colour.*" Fifteen pairs 15(88%) neither recorded nor described the bird; the researcher did not observe and record the bird either.

Table 33: Identification of African Yellow Warbler

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	2(12%)	0(0%)	2(12%)	A yellow bird A small bird	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	15(88%)	0(0%)	10 (59%)		

Cape Wagtail (Motjoli)

Five pairs, 5(29%), recorded the occurrence of the Cape Wagtail in the wetland: three male pairs 3(35%) of males) and two female pairs of students 2(12%) of females. Four pairs, 4(24%), accurately described the bird as a light brown and a white bird *"Ke nonyana e sootho e nang le bosoeu."* One pair, 1(6%), inaccurately described it as a black and a white bird; *"ke nonyana e ntšo e nang le bosoeu."* The bird was neither recorded nor described by twelve pairs 12(71%). The researcher observed and recorded the bird as a small greyish brown bird with a small tail.

Table 34: Identification of Cape Wagtail

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	5(29 %)	3(18%)	2(12%)	Brown and a white bird	A black and white bird
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	12(71%)	2(12%)	10(59%)		

Black Duck (Letata)

Most students, 10 pairs out of 17 (59%), indicated observing the Black Duck: five male pairs 5(29% of males) and five female pairs 5(29% of females). A total of 8 pairs 8(47%) provided a plausible description of the bird, either in terms of colour, other features or behaviour as follows: five pairs 5(29%) described the bird as a black bird with white patches on the wings and occur in pairs; three pairs 3(18%) mentioned that the black duck flies even though it spends most of the time swimming. One pair of students 1(6%) stated that it is a short bird, and the birds are found in pairs.

Two pairs 2(12%) inaccurately described the bird as a dark grey bird. The Black Duck was neither recorded nor described by seven pairs 7(41%) of students. The researcher observed and recorded the Black Duck in term of colour and behaviour as a middle-sized black bird with white stripes on the wings, and further stated that the bird can fly even though it is an aquatic bird.

Table 35: Identification of a Black Duck

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	10(59%)	5(29%)	5(29%)	A black bird with white patches on the wing and found in pairs. A black, fat and short bird with white dots on the wings. The black duck flies.	Bird as a dark grey bird
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	7(41%)	0(0%)	7(41%)		

Rock Dove (Leeba)

The Rock Dove was claimed to have been observed by 14 pairs 14(82%) of students: five male pairs 5(29%) of the males) and nine female pairs 9(53% of the females). Of these fourteen pairs 14(82%), ten pairs 10(59%) gave a plausible description of the bird as follows: six pairs 6(35%) described the bird as a light grey bird with white colour on the tail; four pairs 4(24%) recorded that it is a grey bird. Four pairs 4(24%) incorrectly described it as a big reddish grey bird. The bird was not recorded by three pairs 3(18%). The researcher observed and recorded the bird as a light grey bird with white colour at the end of the tail.

Table 36: Identification of Rock Dove

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	14(82%)	5(29%)	9(53%)	A light grey bird with white colour on the tail.	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	3(18%)	0(0%)	3(18%)		

Red Winged Starling (Lets'oemila)

The Red Winged Starling was reported to have been identified by six pairs 6(35%) of students: four male pairs 4(24% of the male pairs) and two female pairs 2(12% of the female pairs). All six pairs 6(35%) gave a plausible description as follows: four pairs 4(24%) described it as a shiny black bird with yellow colour at the end of the tail and wings and two pairs 2(12%) mentioned the bird as a black bird with red colour at the end of the tail. The Red Winged Starling was neither recorded nor described by eleven pairs 11(65%) of students. The researcher observed and recorded the bird as a black bird with reddish orange colour on the tips of the wings and tail.

Table 37: Identification of Red Winged Starling

Students' Field Observations	**Frequency of Student Pairs N=17**	**Male Pairs N=17**	**Female Pairs N=17**	**Plausible Description of the Bird**	**Implausible Description of the Bird**
Bird Recorded	6(35%)	4(24%)	2(12%)	A Black bird with orange colour on the wings A black bird with red wings	
Bird not Recorded, but Described	0(0%)	0(0%)	0(0%)		
Bird neither Recorded nor Described	11(65%)	1(6%)	10(59%)		

4.3.4 Reflection Phase

The researcher prepared the reflection questions (see Appendix H**)** and students answered in their pairs and noted the answers down, which were then generally discussed by the whole class. The reflection questions covered the following areas: How the students' knowledge changed as a result of field trip challenges the students encountered during the field trip and how such challenges could be solved in the next trip.

Sixteen birds in all were mentioned by students in this cycle. The six most frequently mentioned birds were: Kokolofitoe (Heron) by (100%), with a plausible description by 100%; Lengangane (Hadeda Ibis) by 94%, with a plausible description by 94%; Molepe (Long-tailed Widowbird) by 100% with a plausible description by 100%; Tsoere (Reed Bunting) by 100%

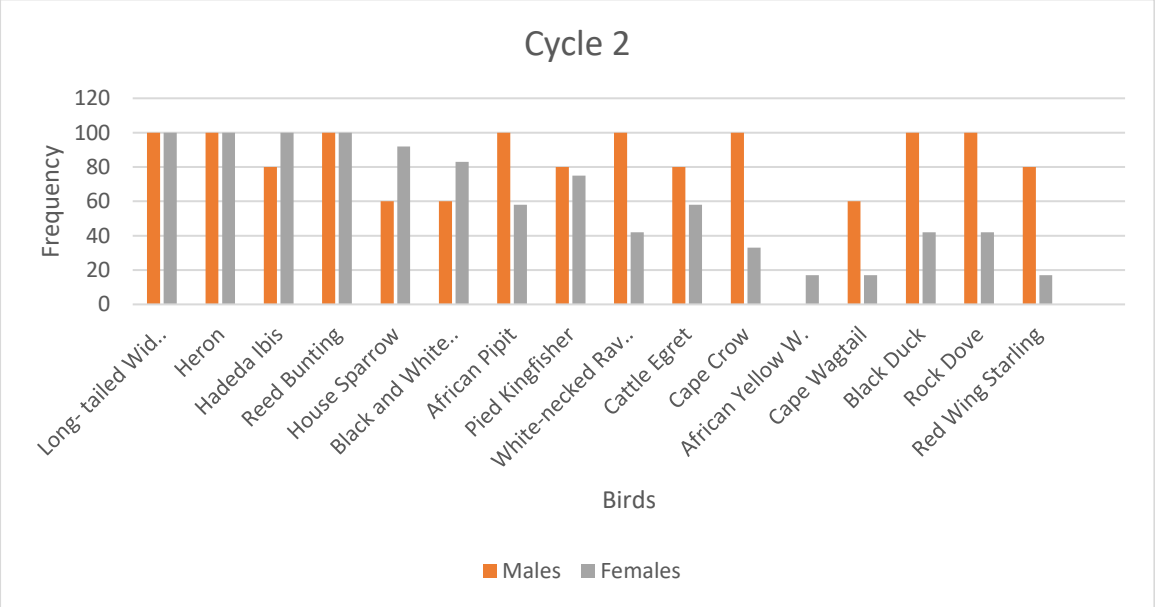
with a plausible description by 82%; Seroebele (House Sparrow) by 82% with a plausible description by 65% and Tsoere (Reed Bunting) by 53% with a plausible description by 41%.

Five new birds 5(31%) were observed in Cycle 2 and these were as follows: Seinoli (Pied Kingfisher) by 76%, with a plausible description by 76%; Letata (Black Duck) by 59%, with a plausible description by 47%; Ts'ase (African Pipit) by 71% with a plausible description by 53%; Motintinyane (African yellow warbler) by 12% with a plausible description by 12% and Motjoli (Cape Wagtail) by 29% and a plausible description by 24%.

Seven birds were reported to have been identified in Cycle 1 but not in Cycle 2, and these were: African Pied Starling, Lefokotsane (Barn Swallow), Phakoe (Lanner Falcon), Lekunkuroane (Cape Turtle Dove), Letoloptje (South Masked Weaver), Seotsanyane (Rock Kestrel) and Fotha (Unknown). On the other hand, four birds were seen in Cycle 2, but not seen in Cycle 1 and these were the following: Seinoli (Pied Kingfisher), Letata (Black Duck), Ts'ase (African Pipit) and Motjoli (Cape Wagtail).

Gender-based results (see Appendix G) revealed that the majority of both male and female pairs described more birds plausibly at higher percentages. Among the gender groups, 10(59%) had plausible descriptions by at least 50% of the females, and 11(65%) birds had plausible descriptions of a minimum by 50% of the males.

Figure 9: Plausible description of wetland birds by male and female students



The field trip reflection session revealed that the students' descriptions of their listed birds were clear enough in many cases, which suggests that they were largely familiar with the birds. A larger number of students, as compared to Cycle 1, indicated to have observed wetland birds with a higher percentage of plausible description. For instance, the five most frequently identified birds, in both Cycles 1 and 2, were recorded as follows: Heron from 82% in Cycle 1 to 100% in Cycle 2, with a plausible description from 71% to 100 %; Long-tailed Widowbird from 65% to 100% with a plausible description from 65% to 100%; Reed Bunting from 53% to 100%, with a plausible description from 41% to 82%; Hadeda Ibis from 65% to 100 %, with a plausible description from 29% to 94 % and House Sparrow from 41% to 82% with a plausible description of 41% to 65%.

The reflection session also revealed that students' knowledge of wetlands birds has improved. This became apparent when students answered the question "*How has your knowledge changed after observing birds in the field trip?"* The typical responses by students were that the observed birds were recorded in high percentages and birds were now described in a more plausible way. This claim is supported by the data on plausible descriptions that the students provided in this cycle. For instance, all pairs of students (100%) described the following birds in a correct way, Long-tailed Widowbird was correctly described as a black bird with a long tail; and Hadeda Ibis was plausibly described by all (100%) pairs of students as a dark grey bird with a long beak.

When asked the question "*How has your knowledge been changed by the birds you have learned from the wetland,"* the students gave varied responses, as shown in Table 38 below:

Table 38: Responses to Reflection Questions in Cycle 2

Questions	**Responses**	**Number of pairs%**	**Plausible description %**
New birds discovered in Cycle 2	• Black Duck • Pied Kingfisher • African Pipit • African Yellow Warbler • Cape Wagtail	59 76 71 12 29	47 76 53 12 24

Problems encountered during the trip	• A lot of rain • Birds hiding • Fast flying birds preventing plausible description and capturing of photos	76 12 12	
How the trip could be improved	• Visit the wetland early in the morning before the birds leave the wetland to hunt for food. • The research should be conducted in different seasons and at the same time of the day. • The research could be conducted late in the afternoon when all wetland birds are back from different places. • Observation time of the birds should be extended.	24% 47% 18%	

Thirteen pairs (76%) of students emphasised that the problem encountered during the field trip was a lot of rain which limited free movement and a closer look at some wetland birds (see Table 17). Twelve pairs 12(71%) stated that the other problem was that some birds were still hiding in the tall grass and 24% pairs of students suggested that the visit should be very early in the morning; 18% of the students suggested that in future, the trip to Pitseng wetland ecosystem should be conducted in different seasons but the time for the trip should be the same. More photos should be captured if possible for reference and more clarification during reflection phase.

Summary of Cycle 2

The above findings revealed that the weaknesses and strengths of the field trip from Cycle 1 influenced the improvement of the findings in Cycle 2. The students recorded a total of 16 birds, 5 less than the number of birds observed in Cycle 1, but the birds were observed with higher percentages during the second cycle of the field trip. Data was collected using Students' questionnaires, observation of birds and use of worksheets so as to address research questions. The record was as follows: pairs 1, 6, 10 and 16 recorded 9(42%); pairs 2, 3, and 14 recorded 11(52%) birds; Pairs 4, 9 and 13 recorded 10(48%) birds; 5 and 8 recorded 8(38%); pairs 7, 11 and 15 recorded 12 (57%) birds, and the highest number of birds was recorded by pair 17 as 14(67%) birds. Pairs 1 to 12 were female pairs while pairs 13 to 18 were male pairs.

Figure 10: Identified birds by each pair in Cycles 1 and 2

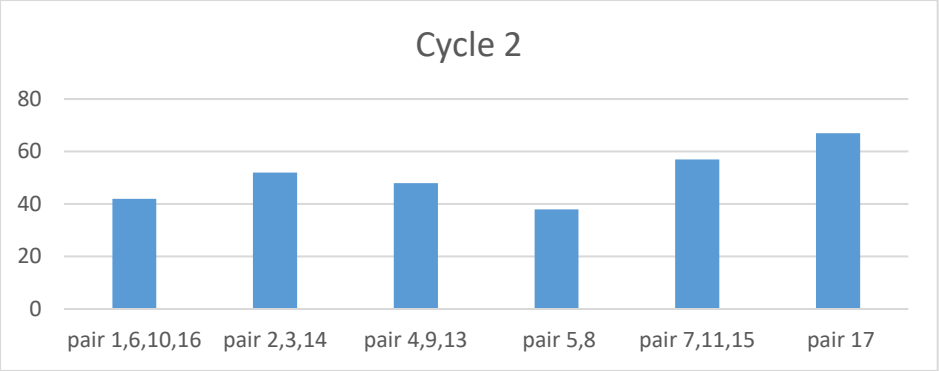
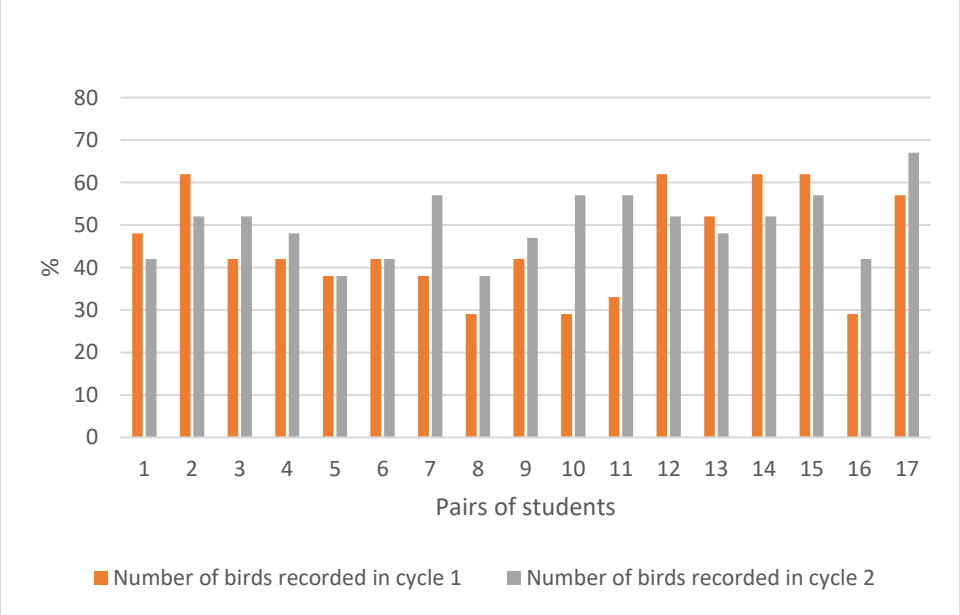


Figure 11: Birds recorded by each pair of students in Cycles 1 and 2



4.4 Conclusion

Chapter four presented the results that were obtained in relation to two cycles of action research conducted. Results presentations were based on the research questions and the presented data analysis was guided by students' competency on the two selected ecological literacy tenets. For each of the presented two cycles of action research, the chapter examined the timing of the fieldtrip, as well as the number of birds that the students identified and described. The chapter further illustrated that use of field trip was reflectively improved over the two cycles, leading to more students' plausible description, regardless of gender. The students' reflections on their experience with the field trip were also presented.

CHAPTER 5

DISCUSSION

5.1 Introduction

This chapter discussed analysed results. To achieve this, the discussion focused on the students' knowledge of wetland birds' diversity before and after the field trip, as well as the conception of students on wetland birds in terms of gender.

5.2 The Conception of Students on Wetland Birds and Related Concepts

Research question one sought to find out students' knowledge of birds and related concepts found in the Pitseng wetland ecosystem. Birds are one of the most diverse vertebrates found in Pitseng wetland and constitute a rich biodiversity in this area. The Grade 11 Biology syllabus requires students to know a diversity of organisms using local ecosystems (NCDC, 2020).

5.2.1 Pre-knowledge of Students about Wetland Birds

The study findings reveal that majority of students in this study (82%) could not correctly identify at least three birds found in a wetland, prior to the field trip. This indicates that the students' knowledge of wetland birds before the field trip was low. Only a few students (18%) could correctly mention a maximum of three birds found in the wetland, such as a Cattle Egret (Leholosiane), a Heron (Kokolofitoe) and a Long-tailed Widowbird (Molepe). Some birds such as vulture, eagle and others were incorrectly thought to exist in the Pitseng wetland.

A study by Oyebamiji et al. (2020) found, that only a few of the 345 students who participated in their study could correctly identify and record 10-14 birds found in a wetland. In a similar study, Sarah (2014) attributes the students' limited knowledge of wetland birds to the failure of biology teachers to use the immediate environment for teaching. Sarah (2014) further

indicates that teachers find field work expensive to conduct, takes plenty of time and the large numbers of learners hinder carrying out field work

5.2.2 Students' Knowledge of Wetland Bird Diversity

The ability to identify organisms in an ecosystem is an important aspect of ecological literacy (Hack, 2015), and this informed the present study to investigate the students' ability to identify birds in the Pitseng wetland. In cycle 1, the field trip was conducted at noon whereas in the second cycle, the visit was at 8:00 a.m. but the results correlate with the findings of Schneider (2023) whose conclusions stated that the best birding hours for people looking to find most birds ranges between 7 and 10 a.m. The students identified a total of 21 bird species in cycle 1 and 16 birds in cycle 2 based on the two action research questions showing that the Pitseng wetland is rich in bird diversity.

Rosen (2011) stated that a bird watcher might observe birds by using their naked eyes, by using visual enhancement device like binoculars or a telescope, by listening for birds sound or voices and by watching webcams and students in the current study observed birds using their naked eyes. In general, the study has found that there were variations in knowledge of wetland birds among students based on the two action research cycles carried out to determine students' knowledge level.

The students' five most frequently identified birds such as Heron, Hadeda Ibis, Reed Bunting and Long-tailed Widowbird are reported by Ambrose (2020 as fauna that are found in wetlands in Lesotho. The findings of the study show that the majority of the students identified more than ten of the birds from the guiding tool given; the worksheet. In a similar study, Yli-Panula et al., (2014) found that secondary students were aware of animals living in ecosystems, especially mammals and birds. However, findings by Radler et al. (2021) revealed that students' knowledge of birds was not higher than that of employees from different sectors. These were employees who were lecturers and administrative staff.

Pied Kingfisher and Black Duck were also recognised in addition to the guiding list. All students named the birds in their mother tongue language, Sesotho, and in some cases students might not have made fine distinctions in their identification of birds of the same family. In this regard, the students seemed to use the names Lenkabelane and Lefokotsane interchangeably for Swallow species.

The bird that one student mentioned (Fotha) whose description seems to match the House Sparrow, illustrates that bird names in Lesotho can be highly localised; yet most of the names that the students used in the present study are widely known and used, and are also in line with Ambrose's (2020) documented bird checklist. Given that the school curricula, on the other hand are not explicit about local bird content, it can be argued that much of the students' demonstrated knowledge about birds is informed by their local communities. Ojikit (2014) illustrates that the home environment can play a significant role students' acquisition of knowledge of wetland birds.

5.2.3 Description of Wetland Birds

The students' descriptions of birds that they identified were used to validate their knowledge of the wetland birds, and thus further affirmed their ecological literacy (EL) competence in terms of ability to identify ecosystem biodiversity. Starrison (2022) stated that the birds are identified basically based on shape, size, colouring, unique field marks such as wing marks, feathers and tail size. Other features include behaviour, habitat, sound, food , season and range as well as geographical location The results of the study show that students' descriptions of birds were mainly on few features being the colour, and that a few were related to the size and the behaviour of birds. The plausible descriptions of the identified birds were higher in the second cycle, indicating that the second field trip enhanced the students' knowledge of the birds.

The students' descriptions, on the other hand, made apparent the possible influence of mother tongue in their use of English colour concepts, as well as their possible language limitations (both English and Sesotho) to describe the organisms they observed. For instance, their use of the word 'blue' could have been a literal translation, to English, of a Sesotho word 'putsoa' which could mean both 'blue' and 'grey'; the use of implausible bird colours such as purple and silver points to the students' limited colour-related linguistic repertoire (Le Wei, 2022).

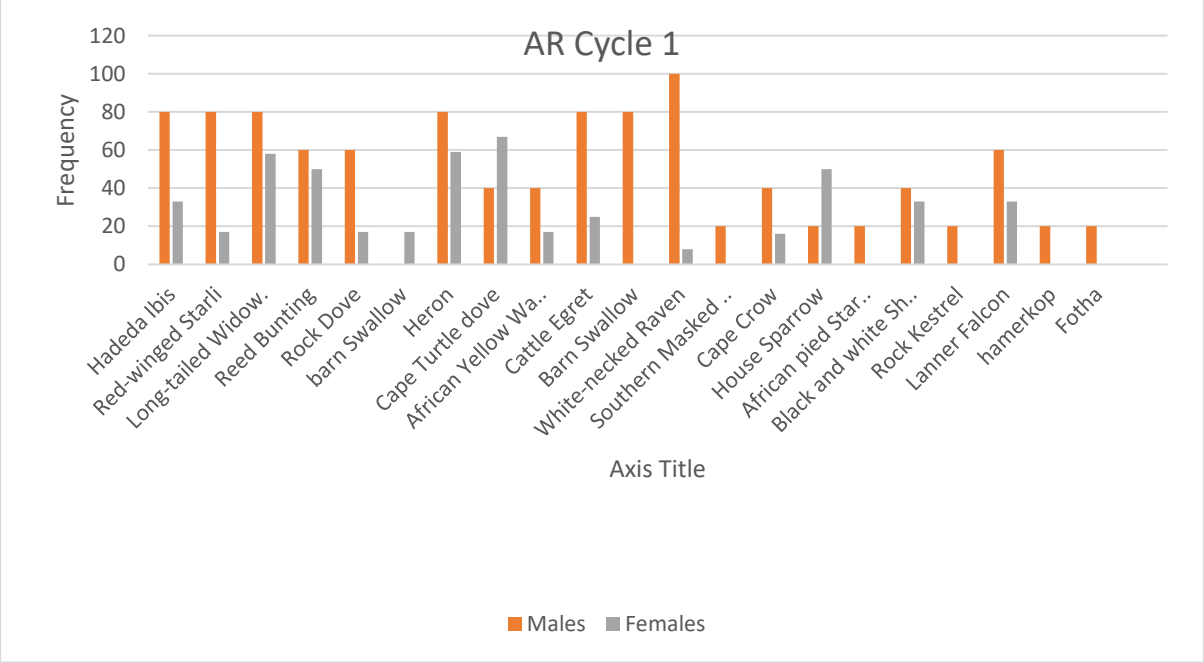
Other limited descriptions seem to have been merely due to lack of the required detail, as students tended to describe the birds in terms of their dominating colour. This may be noted in the description of the Whited-necked Raven (Lekhoaba) as a black bird, without specifying its white patches, which made it indistinguishable from the Cape Crow (Mokhoabane), which is entirely black. Similarly, Heron was described just as a grey bird; the white and black colours were left out. The lack of detail in the description could be due to students' limited of familiarity

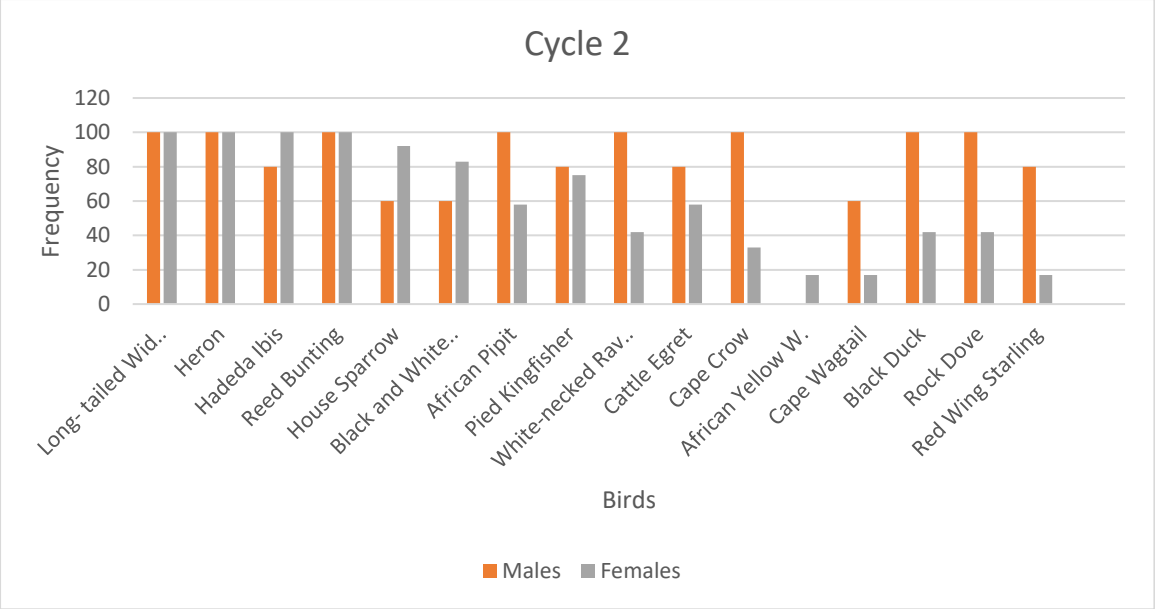
with birds, and seems to parallel the findings of Oyebamiji et al. (2020) that both private and public school's students' ability to adequately describe common birds in their environment and their food resources was low.

5.2.4 Gender Differences

Ecological literacy is correlated with gender among others (Pitman et al., 2018). This study found that the differences in the identification and plausible description of bird species between male and female learners were slightly higher for male learners in cycle 1, and this was a similar view revealed by principal in Khanyane et al. (2016) study which stated that boys in Lesotho perform best in science subjects and the view was not based on any belief. For instance, Cattle Egret was recorded by 41% of the students, which translated to a slightly higher percentage of male pairs 4[24%] of males] as compared to three female pairs 3[18%], and 80% male pairs with plausible description of 60% and 20% female pair with 25% plausible description, and Rock Dove was recorded with male pairs by 18% of males with 40% plausible description of 24% of female with plausible description of 25% plausible descriptions.

Figure 5.1: Identified birds and plausible description by males and females in Cycle 1 and Cycle 2





The above result parallels the findings of Radler et al. (2021) who established that males identified more species of birds than females in a bird watching activity. However, the results obtained by Hummel et al. (2015) using questionnaires showed that girls had consistently higher interest in birds than boys but there were no gender differences as in cycle 1.

5.3 How Students' Knowledge of Birds in Pitseng Wetland and Related Concepts Develops with the Use of Field Trip Approach Overtime

The other research question sought to find out how students' knowledge of birds in the Pitseng wetland developed with the use of field trip overtime, through the reflective process of action research.

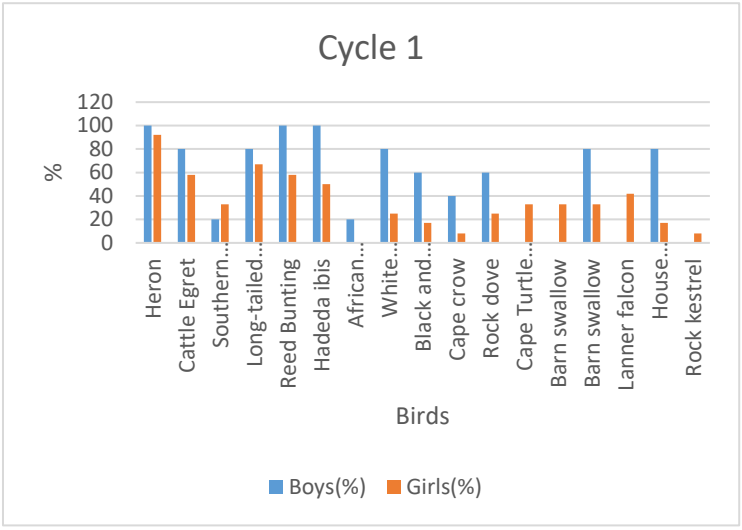
5.3.1 Knowledge of Wetland Bird Diversity

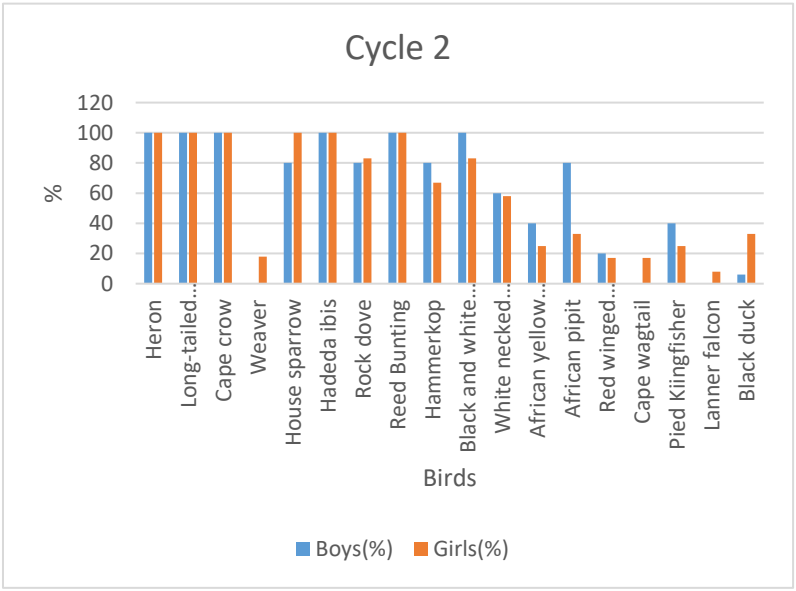
A significant change in the study, brought about by the reflection phase of action research after the first cycle, was to change the fieldwork time in the second cycle. The class visited the wetland in the late afternoon instead of the morning hours, based on the learners' argument that there would be more birds then. This argument was ecologically sound as most birds are active in their habits in the early morning hours, and late afternoon, and this is the time for them to rest. It can therefore be argued that it was expected that during the second field trip cycle, students could observe new birds that they did not see in the first cycle, and that some students would see birds that were much fewer in the first field trip. The Cycle 1 reflection phase also

prepared learners to better identify the birds in the second field trip by use of correct names and plausible descriptions.

The findings indicated that students identified a total number of 16 birds but with higher percentages in the second field trip. Some birds like the Barn Sparrow were identified only in the first field trip. For instance, some birds were identified by the following percentages: Heron from 82% in Cycle 1 to 100% in Cycle 2 and the Long-tailed Widowbird from 65% to 100%. Findings by Rijal et al. (2018) are in line with these results as their findings revealed that more than 79% of students gained knowledge about diversity of vertebrates' characteristics, the status and condition of birds and animals during each field trip activity**.**

Figure 5.2: Birds identified by Males and Females in Cycles 1 and 2



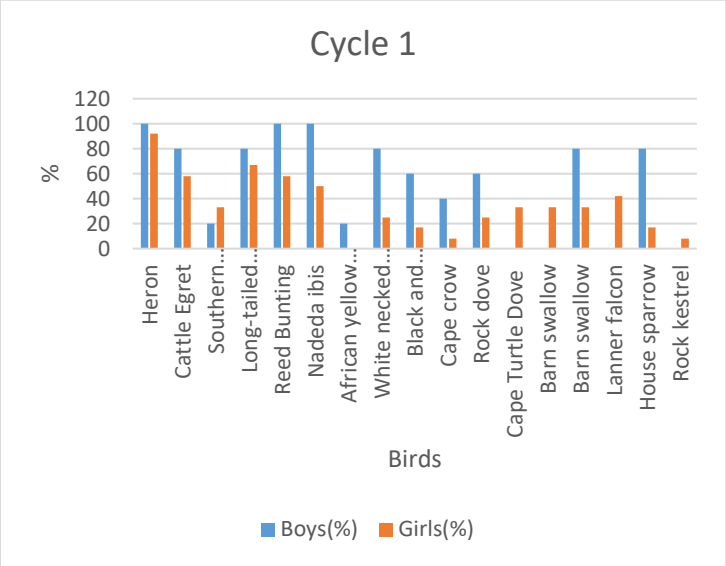


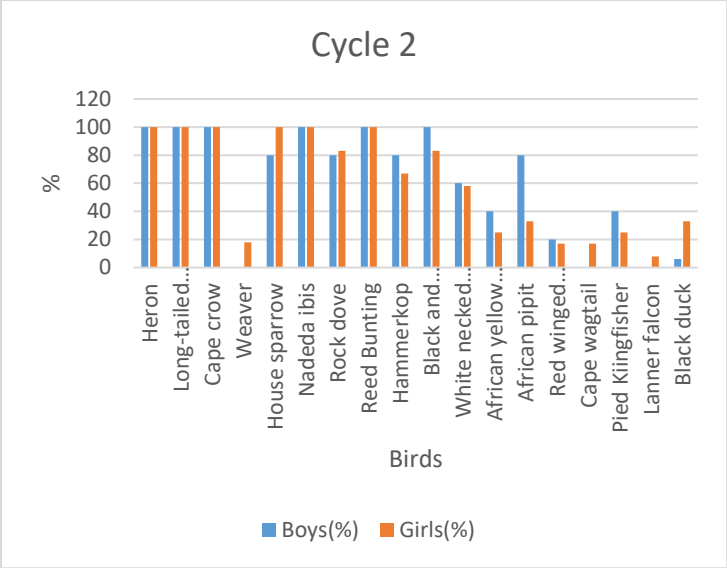
Bird et al. (2020) and Ballard et al. (2017) also show that when students collected data on bird species diversity using the field trip, they gained a broader understanding of birds on their local ecosystem and components within it. Cycle 2 findings affirm the value of outdoor learning to enhance students' knowledge of biodiversity. Adawiah et al. (2014) explored ecological literacy among students with an instrument that used several pictures about animals found in the ecosystems around them, and the study revealed that students' ecological literacy was limited due to their classroom-based learning.

5.3.2 The Knowledge on Description of Wetland Birds

The ability to describe birds is an important dimension of EL as it relates to ability to identify organisms in an ecosystem tenet, as well as an aspect of understanding the natural systems (Hack, 2015). The findings from the current study revealed that the percentage of plausible descriptions of birds after the second field trip also increased. For instance, frequently identified birds were recorded as follows: Heron with a plausible description from 71% in Cycle 1 to 100 % in Cycle 2 and the Long-tailed Widowbird with a plausible description from 65% in Cycle 1 to 100% in Cycle 2.

Figure 5.3: Plausible description by males and females of birds in Cycles 1 and 2





Larsen et al. (2017) demonstrates that exposure to observe biodiversity improves its knowledge, whether virtual or physical. They collected data using both the real and virtual field trips for 211 students and the results generally showed minute differences between levels of knowledge acquisition effectiveness between both field trips.

In conclusion, the results have generally shown that the cyclical use of field trip method results in significant knowledge gains on students' local biodiversity. The students' conception of wetland birds before the field trip, when taught without any exposure to their local environment, was low. After the two field trips, students were able to recognise and identify more birds and this is the reflection of their ecological literacy and this is in line with the ecological literacy concept. Hack (2015) considers the knowledge of students of birds in a wetland as an important indicator of their ecological literacy in that they are able to identify organisms in an ecosystem.

Hammarsten et al. (2019) state that lack of field trips leads to lack of students' ecological literacy. Ecological literacy can be integrated into the science curriculum and be demonstrated in the classroom. That can be achieved by taking students for field trips to local natural ecosystems such as a wetland and teaching them to identify animals such as birds (Hack, 2015).

This study illustrates that ecological literacy, in terms of ability to identify organisms in an ecosystem, is correlated with gender, among others (Pitman et al., 2018), with male students

demonstrating, a better knowledge than female students in identifying more birds in the first cycle.

5.4 Conclusion

This chapter discussed the analysed data so as to address the research questions. The discussion was also based on the theoretical framework, ecological literacy and in relation to the reviewed literature. It was noted that some findings correlated with reviewed literature whereas other findings were in contrast with the literature. It was highlighted that students identified very few birds before they could be exposed to the real local wetland ecosystem and boys identified more birds than girls. However, students' knowledge developed with the use of the field trip overtime, regardless of gender. It was then argued that the field trip method developed ecological literacy of students on wetland ecosystem birds.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

The main focus of this chapter is to state the conclusion of the study, limitations and recommendations of the study based on research questions. This study investigated the development of Grade 11 biology students' knowledge of wetland birds with the use of a field trip. Three research questions guiding the study were: "What is the conception of Grade 11 biology students' knowledge of birds found in Pitseng wetland ecosystem?"; "How does Grade 11 students' knowledge of birds in Pitseng wetland and develop with the use of field trip approach overtime?" and "What is the difference between the conception of male and female students on wetland birds, if any?" In light of these three questions, this chapter summarises the study.

6.1.1. The Conception of Students knowledge of birds found in Pitseng Wetland

The students' descriptions of birds that were recorded were used to validate their knowledge of the wetland birds, and thus further affirmed their ecological literacy (EL) competence in terms of ability to identify ecosystem birds. The results of the study show that students' descriptions of birds were mainly on few features being the colour, and that a few were related to the size and the behaviour of birds. This affirmed low EL because Starrison (2022) stated that the best way to identify of birds should be based on shape, size, colouring, unique field marks such as wing marks, feathers and tail size. Other features that could be used to describe birds include behaviour, habitat, sound, food, season and range as well as geographical location. The plausible descriptions of the identified birds were higher in the second cycle, indicating that the second field trip enhanced the students' knowledge of the birds.

The total number of wetland birds identified by students was twenty-one while Ambrose (2020) states that the number of species in Lesotho has reached 362. Teaching science in ways that promote students' knowledge of their biodiversity can promote its

conservation. Anthropogenic pressures faced by wetland birds, in this context, include overgrazing and use of fertilizers which lead to loss of biodiversity (Chatanga & Sieben, 2019). A wide range of animals, including birds, is essential for a healthy ecosystem (Alfred, 2016). Field trips exposing students to the biodiversity of a local wetland ecosystem connect them with nature both inside and outside of the classroom (Gibbons & Gregory, 2013).

The UN has taken nature conservation measures, such as the UN Decade on Restoration, which aims at restoring ecosystems to achieve the Sustainable Development Goals, mainly in relation to water and biodiversity conservation (UN Decade on Ecosystem Restoration 2021-2030). Furthermore, the UN has proclaimed May 22 as the International Day for Biological Diversity to increase understanding and awareness of biodiversity issues (Waltham, 2020).

Moreover, to address the loss of many migratory birds resulting from illegal killings, the UN Migratory Bird Day is held on 13 May and 14 October annually as an awareness campaign to highlight the need for conservation of migratory birds and their habitats (UN Migratory Bird Day, 2022). To enhance students' knowledge of wetlands birds in this context beyond class field trips, schools can observe these marked international days to further develop students' knowledge of birds and the complex nature of their local ecosystems. Students can achieve this by, among others sharing their comments and personal stories about successes.

6.1.2 How the Students Knowledge of Birds in Pitseng Wetland Developed with the use of Field Trip Overtime?

The study used an enhanced learner-centred approach with the use of field work in order to develop learners' ecological literacy. Based on the research findings, the use of field trip overtime showed significant increase in students' knowledge of birds and this showed the development of students' important aspect of ecological literacy on wetland ecosystem. This competence is in relation to identification of wetland birds and their description, in Cycle 2. The results show that the field trip positively impacted students' wetland ecosystem knowledge of birds. However, students demonstrated limitations in providing plausible description mainly based on colour, size and behaviour.

6.1.3 The Difference Between Male and Female Students on Conception of Wetland Birds

In Cycle 1, gender-based findings revealed that a higher percentage of male students tended to provide more plausible descriptions of birds than female pairs and some birds were not at all recorded by female students. Yet in cycle 2 the majority of both male and female pairs described more birds plausibly at higher percentages. Students' ecological literacy on plausible description of birds developed with time.

6.2. Recommendations and Limitations

Based on the findings already presented and discussed, the researcher wishes to make the following recommendations. The findings can be shared with the relevant stakeholders such as National Curriculum Development Centre, Environment officers, Local Councillors and chiefs, researchers, teachers and students, so that they can. The NCDC should coordinate intervention programmes which expose students more to local ecosystems. A follow up research project on can be made to enhance the use of local ecosystems. The Environment Officers, programmes like ORASECOM and ReNOKA caring for wetlands among others, teachers, students and local councillors can be more integrated with environmental issues, always relating and showing the inter-relations in school subjects.

The Education Policy makers need to incorporate environmental education heavily at schools, primary and secondary. To make biology more relevant to the local ecosystems, science teachers should try out action research-based (AR) field trips in their teaching of ecological topics. Furthermore**,** in order to sustain environmental learning activities beyond short-term science lessons, activities could include observation of UN bird-related international days and formation of school-based birding clubs. In addition, there must an invitation of Guest Resource speakers, debates, drama, film or movie clips organised by teachers. Clubs on environment issues should be established in schools facilitated by teachers

The present research was a case study, and therefore the results are not generalizable to other context. The findings may however be transferred to similar contexts, where they could be tried out by science teachers in their teaching of ecosystems or other forms of

biodiversity. For further research, it is recommended that researchers could explore the conception of students in schools located in different regions of the country, and data be analysed in terms of other demographic variables, such as learners' age and community background.

6.3 Conclusion

This chapter concludes that ecological literacy on wetland ecosystem developed with the use of field trips over time and this was based on the fact that in cycle 2, students' description was more plausible than in cycle 1. Findings also indicated that majority of both males and females demonstrated higher percentage of plausible description in cycle 2 as opposed to cycle 1, where more males identified more birds with plausible description than females. However, the descriptions of wetland birds were mainly on few features such as colour, size and behaviour as opposed to many features which are used in birds' identification. It was also highlighted that the recorded birds aligned with the names of birds in the records of Lesotho birds. The recommendations were that findings be shared with the stakeholders so that students can be more exposed and engaged to more activities in local ecosystems. For further research, the recommendation is that researchers could employ students in schools located in different regions of the country as participants, and data be analysed in terms of other demographic variables, such as learners' age and community background.

References

Adawiah, R. & Jiwa, M. (2013). Ecological Literacy among Secondary School Students. *Conference on Science and mathematics education.*

Ahi, B. (2016). Flying, feathery and Beaked Object: Children's Mental Models about Birds. *International Electronic Journal of Environmental Education 6*(1), 1-17.

Alexandar, R. & Poyyamoli, G. (2014). Teaching Biodiversity in Freshwater Wetlands- A Field Based Teaching Strategy for School students.

Alfred, A. (2016). Exploration of students' biodiversity knowledge and decision making for wildlife conservation, *Socio-scientific Issue*.

Amadebai, E. (2023). The Importance of Data Analysis in Research. *Data Science*

Ambrose, D. (2020). Birds annotated Species Checklist. *Lesotho Annotated Bibliography Section, 16*(7A), 5

Ballard, H. L., Bird, E. B., Harte, P. (2020). Birds Near and Far: Students Investigation on Local Environmental. *National Science Teaching Association, 58* (1).

Bartoszeck, A. B., Vandrovieski, W. & Tratch, V. (2018). What do Brazilian School Children know about Birds in their Country? *European Journal of Educational Research, 7*(3), 485-499.

Bhandari, P. (2020). Population vs. sample| Definitions, differences & examples. Scribbr Official Portal.

Bensusan, K., Cortes, J., Pheros, C., Thompson, I. & Warr, S. (2006). Trip Report: Wetland Winter Bird Count in Northern Morocco. *Bird Report, 53*.

Bloss, J. (2023). Bird-watching: A beginner's guide to: How to start birding your backyard and beyond. *CNN Underscored newsletter*.

Bopardikar, A., Bernstein, D., & McKenney, S. (2023). Boundary crossing in student-teacher-scientist-partnerships: designer considerations and methods to integrate citizen science with school science. *Instructional Science*, 51(5), 847-886.

Bridgewater, P., & Kim, R. E. (2021). The Ramsar convention on wetlands at 50. *Nature Ecology & Evolution*, 5(3), 268-270.

Braun, V., Clarke, V., & Hayfield, N. (2022). 'A starting point for your journey, not a map': Nikki Hayfield in conversation with Virginia Braun and Victoria Clarke about thematic analysis. *Qualitative research in psychology*, 19(2), 424-445.

Brouwer, F. (2001). The Environmental Impacts of CAP: An Overview of the Present State of Knowledge and Research Needs. *Agricultural Use of Groundwater*, 275-289.

Burns, A. (2015). The Cambridge Guide in Research in Language Teaching and Learning (pp. 99-104).

Cerrato, S. (2022). Citizen Science: A powerful way to new learning experiences. https://eu-citizen.science/blog/2022/01/24/citizen-science-powerful-way-new-learning-experiences/.

Cleland J. & MacLeod, A. (2021). The Visual Vernacu-lar: Embracing photographs in a research. *Perspective on Medical Education, 10*, 230-237

Chatanga, P. & Sieben, E. J. J. (2019). Ecology of Palustrine Wetlands in Lesotho: Vegetation Classification, Description and Environmental Factors. *Koedoe 16*(1), 1574.

Cherry, K. (2022). Cross-Sectional Research Method: How Does It Work? Advantages and Challenges.

https://www.verywellmind.com/what-is-a-cross-sectional-study-2794978.

Cohen, K., Manion, L. & Morrison, K. (2011). Research Methods in Education. Routledge.

Lesotho Environment Ministry. (2009). Conservation on Biological Biodiversity Act.

Convention on Biological Diversity (2011-2020). *United Nations Decade of Biodiversity.*

Darmawan, E. (2018). Enhancing Biology Students Motivation through Classroom Action Research based on STAD Learning Model. *Indonesia Journal of Biology Education*, *1* (1), 2654 - 5950.

Department of Environment and Science Queensland (2023). https://www.desi.qld.gov.au/.

Dillion, A. & Boyd, S.DD2023). Integrated Curriculum Definition? Definition, Benefits & Examples. https://study.com/learn/lesson/integrated-curriculum-benefits-examples.html.

Dogru, M. S. (2022). Conceptual Knowledge Experiences and Sources of Information Secondary School Students Have About Owls. *Science Education International*, *33*(1).

Drew, C. (2023). 25 Contemporary Issues. https://helpfulprofessor.com/contemporary-issues/.

Edwards, E. (2013). Applying Action Research to investigate the use of g for ESL Writing. *Language Company English Australia Journal*, *29* (1).

Eteng, O. (2023). Quantitative Data: What Is It? Types and Examples?

Ezechi, N. (2018). Influence of field trip in teaching and learning of biology. *International Journal of Engineering and Scientific Research*, *6*, (10), 2347-6532.

Fanana, M. (2022). The National Programme for Integrated Catchment Management in Lesotho. *Operational plan.*

Gibbons, W., Jeremy, D. Wilson,. & Green, R, E. (2011). Using Conservation Science to Solve Conservation Problems. *Journal of Applies Ecology, 48*(3), 505-508.

Gosler, A. & Tilling, S. M. (2021). Knowledge of Nature and the Nature of Knowledge: Student natural history knowledge and the significance of birds. *People and Nature*, 4(1), 127-142.

Hack, M. (2015). Teach Ecological Literacy in Schools. https://chscommunicator.com/45579/opinion/2015/11/teach-ecological-literacy-in-schools/.

Hardwood, J. (2022). Importance of Birds. Life Science for Middle School. https://www.researchgate.net/publication/276279152_Why_Birds_Matter_Avian_Ecological_Functions_and_Ecosystem_Services.

Hallman, Tyler, A., Robinsin, W. & Douglas. (2015). Teaching Bird Identification & Vocabulary with Twitter. *The American Biology Teacher 77*(6), 458-462.

Hammarsten, M., Askelund, P., Almers, E., Avery, H. & Samelsson, T. (2019). Developing Ecological Literacy in a forest garden: Children's perspectives. *Journal of Adventure Education and Outdoor Learning, 19*(3), 227-241.

Harris-Madden, D. M. (2017). Measuring the Effects of Youths Participation in a Government-Funded, urban After- School Employment and Training Program: A Case Study Summative Evaluation. *Education Doctoral 306*.

Heron, J. (1996). Coorperative Inquiry Research into Human Condition. Sage.

Heydari, M., Omidipour, R. & Greenle, J.M. (2020). Biodiversity, a Review of the Concept, Measurement, Opportunities and Challenges.

Hoover, K. (2021). Evaluating Impacts of a Wetland Field Trip: A case study with urban middle school students. *Applied Environmental Education and Communication 20*(3*)*, 203-220.

Hummel, E., Ozel, M., Jerez, W. M., & Fancovicova, J. (2015). Interest in Birds and its Relationships with Attitudes and Myths. A Cross–Cultural Study in Countries with different level of Economic Development. *Educational Science Theory & Practice, 15*(1*)*, 285-296.

IUCN Programme. (2021). The World Conservation congress set as a Plan to Conserve Nature.

Jones, P. (2014) Ecological Literacy in Social Work Education: Using a Scenario-based Approach to Bring Community Spaces into the Classroom. *XI International Transformative Learning Conference.*

Kahnet, J., Lovering, J., McLean, B. & Weaver, S. (2020). Engaging Students in Outdoor Learning: A Middle School Lesson Plan on Birds and their environment.

Khanyane, M., Mokuku, T., & Nthathakane, M.C. (2016). Perceived Gender Difference in Performance in Science: The Case of Lesotho Secondary Schools.

Kingford, R. T. (1999). Aerial survey of Water birds on Wetlands as a Measure of River and Flood Plain Health. *Freshwater Biology, 41*(2), 425-438.

Larsen, C., Walsh, C., Almond, N. & Myers, C. (2017). Comparison between a real field trip and a virtual field trip in a natural reserve preserve' knowledge gained in Biology and ecology. *Educational studies, 43*(1), 110-121.

Lasien, U. O., Pedrera, O., Telletxea, E., Barrutia, O. & Diez, J. R. (2023). Secondary Students' Knowledge of Birds and Attitudes towards Conservation: Evaluation of an environmental Education Program. *International Journal of Environmental Research and Public Health.*

Le Wei, (2022). Translanguaging as a political stance: implications for English language education. *ELT Journal of Education, 76* (2*),* 172 -180.

Ledwith, M. (2016). Emancipatory Action Research as a Critical Living Praxis: From Dominant to Narrative Counter narrative. *The Palgrave International Handbook of Action Research,* 49-62.

Magpiong, D. (2015). Pass Along the Passion of Birding: "Pledge to Fledge" A New Birder Today. *All About Birds*.

Mahendrian, M. & Azeez, P.A. (2018). Ecosystem Services of Birds: *A Review of Market and Non-market values 7*(2).

Marquardt, M. & Waddil, D, (2004). The Power of Learning in action Research a C Conceptual Analysis of how the five schools are incorporated within the Practice of Action Learning. Action Learning: *Research and Practice*, 1(2), 185-202.

Mauverney, R. (2023). A guide to the Convention on Biological Diversity. *Environmental Policy and Law, 30.*

Massy, E. C. & Roskaft, E. (2013). Knowledge of conservation interest among the people living close to protected areas in Serengeti, Northern Tanzania. *International Journal of Biodiversity Science, Ecosystem Services & Management, 9*(2*),* 114-122.

Mekonen, S. (2017). Birds as Biodiversity and environmental Indicator. *Journal of Natural Science Research 7*(21*).*

Mery, B., Dinda, D.S. & Rian, V. (2023). Instrument Development for Measuring Students Worksheet Media Based on Scientific Approaches. *Journal Pijar Mepe, 18*(2*),* 163-169.

Myers, B. & Jones, L. (2021). Effective use of field trip in Educational Programming: a three-stage approach. *Data Information Systemsitemap, 352,* 392-1761.

Ministry of Education, ECOL. (2018). B0180/2 Examiner's Report. Maseru.

Ministry of Tourism, Environment and Culture -Lesotho (2002). State of the Environment Report - Lesotho.

Ministry of Natural resource, (2004). World Wetland Day seminar, https://www.water.org.ls/events/world-wetlands-day/.

Mokuku, T. & Taylor, J. (2015), Tlokoeng Valley Community's Conceptions of Wetland: Prospects for more Sustainable Water Resources Management. *Journal of education for Sustainable Development, 9*(2), 196-212.

Mokuku, T. & Robert, R. (2011). Outdoor Learning in Lesotho Partnership in Education for Sustainable Development with the United Kingdom. *Caribbean Journal of Education, 33*(1), 0376-7701.

Nathan, J., Waltham, J., Michael, E. & Mitsch, J. W. (2020). UN Decade on Ecosystem Restoration 2021-2030- What Chance for Success in Restoring Coastal Ecosystems? *Marie Ecosystem Ecology.*

NCDC. (2020). LGCSE Grade 10 and 11 Biology Syllabus.

Nurs, J. R. (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing, 25(8),* 652-661.

Oyebamiji, A. O. & Odewumi, O. S (2020). Knowledge of Bird Ecosystem Services among Secondary School Students in Communities around Old Oyo National Park, Nigeria. Ethiopian Journal of Environmental studies & management *12*(6), 739-751.

O'Neal, L. H. (2023). Using wetlands to teach ecology and environmental awareness in general biology. *The American Biology Teacher 57*(3*),* 135-139.

Patric, A. O. (2010). Effects of field studies on learning outcome in biology. *Journal of Human Ecology.*

Padayichie, K. (2022). The Value of Lesson Planning. Structural Learning.

Old Oyo National Park, Nigeria. *Ethiopian Journal of Environmental Studies & Management, 13*(6*),* 739-751

Orange-Senqu River Commission (ORASECOM). (2004) Strategic Action Programme for the Orange -Senqu River Basin.

Patric, A. O. (2010). Effects of field studies on learning outcome in biology. *Journal of Human Ecology.*

Pittock, J. (2010). A Pale Reflection of Political Reality: *Integration of Global Climate, Wetland and Biodiversity Agreement Climate Law, 1(3),* 343-373.

Randler, C., & Heil, F. (2021). Determinants of bird species literacy—activity/interest and specialization are more important than socio-demographic variables. *Animals*, 11(6), 1595.

Rijal, M. Saefudin, and Amprasto, A. (2018). Field trip method as an effort to reveal students' environmental literacy on biodiversity issue and context. *Journal of Physics Conference Series 1013*(01*).*

RMSALLMANNGMAILCOM (2023). The difference between Bird Watching and Birding. https://badgerlandbirding.com/2023/04/23/whats-the-difference-between-birding-and-bird-watching/.

Roche, J., Davis, N. (2022). Citizen science: an emerging professional field united in truth-seeking. JCOM: *Journal of Science Communication*, 16(04).

Ruether, S. (2018). Barriers to Teachers' use of environmentally-based education in outdoor classrooms (Doctoral dissertation, Walden University).

Schneider, C. M. & Ngoyen, A. (2023). A field guide for fledging birders. https://www.npr.org/2021/05/21/999050796/a-field-guide-for-fledgling-birders.

Starrisson, G. (2022). Bird -Watching 101: How to Identify Birds.

Secretariat of CBD. (2021-2030). The Convention on Biological Diversity Report. https://sdgs.un.org/un-system-sdg-implementation/secretariat-convention-biological-diversity-cbd-54146.

Sekercioglu, C. H., Wenny D., & Whelan, J. H. (2016). Why Birds Matter: *Avian Ecological Functions and Ecosystem Services.*

Simplilearn. (2023). What is Data Collection Methods, Types, Tools, Data and Tools Analytics. https://www.simplilearn.com/what-is-data-collection-article.

Steward, R. E. (2016). Technical Aspects of Wetlands, Wetlands as Bird Habitat. *National Water Summary on Wetland Resources 2425.*

Sukhontapatipak, C. (2012). The Role of Field Experiences in Ecological Learning and Values Education: Action Research on the use of Campus Wetlands. *Journal of Biological Education,* 46 (1), 36-44.

Sullivan, B., Roche, M., Mcdonagh, C. (2021) Practitioner Inquiry and Action Research. *International perspective on Teacher wellbeing and Diversity,* 13-43

Suman, D. O. (2019). Mangrove management: challenges and guidelines. In Coastal wetlands (pp. 1055-1079). Elsevier.

Terakini, T., Guebois, C., Wencellius, J., Mundy, P. & Fritz, H. (2018). Intergrading Local Ecological Knowledge for Water Bird Conservation: Insights from Kavango-Zambezi Transfontier Conservation Area, Zimbabwe. *Tropical Conservation Science, 1* (1), 1-17.

Lesotho Government. (2008). The Environmental Act No. 10.

Lesotho Government, Government printer. (1998). The National Environment Policy.

Tlhakola, K. D. & Mokuku, T. (2021). Using DPSIR Framework to Determine Secondary School Students' Conception of Ecological Concepts in the Context of a Wetland Ecosystem. *Interdisciplinary Journal of Environmental and Science Education, 17*(4*),* e2252.

Tunnicliffe, S. D. (2011). Visualisation of Animals by Children: How Do They See Birds? *C. E. P. S Journal 1*(4*).*

Turner, D.P. (2020). Sampling Methods in Research Design. *The Journal of Head and Face Pain.* 60(1).

Udeani, U. N., Atagana, H. I. & Esiobu, G. O. (2016). Implementation of Action Research for the Improvement of Biology Teaching and Learning in Senior Secondary Schools in Nigeria. *Journal of Education and Practice, 7* (7*).*

UN Secretary. (2023). Environmental Programme. Adaptation Report. United Nations.

Utani, N. R. & Abbarwani, R. (2022). The Development of E-Atlas Avifauna of Subaraya as an Identification Tool of Birds and to Train Environmental Care Character for X Grade Students. *Journal of Biology Education 11*(1), 126-137.

Vielliard, J. M.E. (2000). Bird Community as an Indicator of Biodiversity: Results from Quantitative Surveys in Brazil. *Biological Sciences, 72*(3).

Villegas, A. M., Ciotoli, F., & Lucas, T. (2017). A framework for preparing teachers for classrooms that are inclusive of all students. Teacher education for the changing demographics of schooling: *Issues for research and practice,* 133-148.

Waltham, N. J., Elliott, M., Lee, S. Y., Lovelock, C., Duarte, C. M., Buelow, C., ... & Sheaves, M. (2020). UN decade on ecosystem restoration 2021–2030—what chance for success in restoring coastal ecosystems?. *Frontiers in Marine Science*, 7, 71.

Wesslen, A. (2000) A Replicated Empirical Study of the Impact of the Methods in the PSP on Individual Engineers. Empirical Software. *A Software Engineering, 5*(2), 93.

Wieringa, R. J. (2014). Design science methodology for information systems and software engineering. Springer.

Wilkinson, C., Wait, G. & Gibbs, L. (2014). Understanding place as a "home" and "away" through practices of bird watching. *Asstrolion Geographer, 45*(2), 205-220.

Yli-Panula, E. & Matikainen, E. (2014). Students and student teacher's ability to name animals in ecosystems. A perspective of animal knowledge and biodiversity. *Journal of Baltic Science Education 13,* (4*),* 559.

Appendices

Appendix A**: A pre –visit questions given to individual student in preparation for a visit to a wetland**

Purpose: The research is designed to investigate about a wetland birds and related concepts. This survey is comprised of short fill- in questions**.**

Procedures: Your name and your replies will be anonymous and confidentiality is guaranteed. Participation is completely voluntary**.**

Duration: The survey will take approximately 30 minutes of your time.

Name: _____

Age: _____

Grade: _____

Sex: _____

Name of the village you live in Pitseng: _____

Answer all questions

1. Have you ever visited a wetland?

Yes [ ] No [ ]

2. How can you define a wetland?

_____

3. Name at least 6 birds which you expect to find in a wetland_____

_____

4. How does the high population of birds affect the health of a wetland?

_____

5. What is the importance of birds on a wetland biodiversity?

_____

_____

6. In which ways do humans impact the wetland' birds negatively?

_____

_____

7. State two strategies which could be used by students to protect birds in a wetland.

_____

_____

Appendix B**: Lesson Plan in Preparation for the field trip**

LESSON PLAN 1

PREPARATION FOR THE FIELD TRIP

Class: Form E **Time:** 80 minutes **Date:** 21 February 2023

Topics:

Relationships of organisms with each other and the environment.

Classification and Diversity.

Subtopics:

Ecological concepts in an ecosystem.

Birds in a wetland ecosystem.

Objectives: At the end of the lesson, students should be able to

Describe and relate an ecosystem and ecological concepts.

Identify vertebrates (birds) in an ecosystem.

Explain how birds are related to other organisms in an ecosystem

Overview: In this lesson, students should recall and relate ecological concepts and birds to an ecosystem and to build an understanding of the dependency that all living things have on their habitats**.**

Materials: Text books and notebooks**.**

Background knowledge: Students have an initial exposure to learning outcomes associated with ecosystems and birds as content obtained from class.

Instructional strategies: Students are grouped into six homogeneous groups based on gender.

Lesson Development:

Lesson Steps	Teacher's activities	Students' activities	Time
Introduction	Students are asked to define an ecosystem and give examples of local ecosystems orally.	Students define an ecosystem and state examples of local ecosystems.	5 minutes
	Students are asked to state vertebrates found in an ecosystem and give examples of each.	Students mention vertebrates and the examples.	
Activities	Students are asked to form homogeneous groups of 5 based on gender. Each group is given questions based on EL components. The teacher monitors the discussion.	Students form groups and discuss given questions and write. Each member of the group takes part.	30 minutes
	Group members are asked to present their answers in front of the class and other students are asked to listen carefully, pass comments and ask questions.	Students do as directed. One member of the group presents the group's responses. Students from other groups pass comments and ask questions.	35 minutes

Conclusion	The teacher asks some questions orally based on presentations.	Some students answer questions**.**	10 minutes
	The teacher summarises discussed points and corrects where necessary.	Students listen and write notes**.**	

Appendix C**: A Worksheet to be filled by Students during the field trip**

A WORKSHEET TO BE FILLED BY EACH PAIR OF STUDENTS DURING A VISIT TO A WETLAND

NAMES: _____

SEX: _____

DATE: _____

TIME: _____

INSTRUCTIONS

Use a cross {x} to show birds which are found in a wetland and describe their physical appearance as you see them.

LIST OF BIRDS	**DESCRIPTION OF BIRDS BY STUDENTS**	**CYCLE 1** **DATE:** **TIME:** **17 pairs of students**	**CYCLE 2** **DATE:** **TIME:** **17pairs of students**
Family:			
Ardeidae Grey			
Heron			
(Kokolofitoe)			

Cattle Egret
(Leholosiane)

Family: Scopidae

Hamerkop

(Mamasianoke)

Family:

Threskiornithidae

Hadeda Ibis

(Lengangane)

Family:

Saggittarriddae

Secretary
bird(Mamolangoana)

Family:

Falconidae

Lanner falcon

(Phakoe-ea-balisa)

Family:

Phasiandae
francolins, Pheasants,
Partridges and Quail

Zwainson's Spurfowl

(Khoale-lekakarane)

Common Quail

(Koe-koe)

Family:

Columbidae

Rock Dove(Leeba- la-sekhooa)

Family:

Hirundinidae Swallows and Martins

Barn Swallow

(Lefokotsane)

Family:

Corvidae Crows, Jays, Magpies and similar birds

Cape crow (Mokhoabane)

White-necked Raven

(Lekhoaba)

Family:

Laniidae

Black-and-white Shrike

(Tsemeli-Thokoa)

Family:

Sturnidae Starlings

African Pied Starling

(Leholi)

Red-winged Starling

(Letsoemila)

Family:

Ploceidae Weavers, Sparrows, Bishops, Widows and similar birds

House Sparrow

(Seroebele-sa-matlo)

Long-tailed Widowbird

(Molepe, Tjobolo)

Southern Masked Weaver

(Letoloptje)

Family:

Fringillidae
Canaries, Buntings
and similar birds

Cape Canary or Reed
Bunting

(Tsoere)

Cape Bunting

(Maborokoane)

Appendix D: Cycle 1 result

NAMES OF STUDENTS (17 PAIRS)	GENDER	NAMED BIRDS	DESCRIPTION OF A BIRD
Pair 1	F	Hadeda Ibis (Lengangane)	Black and bigger bird but can fly
		Red Winged Starling (Lechomila)	Black and yellow tail.
		Long-tailed Widowbird (Molepe	Black and long tail.
		Reed Bunting (Tsoere)	Brown and small bird
		Rock Dove (Leeba)	Grey
		Barn Swallow(Lenkabelane)	Black
		Heron (Kokolofitoe)	White, black in colour
		Cape Turtle Dove (Lenkoroane)	Grey
		African Motintinyane	Grey and white
		Cattle Egret (Leholosiane)	White feathers
Pair 2	F	Heron (Kokolofitoe)	It is grey, has long neck, its mouth is sharp has long legs
		Rock Dove (Leeba)	White and grey colour
		Cape Yellow Warbler (Motintinyane)	Brown

	Barn Swallow(Lenkabelane)	It is black, very tiny ,it's like fishtail
	Reed Bunting (Tsoere)	Brown
	Hadeda Ibis (Lengangane)	All body is black
	Cape Turtle Dove (Lenkoroane)	Brown in colour and Fishtail
	Long-tailed Widowbird (Molepe)	E ntso e mohatla o motelele'
	Cattle Egret (Leholosiane)	E Tsoeu
	Red Winged Starling (Letsoeomila0	E ntso masiba a mapheo a orange
	White-necked Raven (Lekhoaba)	Lekhoaba le letso le bosoeu molaleng le sefubeng
	Black-and-White Shrike (Tsemeli)	Black and white bird
Pair 3	Rock Dove (Leeba)	It is a grey and a fat bird
	Heron (Kokolofitoe)	E telele maoto le molala. E grey and white
	Hadeda Ibis (Lengangane)	Dark grey in colour
	Reed Bunting (Tsoere)	E brown and grey on the chest

		Black-and-White Shrike (Tsemeli)	Black and white
		House Sparrow (Seroebele)	Se light brown and grey on the chest
		Lanner Falcon (Phakoe)	Brownish in colour
		Cape Crow (Mokhoabane)	Black feathers
		Long-tailed Widowbird (Molepe)	Black with a long tail
Pair 4	F	White-necked Raven (Lekhoaba)	E ntso hohle
		Heron (Kokolofitoe)	E grey and white
		Rock Kestrel (Seotsanyane)	Ke nonyana e ntso le bosoeu, e ea binela
		Cape Yellow Warbler (Motintinyane)	Ke nonyana e nyane e ntso
		Rock Dove (Leeba)	E thokoa bo bosoeu
		Lanner Falcon (Phakoe)	E mala o mothokoa, e manala a matelele
		Long-tailed Widowbird (Molepe	Nonyana e ntso e mohatla omo telele, e ntso
		Cattle Egret (Leholosiane)	E tsoeu, e alosa liphoofolo tse pela mokhoabo
		Hadeda Ibis (Lengangane)	E grey bo dark, e kholo

Pair 5	**F**	Hadeda Ibis (Lengangane)	It has long beak; It has shiny and black feathers.
		Heron (Kokolofitoe)	It has long neck, It is grey in colour and it has another white
		White-necked Raven (Lekhoaba)	It is black in colour
		Red Winged Starling (Lechomila)	It is a small bird and it has a red and black in colour
		Reed Bunting (Tsoere)	It is black and many birds inside the reeds
			It has sharp nails and it is black
		Barn Swallow(Lenkabelane)	Black and many
		Rock Turtle Dove (Lenkoroane)	Brown white
		House sparrow (Seroebele)	Brown and small
Pair 6	**F**		
		Heron (Kokolofitoe)	White and grey bird with long neck
		Barn Swallow(Lenkabelane)	Black and white
		Red Winged Starling (Lechomila)	Black and red
		Barn Swallow(Lenkabelane)	It has a tail

		Rock Turtle Dove (Lenkoroane)	Blue purple
		House sparrow (Seroebele)	Brown in colour
		Long-tailed Widowbird (Molepe)	Black and long tail
		Rock Dove (Leeba)	purple and white dots
Pair 7	**F**		Silver and black
		Heron (Kokolofitoe)	E molala o motelele, e tsoeu , e grey
		Lanner Falcon (Phakoe)	Black
		Rock Dove (Leeba)	Blue white
		Cape Turtle Dove (Lenkoroane)	Grey and dark red
		White-necked Raven (Lekhoaba)	Black
		House sparrow (Seroebele)	White
		Long-tailed Widowbird (Molepe	Black and long tail
Pair 8	**F**	White-necked Raven (Lekhoaba)	Black
		Barn Swallow(Lenkabelane)	Blue and white, e nyenyane, e molomo o monyenyane
		Red Winged Starling (Letsoemila)	Black and yellow

		Reed Bunting (Tsoere)	Brown
		Heron (Kokolofitoe)	Grey and white. She is tall, with long legs and a big mouth
		Cape Turtle Dove (Lenkoroane)	Blue and white
		Cattle Egret (Leholosiane)	All white
Pair 9	**F**	Hadeda Ibis (Lengangane)	It is silver, black
		Long-tailed Widowbird (Molepe)	It is black.
		Cape Turtle Dove (Lenkoroane)	It is silver grey.
		Heron (Kokolofitoe)	It has along neck, it is grey and it has a big mouth
		Black-and-White Shrike (Tsemeli)	It is smooth, it is black and white
		Barn Swallow(Lenkabelane)	It is black
		Lanner Falcon (Phakoe)	It is dark grey and has sharp nails.
		Reed Bunting (Tsoere)	It is brown, it is black
		House sparrow (Seroebele)	It is brown , it is black and white
		Rock Dove (Leeba)	It is fat and is silver

Pair 10	**F**	Hadeda Ibis (Lengangane)	Light black with a long beak
		Cape Yellow Warbler (Motintinyane)	Small bird brownish
		Rock Dove (Leeba)	Grey and white
		Cape Turtle Dove (Lenkoroane)	Ke nonyana e putsoa
		Cape Crow (Mokhoabane)	It is black
		Barn Swallow(Lenkabelane)	It has dark grey feathers
Pair 11	**F**	Heron (Kokolofitoe)	It has long neck, grey in colour
		Barn Swallow(Lenkabelane)	Black in colour
		Long-tailed Widowbird (Molepe	It has a long tail and is black
		Rock Dove (Leeba)	Blue purple
		Black-and-White Shrike (Tsemeli)	Black and white
		Barn Swallow(Lenkabelane)	Dark yellow and long tail
		White-necked Raven (Lekhoaba)	Black
Pair 12	**F**	Rock Dove (Leeba)	Blue and white
		Lanner Falcon (Phakoe)	It is black
		House sparrow (Seroebele)	It is brown
		Cape Turtle Dove (Lenkoroane)	E reddish grey
		Hadeda Ibis (Lengangane)	It is black

		Barn Swallow(Lenkabelane)	Le letso
		Heron (Kokolofitoe)	E tsoeu ena le botso, e telele, e molomo o motso
		African Pied Starling (Leholi)	Black and white feathers at the end of wings
		Long-tailed Widowbird (Molepe	E ntso e kopane le bosoeu, mohatla o molele
		Red Winged Starling (Lechomila)	Le letso
		Reed Bunting (Tsoere)	Back and brown
		Lefokotsane	E ntso mohatla e mohatlanyana
Pair 13	**M**	Heron (Kokolofitoe)	White and grey
		Hadeda Ibis (Lengangane)	Big birds always in pairs or in a group.
		Long-tailed Widowbird (Molepe	E ntso e mohatla o molele
		Barn Swallow(Lenkabelane)	Le letso lena le grey colour
		White-necked Raven (Lekhoaba)	Tall and black
		Red Winged Starling (Letsoemila)	E ntso bo nang le bosoeu
		Cattle Egret (Leholosiane)	E tsoeu e telele
		Rock Dove (Leeba)	Blue and white
		Hammerkop (Mamasianoke)	Brown

		Lanner Falcon (Phakoe)	E thokoa,e manala ama lelele
		Cape Crow (Mokhoabane)	E ntso
Pair 14	**M**	Cape Crow (Mokhoabane)	Black only
		Heron (Kokolofitoe)	E telele,(Its grey and white and tall)
		Reed Bunting (Tsoere)	It is short, black and brown
		White-necked Raven (Lekhoaba)	Black and white on the neck
		Lanner Falcon (Phakoe)	Silver and fat
		Rock Kestrel (Seotsanyane)	White and silver and fat
		Cattle Egret (Leholosiane)	All white and thin
		House sparrow (Seroebele)	Brown, white and black patches
		Long-tailed Widowbird (Molepe	Tail tall and is black
		Barn Swallow(Lenkabelane)	Thin and silver
		Black-and-White Shrike (Tsemeli)	Black and white, short
		Cape Turtle Dove (Lenkoroane)	It is fat and silver
		Reed Bunting (Tsoere)	It is short , black and brown
Pair 15	**M**	Heron (Kokolofitoe)	It is tall, grey and white
		Reed Bunting (Tsoere)	It is brown, black and short bird

		Rock Dove (Leeba)	It is fat and silver in colour
		Cape Turtle Dove (Lenkoroane)	It is fat and silver in colour
		Black-and-White Shrike (Tsemeli)	Black and white in colour. It is a short bird
		Hadeda Ibis (Lengangane)	Is black in colour and it is fat bird.
		Barn Swallow(Lenkabelane)	It is thin brown and or black and white
		Long-tailed Widowbird (Molepe	It is black and has a long tail
		House sparrow (Seroebele)	It is black, white brown in colour and it is small.
		Cattle Egret (Leholosiane)	White bird in colour
		Lanner falcon (Phakoe)	Silver and white fat bird
		Cape Crow (Mokhoabane)	It is black only
		White-necked Raven (Lekhoaba)	Black and white bird
Pair 16	**M**		
		Barn Swallow(Lenkabelane)	Black
		Cape Turtle Dove (Lenkoroane)	Blue
		Black-and-White Shrike (Tsemeli)	Black and white bird

		Cape Yellow Warbler (Motintinyane)	Yellow and Black
		Hadeda Ibis (Lengangane)	All body is black
		White-necked Raven (Lekhoaba)	Black and white.
Pair 17	**M**	Hadeda Ibis (Lengangane)	Dark grey long beak
		Cattle Egret (Leholosiane)	White body
		Southern Pied starling (Letololonoche)	Black and yellow
		Heron (Kokolofitoe)	Grey and white and long beak
		Rock Dove (Leeba)	It is black
		White-necked Raven (Lekhoaba)	Black and white neck
		Red Winged Starling (Letsoemila)	Black in colour and red wings
		Cape Yellow Warbler (Motintinyane)	Black and long tail
		Unknown (Fotha)	Brown
		Reed Bunting (Tsoere)	Black and brown
		Long-tailed Widowbird (Molepe)	black and long tail
		Barn Swallow(Lenkabelane)	Reddish grey

Appendix E: Reflection Questions in cycle 1

REFLECTION QUESTIONS AFTER THE FIRST TRIP

Names: _____

Age: _____

Grade: _____

Sex: _____

1. What part of the trip was a new experience for you? _____

_____

2. Which new bird did you discover?

_____

3. Which bird did you find most interesting?

_____

Explain_____

4. Discuss what you did not enjoy in this field trip and how it affected your learning

_____

5. Were you able to name all the birds you saw?

_____

Explain_____

6. Suggest how the next field trip can be improved_____

_____

Appendix F: Result for cycle 2

CYCLE 2 RESULTS

NAMES OF STUDENTS (17 PAIRS)	GENDER	IDENTIFIED BIRDS	DESCRIPTION OF A BIRD
Pair 1	F	Long-tailed Widowbird (Molepe)	Nonyana e mohatla o motelele, e kholo e ntso
		Heron (Kokolofitoe)	Grey and white. Nonyana e telele e tsoeu, lebo thokoa e ntso e kholo, e molala omo telele
		Hadeda Ibis (Lengangane)	Grey and with long beak
		House Sparrow (Seroebele)	Brown
		Seinoli	Black in color
		African Pipit(Tsase)	E sootho e tsoeu ka limpeng
		Reed Bunting (Tsoere)	E grey e nyane
		Rock Dove(Leeba)	A grey bird
		African Yell9w Warbler (Motintinyane0	E tsehla ka mmala
Pair 2	F	Heron(Kokolofitoe)	E grey ena le bosoeu ka tlase
		Long-tailed Widowbird (Molepe)	E ntso e mohatla o motelele
		Black-and-White Shrike (Tsemeli)	E ntso ena le bosoeu
		Hadeda Ibis (Lengangane)	Le le thokoa

		Reed bunting (Tsoere)	E nyenyane
		Pied Kingfisher (Seinoli)	E ntso ena le bosoeu mapheong
		African Pipit (Tsase)	E tenya e sootho
		Cape Wagtail (Motjoli)	E sootho ena le bosoeu
		Cattle Egret (Leholosiane)	A white bird
		White-necked Raven) Lekhoaba	E ntso ena le bosoeu molaleng
		Rock Dove (Leeba)	A light grey bird with white colour at the end of the tail
Pair 3	F	African Pipit (Tsase)	The whole body is brown and it is thin
		House Sparrow (Seroebele)	It has two colours which are brown and white
		Long-tailed Widowbird (Molepe)	It is black and has a long tail but the body is small
		Hadeda ibis (Lengangane)	It is grey
		Black Duck (Letata)	A black bird with white spots on the wings
		Black-and-White Shrike (Tsemeli)	It is black and white
		Cattle Egret (Leholosiane)	A white bird

	Reed Bunting (Tsoere)	It is very small and its colour is black
	Pied Kingfisher (Seinoli)	It has black colour and the wings are white
	Heron (Kokolofitoe)	It has long neck, white and grey body and black at the end of wings
	Rock Dove(Leeba)	It is grey and white
Pair 4	Heron (Kokolofitoe)	It has a long neck, long legs and it is grey, white and black
	Black-and-White Shrike (Tsemeli)	E ntso bo tsoakileng le bosoeu
	Reed Bunting (Tsoere)	E nyane , e sootho
	Cattle Egret (Leholosiane)	It is white
	Pied Kingfisher (Seinoli)	Se setso sena le bosoeu mapheong
	Hadeda Ibis (Lengangane)	Dark grey and bigger bird
	House Sparrow (Seroebele)	Light brown, with black and white patches
	Rock Dove (Leeba)	Light grey and white
	Long-tailed Widowbird (Molepe)	E ntso e mohatla omo telele
	White-necked Raven Lekhoaba	Le letso lena le bosoeu molaleng, le ka limpeng

Pair 5	F	Black-and-White Shrike (Tsemeli)	Black and white
		House Sparrow(Seroebele)	Brown and white
		Hadeda Ibis (Lengangane)	Le lethokoa, molomo omo telele
		Reed Bunting (Tsoere)	Dark brown and small. Lives inside the reeds
		Rock Dove 9Leeba)	Light grey and white on the part below
		Heron (Kokolofitoe)	Light grey, white and black. It is long and has long neck and legs. But it can also fly.
		Cape Crow (Mokhoabane)	All black
		Long-tailed (Molepe)	E ntso e mohatla omo telele
			Black
Pair 6	F	Hadeda Ibis (Lengangane)	Grey
		Cattle egret (Leholosiane)	White feathers
		Black-and-White Shrike (Tsemeli)	Black and white
		Red winged Starling (Letsoemila)	Black and red on the wings
		Heron (Kokolofitoe)	White, black and grey bird with long neck
		Reed Bunting (Tsoere)	E sootho , e nyane

		Long tailed Widowbird (Molepe)	Black and long tail
		Pied Kingfisher (Seinoli)	Se setso mapheong
		Cape Wagtail (Motjoli)	Black and white
Pair 7	F		
		Long-tailed Widowbird (Molepe)	Ke nonyana e ntso e mohatla omo lelele
		House Sparrow (Seroebele)	Ke nonyana e sootho e nang le bosoeu
		Heron (Kokolofitoe)	Ke nonyana e tsoeu e nang le botso
		Reed Bunting (Tsoere)	Ke nonyana e nyane e sootho, e ipata kahara lifate.
		Hadeda Ibis (Lengangane)	Ke nonyana tse thokoa tse melomo e meholo
		Black-and-White Shrike (Tsemeli)	Ke nonyana e ntso e nang le bosoeu, e mahareng
		Cape Wagtail (Motjoli)	Ke nonyana e sootho e nang le bosoeu marameng
		Pied Kingfisher (Seinoli)	Se setso se na le bosoeu mapheong
		Cape Crow (Mokhoabane)	Ke nonyana e ntso fela
		Cattle Egret (Leholosiane)	Yellow feet

		white-necked Raven (Lekhoaba)	Ke nonyana e ntso e nang le bosoeu molaleng
Pair 8	F	Heron (Kokolofitoe)	Ke nonyana e kholo e tsoeu e nang le botso ka mathokoa, e molala o molelele
		Long-tailed Widowbird (Molepe)	Ke nonyana e ntso e mohatla omo molelele, ena le bofubelu ha e fofa
		House Sparrow (Seroebele)	Ke nonyana e nyane e sootho
		Hadeda Ibis (Lengangane)	Ke nonyana e thokoa e molomo o mosesane
		Black-and-White Shrike (Tsemeli)	Ke nonyana e nyane e ntso e nang le bosoeu
		Reed bunting (Tsoere)	Ke nonyana e nyane e nang le botso le bosoeu e letsang mololi
		Pied Kingfisher (Seinuli)	Ke nonyana e ntso e nang le bosoeu mapheong
		Rock Dove (Leeba)	A light grey bird with white tail

Pair 9	F	Long-tailed Widowbird (Molepe)	Ke nonyana e ntso e nang le litjobo tse telele mohatleng.
		House Sparrow (Seroebele)	Ke nonyana e sootho
		Cattle Egret (Leholosiane)	Thin white bird.
		Hadeda Ibis (Lengangane)	Ke nonyana e kholo e molomo o molelele.
		Black-and-White Shrike (Tsemeli)	E ntso ena le bosoeu.
		Heron (Kokolofitoe)	Nonyana e kholo e maoto a matelele, le molomo oa teng omo lelele. Molala oa teng omo telele haholo.
		African Pipit (Tsase)	E tenya e sootho
		Reed Bunting (Tsoere)	E nyane hape e sootho
		Cape Crow (Mokhoabane)	E ntso
		Black Duck (Letata)	A black bird with white patches on the wing and found in pairs.
Pair 10	F	Long-tailed Widowbird (Molepe)	E ntso hohle ka ‘mala, e mohatla o motelele o litjobo.ka seemo
		African Pipit (Tsase)	Ke nonyana e sootho e tsoeu ka limpeng
		Heron (Kokolofitoe)	Ke nonyana e kholo e tsoeu hohle, e nang le botso ka limpeng ebile e molala omo telele

		House Sparrow (Seroebele)	Ke brown bird
		Hadeda Ibis (Lengangane)	Ke nonyana e thokoa hohle, e kholo e maoto a ma lelele.
		Pied Kingfisher (Seinuli)	Black in colour
		Reed Bunting (Tsoere)	Small bird with grey colour and white and small tail.
		African Yellow Warbler (Motintinyane)	A small bird with yellow colour
		Black Duck (Letata)	Grey bird in colour
Pair 11	F	Long-tailed Bird (Molepe)	E ntso e mohatla omo telele
		African Pipit (Tsase)	E sootho e tsetsane
		House Sparrow (Seroebele)	E sootho ena le botso le bosoeu
		Hadeda Ibis (Lengangane)	E thokoa e molomo o motelele.
		Black-and-White Shrike (Tsemeli)	E ntso ena le bosoeu
		Reed Bunting (Tsoere)	Ke nonyana e nyenyane e sootho e nang le bosoeu.
		Heron (Kokolofitoe)	Ke nonyana e thokoa e nang le l bosoeu ka limpeng e tsesane e molala omo telele.
		Pied Kingfisher (Seinoli)	Ke nonyana e ntso e nang le bosoeu mapheong
		White-necked raven (Lekhoaba)	Ke nonyana e ntso

		Cape Crow (Mokhoabane)	Ke nonyana e ntso e nang le bosoeu molaleng
		Black Duck (Letata)	A black, fat and short bird with white dots on the wings .
		Rock Dove (Leeba)	A grey bird
Pair 12	F	Cattle Egret (Leholosiane)	White bird
		Black-and-White Shrike (Tsemeli)	Black and white bird
		Long-tailed Widowbird (Molepe)	Ke nonyana e ntso e nang le mohatla
		African Pipit (Tsase)	Ke nonyana e soothoana
		Black Duck (Letata)	The black duck flies.
		Hadeda Ibis (Lengangane)	Ke nonyana e thokoa
		Heron (Kokolofitoe)	Ke nonyana e kholo, e thokoa e tsoeu e ntso.
		Reed Bunting (Tsoere)	Ke nonyana e nyane , sootho e
		Rock Dove (Leeba)	E light grey and white
		House Sparrow (Seroebele)	E brown, black and white
		White necked Raven (Lekhoaba)	Ke nonyana e ntso e nang le bosoeu molaleng.

Pair 13	M	Cape Crow (Mokhoabane)	E ntso fela
		Reed Bunting (Tsoere)	E nyenyane ,e sootho
		Black-and-White Shrike (Tsemeli)	E ntso ena le bosoeu
		Long-tailed Widowbird (Molepe)	O motso ona le bofubelu sefubeng, o mohatla omo telele
		African Pipit (Tsase)	E sootho, e nyenyane
		Black Dove (Letata)	The black duck flies.
		Heron (Kokolofitoe)	E ntso, e thokoa, e tsoeu sefubeng. E molala o molele
		Hadeda Ibis (Lengangane)	Le le thokoa .le molomo o motelele
		Pied Kingfisher (Seinoli)	E ntso e na le bosoeu
		Rock Dove (Leeba)	A grey bird with white color
Pair 14	M	Heron (Kokolofitoe)	It is grey and white. It is thin and its legs are long.It is also black
		Black Dove (Letata)	A black, fat and short bird with white dots on the wings
			The black duck flies.
		African Pipit (Ts'ase)	E sootho, e tsesane

		Reed Bunting (Tsoere)	Black, white and brown
		Pied Kingfisher (Seinoli)	It is black and thin
		Hadeda Ibis (Lengangane)	They are grey and thin
		Cattle Egret (Leholosiane)	A white bird
		African Pipit (Tsase)	It is thin and grey
		Cape Crow (Mokhoabane)	It is a black bigger bird
		Rock Dove (Leeba)	It is grey and white
		Long tailed Widowbird (Molepe)	E ntso ena le mohatla
Pair 15	M	Hadeda Ibis (Lengangane)	Le molomo o motelele ,e thokoa
		Long tailed Widowbird (Molepe)	Ke nonyana e ntso e mohatla omo telele
		Pied Kingfisher (Seinoli)	E ntso e tsoeu
		Black Duck (Letata)	A black bird with white patches on the wing and found in pairs.
			A black, fat and short bird with white dots on the wings
			The black duck flies.
		Black-and-White Shrike (Tsemeli)	Ke nonyana e ntso e tsoeu
		Cattle Egret (Leholosiane)	A white bird

		Reed Bunting (Tsoere)	E nyane , e brown
		Heron (Kokolofitoe)	E tsoeu le botso
		House Sparrow (Seroebele)	E brown
		Cape Crow (Mokhoabane)	E ntso
		African Pipit (Tsase)	E thokoa, ke nonyana e nyane
		White-necked raven (Lekhoaba)	E ntso le bosoeu
		Rock Dove (Leeba)	Lele thokoa le bosoeu
Pair 16	M	African Pipit (Tsase)	E brown
		White-necked Raven (Lekhoaba)	Black and white in the neck
		Reed Bunting (Tsoere)	Nonyana e nyane e sootho
		Heron (Kokolofitoe)	Ke nonyana e ntso enang le bosoeu le bo thokoa.
		Black-and-White Shrike (Tsemeli)	E tsoeu e kopane le botso
		House Sparrow (Seroebele)	E brown, black and grey
		Cape Wagtail (Motjoli)	Ke nonyana e sootho e nang le

			Bosoeu
		Rock Dove (Leeba)	Light grey and white
		Long-tailed Widowbird (Molepe)	E ntso e masiba a malele mohatleng
		Cape Crow (Mokhoabane)	Ke nonyana e ntso
		Black Duck (Letata)	A black bird with white patches on the wing and found in pairs.
			A black, fat and short bird with white dots on the wings
			The black duck flies
			A white bird.
		Cattle Egret (Leholosiane)	
Pair 17	M	Heron (Kokolofitoe)	E telele, e thokoa e ntso mapheong, e tsoeu ka limpeng
		Long-tailed Widowbird (Molepe)	E mohatla o molele, E ntso
		House Sparrow (Seroebele)	Se light brown, setso le bosoeu
		Cape Crow (Mokhoabane)	Ke nonyana e ntso
		Cattle Egret (Leholosiane)	White bird

Reed Bunting (Tsoere)	Ke nonyana e sootho
Hadeda Ibis) Lengangane	A mathokoa bo tebileng
African Pipit (Tsase)	Ke nonyana e thokoana
Rock Dove (Leeba)	A grey bird
Pied Kingfisher (Seinoli)	Ke nonyana e ntso e tsoeu
Red winged Starling (Letsoemila)	Ke nonyana e ntso, e mapheo a orange
White-necked Raven (Lekhoaba)	E ntso e tsoeu molaleng leka limpeng
Black Dove (Letata)	A black, fat and short bird with white dots on the wings and the black duck flies.

Appendix G: Reflection Questions in cycle 2

STUDY TITLE: USING A FIELD TRIP WITH GRADE 11 BIOLOGY STUDENTS TO STUDY WETLAND BIRDS AND RELATED CONCEPTS**.**

Names: _____

Age: _____

Grade: _____

Sex: _____

Name of the village: _____

1. Did you discover any new bird different from the ones identified in the first cycle?

_____

2. How have your knowledge been changed by the birds you have learned from the wetland?

_____

_____

_____

3. What challenges did you encounter? _____

4. How can these challenges be solved in the next trip_____

_____

	CYCLE 1			CYCLE 2		
Name of the Bird	**Plausible Description %**	**Male %**	**Female %**	**Plausible Description %**	**Male %**	**Female %**
Heron (Kokolofitoe)	**71%**	**18%**	**53%**	**100%**	**29%**	**71%**
Hadeda Ibis(Lengangane)	**29%**	**12%**	**18%**	**94%**	**24%**	**71%**
Red Winged Starling(Letsoemila)	**24%**	**6%**	**18%**	**35%**	**6%**	**29%**
Long-tailed Widowbird(Molepe)	**65%**	**24%**	**71%**	**100%**	**29%**	**71%**
Reed Bunting(Tsoere)	**41%**	**18%**	**24%**	**82%**	**24%**	**59%**

Rock Dove (Leeba)	**29%**	**6%**	**24%**	**59%**	**18%**	**41%**	

Appendix H: Gender based result Plausible Description

Barn Swallow (Lefokotsane)	**24%**	**0%**	**24%**				
Cape Turtle Dove (Lekunkuroane)	**29%**	**12%**	**18%**				
African Yellow Warbler(Motintinyane)	**29%**	**12%**	**18%**	**12%**	**0%**	**12%**	
Cattle Egret (Leholosiane)	**41%**	**24%**	**18%**	**65%**	**24%**	**41%**	
Barn Swallow(Lenkabelane)	**35%**	**18%**	**18%**				
White-necked Raven (Lekhoaba)	**24%**	**18%**	**6%**	**59%**	**29%**		
Southern Masked Weaver (Letolonche)	**6%**	**6%**	**0%**				
Cape Crow (Mokhoabane)	**24%**	**12%**	**12%**	**47%**	**29%**	**18%**	

House Sparrow(Seroebele)	**41%**	**6%**	**35%**	**65%**	**18%**	**47%**
African Pied Starling(Leholi)	**6%**	**6%**	**0%**			
Black and White Shrike(Tsemeli)	**29%**	**12%**	**18%**	**76%**	**18%**	**59%**
Rock Kestrel (Seotsanyane)						
Lanner falcon (Phakoe)	**35%**	**18%**	**18%**			
Hammerkop (Mamasianoke)	**6%**	**6%**	**0%**			
Fotha	**6%**	**6%**	**0%**			
Pied Kingfisher (Seinoli)				**76%**	**24%**	**52%**
Black Duck (Letata)				**47%**	**29%**	**18%**
African Pipit (Tsase)				**53%**	**24%**	**29%**
Cape Wagtail (Motjoli)				**47%**	**29%**	**18%**

APPENDIX I: Ethical Letters and Consent Forms

LETTER TO HEAD OF THE SCHOOL

Student Name: Makabelo Tenane

Student Number: 199400344

Supervisor: Prof. Mokuku

The Head of the school

RE: REQUEST TO COLLECT DATA FROM GRADE 11 STUDENTS

SCHOOL LEARNERS

My name is Makabelo Tenane. I am based at Pitseng High School under the department of Science Education. At the moment, I am a pursuing my studies at the National University of Lesotho of which major research project is a component. The area of Biology I am going to look into is ecological and is titled "Using a Field Trip to Develop Biology Students' Knowledge on Local Wetland Ecosystem Birds: An Action Research Case Study"

I will be administering a worksheets to 34 learners from Grade 11 class. I undertake to maintain anonymity and confidentiality of the names of the learners and the school. The information will be used for research purposes only.

I also wish to indicate that participation in this research activity on the part of your school is voluntary. If you allow your learners to assist me in this respect, please sign the enclosed consent form for me. Should you require further clarification, feel free to use the following numbers to contact me.

……

Makabelo Tenane

Contacts: 58868106

CONSENT FORM FOR THE HEAD OF THE SCHOOL

I ---------- agree that the researcher Makabelo Tenane collects part of the data she needs from my school. I have read and understood the contents of the information letter, which I am presently keeping.

I give consent to interviewing of Form E Biology students.

Head of the school Date

---------- ----------

Researcher Date

---------- ----------

Witness Date

---------- ----------

LETTER TO FORM E BIOLOGY TEACHER

National University of Lesotho

Student Name: Makabelo Tenane

Student Number: 199400344

Supervisor: Prof. Mokuku

10 April 2022

Dear Form E Biology Teacher

RE: REQUEST TO COLLECT DATA FROM BIOLOGY GRADE 11 STUDENTS

My name is Makabelo Tenane. I am a part time education student at the National University of Lesotho.As part of my studies, I am undertaking a research. The Biology area I am looking at is "Using a Field Trip to Develop Biology Students' Knowledge on Local Wetland Ecosystem Birds: An Action Research Case Study". The head of your school has granted me permission to get some information from your learner. I will be administering questionnaires to 20 learners based on gender on mentioned topic. If you agree, I will request you to sign the attached consent form. Please note that participation in this activity is voluntary. Withdrawal from it is possible at any stage.

I undertake to protect their identity and the information they will provide will be used purely for research purposes. In cases where information is used for biology education community or journals, names will be referred to by as pseudonyms.

Would you need any further information, feel free to use the following contacts.

Contact: 58868106

Email: makabelotenane@yahoo.com

CONSENT FORM FOR GRADE 11 BIOLOGY TEACHER

National university of Lesotho

Student name: Makabelo Tenane

Student number: 199400344

Supervisor: Prof. Mokuku

I ---------- agree to allow my learners to participate in research activity undertaken by Makabelo Tenane. The details and purpose of the research have been explained to me. I give consent to the following:

Possible future use of the information.

Signatures

---------- ----------

Teacher Date

---------- ----------

Researcher Date

---------- ----------

Witness

LETTER TO PARENT/GUARDIAN

National university of Lesotho

Student name: Makabelo Tenane

Student number: 199400344

Supervisor: Prof. Mokuku

3 April 2021

Dear parent/guardian

RE: REQUEST TO COLLECT DATA FROM YOUR MINOR LEARNER

My name is Makabelo Tenane and I am a Science education student at the National University of Lesotho. My study focuses on "Using a Field Trip to Develop Biology Students' Knowledge on Local Wetland Ecosystem Birds: An Action Research Case Study".

Learners will be given a worksheet to fill and learners' identity and responses will be kept confidential. This activity is voluntary and participants have the right to stop participating at any time. Since this work involves minor learners, permission should be obtained from their parent or guardian for the participation. If you agree, I will request you to sign the attached consent form.

Should you need any further information, feel free to use the following contacts:

Contacts: 58868106

Email: makabelotenane@yahoo.com

CONSENT FORM FOR PARENT OR GUARDIAN

Student name: Makabelo Tenane

Student number: 199400344

Supervisor: Prof. Mokuku

I----------agree to allow my child to participate in research activity undertaken by Makabelo Tenane. The details and purpose of the research have been explained to me. I give consent that my child be used to collect data in this study.

Signatures:

---------- ----------

Parent/Guardian Date

---------- ----------

Researcher Date

---------- ----------

Witness Date

LETTER TO GRADE 11 LEARNERS

National University of Lesotho

Student name: Makabelo Tenane

Student number: 199400344

Supervisor: Prof. Mokuku

3 April 2021

Dear Learner

RE: REQUEST FOR PARTICIPATION

My name is Makabelo Tenane. I am a Science Education student at the National University of Lesotho. As part of my study programme, I am conducting a research in which I would like to find more on "Using a Field Trip to Develop Biology Students' Knowledge on Local Wetland Ecosystem Birds: An Action Research Case Study".

May I therefore request you to be my participants and pseudonym will be used to protect your identity. If you agree, I will request you to sign the attached consent form.

Should you need any further information, feel free to use the following contacts.

Contacts: 58868106

Email: makabelotenane@yahoo.com

CONSENT FORM FOR LEARNERS

National University of Lesotho

Student name: Makabelo Tenane

Student number: 199400344

Supervisor: Prof. Mokuku

I ---------- agree to participate in research activity undertaken by Makabelo Tenane. The details and purpose of the research have been explained to me. I give consent to the following:

Collecting data at Pitseng Weland.

Possible future use of the information.

Signatures:

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Learner	Date
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Researcher	Date
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Witness	Date