

Recognizing bio-literacy in nature: An ethnozoological photovoice-based approach to prospective teacher

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ABSTRACT

This qualitative study aims to examine the learning experiences of prospective teachers through the photovoice approach. This research employs photovoice taken by the prospective teachers to obtain main themes regarding the scientific perceptions of the students in ethnozoological bio-literacy studies. This research was conducted in three different places, mountain sites, beaches, and nature reserve tourism destinations. There were 135 prospective teachers divided into nine groups producing 675 photos. The themes include several examples of animal rehabilitation for recovery, animal breeding and increasing of endemic animal populations to natural habitat (ex-situ), habituation of animals, changes in animal behavior, and sale of economically valuable animal shells. Study findings suggest that education must consider themes that arise in the surrounding environment to individualizing their observations in ways meaningful to them and enabling them to assimilate or accommodate the experiences to their schema. Drawing on this empirical evidence, the practical implication of ethnozoological photovoice is further discussed in this study. Based on the perspective of prospective teacher by the difference photograph and difference sites (mountain, beach, and nature reserve tourism) they are found the positive or negative meaning of photograph.

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1. INTRODUCTION

Over the past few decades, biological knowledge has grown significantly, resulting in the development of biology practices. The urgency of implementing education to improve students' scientific abilities has been widely recognized in various countries (Switzerland, Australia, Germany, and the United States) [1], [2]. However, the practice of biology education for prospective teachers does not reflect this progress. Although studies on practice scientific skills already exist in the field of science education, the main concepts of science learning (bio-literacy) which are used today are not utilizing the potential of natural resources and human resources [3]. Integrating various sources of knowledge to investigate a particular phenomenon for obtaining an understanding is still rarely done, an example can enrich the study of the way in which students engage in learning activities can support authentic conversations about how learning occurs and can inform on what students are thinking regarding the process of metacognition [4], [5]. Thus, the biological constitutions about the aspects of the science process (hands-on), science products (minds-on), and the attitude of science (hearts-on) are not clearly understood.

Real changes in biological constitution can be realized through effective education by laying the cognitive and behavioral foundation for further learning throughout life [6]. Through the concept of lifelong

learning, education for all and lifelong learning are considered important elements and factors that can achieve the millennium development goals [7]. It addresses the question of how to encourage individuals to realize his potential (self-competence) and socialize the ethical values and cultural norms to the academic society so that scientific characters can be nurtured by expanding their mental horizons [8], [9]. It refers to self-competence that prospective teachers have about teaching tasks and a higher self-competence. It is necessary to explain how learning can be improved with the support of internal motivation as a strength to act and behave in certain modes [8].

One promising approach to getting the perspective of prospective teachers is through photovoice. Photovoice is one method that enables an educator to view an experience from a prospective teacher's perspective. This study examined how teachers might use photovoice during an informal learning experience to understand the prospective teachers experiences and experiential gain [10]. Photovoice method has gained in popularity in the two decades since its inception by Caroline Wang and Mary Ann Burris in the early 1990s. Photovoice has been successfully used in the fields of education, the built and social environment, disability studies, public health, and the impact of disasters [11]–[13]. Photovoice as a method plays an important role in identifying and highlighting an event [14]. The photovoice dimension used by our research team is to understand the perspective of students through bio-literacy in the ethnozoological context.

Ethnozoology is a science that studies the relationship of animals in the surrounding environment as a local wisdom of the place [15]. Indonesia has mega-biodiversity which shows the diversity of fauna throughout the region and leads to a wealth of potential natural resources and resources in the country [16]. However, there are few data that utilizes local resources to develop students' potential, independence, and self-confidence. For this reason, biology learning through ethnozoological packaging is designed to provide positive knowledge and attitudes about local potential and local wisdom of the region.

Ethnozoology can be used as a trans-disciplinary study of thoughts and perceptions (knowledge and beliefs), sentiments (affective representation), and behavior (attitudes) about the relationship between humans and animal species in the surrounding ecosystem [17]. New initiatives to improve the learning experience of prospective teachers target different segments throughout the continuing education system. The purpose of this study is to report prospective teacher's perceptions on ethnozoological bio-literacy phenomena through the photovoice approach with the aim of developing new strategies in biology learning, quantitative reasoning, and scientific skills.

2. RESEARCH METHOD

2.1. Photovoice in bio-literacy

The dimensions of expanding ethnozoology-based biology education with action research involve communities and places around the local environment. In understanding this bio-literacy, to improve educational goals by taking action and change through sustainable use of biological resources. High priority is given to species that are widely exploited by humans [18]. This photovoice approach recommends students to think creatively, formulate questions about nature, reason logically and critically, evaluate information, make personal and ethical decisions related to biological problems and apply biological knowledge to solve problems [2]. Through photovoice, students tell stories in bio-literacy view of photographs. The results of their choices offer a significant role for the interaction between biology and society in ethnozoological studies [19], [20].

2.2. Research design

The design of our study incorporates a modified photovoice approach to understand the perceptions of prospective teachers about ethnozoology. Exploration of photovoice perceptions includes the scientific literature describing photovoice as a participatory action research method in which participants use cameras to take photographs of persons, contexts, or situations they consider representative of a particular aspect of their individual and/or social life [12]. The experience of taking photographs is a phenomenological inquiry that shows the various possibilities of how they can be explained and how they have the ability to communicating their experiences with others [10], [12]. Another important component when assessing the scientific abilities of prospective teachers is conducting interviews with the aim of providing full assessment of the views of ethnozoological bio-literacy.

2.3. Study areas

For this study, prospective teachers selected a number of places which allowed prospective teachers to take photos of animal species related to ethnozoology, such as the coastal area, a mountainous area, and a tourist area or educational institution. This project was carried out when the students conducted field practice activities. The activities are carried out annually in different locations are beaches, nature reserve tourism sites, and mountain sites.

2.4. Photovoice procedures

We developed photovoice procedures from several photovoice sources [12], [13] and modified them to fit the project parameters. Photovoice analysis was conducted by the students by selecting 10 images from the photos from each site and writing a short narrative for each selected picture. When we delivered the worksheets to the participants, we asked questions that encourage them to speak by giving question about each of the 10 photos selected, to see: i) whether the photo represents the place where the field practice took place or something else; ii) what happened in the photo; iii) why they decided to take the photo; iv) what the photo tells the community; and v) to choose positive or negative choices regarding relationships with photos.

Photovoice assignments given to prospective teachers include a series of questions that facilitate student self-exploration through experiential learning. These exercises focus on perspectives on ethnozoology, which can help in the practice of applying theory. Furthermore, by sharing their responses with other friends, prospective teachers can have the opportunity to absorb the perspectives of others and recognize the validity of various and diverse perspectives [21], [22].

3. RESULTS AND DISCUSSION

There were 135 prospective teacher students divided into nine groups which produced 675 photos. More than half of the participants (63%) were women. The average age of the prospective teachers were 18-20 years. The beach site consists of 50 participants and 250 photos. Mountain sites include 55 participants and 275 photos. The educational institution website consists of 30 participants and 150 photos. Qualitative analysis was conducted to analyze the equations at each site where the fieldwork occurred [23]. Each participant selected at least 30 images to write a brief narrative of what the picture are its significance, and whether the image has a positive or negative relationship. Overall, the percentage of photos with positive and negative meanings is shown in Table 1.

Figure 1 shows an ethnozoological photovoice-based approach network for teacher candidates. Based on findings in the field, some ethnozoologists have shown a positive relationship, such as primate rehabilitation sites; but some show a negative relationship, such as changes in the behavior of *Macaca fascicularis* in the Pangandaran Nature Reserve. Some demonstrate a positive and negative relationship between the two, as with souvenirs found at the handicraft market in Pangandaran. A positive relationship means that the activity positively impacts the animals. A negative relationship means that what happens harms the animal. Meanwhile, the negative-positive relationship has a positive influence; for example, on economic activity. Still, on the other hand, it has a negative effect because of the exploitation of animals.

Table 1. Selected photos of prospective teachers result based on different sites

Images	Mountain site (%)	Beach site (%)	Tourist site (nature reserve) (%)
Positive	90.48	36.11	38.66
Negative	4.76	38.89	42.23
Positive and negative	4.76	25.00	19.11

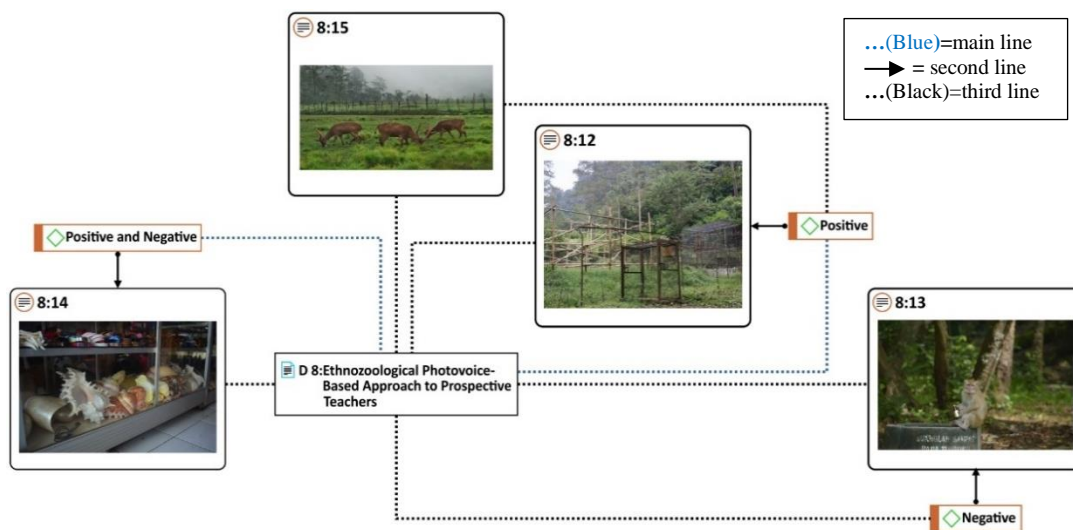


Figure 1. Network ethnozoological photovoice-based approach to prospective teachers

3.1. Positive and negative relationships

Selected images that have a relationship with each site or place according to the theme are presented in Table 1. The highest positive relationship was 90.48% obtained from students taking photos on mountain sites. The highest negative relationship was obtained from students' taking photos of nature reserve tourism sites as much as 42.23%. The highest positive-negative relationship was obtained from photos taken from the beach site as much as 25.00%. The positive relationship interpreted by most student groups is more likely to be in the primate rehabilitation central. They got an explanation from the manager at the rehabilitation center in the interview. The following is an excerpt from the interview:

"Mapping the cages is based on the conditions of the primate, because there are stressful effects of previous bad behavior, there are also primates who are recovering due to skin diseases and primates who are ready to be released into the free forest." (Manager 1)

More negative relations were found from photos of *Macaca fascicularis* who have behavior changed in nature reserve tourism sites. In this place, there is a level of concern of tourists towards the aggressive behavior of *Macaca fascicularis* with tourists' interest in the presence of monkeys by giving any food to the monkeys. The results of interview quotes include:

"I like to bring children on vacation to nature reserves as educational tours. But I am worried about the behavior of the monkeys that continue to approach and target food, children are afraid that the monkey is biting." (Tourist X)

A negative-positive relationship occurs when faced with different views regarding the tourism market around the coast. Many tourists do not know and they even do not want to know about decorations as souvenirs that are labeled, also the animal oil which is used as herbal medicine. Some of these animals are found to be worthy of protection, the reason is that the population is declining. This is reflected by a quote from an interview with one of the tourists:

"So creative these decorations are made from shells and the price is quite expensive. I think it's cheap for souvenirs for office friends." (Tourists Y)

Figures 2 to 4 show four photos and the types of relationships produced with each different site. Figure 2 (a) is a representative image (positive relationship) taken from a mountain site. The narrative for this picture reads, 'primate rehabilitation cage'. The photo tells a photo of a cage used for a Javanese primate rehabilitation place which is divided into two types, namely quarantine cages made of iron nets and socialization cages made of bamboo. Between the net and the wooden cage, there is also a kind of aisle connecting the two cages. These rehabilitation pens are in the middle of a forest surrounded by shady trees as well as the condition of the forest in their natural habitat. This socialization enclosure made of bamboo helps primates get used to returning to hanging like in the wild [24].

Figure 2 (b) is a representative image (positive relationship) taken from a mountain site. The narrative for this picture reads, 'deer breeding'. The photo shows deer eating grass in captivity. The deer are deer *timorensis* or called Java deer. In terms of morphological view, this deer is easily recognized because it has wide ears, a tuft of bright colored hair above its eyebrows, has three large branched horn. Its hair is grayish brown and often looks coarse textured.

The researchers decided to take the photo because it was quite interesting to use an electric wire with a voltage of 9 Volts. The cage is intended to keep the *Hylobates Moloch* type of primate or Javanese gibbon from being separated. The type of *Hylobates Moloch* has a strong memory so that when it is electrocuted when holding a wire in its cage, it will not try again to approach it. This reason was written in the students' narrative based on the results obtained from the interviews with the expert team at the rehabilitation center.



Figure 2. Photograph of a positive relationship on a mountain site, namely (a) primate rehabilitation cage and (b) deer breeding

Figure 3 is a representative image (negative relationship) taken from a nature reserve tourist site. The narrative for this picture reads, 'post-invasive *Macaca fascicularis* behavior'. The photo tells a negative relationship between the levels of tourists' concern with the monkey's aggressive behavior. The monkeys like to take food from the visitors. They become accustomed to eating rice, drinking from bottled drinks, and the like. This shows that the monkeys that behave aggressively tend to be unattractive as objects and natural tourist attractions, because it will make tourists feel uncomfortable and threatened.

Figure 4 is a representative image (positive-negative relationship) taken from the coastal site. The narrative for this picture reads, 'gastropod shells of economic value'. The photo shows a collection of shells from the gastropod group that are traded for decorative purposes. This gastropod species has an exotic and beautiful shell. So, many people take it as collections and trade as souvenirs. Some of the subfamily contained in the photo under international conservation status have been proposed to be a concern with the declining population.



Figure 3. Negative relationship photos on a nature reserve tourism site



Figure 4. Photograph of a positive-negative relationship at a tourism site around the beach

3.2. Word trend in narrative data

Narratives are reviewed to identify which words are mentioned most often. The researchers then checked the word trends in the groups of words. In terms of problems and features related to 'conservation', 'observation', 'environment' and 'habitat'. Mountain groups used words 'conservation' (17 times), 'observation' (27 times), 'environment' (23 times), and 'habitat' (78 times). The beach group used words 'conservation' (13 times), 'observation' (16 times), 'environment' (22 times), and 'habitat' (23 times). Nature reserve tourism groups used words 'conservation' (11 times), 'observation' (22 times), 'environment' (31 times), and 'habitat' (59 times). Words with negative connotations of 'arrests' appear in narratives for mountain sites (11 times) and nature reserve tours (7 times). The accumulated results are shown in Figure 5.



Figure 5. Word cloud with various theme the mountain, the beach, and nature reserve tourism

Comparisons between the results of positive and negative associations (Table 1) with the results of textual trends (word trend in narrative data) reveal conflicting results. Despite the differences between the three groups with respect to the mention of 'arrest', the three groups had similar ratios from positive associations to negative for photographs, with approximately more than one third of the selected photos having a negative association (4.76% for the mountain group, 25% for beach groups, and 19.11% for nature reserve tourism groups). The frequency of words can be regarded as an indicator for the bio-literacy abilities of prospective teachers. Here, the words 'observation', 'environment', 'habitat' and 'conservation' can be the key words when associated with ethnozoological studies [25].

The keyword 'observation' underlies the activities carried out by the prospective teachers on three different sites. Students conducted simple observations to answer the fundamental questions in understanding the meaning of practical lectures directly on the original 'environment' and animals that live in their original 'habitat'. There is a new experience that is shared by the students such as knowing clearly the biological clock of a group of primates to do hours of sleep and eating. There is a group of primates that live in groups such as *Trachypithecus auratus* with the local name of 'Java Lutung' which is one of Indonesia's endemic species [26]. Students can also interpret directly how the environmental carrying capacity affects the lives of these animals.

Other keywords in the form of 'conservation', are the main focus in ethnozoology studies. Conservation can be maintained well when there is good communication between the local community and the academic community. Both of them can mutually transfer knowledge and enhance communication with regard to community-owned local genius. Local genius can be maintained as an indigenous knowledge. Indigenous knowledge is known as traditional or local knowledge which includes special abilities, experiences, and insights that are formed in an evolutionary way. So, they slowly create methods or ways to build knowledge. These are basically indigenous ways to maintain biodiversity on earth [27]. Studies conducted by prospective teacher students can help in evaluating the impact of the human population on regional fauna and in developing sustainable management plans and as a basis for conservation efforts.

Student narratives are arranged into papers. This paper is a parameter of how students can demonstrate their scientific abilities through the experience gained when practicing field studies and contribute to greater social connectedness. Being interpreted philosophically, this is in line with Piaget's development theory which views that one of the most important principles in educational psychology is that teachers or lecturers do not only provide knowledge to students, but students must build their own knowledge in their minds through experiences and interactions [28], [29].

3.3. Photovoice role in highlighting ethnozoological features and problems

Photovoice plays several roles in expressing the narrative of prospective teachers, including: i) Enabling local knowledge as initial knowledge; ii) Identifying priority problems; and iii) Identifying potential opportunities for ethnozoological studies. The study found the modified photovoice procedure to be an effective tool in working with prospective teacher students to identify which features are important in ethnozoological studies and to explain why these features are important for them [10]. Because the participants can choose which photos to write, the photos expand the narrative in an exploratory manner. Part of photovoice's success in learning is the interactive, exploratory, and open nature of this approach that gives the participants the freedom to elaborate and communicate what is significant in the context of ethnozoological studies. Examining what is photographed and read (bio-literacy), and why certain photos are chosen are useful in understanding the problems and themes that are important for the participants [30].

Conservation status is an indicator used to see the level of threat to living species sustainable conservation plans in biologically rich and monetarily impoverished communities [31]. In order to effectively document, preserve, and sustain knowledge, as well as protect the distinct biodiversity, it is imperative that both non-governmental organizations and government authorities collaborate and contribute their combined efforts [32]. It suggests that current conservation strategies need to be rethought [33]. The conservation of biodiversity is a complex endeavor due to the intricate interplay of numerous non-biological elements. Hence, it is imperative for conservation practice to integrate theoretical principles with practical considerations, ultimately impacting individual behavior, values, and decision-making processes [34].

Figure 6 shows the narrative result which explains that there are animals with the following conservation status: i) Endangered (precarious or threatened). Based on the International Union for Conservation of Nature (IUCN) Red List, this status needs special attention, especially for species that are facing the risk of extinction in the wild in the high category in the future; ii) Vulnerable, this status needs special attention to species that are facing the risk of extinction in the wild in the future; iii) Almost threatened, the conservation status is given to species that may be in a threatened or approaching state of extinction; and iv) Least concern (low risk), deficient data (less information) and not evaluated (not yet evaluated). This conservation status category based on the IUCN Red List gives us an idea of the condition of living creatures.

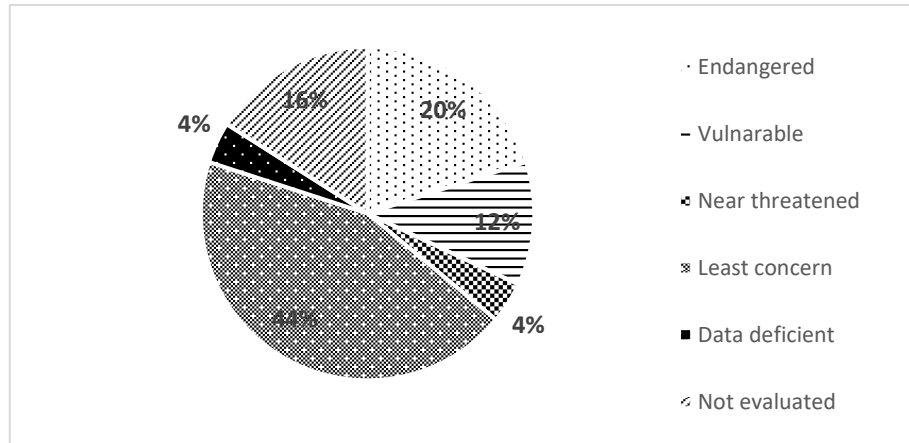


Figure 6. Analysis based on conservation status

In the context of research and education mountain sites, beaches and nature reserve tourism are visual components of photovoice in Indonesia. In terms of taking photos selectively, the features of rehabilitation sites in the mountains are good to be made into a positive implication about animal conservation including: i) The process of restoring the pattern of behavior of a group of primates through a rehabilitation enclosure indirectly restores the behavior of primates who have undergone changes caused by people who hunt and deliberately teach patterns of behavior that are not in accordance with their original habits. This component has implications regarding the importance of rehabilitation sites with dense forest areas covered by tall and large trees to help primates adapt to their habitat; ii) The second implication relates again to the themes taken from photographs according to the narrative. The photovoice role in directing the direction of the written narrative reveals the overlapping relationships made by students in the context of the

use of gastropod shells to connect the sense of responsibility related to conservation status and the community by cliché reasons for using shells as waste for economic purposes; and iii) The third implication also relates to a written narrative that links an effort in the multiplication of breeding and animal breeding and increasing of endemic animal populations to natural habitat (ex-situ) by maintaining the purity of its kind through a breeding business [31].

4. CONCLUSION

This modified photovoice functions as an effective device to train the prospective teachers about bio-literacy and ethnozoology. Given the nature of the open investigation of photovoice as a method, we broaden and enrich our understanding of the perspectives of the selected photos of prospective teachers result based on different sites about mountain sites, beaches and nature reserve tourism and how they make connections between conservation, environment, habitat, observations, the need to take action, ethnozoology and the role of the community. Despite the differences in the characteristics of mountains, beaches, and nature reserve tourism, the prospective teacher students shared positive and negative experiences. In the future, these photos and narratives can be presented back to the community and exhibited. Photovoice can be used for further research based on investigations regarding the bio-literacy of individuals.

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