Using a Field Trip with Biology Students to Study Wetland Ecosystem Birds

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Abstract

Wetlands ecosystems in Lesotho are significant for their rich biodiversity of birds and other species, yet citizens have limited knowledge about their value, and wetlands are faced with destructive anthropogenic pressures. This study investigated the effectiveness of using a field trip with Grade 11 biology students to study local wetland ecosystem birds. Three questions guided the study: "What is the Grade 11 biology students' knowledge of birds found in Pitseng wetland ecosystem?"; "How does Grade 11 students' knowledge of birds in Pitseng wetland develop with the use of the field trip approach over time?" and "What is the difference between male and female students' knowledge of wetland birds, if any?" Using ecological literacy as a theoretical framework, a case study design, in the form of an Action Research method, was employed to answer the research questions. Data was generated using an open-ended questionnaire and fieldwork observations. The participants were 34 biology students. The analysis of data was both qualitative and quantitative. The findings revealed that students' knowledge on wetland birds was low but increased with the use of field trip over time, regardless of gender. It is concluded and recommended that a field trip is an effective strategy for developing students' ecological literacy and should be used widely for further research of biological concepts.

Keywords: *birds, field trip, ecological literacy, wetland*

Introduction

There are 364 species of birds recorded in Lesotho (Ambrose, 2020). This makes birds in this context, vertebrates with the most diverse species here (Ministry of Tourism, Environment and Culture, 2020). Lesotho is rich in wetlands and related biodiversity (Chatanga & Sieben, 2019) and the present study focused on Palustrine wetland in Pitseng which is situated within a rangeland that is facing threats such as overgrazing, burning of grass and pollution by fertilisers. Although birds are important organisms in wetlands (Sekercioglu et al., 2017), there is a limited research in Lesotho on field studies on wetland birds with secondary school students. 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). Udeani et al. (2016) emphasised that teachers must move away

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from lecture-based teaching to more participative approaches. Hence the aim of this study was to explore the use of a field trip with biology students, to study biodiversity of birds over time in a local wetland ecosystem.

The Lesotho General Certificate for Secondary Education (LGCSE) Grade 11 syllabus indicates that local natural resources should be incorporated in learners-centered teaching. Topic 5 states, "*Describe Relationships of organisms with one another and with the environment,*" and further suggests that students should be able to *"Discuss an ecosystem as a unit containing all organisms and their environment interacting together in a given area."* The syllabus learning outcome (LO) also states that students should be able to *"Discuss conservation of resources",* and the assessment of this LO makes reference to students being able to *"Describe the need for conservation of natural resources (limited to water)* (Ministry of Education and Training, 2020). It is noteworthy, however, that the biology curricula in Lesotho does not specifically cover wetlands as unique ecosystems that should be conserved, despite their significance as water sources and as ecosystems rich in biodiversity. While biology topics and the learning outcomes do not specify birds either, the researchers considered students' knowledge of the species as an essential knowledge for comprehension of wetlands' ecological concepts and processes amongs learners. Thus the study did not set out to develop the syllabus LO amongst learners per se, but to use a field trip to develop knowledge that is aligned to the syllabus LO, based on a wetland ecosystem. The engagement of the learners in a field trip activity enables them develop competencies to explore, investigate, inquire and recognise, in terms of the Lesotho Basic Education Curriculum Policy (Ministry of Education and Training, 2021).

The government of Lesotho has taken various initiatives to conserve wetlands by accession to programmes such as Orange Senqu River Commission (ORASECOM, 2024) and ReNOKA (Ministry of Natural Resources, 2024) and the related recognition of World Wetland Day. These agreements and programmes create a framework for engagement of schools, through curriculum. Yet the involvement of both teachers and students is minimal. The LGCSE Biology examiner's report stated that the performance of Lesotho students on ecological concepts was extremely poor and recommended the use of learner-centred approaches for effective learning of the topic (Examinations Council of Lesotho (ECOL), 2018). This study set out to address this problem guided by the following three questions: "What is Grade 11 biology students' knowledge of 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 over time?" and "What is the difference between male and female students' knowledge of wetland birds, if any?"

Literature review

Animals such as birds surround our daily life and children have different opinions about ecological concepts (Ahi, 2016). Studies show that secondary students' factual knowledge regarding birds is limited, particularly their bird identification skills (Hummel et al., 2015;

Lasuen et al., 2023; Oyebamiji & Odewumi, 2020). Similarly, in a study that involved 345 students from selected schools surrounding five ranges of the park, few of the students could correctly name 10-14 birds (Oyebamiji & Odewumi, 2020). The study concluded that students' ability to adequately identify common birds in their environment is low. Radler and Heil's (2021) findings showed that males could identify more bird species than females.

It can be argued that students' ability to recognise birds, develop students' positive view of birds and to enhance their ecological literacy may best be developed through a field trip teaching strategy (Rijal, et. al. 2018). Other studies have also attributed students' improved comprehension and achievement in biology to field trips (Larsen et al., 2017; Patric, 2010). Mmassy and Roskaft's (2013) findings showed that students had less ability to identify birds as compared to residents living adjacent to a park; the men and older people seemed to know birds better, as they could better recognise the photos of eight selected bird species. This was an unexpected finding as people with little or no education had greater ability of recognising birds than those who received secondary and/or higher education; this was mainly attributable to their interaction with the environment.

Similarly, Jiwa and Esa (2013) 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 limited exposure to the environment. However, Hallman and Robinson (2015) found that the use of Twitter improved students' bird descriptions and identification. Students identified birds from instructor-provided lists or from field guides on their devices, and wrote short description of birds to identify the chosen species, and the descriptions were sent on Twitter. Results revealed that the vast majority of students actively improved their bird identification and description (Hallman & Robinson, 2015). Similarly, the use of E-Atlas Avifauna in some studies, resulted in improved students' ability to identify birds with ease, with the use of photos and pictures (Riley, 2020; Utani & Abbarwani, 2022).

Gender also plays a vital role in students' knowledge about birds. Hummel et al.'s (2015) study revealed that girls had a consistently higher interest in birds than boys in all countries which participated in their study, but there were no gender differences in the students' factual knowledge about birds. In addition, in a school-based outdoor learning experience which focused on a pond, both male and female students gained a broader understanding of ecological content and their knowledge of birds in their local ecosystem improved, as well as the development of a positive attitude towards wildlife (Bird et al., 2020; Ortiz et al., 2018). In a similar way, students in lower and higher grades participated in a study conducted to investigate specific birds such as a pigeon and an owl in their area. Instruments and interviews were used to collect data. Findings showed that students in lower grades had relatively limited information and less biological literacy than the ones in upper grades. Older students, both males and females, in secondary school had more specific knowledge of birds' characteristics (Bartoszeck et al., 2018; Dogru, 2022; Radler et al., 2021;

Tunnicliffe, 2011). In contrast, the Radler and Heil (2021) study collected data via online questionnaires, containing demographic data, engagement in bird watching activity, and images of 28 bird species native to Germany. Participants were students, lecturers and administrative staff. Males identified more species of birds than females, but generally employees scored higher than students did and this implied that students' knowledge of birds was lower.

Bopardikar et al. (2023) indicated that a powerful way of engaging students in environmental education can be school-based citizen science whereby science curricula activities can be developed around community social scientific issues. Bopardikar et al.'s (2023) research presented a participant observation case study of a curriculum designer's thinking and processes in generating and integrating in-class curriculum with citizen science fieldwork. Data were collected using interviews, observations and document and the work was aimed at improving middle school students' knowledge of their environment. Findings revealed that the curriculum designer's work evolved through various measures, including appraisal by external advisers and inspiring examples, surveys of teachers' implementation and written pre-post assessment and evaluation of the curriculum. The key consideration for designing school-based citizen science emerged from learning environment around the fieldwork, as well as making scientist-designed fieldwork engaging to students. Specifically, the main findings were that students gained a broader understanding of their local ecosystems.

According to O'Neal (1995), through education, hopefully, wetlands could be saved, students' attitudes and knowledge developed, and this would ultimately save the global environment. In this study students took a field trip to a mangrove forest and freshwater marsh wetland to be taught about ecology and environmental awareness in general biology. They observed different plants and animals including birds and recorded their observations on data sheets and answered guiding questions, as in the current study. The students thought that field trips were the best laboratory experiences, and gained some understanding of the structure and function of the wetlands (O'Neal, 1995).

Theoretical framework

Ecological literacy (EL) is the theoretical framework underpinning this study. Orr (1990) was the first to introduce the term EL. EL involves a better understanding of the natural systems and assists learners to understand nature and their place in it (Boehnert, 2015). Furthermore, Jones (2014) emphasises that EL provides guidance in the teaching of how nature works in terms of biodiversity changes, interconnections and relationships of living things and non-living things.

Ecologically literate students have the knowledge and competencies necessary to address severe environmental problems (Boehnert, 2015). EL can be integrated into the science curriculum and be developed in the classroom by taking students to local natural ecosystems for identification of vertebrates (Hack, 2015). EL is correlated with gender

among others, with males demonstrating higher levels of EL than females (Pitman et al., 2016). Overall EL is characterised by a number of key tenets, which include students' ability to describe biodiversity changes, identify organisms in an ecosystem, describe the natural systems better, describe and respond to severe environmental problems based on ecological knowledge, and to relate the relationships between humanity and nature as fundamental to the health and survival of many species. In this study, the focus was on one of these, namely identification of organisms in an ecosystem, in relation to changes in students' knowledge with the use of a field trip.

Methodology

Research design and methodology

This research employed action research (AR) to engage a class of students in recurring cycles of planning, action, monitoring and reflection phases (Cohen et al., 2017), with the aim to develop students' ecological literacy over time through a field trip. The action research involved both qualitative and quantitative data collection methods, and these were field notes, students' completed worksheet during the fieldtrip, and class reflection notes following the fieldtrip.

Population, sample and sampling method

The target population was Grade 11 biology students because they are engaged directly with LGCSE Biology (0180) curriculum topic 5 which refers to the 'Relationships of organisms with their environment, including biodiversity in ecosystems'. The sample of population comprised of 34 students in an intact class (24 females and 10 males) in Pitseng, a small town with a largely subsistence community located in the foothills. Purposive sampling was used to select the research school owing to its proximity to the wetland and it being the principal researcher's place of work, thus enabling planned action research implementation with ease. The wetland is situated about twenty minutes' walk from the school.

Data collection method

The study involved two AR cycles, with a three-week time lapse in between, and data was generated primarily through students' worksheets or questionnaires and the researcher's field notes. The instrument covered broad content on a wetlands ecosystem, including names of birds and was face-validated by two specialists in biology education.

The students were arranged to work in 17 gender-based pairs to enable conversation, to co-validate observations, during the field trip sessions: 12 pairs of girls, and 5 pairs of boys. Each pair was required to name the observed bird and to further describe its features and appearance; this was to validate the students' bird identification. The data were generated through the four phases of action research as follows.

Planning phase

In addition to worksheet, a lesson plan (see Table 1 below) was developed, concerning Cycle 1, to engage learners to recall and relate ecological concepts and birds to an ecosystem and to build their understanding of the dependency that all living things have on their habitats.

Table 1: *Lesson plan activities in preparation for field trip*

Lesson steps	Teachers' activities	Learners' activities	Time
Introduction	■ Students were asked to define an ecosystem and give examples of local ecosystems orally. ■ Students were asked to state vertebrates found in an ecosystem and to give examples of each.	■ Students defined an ecosystem and stated examples of local ecosystems. ■ Students mentioned vertebrates and examples.	5 minutes
Activity	■ Students were asked to form small groups of 5, to discuss a number of EL based questions, that related local ecosystems to ecological content learnt in class.	■ Students formed groups to discuss given questions. Each group wrote responses and reported to the whole class.	1 hour
Conclusion	■ The teacher summarised the lesson underscoring the importance of ecological concepts in local ecosystems.	■ Students took notes.	10 minutes

The worksheet, which was to be filled in by students during their observation of wetland birds, was developed by the principal researcher together with the students; it listed birds that they thought were found in Pitseng wetland. The worksheet was intended to guide students on what to observe and focus on, during the field trip and to increase the learning effectiveness on targeted concepts (Myers & Jones, 2021), such as naming an identified bird and giving both a general and unique description.

Action phase

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 first wetland visit took place on 16 February 2023 with the second cycle on 9 March 2023.

The students were required to use their senses of sight and hearing to observe and identify the birds from a distance and were told to avoid disturbing the birds. The learners made a tick against a bird observed on the worksheet, and were also allowed to record and describe any other bird which was not on the given list of birds, using either Sesotho or

common English names. The researcher went around checking on the students. Mobile phones and cameras were allowed to photograph birds, for later verification. Captured photos in a research become observationally accurate and reliable sources of data (Cleland & MacLeod, 2021). The worksheets were retrieved directly from learners after completion of the two cycles by the researcher for data analysis. The principal researcher kept her own diary about the field trip.

Observation phase

Observation in action research involves analysis, synthesis and interpretation of collected data; key issues related to the problem are identified and this leads to reflection phase. In this study, observation in the two cycles involved presentation of learners' field trip findings, analyses of the students' worksheet data and the principal researcher's own diary to assess the impact of the field trip on the students' knowledge of wetlands birds in preparation for the next cycle.

Reflection phase

This phase involved students' discussion of questions that were prepared to guide a reflection on the field trip experience and findings. The students were asked to reflect on, among others, the most frequently identified and recorded birds; description of birds and how the next trip could be improved. These were first answered in pairs, and then discussed generally by the whole class. The reflection phase involves 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).

All involved parties, in the study, were assured that the data and information collected would be kept confidential and would be used for the study only. They were further informed that the real names of participating school and respondents would not be used for confidentiality; instead pseudonyms would be used where appropriate. This was done in line with the principle of anonymity and confidentiality (Cohen et al., 2017).

Data analysis

The data were analysed both quantitatively and qualitatively and presented in the form of frequencies in tables and bar charts, based on the research questions, guided by the ecological literacy tenet on the ability to identify organisms in an ecosystem (Ary et al., 2009), as a framework of analysis of the students' developing knowledge. Thus trends and patterns were determined in relation to the students' knowledge changes over the two cycles of AR, and the data were disaggregated in terms of gender for comparison.

Findings

Students' prior knowledge of birds

The students' knowledge in relation to Pitseng wetland, before the study intervention, shows that 18 (53%) of 34 participants had never been to the Pitseng wetland and did not mention any other wetland, and less than half of the students, 14 (41%), had been at least once 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, out of 34 students, only 6 students (18%) were able to mention a maximum of three birds correctly - Cattle Egret, Heron and Long-tailed Widowbird, for example (see Table 2). Some students' included a vulture and an eagle on their lists, birds which do not typically inhabit the Pitseng wetland, and one mentioned a bat, which is a mammal. The birds' names were all mentioned in the student's first language, Sesotho.

Table 2: *Students' prior knowledge of Pitseng wetland birds*

Students' prior knowledge of Pitseng wetland birds	Frequency (%) (N=34)		Students' correctly mentioned wetland birds	Frequency (%) (N=34)	
	Female	Male		Female	Male
Vulture	59	12	Cattle Egret	41	65
Eagle	35	29	Heron	59	15
Bat	6	6	Long-tailed Widowbird	35	84
			House Sparrow	29	71
			Dove	24	65
			Raven	59	71

The first cycle

Students' field knowledge of wetland birds

During the first cycle, students recorded 20 birds in Pitseng wetland (see Table 3 below). Of these birds, the most frequently mentioned included: Heron mentioned by 82% of students, with plausible description by 71%; Hadeda Ibis by 65%, with a plausible description by 29%; and Long-tailed Widowbird by 65% with a plausible description by 65%. An unknown bird name *"Fotha"* was mentioned by one pair of students (6%).

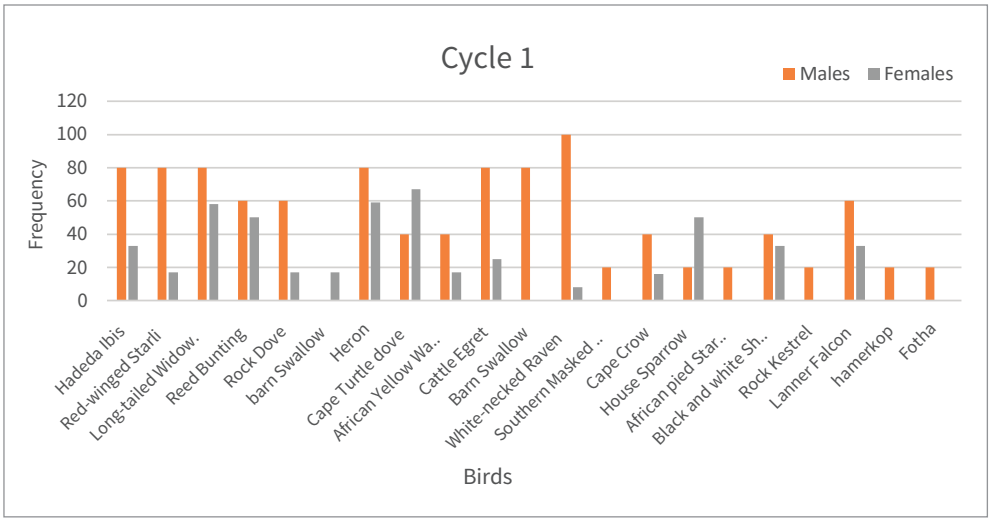
Table 3: *Identified birds in Cycle 1*

Bird name	Pairs that observed the bird (%)	Plausible bird description (%)
Heron	82	71
Cattle Egret	41	41
Barn Swallow (*Lefokotsane*)	24	6
Long-tailed Widowbird	65	65
Reed Bunting	53	41
Hadeda Ibis	65	29
African Pied Starling	6	6
White-necked Raven	35	24
Black and White Shrike	35	29
Cape Crow	24	24
Rock Dove (*Leeba*)	41	29
Cape Turtle Dove	59	42
House Sparrow	41	41
Lanner Falcon	41	35
Rock Kestrel	6	6
Barn Swallow (*Lenkabelane*)	59	24
Southern Masked Weaver	6	6
Red-winged Starling	35	24
Hamerkop	6	6
Fotha	6	6

Gender-based field knowledge of wetland birds

A higher number of male pairs identified birds more accurately than females, as indicated by the comparatively high frequencies of plausible descriptions of birds that they observed. The examples of such birds included: Cattle Egret (80%), Long-tailed Widowbird (80%) and Hadeda Ibis (100%). Some male students also identified and gave more plausible descriptions of 4 (24%) birds which were not recorded by female pairs, and the birds were Hamerkop (6%), Rock Kestrel (6%), African Pied Starling (6%) and Southern Masked Weaver (6%).

Figure 1: *Identified birds and plausible description by gender in Cycle 1*



Cycle 1 General Reflections

During the reflection phase, useful insights emerged from students' response to the question "*How has your knowledge been changed by the birds you have learned from the wetland*"; and the responses were as follows (Table 4):

Table 4: *Students' expressed knowledge changes from Cycle 1*

Pair No.	Gender	Expressed Knowledge Change	Students' clarifying comments
1	F	New birds were discovered	New birds and new names learnt during the reflection phase
2	F	New English names for some birds	Barn Swallow Long-tailed Widowbird
3	F	Birds in wetlands also found at their homes	House Sparrow and Dove are examples
4	F	Boys identify more birds	Hamerkop and Fotha
5	F	Physical description of birds becoming clearer	Heron has many colours
6	F	Some birds identified with a different Sesotho names	Barn Swallow used for *Lenkabelane* and *Lefokotsane*
7	F	More passionate about bird identification even in different places after a visit to the wetland	Birds can be protected or conserved
8	F	Eager to visit the wetland again after the reflection phase in Cycle 1	Field trip makes learning better

Pair No.	Gender	Expressed Knowledge Change	Students' clarifying comments
9	F	The behaviour of some birds is influenced by their food source	Example, many Cattle Egrets due to presence of many animals and its behaviour of sitting on animals' back
10	F	Pictures and videos can help in bird identification	Some birds were too small and fly too fast
11	F	Some birds have many colours but there is one colour dominating	As in Heron but all colours should be reflected
12	F	Some colours of some birds were hard to identify	Example: Red-winged Starling
13	M	Some birds hide in grass to avoid heat at noon or to hide from prey birds	Lanner Falcon
14	M	Some birds fly over the wetland to look for their food	Lanner Falcon
15	M	Working in pairs helped in better identification of bird	The discussion helps in specific identification
16	M	Some birds were easily identified by their sounds	Cape Crow, Reed Bunting birds
17	M	Some years back, some birds were seen in large numbers	Cattle Egret and White-necked Raven

It further became evident during the reflection phase that the students used different Sesotho names for the same birds and that 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%), seemed to fit the House sparrow, suggesting that the former is a rarely used name for a House sparrow.

The students also had insightful views on the field trip itself. They suggested that the next field trip to the wetland could be improved by visiting in the late afternoon, around 4 p.m. when more birds, which left the wetland during the day, are back. Some suggested that the visit should be early in the morning, around 8 a.m. when the birds were not hiding from the heat inside the long grass or reeds, and when many birds had not yet left the wetland.

The second cycle

Students' field knowledge of wetland birds

The total number of birds recorded, on the day and time of the field trip, was 16 (see Table 5); five birds less than the number of birds observed in Cycle 1, but the birds were identified by more students during the second cycle. The most frequently mentioned birds included: Heron by 100%, with a plausible description by 100%; Hadeda Ibis by 94%, with a plausible description by 94% and Long-tailed Widowbird by 100% with a plausible description by 100%.

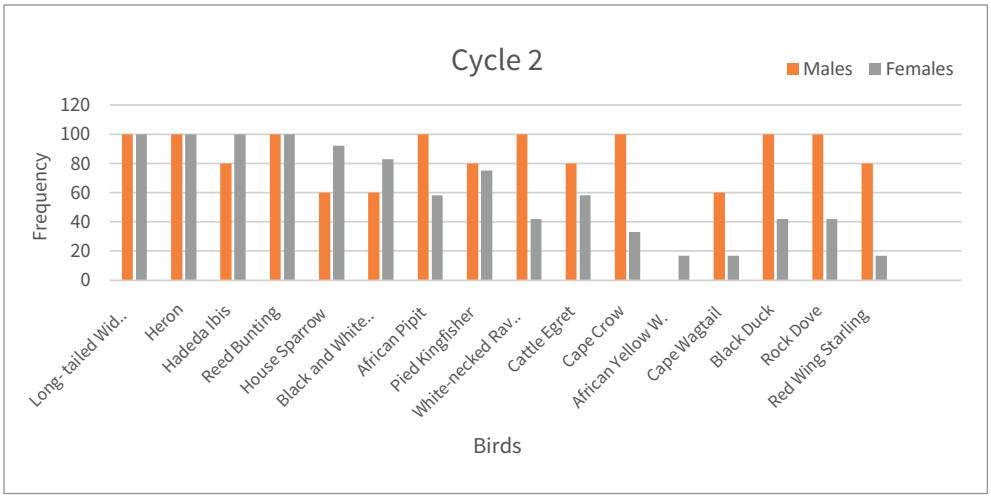
Table 5: *List of Observed Cycle 2 Birds*

Bird name	Pairs that observed the bird (%)	Plausible bird description (%)
Long-tailed Widowbird	100	100
Heron	100	100
Hadeda Ibis	94	94
Reed Bunting	100	82
House Sparrow	82	65
Black and White Shrike	76	76
African Pipit	70	53
Pied Kingfisher	76	76
White-necked Raven	59	47
Cattle Egret	65	65
Cape Crow	53	47
African Yellow Warbler	12	12
Cape Wagtail	29	24
Black Duck	59	47
Rock Dove	82	59
Red Winged Starling	35	35

Gender-based field knowledge of birds

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

Figure 2: *Identified birds and plausible descriptions by gender in Cycle 2*



Cycle 2 Reflections

The reflection session revealed that the students' descriptions of their listed birds were clear enough in many cases. The reflection session also revealed that students' knowledge of wetlands birds improved. This became apparent when students answered the question "How has your knowledge changed after observing birds in the field trip?" Their responses are shown in the Table 6 below:

Table 6: *Students' expressed knowledge changes from Cycle 2*

Pair No.	Gender	Expressed Knowledge Change	Students' clarifying comments
1	F	More clear identification of birds	One bird has many colours, e.g. Heron
2	F	Use of common English name for one bird which has many names in Sesotho	*Lefokotsane* and *Lenkabelane*
3	F	Clear observation and similar description of many birds' features after reflection session in Cycle 1	Specific English names for birds after reflection session in Cycle 1, e.g. rock dove and cape turtle dove
4	F	Identification of birds is good when voices are kept low	Birds do not fly away
5	F	Identification of birds includes the behaviour of a bird	Heron shows white colour when it flies
6	F	New birds were discovered during Cycle 2	Pied Kingfisher
7	F	Some birds identified in Cycle 1 were not identified in Cycle 2	Some birds do not permanently stay in a wetland.

Pair No.	Gender	Expressed Knowledge Change	Students' clarifying comments
8	F	Time of the day determines birds' identification	Birds have different habitats other than a wetland
9	F	Identification of birds needs a closer look	Rainy season made it hard for a closer look of a bird's features
10	F	Boys are good in identifying birds by their calls/songs	Some birds hide in tall grass or reeds in a wetland.
11	F	Boys who have been in a wetland before identified more birds	Boys take livestock from their homes to wetlands for grazing and they are familiar with more birds.
12	F	Some birds were found in a wetlands at certain times of the day	Time of the day influences identification of birds
13	M	Being closer to birds help in clear identification	More features of the bird are well identified at a closer look
14	M	Some birds live on different habitats	House Sparrow
15	M	New discovery of some birds which were not discovered in Cycle 1	Black Duck
16	M	One bird was name was used for a specific bird as it was agreed during the reflection in phase 1	*Lenkabelane* and *Lefokotsane* no longer identified as two birds but as one being Barn Swallow
17	M	New birds discovered	Black Duck and Pied Kingfisher

Additionally, 13 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. Twelve pairs (71%) argued that the problem with Cycle 2 was that the trip occurred too early, and that some birds were still hiding in the tall grass. Three pairs (18%) of students suggested that in future, data collection should be in more than two cycles and more photos should be captured if possible for reference and more clarification during reflection phase.

Five new birds (31%) observed in Cycle 2 were as follows: Pied Kingfisher by 76%, with a plausible description by 76%; Black Duck by 59%, with a plausible description by 47%; Cape Wagtail by 29% and a plausible description by 24%. Birds identified in Cycle 1 but not in Cycle 2 were as follows: African Pied Starling, Barn Swallow, Lanner Falcon, Hamerkop, South Masked Weaver, Rock Kestrel and *Fotha*.

Discussion

According to Hack (2015), the ability to identify organisms in an ecosystem is an important aspect of ecological literacy. Prior to the field trip, only a few students (18%) could correctly mention three birds found in the wetland, such as a Cattle Egret, a Heron and a Long-tailed Widowbird. Some incorrectly thought that birds such as vultures existed in Pitseng wetland. Oyebamiji and Odewumi (2020) similarly found that only a few of the students

who participated in their study could identify 10-14 birds found in a wetland. Researchers have attributed this to indoor learning of biology (Adawaih & Jiwa, 2014; Sarah, 2014; Hammarsten et al., 2019). In this study, the students' knowledge of wetlands birds improved with the Action Research intervention. In line with previous research (Radler & Heil, 2021), more male than female students accurately mentioned birds during the first cycle of AR. Cycle 2 findings reflected a more accurate identification of birds by both males and female students, which is attributable to the field trip (Rijal et al., 2018). The correlation of ecological literacy with gender has previously been observed by Pitman et al. (2018) and in this study, the initial outperformance of females by males in identifying birds could be associated with the local peri-urban cultural practices that connect male youth more with the environment such as livestock herding and wildlife hunting.

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 indigenous. Additionally, the students' bird descriptions made apparent some influence of the mother tongue, as well as the students' possible language limitations (both in English and Sesotho). For instance, their use of the word 'blue' in Cycle 1 could have been a literal English translation of a Sesotho word '*putsoa*', which could mean either 'blue' and 'grey'; the use of implausible bird colours such as purple and silver points to the students' possible limited colour-related linguistic repertoire (Le Wei, 2022). Other limited bird descriptions seem to have been merely due to lack of the required detail, as students tended to describe the birds briefly in terms of their dominating colour, as noted in their description of the Whited-necked Raven as a black bird, without specifying its white patches, which made it indistinguishable from the Cape Crow. Similarly, the Heron was described simply as a grey bird; the white and black colours were left out. The students' poor bird descriptions in Cycle 1 could be attributed to their limited familiarity with birds.

In relation to bird naming, most of the names that the students used are widely known and locally used, and were in line with Ambrose's (2020) documented bird checklist. There were a few cases where different Sesotho names were used for the same birds, and where a distinction was not made between different bird species, of the same family. The students had the latitude to use either language to identify and describe the birds, and they preferred to use Sesotho. Sarah (2014) illustrates that the home environment can play a significant role in students' acquisition of knowledge of wetland birds.

It became apparent that the number of birds seen and recorded depended on the time of the day the fieldtrip was conducted, a finding that was inductively discovered by the students at the reflective stage of AR. Russel (2023) observes that the best birding hours range from early morning, from the hour before dawn to about 10 a.m. As indicated earlier, however, Cycle 2 of the AR yielded slightly fewer number of birds observed, in the present study.

Conclusion

The maximum number of wetland birds identified by students was 20 in Cycle 1, as compared to 362 birds that are found in Lesotho (Ambrose, 2020). Lesotho's wetlands and associated biodiversity, are faced with anthropogenic pressures such as livestock overgrazing, burning of grass and use of chemical fertilisers (Chatanga & Sieben, 2019). Teaching science in ways that promote students' knowledge of their biodiversity can help promote its conservation. This study affirms the value of using a fieldtrip in biology teaching, over time, to enhance the students' knowledge of birds, which constitute the most diverse vertebrate species in this context. This knowledge gain, in relation to identification of birds and their descriptions, constituted the development of students' important aspect of ecological literacy on wetland ecosystem, in a peri-urban environment, where a wetland is located close to a school. The use of a field trip in similar contexts can help advance students' knowledge of the wetland species. It is recommended that science teachers should try out action research-based (AR) field trips in their teaching of ecological topics at all grade levels, to enhance students' knowledge of their local environment, as a basis for its conservation. At least two action research cycles on a given environmental topic could be carried out, for effective learning, as demonstrated in the present study.

Notes on Contributors and their Contributions

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The late Makabelo Tenane was a science teacher and graduated with a Master's of Science Education at the National University of Lesotho. As part of her studies, the Erasmus+ student mobility programme greatly enhanced her conservation pedagogy and inspired her academic writing.

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Percentage contribution

Areas of contribution	Author	% Contribution per area, per author (each area = 100%)
Conception or design of the paper or theory	Tenane	70%
	Mokuku	30%
Data collection	Tenane	80%
	Mokuku	20%
Analysis and interpretation	Tenane	60%
	Mokuku	40%
Drafting the paper	Tenane	70%
	Mokuku	30%
Critical review of paper	Tenane	50%
	Mokuku	50%

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