Overcoming Barriers to Effective Ecological Education: A Malagasy Case Study

by
Kimberley Preston

A PROJECT

submitted to

Oregon State University

University Honors College

in partial fulfillment of
the requirements for the
degree of

Honors Baccalaureate of Science in Fisheries and Wildlife Sciences
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(Honors Scholar)

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Anne Bahde

Abstract

Honko Mangrove Conservation and Education is a Western non-governmental organization based in Madagascar that serves as a source of public science education and caters to diverse audiences. My thesis examines barriers of culture, language and epistemology that may constrain *Honko*'s ability to conduct effective public education, if they decide to expand their organization. *Honko* should implement a three-pronged action plan that includes a dynamic epistemological model drawing from Western and Traditional Knowledge Systems and an strategy to actively identify changing audience and stakeholder bases. These two steps plus a shift towards constructivist educational philosophy that encourages reflection and incorporates social-context into science could help *Honko* attain their educational goals and overcome cultural barriers to ecological and public education.

Key Words: Epistemologies of science, public science education, international conservation

Corresponding e-mail address: prestonk@onid.oregonstate.edu

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APPROVED:

Anne Bahde, Mentor, representing Special Collections and Archives Research Center

Amy Below, Committee Member, representing School of Public Policy

Nicholas Fleury, Committee Member, representing International Degree and Education Abroad

Shireen Hyrapiet, Committee Member, representing Earth, Ocean and Atmospheric Sciences

Toni Doolen, Dean, University Honors College

I understand that my project will become part of the permanent collection of Oregon State University, University Honors College. My signature below authorizes release of my project to any reader upon request.

Kimberley Preston, Author

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1 INTRODUCTION

Rapid globalization has led to increased cross-cultural interactions and an increased need to adapt teaching strategies in consideration of diverse cultural ideologies. As Western non-profit organizations establish in Non-Western cultures, incongruous pedagogy can prevent effective informational exchanges and learning opportunities. The mangrove conservation and public outreach organization *Honko*, of Ambondrolava (23°15'41 S, 43°37'42 E) Madagascar faces this very challenge. Since *Honko* hosts a wide variety of visitors with different cultural backgrounds, they must work to identify their audiences and target their messages. *Honko* interpretive leaders must work to identify their primary target audiences. This thesis will explore and recommend different strategies for different audiences, accounting for diverse cultural, scientific and educational backgrounds.

Figure 1. *Honko* is located on the south-western coast of Madagascar, which is an island off the southeastern coast of Africa (Google Earth 2015)

Thesis Statement

Honko should implement a three-pronged action plan that includes a dynamic epistemological model drawing from Western and Traditional Knowledge Systems and an strategy to actively identify changing audience and stakeholder bases. These two steps plus a shift towards constructivist educational philosophy that encourages reflection and incorporates social-context into science could help *Honko* attain their educational goals and overcome cultural barriers to ecological and public education

1.1 Approach and Methodology

In the fall of 2013, I spent fifteen weeks studying biodiversity and natural resource management throughout Madagascar. I spent four of those weeks conducting an independent study surveying avifauna in the mangroves and saltpan habitats of *Ambondrolava*—a small town on the southwestern coast of the island.

The bird survey and subsequently, this thesis, arose after visiting a Belgan conservation organization based in *Ambondrolava* called *Honko* (pronounced *Hoonkoo*) Mangrove Conservation and Education (Figure 1). As their title suggests, they strive to protect and rehabilitate the regional mangrove stands that had been heavily timbered and educate the public about this unique ecosystem. They are a relatively small organization, with an average of six to seven employees and few, sporadic volunteers.

During my initial visit, one of the managers expressed a desire to expand the organization—hiring more staff and volunteers, upgrading the education center, rebuilding the Woman's Association's souvenir shop (which had been washed out in a hurricane), and increasing the number of visitors. While *Honko* receives some funding through grants, most of their financial support is from visitor and sponsor donations. Thus drawing in more visitors—whether school groups, Malagasy or foreign tourists, or ecotourists (travelers focused on natural areas)—would facilitate *Honko's* conservation work, capacity building efforts, and would directly support local livelihood.

Thus *Honko* invited me to their facility to collect data on the local avian community composition for two reasons: to give a baseline of bird populations at this stage in the habitat rehabilitation and to entice more tourists, particularly international birdwatchers, to visit the area.

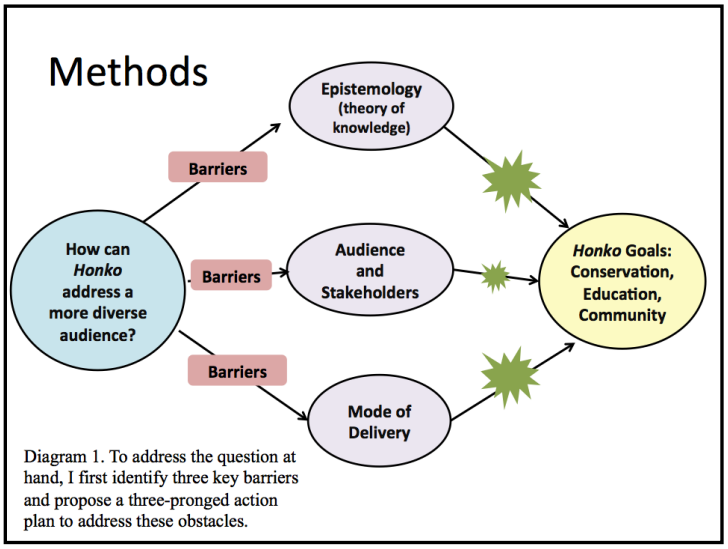

Diagram 1. To address the question at hand, I first identify three key barriers and propose a three-pronged action plan to address these obstacles.

During my time studying in *Ambondrolava*, I lived at the *Honko* center and conducted bird surveys in the preserve area. I regularly interacted with *Honko* staff, community members and groups that came to tour the mangroves. After leaving *Honko* and Madagascar, I was curious to explore what barriers *Honko* (and potentially other international NGOs) would face if they did indeed decide to expand (Diagram 1), taking into account their current practices and resources.

Drawing from my background in Western Science, my experience at *Honko* in Madagascar, and my involvement in public education, I take a deeper look into the hurdles that may arise if *Honko* expands—such as reaching a more diverse audience while aiming for multiple goals (education, conservation, local livelihood). I look at *Honko*'s current model, identify potential barriers, then I propose methods to overcome those barriers and ways in which *Honko* or other international organizations can be adaptive to address their situational needs.

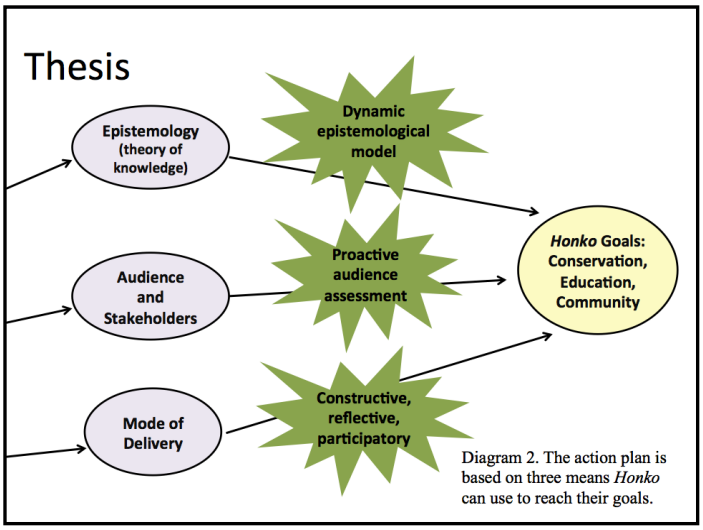

Diagram 2. The action plan is based on three means *Honko* can use to reach their goals.

To support my proposal I draw from an interdisciplinary literature review of journals, scholarly writings and case studies that address Traditional Knowledge systems, Western Science, public science education and effective communication. I identify *Honko*'s published educational objectives (from their website), then integrate those goals with a base knowledge of public education, diverse systems of science and audiences (including Western scientists and local Malagasy) to develop strategies to overcome these barriers (Diagram 2).

1.2 Anticipated Outcome and Significance

I expect to encounter layers of converging and diverging ideology among different groups. Western-based conservation organizations establishing themselves in Non-Western communities and catering to different audiences need to adapt their outreach material through diction, themes, and educational tools for effective educational exchanges. Also, exploring means of communicating inaccessible scientific concepts will be crucial in the context of citizen-initiated environmental stewardship.

2 MADAGASCAR BIODIVERSITY

The island of Madagascar is among the most important biodiversity hotspots, possessing 3.2% and 2.8% of the world's endemic plants and vertebrates, respectively (Myers et al 2000). Madagascar's high endemism rate is largely ascribed to the island's 88 million years of isolation from other landmasses (Rakotoarinivo et al 2013). Possessing tropical rainforest in the east, spiny deserts in the south, Madagascar is home to 283 bird species (100 or more of which are endemic), 12,000 known vascular plant species (90% are endemic), more than 300 amphibian species (nearly 99% are endemic), and 93 species of lemurs (all of which are endemic) (WCS 2015). Furthermore,

Madagascar hosts the Great Reef along the western coast, which is considered to be the third largest reef-complex in the world (Reef Dr. 2014).

However, a culmination of political instability, poverty, and international exploitation of Madagascar's natural resources has led to habitat degradation but also an influx of non-governmental organizations into Madagascar's environmental conversation.

3 HISTORY OF *HONKO*

Honko Mangrove Conservation and Education (Figure 1) is a Belgian-registered, non-governmental organization located on the southwestern coast of Madagascar. *Honko* (meaning 'mangrove' in Malagasy) was established by a Belgian conservationist in 2007 in response to regional deteriorating mangrove ecosystems. *Honko* has been working in conjunction with the local community of Ambondrolava to rehabilitate over 200,000 acres of mangrove forest by prohibiting timber harvest, planting mangrove saplings, and developing alternative means of livelihood.

3.1 Accomplishments

To date, *Honko* has helped facilitate 41 plantation events covering over 13 hectares. Local employees maintain a nursery of mangrove trees and alternative-wood trees. *Honko* employs local people as guides, guardians, nursery caretakers, out-reach educators and liaisons between *Honko*'s Mangrove Information Center and the greater community.

3.2 Mangrove Ecology and Importance

This mangrove complex, just outside the major city of Tulear, supports five coastal villages including Belalanda, Tanambao, Belisake, Ambondrolava, and

Ambotsibotsike. Mangroves grow along tropical coast lines and have adopted different strategies to cope with changing salinity, oxygen and water levels (Beentje 2007).

The once mangrove-rich western shoreline of Madagascar has deteriorated as coastal inhabitants have broken-down and collected wood from the mangroves to construct homes, build *pirogues* (boats), fuel fire and make lucrative *charbon* (cooking charcoal). The mangroves also buffer the coast from intense tides and shelter fish nurseries, which provide fishermen with a source of income and community members with a source of protein.

The mangrove forest is also important for local wildlife as it serves as "shelter for roosting or nesting [birds], while the abundant life of the mangrove and adjacent mudflats and saltmarshes offers rich food supplies" (Spalding 2010). Mangroves provide invaluable ecosystem services such as carbon sequestration and erosion prevention. Degraded mangrove forests are less fit to perform these duties and their absence can alter habitat composition.

Thus, preserving and rehabilitating the mangrove complex along Ambondrolava is beneficial to both the local community and the surrounding ecosystem. *Honko* aims to conserve the mangrove ecosystem and support the community's long-term ability to manage natural resources through capacity building and education (*Honko* 2015).

3.3 Organization

Honko Mangrove Conservation and Education Organization is currently administrated by a six-member onsite team –including two Westerners (a male program manager and a female project coordinator) and four Malagasy naturalists (one male and one female socio-organizer and two male mangrove guides). *Honko*'s key strategy is

community-based management. In 2010, *Honko* supported the formation of *VOI Mamelo Honko*, a village-based association working alongside *Honko* to conserve natural resources for future generations and to strengthen the community's role in management (Honkomad 2013).

Figure 2. A deforested area of *Ambondrolava* planted with mangrove propagules from *Honko*'s nursery.

The *VOI*, composed of representatives from the five surrounding villages, garnered support for a *DINA* local law that bans use of mangrove wood for charcoal production and prohibits fishing in the mangrove channels (*Honko* 2015). This *DINA* (decree 60 133) is a local law formed by all villagers concerned then approved by judicial authorities and put into force (Honkomad 2013). The *VOI* association is also involved in capacity building. In 2014 the *VOI* received funding to build a nursery and cultivate mangrove tree seedlings. Since 2009, "over 300,000 seedlings and propagules have been planted across 15ha" (*Honko* 2015) to restore the deforested mangrove stands (Figure 2).

Additionally, *Honko* helped found the *Mamelo Honko* Women's Association based out of the information center. Through the association, local women are trained in business skills "including financial management, bookkeeping, and customer relations" (*Honko* 2015), as they make and sell woven reed items to tourists and visitors. *Honko* has also worked to establish other alternative livelihood in the area, including apiculture (beekeeping), aquaculture, and nurseries to grow trees for timber harvest.

3.4 Current Education Programs

Figure 3. *Honko*'s education center serves also as staff conference room, staff kitchen, and home to the program manager.

Current educational practices depend on outreach. *Honko*'s Mangrove Information Center (Figure 3) is located in the village of Ambondrolava and serves as their main operating unit, where staff and volunteers live, as well as the headquarters for their education outreach. Stemming from the Information Center is a network of board walks that lead out into the mangroves. *Honko* guides offer tours around the mangroves, reed beds, saltpans and mud flats (that compose the restoration areas of Ambondrolava) for tourists, school groups and various other visitors. Interpretive signs (in French and English) are located along the board walk, illustrating topics like the important ecosystem services the mangroves provide and the local flora and fauna.

3.5 Barriers

Honko, however, has to navigate through a number of physical and figurative barriers, including access to resources, geographic isolation, and political instability. As a non-governmental organization, *Honko* relies on sponsors, grants, and visitor donations to support their efforts and staff. The arid southwest is one of the most impoverished areas in Madagascar, with little infrastructure (like navigable roads and sanitation) and limited access to resources (including personnel, materials, and technology). *Honko* must also navigate shifting political hierarchies, in which changes or project proposals must be passed through a tangled web of authorities before legitimized.

Honko faces less tangible barriers as well. They interact with and cater to international actors (sponsors and tourists) while collaborating with Malagasy community members to achieve and sustain local livelihoods and ecosystems. *Honko* serves as a significant, though localized, source of public science education in Madagascar. Different conceptualizations (eg: Western and Non-Western) and manifestations of science and science education in a public setting can be a barrier to knowledge exchange to *Honko*, if not addressed.

Honko also caters to an array of audience members—all of whom view the world through a unique lens and seek to fulfill a specific goal by visiting *Honko*. Thus, this individual-specific nature of science/ecological education can be an obstacle in *Honko*'s ability to capture attention, engage the audience, and ultimately execute their role as educators.

In order for *Honko* to reach their goal of educating the public and community about mangrove ecology and conservation, they should approach their lesson plans from different angles. This will help *Honko* effectively reach a variety of audiences while expanding the education staff's ability to identify and overcome barriers that arise on a per-group basis.

4 BARRIER: PUBLIC SCIENCE EDUCATION

Honko serves as a significant, though localized, source of public science education in Madagascar. Different conceptualizations (Western and Non-Western) and manifestations of science and science education in a public setting can be a barrier to knowledge exchange for *Honko*, if not addressed.

4.1 Public Science Education Overview

For the purposes of this study, 'the public' is defined as 'the non-scientist community at large' and 'public science education' refers to education both in and outside of formal institutions. The broad goal of public science education is to prime future scientists and prepare citizens to private and civic decisions (Feinstein 2015). Science does not occur in a vacuum, rather, it develops and evolves in time and space—adapting and responding to cultural needs (Grigorenko 2007; Dagher 2004).

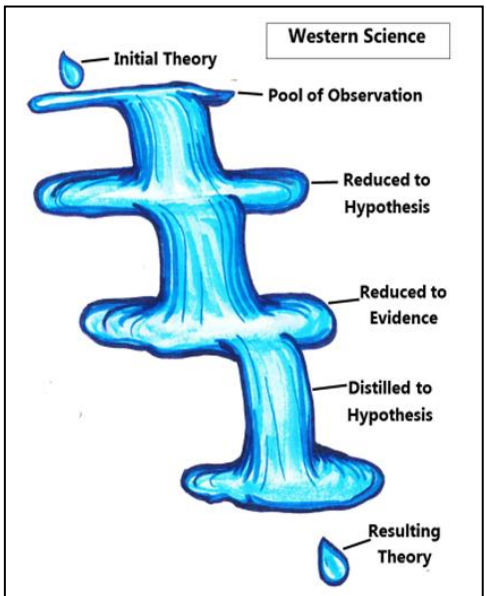

Figure 4. Western science is linear, deductive, consisting of hierarchical steps to support a conclusion.

4.2 Epistemology of Western Science

On a temporal scale, the Western education system is relatively young compared to knowledge systems found, for instance, in Ancient China. Western Science is the offspring of ancient Greek philosophers and has evolved to be the "secular educational paradigm of the west" (Grigorenko 2007). According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), as of 1998 about "80% of world's children were enrolled in public school, had a structured school day, used textbooks (when available), and followed some curriculum," mirroring Western methodology.

This mode of study was developed in part, to standardize measuring units or procedure and render the process replicable (Jasanoff 1995). For instance, perspective geometry uses proportions and relative sizes that can be compared at a distance (Turnbull

et al 1993). This mode of standardization attempts to remove human bias and connection to the exterior, social world and creates a replicable model.

Western methods of conducting science are characterized by a linear organization of thought, rooted in systematic deduction (Figure 4). Credibility is established in a hierarchy, from speculation to hypothesis, theories, law, to facts (Dagher 2004). Science deviating from an empirical theory is often viewed as less credible.

Similarly, Western Science tends to be taught in linear, hierarchical manner in which teachers supply students with information (Dunne 2013). This teacher-centered methodology favors topical-based knowledge transmission rather than conceptual or issue-based transmission. According to Cole (2005), typical Western education requires certain functional characteristics including a population large enough to separate schooling and labor; some level of economic development; a bureaucracy to standardize education; symbolic systems (like alphabets and books); and finally, an inclusive, public nature. While methodical Western Science has yielded many discoveries and produced important advances, it also has exhibited cultural, social, and institutional limitations (some inherent, others superficial).

Considering these general criteria, when western colonizers began to establish themselves around the globe, they brought their institutions with them. In Africa, unofficial schools abounded and colonizers focused on training local teachers enough to serve as administrators in the new establishment, but only to the extent to which colonial language and institutions would spread (Grigorenko 2007). The educational focus on colonizer language, way of life and pedagogy often suppressed expression or education of local traditions or knowledge—setting a precedence of stratified pedagogy.

Currently, the scholastic focus in African nations has been to increase student numbers. However, while student count has increased, the quality of education has gone down. This increase in students has led to a shortage of educational material and an increased hiring of under-qualified teachers with no guarantee that extra schooling will help students become professionally successful (Grigorenko 2007). As a result, parents have become dubious of the cost/benefit outcomes of sending their children to school—the latest frame of mind is that school is not showing results, so parents are keeping their children home. This illustrates the necessity for integrative education to meet the needs and values of communities on a more localized, rather than globalized scale. Adapting education to the cultural context is crucial. While Western Science education may be effective in some locales, it is not universal.

Furthermore, the Western Scientific view tends to tackle issues without considering the broader implications. For example, a rangeland ecologist has, using the scientific method, developed a management plan to restore a riparian habitat back to its historic state. However, there are several issues to consider here that, until recently, have largely been neglected when developing management plans: what constitutes a 'historic state' (fifty years ago? 200 years? 10, 000 years?)? What are the social implications of this restoration (is it impacting rancher's grazing rotations? Has it diverted water from surrounding communities? Has it changed land use policies?)?

Another limitation to Western Science education is that it does not incorporate the nature of science. In other words, the established curriculum rarely addresses that "scientific reasoning is not itself compelling without appeal to social, moral, spiritual and cultural resources" (Pumfrey 1991). Science lessons often entail students memorizing an

established theory then verifying it by conducting a "carefully set up demonstration" (Pumfrey 1991), thus constructing science as a closed-ended event rather than an open-ended process.

Engraining science instead with the concept of humanity will help students overcome the sense of alienation some experience when confronting scientific concepts. Understanding that discussion in science is always rooted, at some point, to value judgments and cultural context will prepare students to face complex ecological issues (as scientists) or prepare them to make informed, critical decisions (as citizens).

The functional limitations of Western Science in Madagascar have hindered conservation efforts. Western environmentalism tends to function on a double standard that aims to preserve wilderness (an ecological metric) and simultaneously works to maximize sustainable yield (an economic metric). This double standard heightens the stratification between humans and nature that has defined Western conservation. This duality "creates complications in parts of the world where human interactions with nature do not adhere to solely aesthetic or economic standards" (Evers et al 2013). Foreign-led projects, including initiatives of non-profit and non-governmental organizations, tend to be locally viewed as *mivarotra tanindrazana,* meaning the 'selling off the land of the ancestors' (Evers et al 2013). This clash in ideology is a critical barrier that must be resolved to implement fruitful, temporally sustainable conservation action plans.

4.3 Epistemology of Traditional Knowledge

Taking a step outside of Western Science does not reveal a singular, opposing pedagogy. Nations and communities throughout the world express an incredible diversity of local education or knowledge transmission systems, thus it is not appropriate to use a

single, all-encompassing term to reference these systems as if they are of one body. However, for the purposes of this work and for the sake of clarity, this collection of pedagogy will be referred to as 'Traditional Knowledge' with the understanding that it represents a heterogeneous assemblage of epistemologies. Furthermore, the term 'traditional' denotes having a long legacy, not as being outdated or not modern.

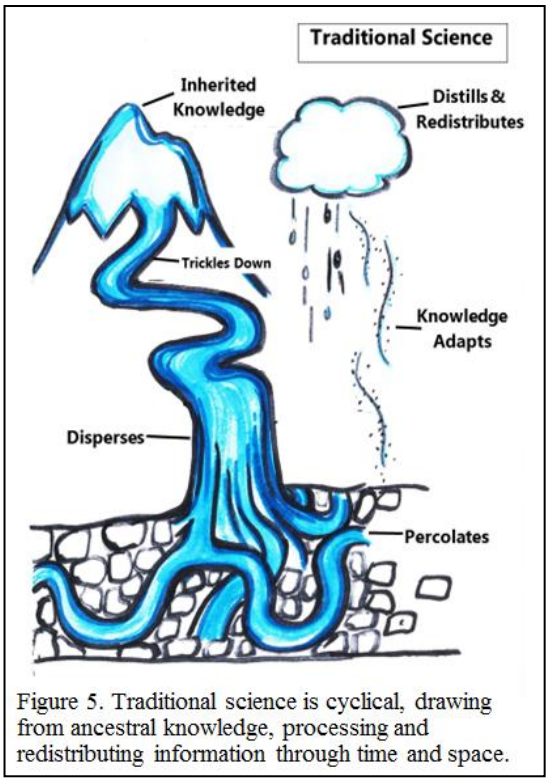

Figure 5. Traditional science is cyclical, drawing from ancestral knowledge, processing and redistributing information through time and space.

Traditional Knowledge systems are as diverse as the people and cultures they represent. In a general sense, Traditional Knowledge systems are characterized by a cyclical organization, based on intuitive, inductive reasoning (MacEachran 2004). Inherited knowledge is often passed down orally, through text, images, or experiences. It then interacts with the mainstream and is influenced by a complex web of relationships across time and space.

An effective metaphor to understand the role Traditional Knowledge can play is to see it as a map. Maps are visual representations of knowledge that express spatial or conceptual relationship among its components. Maps represent phenomena in space that is used as source of information and can aid in decision-making behavior (MacEachran 2004). Furthermore, maps, like knowledge, are made and interpreted based on an accepted set of rules from which cultural baggage cannot be removed. They also convey a consciousness and understanding of world and world-order (Turnbull et al 1993) that

has arisen from a culmination one's experiences. Maps, like many Traditional Knowledge systems (Figure 5), tend to be intuitive and holistic (looks at the whole picture/map), whereas Western Science is inductive, reductionist (breaks down the image/map into manageable pieces) (MacEachran 2004). In Western Science, the cartographers are usually trained scientists and researchers where as in Traditional Knowledge systems, the cartographers are often elders, local *ombiasa* (shamen or medicine men), or familial connections.

European maps are usually based in geometry, perspective, coordinate systems, and standard units (Turnbull et al 1993). Some TK systems, on the other hand, incorporate context-specific elements such as landscape, culture, and time. To illustrate this, consider aboriginal Australian traditions of *Altjiranga* or 'Eternal Dream Time.' In Aboriginal traditions, ancestral, immortal entities still inhabit features of the landscape today. The tribe's spiritual connections to these features are relayed through maps of song, dance and oral tradition to "teach and guide the souls of the initiates through the world in the Dream Time" (Clark 2005). However, the spiritual connections can also translate into spatial connections because the ancestral entities manifest in the landscape. Thus, visual maps serve as "practical guides to the natural world" (Clark 2005). These ancestral footprints represent large amounts of knowledge that has been sustained and transmitted.

The knowledge systems in Madagascar are also diverse, differing from region to region, ethnic group to ethnic group. In general, traditions and worldviews in Malagasy communities are rooted to rules of the spirits (*fady*), ancestors, and land (*tany*). *Tany* expands beyond the ecological elements of land and is "interwoven with spirits,

ancestors, burial grounds, and agricultural fields" (Osterhoudt 2010). Ancestral *fady* or taboos are interwoven with *tany* and, by in large, construct Malagasy knowledge systems, dictate the way they navigate the world and guide use of resources. During my time in Madagascar, we came across a number of *fady* in daily life, from table manners, to interactions with elders to encounters with special natural spaces. For instance, while I was exploring a small, rural town in the south east of the island we came across a number of sites with associated *fady*. The first we encountered was a large vernal pool just outside of town—a scared site of cleansing newborns. In this case, it was considered *fady* or taboo to swim in the pool or drink from it, to avoid tainting its purity.

Tany is dominant conceptualization of the landscape and one's connection to the land. However, with the increasing international pressures to preserve Madagascar's threatened biodiversity, the term *tontolo'iainana* has arisen to denote 'environment' or 'the world in which we live, including land, animals, people, cities and cars and is as a more "global and secular idea" (Sodikoff 2012). Coined in the late 1980's, *tontolo'iainana* is a synthesis of Malagasy words and has strong association with the Merina ethnic group (people of the upper plateau who have a long history of oppressing the 'inferior' ethnic groups) and with the *vazaha* (outsiders). The term is not widely used in everyday conversation (due to its associations and removed relationship to the land) and arises almost exclusively in conservation settings (Sodikoff 2012).

While there is a call for integrating traditional knowledge into science, this does not mean that all traditional ways of life are models of holistic sustainability. As in the case of Madagascar, slash and burn practices (*tavy*) for agriculture fields and zebu pastures has greatly reduced forest expanse and threatens the island's biodiversity. Thus,

both systems of thought have strengths and limitations that should be identified to move forward. Also, the localized nature of Traditional Knowledge systems and their limited reach beyond their immediate social surroundings can constrain dissemination of their practices.

5 Overcoming Public Education Barriers

The scope of Western Science epistemology should be broadened to include humanity and the nature of science. We also need to integrate traditional models into 'traditional conservation' programs and encourage a shift in epistemology in the West. This can be achieved by shifting the *ways* in which educators talk about science.

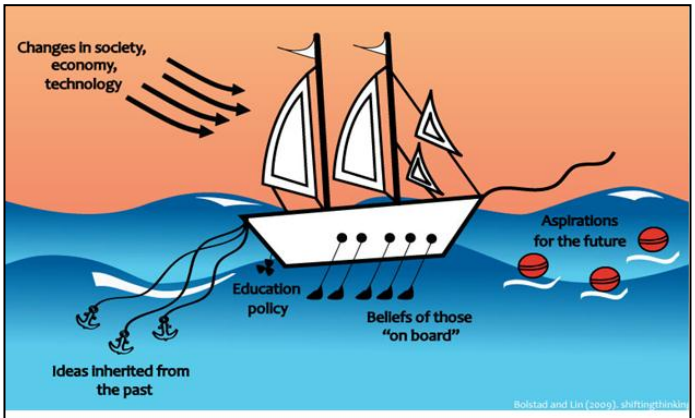

Figure 6. This represents an integrated conceptualization of science, incorporating historical ideas with technology; the political and belief-based ideology with scientific aspirations (Bolstad and Lin 2009).

As illustrated earlier, the linear, reductionist methods of Western Science cannot substitute the cyclic, adaptive system of Traditional science; however, they can be merged into an integrated, collective model. (Figure 6) illustrates a fusion of Western and Traditional Knowledge systems. It captures the constant motion/progression of ideas being propelled by innovation and larger context of societal trends while stabilized by knowledge/beliefs of the past. This graphic also incorporates the passengers on board that can shape the course of the Knowledge ship towards future goals, adding the humanity that is absent from the Western model. The rudder of education policy also helps steer the ship, keeping it on track.

I argue that this integrative, dynamic model of science has a greater degree of resiliency to address complex webs of relationships and unpredictable feedback systems. The West is uncomfortable with uncertainty, which, while inherent in every form of science, is a dangerous mindset when tackling complex soci-ecological issues. Fortunately, the shift towards the integrated model has already begun—there has been a conscious trend towards an issue-based approach to conservation. The dynamic issue-based approach mixes local, regional, national and global issues concerning human health, food resources, energy and resource consumption (Hodson 2003) as well as the ethic and social responsibilities of conservation ventures.

This can and should be applied to public science education in intra and inter-cultural settings. Educators need to acknowledge that while science is a crucial tool aiding understanding of the physical world, it is also a human construct –a fact that tends to get overshadowed by a fixation with objectivity in the West. Following the dynamic model, pupils have the right to develop their scientific ideology with the understanding that scientific ideas morph over time and are "affected by the social, moral, spiritual and cultural context in which they are developed" (Pumfrey 1991). This is also called the nature of science, which relies on the Traditional Knowledge theme of constructivism, not so much on objectivism. Constructivism focuses learning on sensory input, layers of meaning, includes social/cultural context of learning, and allows time for the learner to ponder and reflect.

From a constructivist approach, Western educators should encourage students to reflect on the cultural importance of science and to be aware that scientists disagree. Local educators or community members involved in *Honko* should also be encouraged to

reflect on *tany* and *tontolo'iaina*. In other words, they should reflect on their value of ancestral land and how that value connects to the greater scope of the international ecological conversation. Perhaps this would catalyze movement beyond *mivarotra tanindrazana* ('selling off the land of the ancestors') and lead to economically and culturally sustainable conservation measures.

Thus far, most of Madagascar's conservation efforts have focused on protected areas and 'no take' zones. However, these policies have excluded many rural households from utilizing the resources upon which they once depended. Fortunately, as policy is shifting towards community-based management of resources, so too are the management strategies of non-governmental organizations such as *Honko*. Implementing community-based management strategies and educating based on a dynamic knowledge model, epistemic constraints will more easily be overcome.

6 BARRIER: AUDIENCE AND STAKEHOLDERS

Effective ecological education depends on the relationship between the educator and the audience. Multifunctional organizations, such as *Honko,* regularly interact with a wide variety of audiences and stakeholders—from scientists to community members to school groups to ecotourists. Failing to identify one's audience reduces the impact of one's educational messages or professional goals. For instance, failing to identify your audience would be like serving cake when the customer ordered pie—he or she is still receiving *something* but not the *desired something*—thus diminishing the server's credibility or weakening his or her impression on the customer. Understanding these stakeholders and audiences would empower *Honko*'s ability to work with and effectively

communicate with these actors. Identifying the stakeholders and audiences is important to reinforce an organization or educator's credibility and relatability.

6.1 Audience and Stakeholder Identity

There are many factors to consider when identifying one's audience. These are questions to ask before conducting a public education event, a committee meeting, or writing grant proposals: Who are they or how do they identify themselves (individuals or organizations? International? Donors, political actors, public sector agencies, interest groups, commercial or nonprofit organizations, civil society members and users/consumers?)? Identity is a complex, dynamic component of 'self' that is felt and experienced in many ways—from age, to gender, to culture, to values and goals—and impact the way one interacts with the external world.

What is their interest or stake in the subject at hand? Why do they care (economic reasons? Family? Culture?)? Putting energy and time into understanding stakeholder interest helps the organization cater to that group's specific interest or helps the audience attain its specific goal for visiting the organization (science education, bird identification, conservation, capacity building). This also can help the organization focus on key concepts, ideas and themes as well as fill gaps in understanding. Furthermore, identifying audience interest level or type of interest (Figure 7) could enable *Honko* to shift the audience's status, from, say, a low interest/apathetic

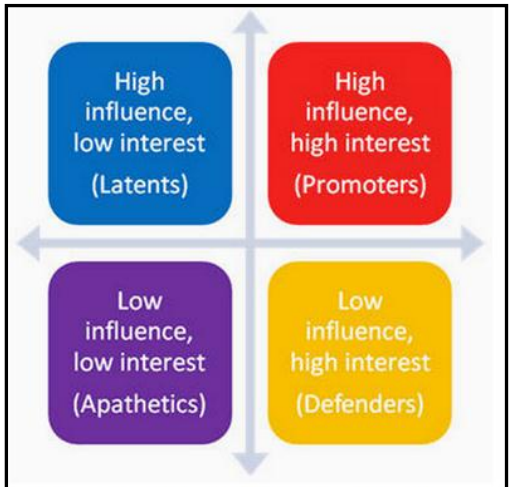

Figure 7. Plotting a group in question based on their interest and influence levels can help gauge how they may self-identify with the subject at hand (CTB 2015).

group to a high interest/defender group. This being said however, this type of model is merely a two-dimensional representation of an intricate, three-dimensional concept of identity and meant to be used as a guide, not as a substitute for identity discovery through person to person interaction.

6.2 Audience in Effective Communication

The effectiveness of communication is rooted in a sense of commonality among the actors involved. "[A]s a process of mutual exchange and understanding, communication is inherently social—so that *who* we communicate with is just as important as *how* we communicate" (Greenaway 2014). A barrier non-local organizations like *Honko* face, is identity. A study conducted by Greenaway et at 2014 analyzed the influence of 'shared identity' on the perception of the "communication experience as well as the actual communication performance" through instruction-giving and task performance. The study found that when communication occurred between two people of apparent shared identity or between two ' ingroup' members, " not only were the ingroup communicators *perceived* to be more effective than outgroup communicators, they *actually were* more effective" (Greenaway et al 2014) in using their instructions to complete the task at a higher quality.

7 OVERCOMING AUDIENCE AND STAKEHOLDER BARRIERS

This does not mean, however, that two groups *must* share the same identity to work together effectively. In fact, it is argued by Postmes et al (2005) that "individual distinctiveness can be the very basis for solidarity within a group." In other words, recognizing differences within a group can contribute to or be overridden by a common goal.

Initially, Belgian *Honko* and the *Ambondrolava* community struggled to implement an effective conservation management program. A disconnect between 'ingroup' members and 'outgroup' members caused stagnation in the implementation process. The apparent clash of identities was perceived to prevent the establishment of solidarity between the groups, thus little conservation was achieved. It was perceived that in order to collaborate and work as a unit in this conservation effort, one group would have to forfeit their own identity to the other group.

However, in 2010, three years after *Honko* was founded, the community-based association called VOI Mamelo was established. The VOI became a pillar of community identity and turned out to be the missing link that was able to tie the community and *Honko* together. Neither identity was snuffed out, to the contrary—this acknowledgement strengthened the sense of identity and enabled productive collaboration.

This step fundamentally led to increased capacity in their conservation efforts, since capacity "arises from participation in a group whose members view themselves as essential to that group and its critical activities" (Campbell et al 2012). If *Honko* expands their organization, they should continue to follow this model and should integrate this model into future designs, enabling holistic agreement of the practical and ethical concerns of the group moving forward.

Furthermore, looking towards the future, I recommend that *Honko* periodically conduct exercises that entail 'metacognition' or learning about the group's own processes of learning and "question the adequacy of familiar knowledge sources" (Campbell et al 2012). Consciously integrating and discussing epistemology will supplement and facilitate interactions amongst themselves and between *Honko* staff and their audience.

To do so, I suggest that *Honko* create assessment tools such as that displayed in Figure 7 as an exercise to consider different audiences. Continuing to follow a multi-stakeholder approach will help the *Ambondrolava* community and their *Honko* collaborators accommodate divergent ideology in the interest of common goals.

8 BARRIER: MODE OF DELIVERY

As stated, *Honko* interacts with many different audiences at their education center. Complementing audience identification, it is also important that *Honko* addresses different modes of learning. Learning is an active process during which multiple senses fire at once to construct a single picture out of different fragments. Everyone processes information in unique ways and uses a culmination of modes of learning—oral, written, auditory, kinesthetic, visual, tactile, and/or participatory—to make connections. On the outset, this may seem like a barrier for *Honko* because of their limited access to resources such as internet, electricity, and running water. Identifying the components of each mode of learning is a useful way to see where *Honko* is weak, where they are strong and how they can improve.

8.1 Language and Diction

Mode of presentation is a crucial consideration in public science education—especially in the context of a diverse audience. In this setting, language is often the most immediate issue recognized. While the Merina dialect of Malagasy is one official language of Madagascar, there are dozens of regional dialects with a common base, but noticeable divergence. Alongside Malagasy, French is a second official language, taught and spoken mainly in schools. Though French is widespread, there are regions and villages throughout the country where French is not spoken. There are also pockets of

Italian, Arabic and English, though not nearly as prolific as French or Malagasy. Thus, language and dialect can be an obstacle. To combat this barrier, *Honko* publishes most of their educational material in two (Malagasy and French), if not three languages (adding English). Furthermore, during my time at *Honko*, the Malagasy staff, for the most part, was bilingual (Malagasy and French) and knew a smattering of English. Foreign staff knew English, basic Malagasy and some French. This range of language proficiency allows *Honko* to reach a number of audiences.

Diction, or word choice, is also important for *Honko* to consider. As illustrated earlier, terminology such as 'environment' has different connotation in English as it does in Malagasy. Finding the balance between communicating technical concepts with both a technical and a non-technical audience can be a challenge—adapting concepts using audience-appropriate diction without demeaning or 'dumbing down' the information can make the concept more tangible.

Figure 8. Philemon Eugene, president of VOI Mamelo *Honko* and lead 'eco-guide,' using an interpretive sign in the mangrove (Honkomad 2013).

8.2 Participatory Approach

Honko has the advantage of setting on their side—an auditory, visual, and tactile wonderland for the senses. The mangroves and mudflats are their classroom. The majority of their educational material is disseminated during tours or projects out in the field. As noted, they have a number of interpretive signs along the way to supplement concepts with images and words (Figure 8). Visuals "elicit emotional cues

and presentation of implicit association, comparisons, or correlations" and "can convey affective and cognitive information at a glance" (Lazard & Atkinson 2015). Also, visual representation is a compelling source of communication because it forces individuals to decipher relationships among images and between the images and themselves.

Figure 9. Board walks allow guests to tour through the mangroves.

Again, *Honoko* draws upon the immediate mangrove and saltpan environments to educate their audiences. Audiences are led along raised, wooden walk ways (Figure 9) that enable visitors to avoid the silty soil and saline waters that flood the forest during high tide. The audience is immersed in the environment that they are learning about—they can smell the salty, brackish water; hear the leaves in the breeze; see the complex mangrove root systems; and even, on occasion, they can participate in propagule plantation events. In this sense, *Honko* is able to move their science education beyond the Western, linear, deductive methods and focus on the processes and hands-on experience of science.

9 OVERCOMING MODE OF DELIVERY BARRIERS

Honko, as illustrated, is equipped with a number of tools to provide stimulating, engaging educational lessons about mangrove ecology and preservation and cultural significance of natural resources. From a more theoretical angle, the Western-trained project managers should not limit lesson plans to the objectivist, deductive education styles that they were taught. As such, Campbell et al (2012) claims that to overcome this

(teachers teaching as they were taught), educators must "carefully plan these sessions, so that structure, goals and reflection will maximize potential impacts on students' integration of new ideas and experiences into their mental frameworks." However, I would argue that creating and abiding by a specific lesson structure is not what is needed to 'maximize' students' learning. *Honko* has the experiential venue readily available and implementing structured, prescribed lessons would only be a limiting factor. Indeed, the 'new ideas' will follow, *if* students are given the chance to 'experience'. Thus, I recommend *Honko* focus less so on explicit curriculum, but more so on the information people gain by participating in activities. Staff should perform workshops to identify appropriate diction, constructivist language, and help students examine their current knowledge framework and how it may shift overtime.

As part of the dynamic, constructivist model, *Honko* should consider integrating reflection as an active component of their education methods. Reflection is a tool to help pupils "assimilate the experience into their working knowledge, and reconstruct their theoretical understanding of pertinent content related to their experience" (Campbell et al 2012). This could take many forms—journaling, drawing activities or verbal exchanges or simply asking open-ended questions—but can help spark visitors to think about their past/current experiences, worldview and how that pertains to the lessons at hand. Sparking this line of thought carves greater contextual substance into the minds of *Honko* visitors, community members and beyond.

10 CONCLUSION

Honko and the VOI Mamelo have worked together to protect and preserve the mangrove ecosystem for future generations. In the process, they have also established

different avenues of local livelihood and supported ecological education. However, to expand and reach a more diverse and dynamic audience base, *Honko* could employ a three-pronged action plan that incorporates a more dynamic epistemology of science, a proactive strategy to address the needs of a shifting audience and a philosophy of education that emphasizes the social context of science.

11 DISCUSSION

11.1 Future Studies

After identifying the cultural and epistemological obstacles and designing an action plan, as I have done, the next step would be to present the action plan to *Honko* and the *VOI Mamelo*. If *Honko* and the community decide to implement the three-pronged action plan, further studies could be conducted to analyze how, if at all, the plan helped them attain their conservation and education goals.

Additionally, I would like to further explore they inter-staff relationships. My current research focuses on the *Honko*-community or *Honko*-visitor relationships but in future work, it would be valuable to consider the structural workings within *Honko* and explore the concept of ownership. In other words, I would like to better understand how staff members and educators view their own authority or ownership over the information and messages they are teaching to glean insight into the group identity.

The project would also benefit from researching the role of women in this setting. During my time at *Honko* the staff was composed of four men and two women (one Malagasy and one Western woman at mid-level positions). *Honko* supports Ambondrolava's Women's Association, however, it is important to consider the male/female power dynamic within the education portion of the organization.

11.2 Limitations

Additional research could be conducted to determine the applicability of this plan to other inter-country non-governmental organizations functioning throughout the world. Also, my proposed action plan could be strengthened by examining successful Malagasy non-governmental conservation organizations and draw from their strategies.

My proposal would have also have been strengthened by conducting interviews with *Honko* staff and community members, to discuss first-hand, barriers they face and their current and future goals.

My research and analysis was limited, to an unknown degree, by my own epistemology and viewpoints as a Western-trained scientist and scholar. However, by drawing from a diverse literature base, I made a conscious effort to reflect upon my writing critically to avoid obtuse biases.

For further reflection, Madagascar is a place of biological wonder and cultural richness. It is also a place of great international interest for its wealth of natural resources as well as its ecologically important biodiversity. Though Madagascar has been independent from France for 55 years, they now operate in a highly globalized world in which many different players stake claim in Madagascar's future—from mining companies, to vanilla exporters, to conservation organizations.

In the past, ecological and natural resource management in Madagascar and beyond, have not adequately included indigenous people or addressed "social conflicts around protected areas" (Chandra and Idrisova 2011), nor have they bolstered widespread public awareness and education regarding biodiversity (Chasek 2010). There is a growing

need to incorporate non-state actors and implement corresponding mechanisms into the framework for preserving natural resources.

International environmental actors should start transitioning beyond the historic, Western-dominated paradigm towards a greater promotion of local actors and collaborative action. If we use tools available to us, we can move beyond this "paradigm paralysis in which certainty prevents the mind from opening to new possibilities" (Campbell et al 2012).

Applying integrated, context-specific methods to tackle these complex issues such as climate change, has great potential. More, now than ever, we need integrated methods to tackle these complex-web issues such as climate change. Not just integrated methods, but deeper—how we teach the next generation to think. The very foundation of their critical thought process must be primed to think beyond the structural bounds of science.

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