PRACTICUM REPORT

DISCUSSION, DATA VISUALIZATION, AND DIALOGICAL
LEARNING MATERIALS FOR DIVERSE AUDIENCES
Education and Action for The Last Animals Foundation

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This practicum report was written to fulfill the capstone requirement for the authors to graduate
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Abstract

The struggle to conserve endangered species is often framed as military or punitive legislative and policy action. We worked with The Last Animals Foundation (TLAF), formed from Kate Brook's documentary, to change that framing, using the film to advance environmental education and formalize data visualization tools.

We structure our materials according to Paolo Freire's levels of relational knowledge production outlined in *Pedagogy of the Oppressed*.

(1) For young learners, through literature review and consultation with multiple partners in the U.K. and Indonesia, we synthesized environmental education policies, the educational use of films, and conservation priorities in the Leuser ecosystem in Indonesia. That synthesis informed the development of a curriculum that builds secondary school students' understanding of wildlife conservation and related environmentally sustainable career options .

(2) For the media and an engaged public, we developed a case study sharing tactics that fostered increased global impact for the film, using ESRI's StoryMaps. Users immerse themselves in the film's story, learn about outreach work, and see the result of that work in the forms of public engagement (through interactive maps) and policy outcomes (through explanations and videos).

(3) For specialists and scientists, we partnered with a team of U.S. and foreign government agencies led by prominent conservation biologist Dr. Samuel Wasser to produce an ivory seizure network application to assist in prosecuting the heads of transnational crime organizations driving elephant poaching and the ivory trade. This work is in review at a prominent scientific journal and being presented at international conferences.

Introduction

Poaching and the illicit wildlife trade are global issues requiring immediate attention. Our work is based upon the award-winning documentary, *The Last Animals,* which presented those issues and spurred the establishment of The Last Animals Foundation. We took a 3-pillar approach to addressing these issues. Each pillar corresponds to a different level of initial understanding about them.

First, we asked, how can we enhance models for digital media social impact practice; specifically how can a film 1) reach wider public audiences to shape consumption behaviors and norms, 2) have greater impact on key decision makers and policy and 3) be in wider educational use in work to end poaching and the wildlife trade? To answer this question, we partnered with prominent film Director Kate Brooks and The Last Animals Foundation to create an immersive case study depicting public engagement with and meaningful policy outcomes from the film. This case study will accompany film screenings to educate media professionals and the public on, as well as inform policymakers about, ways they can contribute to dismantling poaching and the wildlife trade.

Second, How can secondary school aged learners grasp complex wildlife trade and consider careers in conservation when the attention to education for sustainable development globally and in biodiversity hotspots such as Indonesia is still lacking? To answer this question, we first work with The Last Animals Foundation and partner with Encounter Edu and Good Docs to develop a writing assignment to supplement an Earth Day Live Panel and a dialogical discussion guide to scaffold the educational content on wildlife trade and conservation of *The Last Animals* film. We then conducted a literature review and consulted with local conservation leads from HAkA Foundation, Leuser Conservation Forum, Orangutan Information Forum, and SOS Rhinos in Leuser biodiversity hotspot in Indonesia to further develop those assignments and the discussion guide into a more complete and contextualized curriculum. These processes and partnerships enable us to overcome some of the challenges that might explain why education for sustainable development is lacking as different places need different pedagogical approaches, content based on their conservation priorities, and actors that enable implementation.

Third, and lastly, we asked, how can we support experts who have dedicated their careers to stopping poaching and the wildlife trade? To answer this question, we partnered with renowned conservation biologist Dr. Samuel Wasser to design an interactive network application to visualize links between global seizures of ivory. This application will be used by prosecutors in taking down transnational criminal organizations driving the ivory trade and lays the groundwork for future scientific studies.

As a result of our work, we honor the impulse of educational theorists like Paulo Freire, addressing multiple audiences and integrating multiple forms of knowledge, from ethical to ecological. Our deliverables have reached implicated communities confronting issues in situ, wider publics and the journalists who help them understand these issues, and finally the specialists whose work is producing new knowledge and shaping possibilities for these issues into the future. We further adapt those frames to account for the reach of digital communities of learners, engaged citizens and experts that cross national and cultural boundaries.

Background

Illegal poaching, the wildlife trade, and inadequate conservation policies are real, major issues that are contributing to the mass extinction of iconic and culturally significant megafauna species such as rhinos and elephants. In 2006, on average, the number of African rhinos killed per year was 310. By 2015, poachers were killing African rhinos at an average rate of 1,263 rhinos per year, which represents a nearly 400% increase. More recently, in 2019, a lack of conservation policy in Malaysia led to the local extinction of the critically endangered Sumatran rhinos.[1] Notably, these instances are only two of many examples portrayed in *The Last Animals* film.

The Last Animals film is an engaging, accessible resource that advances environmental education without reducing the complexity surrounding the topics of those issues of illegal poaching, the wildlife trade, and inadequate conservation policy from the African continent to Southeast Asia both inside and outside of the classroom.[2] Notably, the documentary has sparked the establishment of The Last Animals Foundation (TLAF). This organization has experience leading educational programs for corporate and community partners, hosting screenings and discussions of the film, including targeted screenings for the European Parliament, in Hong Kong, and Congressional hearings in the U.S., all timed with deliberations on ivory bans. Wider public outreach has also been part of the portfolio: for instance, TLAF recently partnered with HOWE London, an antiques and interior design company, for one of these educational programs among their clients and patrons, in addition to public screenings at festivals and universities around the world, from Ann Arbor to Nairobi.[3]

Education is central to wildlife conservation and is The Last Animals Foundation's mission. Most conservation programs and policies require approval and support from the local population. Thus, the public needs to have the knowledge, motivation, and skills to internalize the importance of the ecosystems in which they live and the wildlife with which they coexist.[4,5]

This need is becoming more apparent today as organizations focusing on conservation, such as the World Wildlife Fund, aim to spur long-term impacts.[6] This longer-term change can only be achieved through a combination of scientific, ecological approaches with education for the public. Indeed, threats to wildlife such as illegal poaching, the wildlife trade, and inadequate conservation policy persist in the face of current, exclusively ecological approaches as these approaches tend to only result in short-term change. Adding an educational component to conservation is key to inciting long-term changes.

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[1] Emslie, R. H., Milliken, T., & Talukdar, B. (2012). African and Asian Rhinoceroses – Status, conservation and trade. *CoP16, Doc. 54-2-Annexe 2*. CITES Secretariat, Geneva, Switzerland.

[2] Gifreu-Castells, A. & Zambrano, V. (2014). Educational multimedia applied to the interactive nonfiction area. Using interactive documentary as a new model for learning. *Edulearn14 Conference*, 1306-1315.

[3] Butt, B. (2019). The Last Animals. In Alliances, a Newsletter of the African Studies Center, University of Michigan, last accessed online February 27 2020 at https://lsa.umich.edu/content/dam/asc-assets/asc-documents/asc-publications/2019_Alliances_SPREAD_web.pdf

[4] Fien, J., Scott, W., & Tilbury, D. (2001). Education and conservation: Lessons from an evaluation. *Environmental Education Research, 7* (4): 379-395, DOI: 10.1080/13504620120081269

[5] Morar, F. & Peterlicean, A. (2012). The role and importance of educating youth regarding biodiversity conservation in protected natural areas. *Procedia Economics and Finance 3*, 1117 – 1121

Education also strengthens community participation in conservation efforts. In particular, current research shows that this education can motivate individuals to organize their own community conservation initiatives and even begin ventures such as the creation of an ecotourism company.[6]

Through advancing education on the importance of ecosystem and wildlife conservation, we are not only preserving the wildlife that exists within those ecosystems but protecting an educational resource – wildlife in their natural habitats – for learners.[7] Therefore, we developed and used dialogical learning materials and data visualization tools that support *The Last Animals* film to advance students, public, media, and scientific knowledge on the topics of poaching, the illegal wildlife trade, and inadequate conservation policy.

Dialogical learning based on *The Last Animals* has the potential to be an effective education approach that strengthens students' knowledge, but also moves them toward conservation action. The process of dialogical learning includes: (1) becoming more aware of the experiences and the emotions that accompanies them; (2) giving meaning to those experiences through internal conversation (reflection) and conversation with others; (3) select or focus which experiences they can act upon; and (4) develop identities as actors in issues that relate to their experiences.[8] This alternative to teacher-centered learning frame questions for discussions that encourage students to engage in information that might or might not align with their own experiences, reshaping the meaning of those experiences.[9] It contextualizes the information that learners receive. This method of learning may also be able to address the ambiguity of environmental issues we are facing.[10] It can be an alternative to just bombarding learners with the overly abundant information about wildlife conservation.

Furthermore, dialogue with partnering scientists or experts from other institutions such as those shown in *The Last Animals* documentary and past panel talks can help resolve the issue of overwhelmed educators due to the large number of learners[11] Further, the dialogue is a way of democratizing education by involving parents and local community members in shaping the learning outcomes of the students.[12] Despite the extensive literature on how dialogical learning can be an effective education, to our knowledge only a very few researchers have implemented it

[6] Macharia, J. M., Thenya, T., & Ndiritu, G. G., (2011). Management of highland wetlands in central Kenya: the importance of community education, awareness and eco-tourism in biodiversity conservation. *Biodiversity and Poverty Alleviation, 11*, 1-2, https://doi.org/10.1080/14888386.2010.9712652

[7] Sugandi, D. (2013). Environmental education and community participation: The importance of conservation lessons in teaching and learning for environmental conservation efforts in the region of Sagara Anakan. *Sosio Humanika, 6*, 2

[8] Meijers, F., Lengelle, R., & Kopnina, H. (2016). Environmental identity and natural resources: A dialogical learning process. *Resources, 5*, 1,https://doi.org/10.3390/resources5010011

[9] Stewart, T. T. (2010). A dialogic pedagogy: Looking to Mikhail Bakhtin for alternatives to standards period teaching practices. *Critical Education, 1*, 6. Retrieved on 24 April 2020 from http://m1.cust.educ.ubc.ca/journal/index.php/criticaled/issue/view/59.

[10] Brugnach, M., Dewulf, A., Henriksen, H. J., & van der Keur, P. (2011). More is not always better: Coping with ambiguity in natural resources management. *Journal of Environmental Management, 92* (1): 78-84, https://doi.org/10.1016/j.jenvman.2010.08.029

[11] Valenti, M. W., de Oliveira, H. T., & Logarezzi, A. J. M. (2017) Exclusory and transformative dimensions of adult environmental education in two Brazilian protected areas. *Environmental Education Research, 23* (5): 675-686, DOI: 10.1080/13504622.2015.1077503

[12] Medellu, C. S. (2015). Democratization of learning through thematic assignment. *International Education Studies, 8*, 4

specifically for wildlife conservation education, especially for young students. Most literature focuses on general environmental issues for students in higher education as well as adults. From this research gap, we have decided to evaluate the dialogical learning method before implementing it in model learning materials together with the data visualization for a wider audience of *The Last Animals* film.

The implementation of this dialogical learning also supports the attainment of the Sustainable Development Goals, including target 4.7 to mainstream Education for Sustainable Development (ESD) in national education policies, curricula, teacher education, and student evaluation. Out of all environment-related targets, target 4.7 is progressing most slowly as no country even has any data to report.[13] UNESCO showed that in 2016 only 58 countries emphasized sustainable development issues in their curricula, only 5 integrated it into their teacher education, and no one can agree on how to measure the outcome.[14] Indonesia is not one of those countries that has emphasized sustainable development issues in their curriculum or teacher education, even though it needs ESD direly. As high as 33-36% of students in Indonesia have never heard of or cannot explain what is air pollution and species extinction, lower than other Southeast Asian countries.[15] Indonesia also has the lowest environmental awareness than other Southeast Asian countries.[16] This is why we also developed the dialogical model learning materials contextualized and translated to Indonesian context. Education in secondary schools is evolving rapidly due to the COVID-19 pandemic with innovations such as delivering learning packets to students' homes. But education for sustainable development (ESD) is lagging behind, particularly in the sites where biodiversity remains highest thus sustainable development is most strongly needed.[17, 18, 19] We consider challenges to educators in combining digital media with in-person place-based learning, and in combining scientific content with careers relevant to biodiversity conservation and wildlife management.

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[13] UNEP. (2020). *Sustainable development goals scorecard*. Retrieved on April 27, 2021 from https://wesr.unep.org/sdg/scorecard/

[14] UNESCO. (2016).*Global education monitoring report: Target 4.7 | Sustainable development and global citizenship*. Retrieved on April 27, 2021 from https://gem-report-2016.unesco.org/en/chapter/target-4-7-sustainable-development-and-global-citizenship/

[15] OECD. (2020). *OECD working papers: Non-cognitive characteristics and academic achievement in Southeast Asian countries based on PISA 2009, 2012, and 2015*. Retrieved on April 27, 2021 from https://www.oecd-ilibrary.org/docserver/c3626e2f-en.pdf?expires=1607902738&id=id&accname=guest&checksum = 74678C43CAA1C88C16A0BE7C36E2D474

[16] OECD. (2018). *Education at a glance*. Retrieved on April 27, 2021 from https://www.oecd-ilibrary.org/docserver/eag-2018-en.pdf?expires=1607902566&id=id&accname=guest&che cksum=FFA8BD9ABC470F240422378E14457D6D

[17] Higgins, D. (2020). *Will COVID-19 spell the end of outdoor and environmental education?* Retrieved March 13, 2021 from https://www.smithsonianmag.com/innovation/will-covid-19-spell-end-outdoor-and-environmental-education-180975295/

[18] CU Boulder Today. (2020). *The great outdoors: COVID-19-compatible learning experiences for all.* Retrieved on March 13, 2021 from https://www.colorado.edu/today/2020/11/03/great-outdoors-covid-19-compatible-learning-experiences-all

[19] Collins, et. al. (2020). A field at risk: The impact of COVID-19 on environmental and outdoor science education. Retrieved on March 13, 2021 from https://www.lawrencehallofscience.org/sites/default/files/EE_A_Field_at_Risk_Policy_Brief.pdf

Data visualization that supports *The Last Animals* film is also an effective way to educate the public on wildlife conservation. The improvement of technologies for conservation especially in data visualization is helping conservation organizations to monitor wildlife and prevent them from being exploited.[20] Specifically, visual data from remote sensing, crowdsourcing, DNA sample collection from animals' feces, and other sources has become the preferred method to monitor wildlife as it is more cost-effective and less invasive compared to surveying individuals through helicopters or fixed-winged aircraft or radio-collars.[21] Moreover, data visualization has been used in the past to provide land managers and local community members with basic computer skills with information on habitat classification, anthropogenic structures, camera trapping records, vegetation biomass, greenness and grazing pressure estimations, and species population estimation. This data visualization work has been especially prevalent in Kenya, where *The Last Animals* was filmed.[22] This work informed our decision to use data visualization as an educational material that can tackle the complex issues of poaching, the illegal wildlife trade, and inadequate conservation policy.

[20] Verma, A., van der Wal, R., & Fischer, A. (2016). Imagining wildlife: New technologies and animal censuses, maps and museums. *Geoforum, 75*, 75-86, https://doi.org/10.1016/j.geoforum.2016.07.002

[21] Pim, S. L., et.al. (2015). Emerging technologies to conserve biodiversity. *Trends in Ecology and Evolution, 30* (11): 685-696, https://doi.org/10.1016/j.tree.2015.08.008

[22] Mose, V. N., Western, D., & Tyrell, P. (2018). Application of open source tools for biodiversity conservation and natural resource management in East Africa. *Ecological Informatics, 47*, 35-44, https://doi.org/10.1016/j.ecoinf.2017.09.006

Three Pillars of Knowledge Production: Engagement, Education and Interactive Networked Data Innovation

1. Media for Public Engagement (lead - joint):
   How can we enhance digital media social impact practice to better involve the public in work to end poaching and the wildlife trade?

   We partnered with Brooks and The Last Animals Foundation to develop a fully updatable and interactive case study aimed at demonstrating the impact of *The Last Animals* documentary on public engagement and legislative action in the fight against the illegal poaching and trade of endangered wildlife. It is particularly targeted at informing the media and an engaged public. The case study was created via ESRI's ArcGIS Online using a Cascade StoryMap. Maps within the case study were produced using ArcGIS Online's API for Python to enable simple and frequent updates as TLAF grows and continues expanding its impact.

   The StoryMap lays out the strategies Brooks and The Last Animals Foundation used to ensure her documentary would have the largest impact on the greatest number of people. The case study discusses four strategies: (1) Ubiquity, (2) Intentionality, (3) Accessibility, and (4) Publicity.

   Ubiquity centers around the idea that Brooks screened her films at as many festivals, educational events, and political forums as possible in order to spread her message. We provide an interactive map showing information on each individual screening (of which there were almost 200).   Intentionality focuses on targeted screening events that were particularly useful in spurring desired policy outcomes. For instance, Brooks held a screening before the Hong Kong ivory ban and spoke at hearings prior to the ban. Accessibility focuses on making the film available, viewable, and understandable for as many people as possible. We discuss, for example, the languages to which the documentary has been translated, and display a map showing streaming availability and broadcasts of the film across the world. Lastly, publicity focuses on getting the word out about the film through publications such as newspapers and across social media platforms. Looking holistically at these four strategies, we are able to get a sense of the film's overall impact.

   To engage with the StoryMap, click the following link: https://arcg.is/195XrG0

   In addition to synthesizing the impact of The Last Animals film through the story map, we also formalized models of learning that TLAF has done in many of its screening events, which are film discussions and panel talks. We formalize it through the development of 2 documents that are a discussion guide and a writing assignment that are expected to engage the public from varying backgrounds, educational levels, and professional fields. Those 2 documents and the curricular learning materials in the next section will be shared here and also in The Last Animals Foundation's website. The first public facing deliverable is a discussion guide that can be used either in festivals or community screenings, or in more formal curricular and training contexts, discussed in the next section. The discussion guide aims to be a general starting point for learners to learn about wildlife trafficking and the multifaceted aspects of wildlife conservation in the 21st century, think about how different fields of study and professional specialities that can be applied to conservation to make it more effective and more just, engage with people from those fields and those professionals, and to find options for taking action locally and nationally, and to

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support international conservation efforts. While it does not require formal facilitation and can be used among participants at a screening event, it could also work with invited guest speakers and greater guidance from an event host or lead. It contains background information on each of the themes presented in the film and the questions that facilitators can use in guiding the discussion. Each theme can be used in one event or used as modules that can be done separately in accordance to the needs of the event organizer and the audience.

To develop the discussion guide we started with reviewing 7 other discussion guides curated by Dr. Rebecca Hardin that are also based on films to identify what structure we want to use. We then build on the theme identification from the Earth Day Live Event by time coding the film based on those films to help discussion facilitators or teachers to go directly to the topic they want to teach or discuss about. We then wrote the discussion guide based on this structure and themes on the film through numerous iterations, mainly with Dr. Rebecca Hardin, Kate Brooks, and other UM SEAS students in the WILD RHINOS group, throughout May 2021 up to the point this report is written. We also discussed in developing some illustrations that could help facilitators and teachers have better background information about the issue at hand before teaching or discussing it. This process is mainly driven by the content of the film itself and the film's director, Kate Brooks.

Further, we developed materials for an [Earth Day Live Event](#) for The Last Animals Foundation in the Encounter Edu platform in April, 2020. This event comprised two panel talks that featured the figures in The Last Animals film and other relevant speakers. It tested educational demand for on the issue of wildlife conservation and international wildlife trade, as well as offering us a sense of content fit with different kinds of home based and classroom based learning communities, and offered a first step toward creating formal curricular materials: a set of writing assignments for secondary school students (middle and high school students) to supplement the panels and underscore the major themes or issues related to wildlife conservation that are presented in the film.

To generate these assignments we first grouped the speakers based on discussion themes, and then brainstormed what knowledge and activities could scaffold the topics that they might address in the live event, to deepen the dialogue among students and offer opportunities for reflection even after the events are complete.. We developed teaching guides and instructions, pegging each assignment to relevant US based [Common Core Standards](#) objectives. We then went through several iterations with Benyamin, Dr. Hardin and Kate Brooks, as well as leadership and staff from Encounter Edu to revise and then publish the materials on the website of the event, where learners can also find the recorded panel events.

2. <u>Curricular and Facilitation Tools (lead - Benyamin):</u>
   How can young learners grasp complex wildlife trade issues and consider careers in conservation and how can we prepare facilitators to lead that learning process for young learners?

   Conservation education, itself undergoing a process of decolonization and digital transformation under the current pandemic circumstances. It spans across many levels of education from elementary, secondary, university and vocational or continuing education levels of learners. Our structured curricular work with TLAF honed focused on elementary, secondary and college or

vocational level learners, and on tools for training and facilitation in distinct learning contexts (classroom, museum and home or field settings). These curricular innovations (and interventions) aim to be a more structured and guided process to increase learners' environmental literacy, specifically on the issue of wildlife trade and conservation. We further break it down to knowledge (cognitive), affect, and behavior components. The cognitive component aims to increase learners' knowledge on the perspectives related to wildlife trade and conservation. The affective component aims to increase their connection or relatedness to the issues and wildlife. The behavioral component aims to develop possibilities for linking their interests in conservation and environment to possibilities for pursuing further education and/or professional training.

Development of the curriculum: Problem framing and design partnership

To achieve that objective of increasing secondary school students' environmental literacy we build on the discussion guide and writing materials elaborated in the previous section, and expand it to a complete curriculum. The curriculum consists of a general description of the learning opportunity based on The Last Animals film, three lesson plans, and some supporting materials. The curriculum consists of three lesson plans: (1) discussion guide, (2) classroom photovoice project, and (3) panel talk, that are expected to increase students' knowledge on wildlife conservation issues and enable them to envision themselves for environmentally sustainable career options. The discussion guide is developed in consultation with The Last Animals Foundation. It deepens the understanding of the many issues of wildlife conservation presented in The Last Animals film that spurred the establishment of the foundation. The classroom photovoice project contextualizes that understanding in local areas of conservation where the curriculum is implemented and connects students to social values and norms that promote conservation. The panel talk exposes students on how that understanding on conservation is applied to real-life work and the various professions that can apply it.The panel talk is also complemented with the writing assignments adapted from the Earth Day Live 2020 event. The supporting materials include the time coding of the film, the contextualized transfer framework literature review with practical tips for teachers or facilitators, and the pre-post surveys. This lesson is based on partnerships with multiple stakeholders from the U.S. and U.K. where the project started and the current study's target population in the Leuser biodiversity hotspot in Indonesia. This curriculum utilizes the unique hybrid learning environment that the pandemic triggered by grounding students understanding through low-tech alternatives of these lesson plans and taking advantage of how the world is much more connected digitally during this pandemic.

The curriculum is expected to be able to be implemented in 2 days. The 2 days can be scheduled right after the other or preferably with a delay between them. The first day would include the introduction, community building, and the photovoice briefing sessions from the second lesson plan, and also the first lesson plan. Between the first and second day, learners will be given the opportunity to take photos and reflect on the meaning of those photos for the photovoice project. This process is the reason why it is recommended to give some time between the first and second day. On the second day, the photos from the photovoice are discussed and students will start to write the description of the photos and prepare for the exhibition, and go through the third lesson plan. These lesson plans could also be done in a modular approach in a sense that each of them can be implemented independently.

To develop the curriculum we conducted semi-structured interviews with 5 key conservationists that worked on the Sumatran rhinos and especially in the Leuser ecosystem in Indonesia and we also conducted a literature review using the contextualized transfer framework. The objectives of the interviews were to assess what education for sustainable development programs needed in the context of Aceh province, Indonesia, including what has been done in the past, the conservation priorities of the Leuser ecosystem, and identifying potential partnerships to develop and implement the discussion guide in Leuser. The key conservationists are directors of the HAkA Foundation (female), Orangutan Information Center (female), Rhino SOS (female), and Leuser Conservation Forum (male), and also the education programs manager of the Leuser Conservation Forum (male). They were selected purposively based on the knowledge of Film Director Kate Brooks' and TLAF board member Farwiza Farhan, who has expertise of the conservation in the Leuser ecosystem.

The interviews were conducted through Zoom, except for the interview with the Rhino SOS director (June 22 2020), which was conducted by phone. All were conducted individually, except for the interview with the both directors of Orangutan Information Center and Leuser Conservation Forum (June 11, 2020). The interview with the director of HAkA Foundation was conducted on May 28, 2020. Interviews with the education programs manager of Leuser Conservation Forum were conducted on February 22 and 24, 2021. All of these dates are based on Eastern Time and might differ with the Western Indonesia Time (WIB). All interview durations span from 1-2 hours. The interview results were noted using Google Docs during the interviews.

Based on the results of these interviews, we identified the Leuser Conservation Forum as our most appropriate partner in developing and implementing the discussion guide and curriculum. Meanwhile, the Leuser Conservation Forum, Orangutan Information Center, and HAkA Foundation agreed to partner with us by becoming speakers in replicating the panel talk of the Earth Day Live Event, adapted for the Indonesian context. Rhino SOS while not a good fit for this practicum, will be apprised of our results and perhaps contacted for future collaboration.

From these interviews and partnerships there are 3 themes of information we found: (1) pedagogy (mode of learning); (2) content (conservation priorities); and (3) implementation possibilities. Under the theme of pedagogy, we found that there is a need to find a low-tech alternative to the discussion guide and curriculum, which would mean that Zoom video conferencing will not be feasible. We also found that the organizations preferred the curriculum to be implemented as a 1-2-days enrichment program rather than a longer-term program or integrated to classes.

As there is also a need to re-emphasize cultural norms in protecting wildlife, we cannot just connect the curriculum and discussion guide to science subjects, but also to religious studies and arts. Under the theme of content, we found that the conservation priorities in the the Leuser ecosystem include connecting education materials to national parks through field visits and bringing up relevant issues happening in the parks, strengthening regulations and local values, the need to counter the threat of land conversion due to the massive palm plantation industry, and lastly poaching and wildlife trade. Under the implementation possibilities theme, we found that undergraduates and volunteers would work best as facilitators, partner organizations' representatives can also be panel speakers, we need to build on partners' past education programs, and that a hybrid interface would be best during this pandemic. This is why the

workshop that we conducted later on invites undergraduate students and teacher facilitators that are already part of Leuser Conservation Forum's young conservationists group.

The literature review used a contextualized transfer framework as designed by Reimers, Cooc, and Hashimi (2011). Contextualized transfer framework is:

> the process of adapting practices that have demonstrated effectiveness in one context to another while examining the way in which various policy interventions related to policy outcomes across national contexts, analyzing the dependency of those relationships on characteristics of the context, and determining how differences among these contexts might limit the transferability of policy effects (p.316).[23]

The practices included in the framework include what is being taught, how to teach it, how to organize school systems, how to support the professional development of teachers that are going to deliver it, how to develop education plans, and how to monitor the performance of the education programs we transferred. But due to the limited scope of this practicum and the limited kind of work we can do during the COVID-19 pandemic, we focused more on the first two.

The objective of this process is so that we contextualized the content and the dialogical learning approach so that it works with learners both in the U.S. and Indonesia, more specifically secondary school learners. For the content, we specifically focused on the current condition of education for sustainable development and the use of films in classrooms in both countries. For the approach, we particularly focus on how to adapt the discussion that is central to dialogical learning approach and are more commonly used by the TLAF on adult audiences, for the use in secondary school level. As part of this contextualization of our intervention we also translated the discussion guide and curriculum to Indonesian language, and engaged with a professional translator enterprise (Deluxe) to create a dubbed version of the film.

There are 5 steps in this framework: (1) identifying the needs; (2) analyzing the context where the problem exists; (3) synthesizing existing research; (4) analyzing the gaps between research and context; (5) designing the innovation or practices that are going to be transferred. These are the steps that we followed in developing the curriculum with as much consultation with the Leuser Conservation Forum as possible, mainly through Whatsapp conversations. Step 3 was also conducted in consultation with Dr. Michelle Bellino, given Benyamin's enrollment in her Educ 644: Comparative and International Education in the Winter 2020 term.

From the contextualized transfer framework literature review, the practical guidelines for teachers or facilitators can be differentiated to those in the U.S. and Indonesia context. In the U.S. context, the guideline include:

a. Set a clear objective of using The Last Animals film in your class and how it can relate to the topics or projects you have in your subject. You can check our reference of the activities to the Common Core Standard.
b. Be efficient in using your time for in-class activities. Use the "Time Codes for Relevant Scenes in the Documentary" to identify whether you need to show the whole film or just

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[23] Reimers, F., Cooc, N., and Hashmi, J. (2011). Adapting innovations across borders to close equity gaps in education. In Heymann, J. & Cassola, A. (Eds.), *Lessons in Educational Equality: Successful approaches to Intractable problems around the world* (pp. 315-339). New York: Oxford University Press.

one or more specific clips of it.[24] Watch the film yourself first before using it as an educational tool. You can also assign students to watch the documentary at home should online streaming through our partners platform (Good Docs and Amazon) is feasible. If you assign a home watching activities, make sure your students have the necessary computing facilities, internet connection, and the school facilitated financially and/or technically for the purchase of the film.

c. Providing prior knowledge through a prepared lesson about the topic or by repeat viewing of the film could enhance memory of important information from the film.[25] You can read through the "The 5 Pressing Issues" and further resources section.

d. Be mindful of the diversity in race, ethnicity, culture, economic condition, and other background of the students in your class. You can make the activities and discussion questions more relatable to the issues your students are facing with their family right now (e.g. discrimination, gun violence). A few examples could be:
- In The Last Animals film, we see how the traditional belief of rhinoceros horns and elephant ivory for medicinal purposes could drive those animals into extinction. Do you think any of the beliefs you have from your family or culture, could become a threat to animals too? How?
- In The Last Animals film, we see how the work of rangers in protecting animals could be really dangerous and involve the use of firearms such as guns. Do you think the use of guns in their work and possibly other human activities (e.g. hunting) could be justified?

Meanwhile, in the Indonesia context, the guideline include:

a. Determine your learning outcomes in relation to the philosophy of four subject categories: religious study, diversity and personality, science and technology, aesthetics, and health and their grading system.

b. Conduct periodical meetings with other teachers in your school to coordinate how to connect different concepts between subjects.

c. Conduct periodical meetings with teachers from other schools to share the learning outcomes of your class. Measure the grades improvement of the subject you teach after viewing The Last Animals documentary and possibly other psychological factors elaborated above. Evaluation is really important to further develop the education for sustainability in Indonesia, as currently research is scarce and it is needed to advocate a stronger policy in Indonesia or in your local area.

d. Connect The Last Animals film content and activities to a national park or other protected areas in Indonesia. If resources allow, complete your lesson on the topic which you use the documentary for with a visit to a national park or other protected areas so that your students can apply their learning outcomes.

e. Use Indonesian subtitles when watching The Last Animals documentary. It would be better, if you as the teacher have sufficient fluency in English to be able to explain content of the movie that might need further elaboration or not translated completely.

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[24] Fryer, W. (2010). *Showing full length copyrighted movies for leadership class*. Accessed on 28 April 2020 from http://www.speedofcreativity.org/2010/01/11/showing-full-length-copyrighted-movies-for-leadership-class/

[25] Michel, E., Roebers, C. M., & Schneider, W. (2007). Educational films in the classroom: Increasing the benefit. *Learning and Instruction, 17* (2): 172-183, https://doi.org/10.1016/j.learninstruc.2007.01.005

f. If language is an issue, you can use partial clips of The Last Animals documentary (Look at the Time Code of relevant Scenes in The Documentary of the curriculum) and combine it with other relevant videos with Indonesian language.
g. If classroom film/video viewing facilities are not available, assign your students to stream the documentary online through our partners platform (Good Docs and Amazon) as feasib

Implementing the curriculum with learners: Piloting Educational Innovations

From the start we tried to find alternative activities to the curriculum in response to guidance from partners in Leuser noting learners there do not have access to stable internet and/or computing gadgets to implement the discussion guide and curriculum during the COVID-19 pandemic. We responded to that by trying to find a hybrid or a more low-tech alternative, especially for the film screening and also the panel talk. We developed that alternative through a training series provided by the University of Michigan Museum of Natural History (UMMNH) for its Science Communication Fellow in the Fall 2020 term. We went through a brainstorming session with the fellows, then we workshopped our proposed learning activity, and then tried the activity in a Meet the Scientist event from the museum. We developed a card game through the UMMNH Science Communication Fellow program. The card game called "My Animal Kingdom" invites students to roleplay as the presidents or leaders of their own kingdom with the authority to buy animals (in the form of "cards") to fill in their kingdom from the facilitator who acts as the broker. Each animal gives different levels of points based on two facets of the animal's potential socio-economic and environmental impact over time, which learners discover as they make their decisions.

Economy points reference the quality of the kingdom people's daily business of life. How much money will people have to spend to go to the kingdom? Will the animals they buy bring happiness to the people? Will the animals have any social and cultural value? And at the end of the day, will those animals bring more money to their kingdom? Generally, the point for this facet is based on the consideration that the rarer is the animal, the more money it will also bring to the kingdom.

Environment points reference the quality of how nature in the kingdom can support the people's daily lives. Nature needs a lot of different species so that the trees and forest can keep growing to give us the air we breathe or the clean water we need to drink, take a shower, and make our food. Some animals are becoming rarer in the environment, so selling it and sending it out from where they can be found naturally can lower the quality of the environment. The game features vacillations in market value and protection status that shape the points available.

The student or group of students that will be able to get the most social and environmental points by the end of the game by buying different combinations of animals sold with their limited budget will win. This simulates a very simplified version of the interaction within the process of wildlife trade presented in the film. The card game is especially made in case that the film screening is completely not feasible because there are no computing gadgets or if it is too costly to get access to the film. After the game, students will continue with the discussion and the following two lesson plans as intended by the curriculum.

We then look at how this low-tech alternative and a shorter version of the discussion can be applicable to 5th grade students at the UMMNH Meet the Scientist event. The low tech version is conducted using an excel sheet in this case, but the card game can also be done by physically printing the cards. Generally, the students in Ann Arbor public schools that participated in this event are more tech-savvy than expected as they familiarize themselves with the Google Sheet platform quite quickly. We also realize that in the online format, facilitators need to prepare to engage learners even if we can't see them as there might be a norm to allow students to turn off their camera if they do not feel comfortable and most students did actually turn it off. Having the homeroom teachers active in the game helped, as they connected the content that we delivered to the content the class had learned previously. They also knew the students better so they could help facilitate the discussion with a personalized touch. A summarizing comment from the organizer at the UMMNH conveyed the energy of the event:

> "Thank you for a fantastic event today! I wish I could have been everywhere at once, but from what I observed myself or heard from others, The students and teachers really enjoyed the presentations and learning more about all of the exciting things that you do. You are all very passionate about what you study and that certainly comes through.
>
> ...
>
> One of the teachers remarked to me that although her students remained quiet and didn't ask many questions during one of the presentations, she did a reflection assignment with them afterwards and they had all sorts of things to say and were very enthusiastic. So even if you didn't "see" a reaction from them doesn't mean that what you said didn't sink in!"

Implementing and evaluating the curriculum with facilitators: Field Based Innovations

a. Survey construction

On the evaluation of the dialogical learning materials we collected qualitative feedback and a quantitative survey to assess the feasibility of each component of the materials. Qualitative feedback was collected from observing the live chat during the panel talk, workshopping all the materials with the WILD RHINOS groups led by Dr. Rebecca Hardin, and personal archive of communication with partners. As for the quantitative survey, we used a pre-post design in evaluating the discussion guide and curriculum. The pre-post surveys were distributed before and after a workshop conducted to train potential facilitators that are going to implement the learning materials with secondary school students in Aceh and North Sumatra provinces in Indonesia where the Leuser ecosystem is located. The workshop consists of an introduction to education for sustainable development, dialogical learning, simulation of the discussion guide and curriculum implementation, and a planning session on how to implement it with secondary school students there.The pre-test was distributed at the beginning of the workshop on April 24, 2021 and the post-test was distributed right before the workshop ended on April 25, 2021. It was a 2-day workshop with 5 hours of various sessions for each day from 1-6 p.m. Western Indonesia Time (WIB; 2-7 a.m. Eastern Time).

The surveys were distributed using Google Form. A total of 16 participants filled the survey out of 26 participants present during the training. Most that didn't fill the form had technical issues to access it because they were joining from their phone or because of unstable internet connection. The survey participants are either undergraduate or post-secondary vocational

students, or bachelors, or graduate students from 9 different higher education institutions in Aceh and North Sumatra. They major in agribusiness, agrotechnology, Islamic philosophy and aqidah, biology (5 participants), pharmacy, English studies, law, veterinary medicine (2 participants), animal bioscience (master), marketing management, and statistics. Their average age is 25 years old (min = 21; max = 32). Most of the participants (62.5% or 10 people) were male. The number of participants during the workshop fluctuates and only 4 participants consistently participated in all of the sessions. We analyze the survey data using basic descriptive statistics to show initial trends on how the learning materials might be effective, which of course need further investigations with more rigorous study design. We also record the workshop so we can analyze the discussion content using a simple thematic analysis.

For the surveys to evaluate those materials, there are 3 parts consisting of an adapted environmental literacy assessment, an environmental awareness assessment, and general qualitative evaluation of the facilitators workshop on the discussion guide and curriculum. First, the environmental literacy assessment that assesses the knowledge on ecological concepts (cognitive), attitude and concern that motivate individuals to perform environmental behaviors (affect), and the skills to perform those environmental behaviors (behavioral). We adapted the survey from 2 studies that have measured the construct in developing countries. The first one is adapted from the Environmental Literacy Survey that was a modified version of the Wisconsin High School Student Environmental Survey.[26] This one is validated with 130 secondary school students in Sabah, Malaysia with Cronbach's Alpha of 0.42 for its cognitive dimension, 0.46 for its affect dimension, and 0.76 for its behavioral dimension, and 0.61 overall. Although the Malaysian context of this version of the adaptation is closer to the Indonesian context that we are targeting, the overall validity of this measurement tool is not promising. Therefore, I tried to cross check it with a second version of the tool's adaptation that is based on a set of similar surveys consisting of the Environmental Knowledge Test, Environmental Affect Scale, and Environmental Behavior Scale.[27] This version was validated with 258 8th grade students in Amasya, Turkey. The items of these surveys were very similar to the ones used in Malaysia. The average difficulty of the Environmental Knowledge Test is 0.542, the Cronbach's Alpha for the Environmental Affect Scale is 0.86 and for the Environmental Behavior Scale is 0.773. This better validity might be due to this version having more detailed components and having the items developed by the researchers themselves.Following the approach of the Turkey surveys, I adapted the items from the Malaysia surveys.

The adaptation process entailed consulting with Dr. Rebecca Hardin and then translating the items to Indonesian language. Then I adjusted the topic to be more specifically focused on wildlife conservation and wildlife trade, instead of just general environmental issues. This process resulted in 5 items for each of the three dimensions of environmental literacy. The cognitive dimension asks a question like "Rhino horns are made of the same substance as which part of our body?" Participants can choose 1 out of multiple options answers. Answering correctly will give them a score of 4 and incorrect answers get 0, so the maximum score is 20 and the minimum is 0.

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[26] Fa, L. Y. & Sirisena, A. (2014). Relationships between the knowledge, attitudes, and behavior dimensions of environmental literacy: A structural equation modelling approach using SMARTPLS. *Jurnal Pemikir Pendidikan 5*, 119-144.

[27] Sontay, G. Gokdere, M., & Usta, E. (2015). A comparative investigation of sub-components of the environmental literacy at the secondary school level. Journal of Turkish Science Education, 12, 1.

The affect dimension asks participants to rate from Extremely Disagree, Disagree, Agree, to Extremely Agree on statements like "I am not concerned about the rate of species extinction in the world." The response is scored 1-4 with 1 being Extremely Disagree and 4 being Extremely agree on 2 statements that are positive, and the opposite applies for the reversed items. Thus, the maximum score for this dimension is also 20 and the minimum is 4.

For the behavioral dimension, we altered the language so that it will measure the intention of individuals to do behavior related to wildlife conservation, trade prevention, and career planning to adjust it to the type of behaviors that someone might be able to do and to synchronize it with the learning materials' objectives. We also changed it to behavioral intention because the span of time of the implementation of the curriculum that could be done in as short as 2 days won't allow any real behavioral change. So, we can only measure students' intention to change. The behavioral dimension is also measured by rating statements like in the affect dimension, but all of the items are positive. A sample item is "I talk to my family and friends about what they can do to help protect endangered (rare) animals." All the three dimension scores were then added to create a composite environmental literacy score.

Next, we also included an open-ended question on the end of each section that represents each dimension of the pre-test asking whether there's any part of the question that they don't understand or confusing. Only two comments come from this, both are for the affect dimension items. The first one said that the phrase "I am not concerned…" can be unclear and misleading. The second one is commenting on an item "I'm not interested in consuming (reading, watching, listening, etc.) more information about illegal wildlife trade in any medium.". The comment said that the word "information" is unclear. These comments on the qualitative validity of the environmental literacy survey will be considered in its future revision.

We also adapted an environmental awareness instrument from the ENVAWARE tool developed by PISA that has been used in Indonesia.[28] The original instrument asks "How informed are you about the following environmental issues?" on 7 different environmental issues. We took the item on the consequences of clearing forests for other land use, extinction of plants and animals, and added 1 item on illegal wildlife trade to make it more relevant to the objectives of the dialogical learning materials. Participants can choose 1 of 4 possible responses from "I have never heard of this", "I have heard about this but I would not be able to explain what it is really about", "I know something about this and could explain the general issue", "I am familiar with this and I would be able to explain this well."

We scored those responses from 1 to 4 so that the maximum score that someone could get on this measurement is 12 and the minimum is 3. Although this instrument measures environmental awareness, its definition includes both knowledge and awareness of the environment when an individual lives and tends to influence the development of their communities with their pro-environmental behavior. So, in a way it also looks at the students' knowledge but through a self-assessment approach. We also choose this measurement because it's the only nationally representative assessment on constructs closely resembling and related to the environmental literacy that is the focus of the evaluation of the materials of this practicum for Indonesian

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[28] Susongko P. & Afrizal T. (2018). The determinant factors analysis of Indonesian students' environmental awareness in PISA 2015. *Jurnal Pendidikan IPA Indonesia, 7* (4): 407-419.

secondary school students'. This is important so that there is a baseline that we can use to determine the effectiveness of the learning materials.

In addition to that, we also asked general demographic questions (age, university name, major) and general evaluations of the workshop. In the pre-test, we asked what participants hope to get out of the workshop. In the post-test we asked whether that hope is fulfilled and if yes, what are the 5 keywords that they learned from the workshop. We also asked evaluations on the presenter of the workshop, also the content of the workshop, challenges in following the workshop, the workshop's strengths, and what can be improved from it.

b. Results

We analyzed the qualitative general evaluation of the workshop that tried to implement the discussion guide and curriculum, as well as its quantitative survey. From the qualitative general evaluation we found that generally the discussion guide and curriculum are feasible to be implemented in Indonesian context, with some changes. All participants either Agree or Extremely Agree that the content presented in the workshop makes them more interested in the issues of wildlife conservation and illegal trade, know more, and want to contribute to the issues more. The same result can also be observed in their evaluation of the capability of the speaker to explain the materials deeply. The exact numbers from this part of the evaluation can be seen in the graphs below.
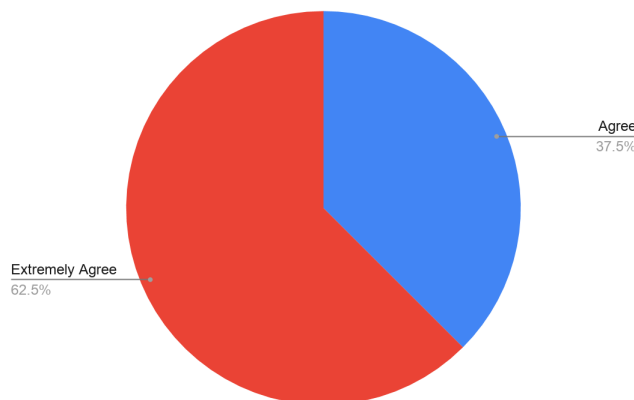

Graph 1. The workshop trainer is capable to give a deep explanation on the topic.

Agree 25.0%
Extremly Agree 75.0%
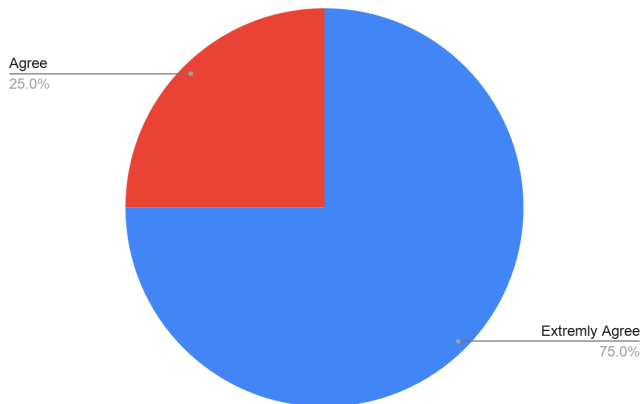
Graph 2. The content presented in this workshop makes me more interested on the issues of wildlife

Agree 37.5%
Extremely Agree 62.5%
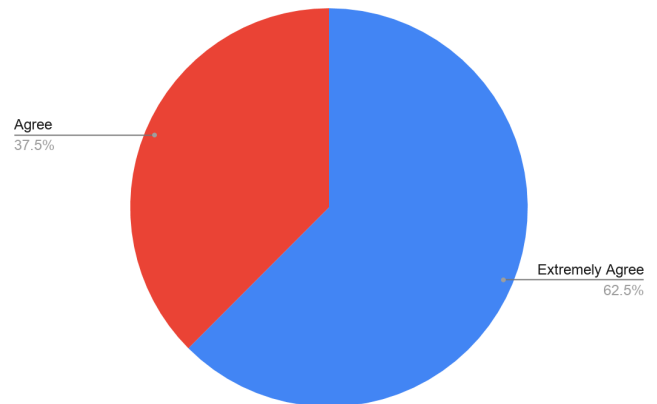
Graph 3. The content presented in this workshop makes me know more about the issues of wildlife

Agree 37.5%
Extremely Agree 62.5%

Graph 4. The content presented in this workshop makes me want to contribute more on the issues of

Agree 37.5%
Extremely 62.5%
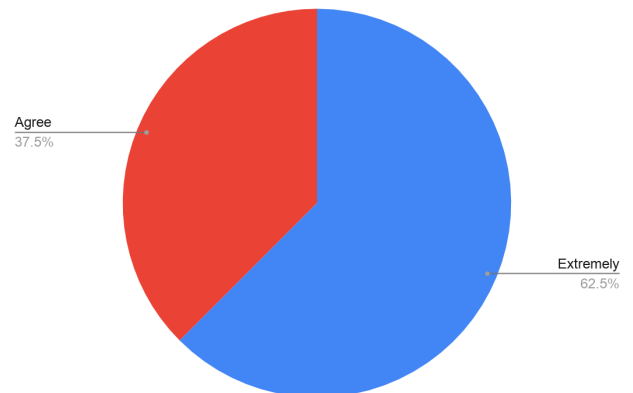
All the participants also said that they did learn what they hope to learn from the workshop. More participants are interested in the content of the curriculum about the issues of wildlife conservation in general, but there are also some that are interested in both the content and the pedagogy of conservation education. More specifically, out of the pedagogical materials of the workshop, more participants seem to take away materials on photovoice than the general discussion or dialogical learning. This should be considered when interpreting the quantitative result of this evaluation, as they are motivated to learn through the workshop. The image below shows a word cloud with words with bigger font size representing the keywords that are mentioned more frequently by the participants.

*Image 1. Word Cloud of most mentioned keywords that workshop participants took away*

Nevertheless, there are also some challenges and things to improve on the workshop that can be considered when TLAF plans to train more facilitators or teachers in the future to implement this discussion guide and curriculum. The most concerning challenge is the fact that internet connection quality in Indonesia is still very poor and the inequality of access to remote learning from big cities to more rural areas is large. This shows through how the majority of the participants responded that unstable internet connection is their main challenge to participate in the workshop. So, simply buying them an internet data package will only help a small few as the infrastructure for the area in Aceh and North Sumatra is insufficient. This is coming from participants that are at least studying in college that are more familiar with the technological requirements to learn remotely, which means that this challenge will be even more problematic when we try to implement it with secondary school students.

Another point is that the workshop participants who are committed to implement the discussion guide and curriculum were also divided between doing it remotely or in-person. The participants decided that we will decide based on what the school, parents, and students themselves want. This also reflects what we found in the interview with the education program manager of Leuser

Conservation Forum that said even for schools in the city, if they want to attend a Zoom meeting, they have to do it from a computer laboratory facility in their school in-person.

Some other feedback from the participants to improve the workshop said that we can involve the participants more actively, invite other speakers to present materials in the workshop, increase the variation of the activities in the lesson plans, and possibly conduct the workshop in-person in the future. To respond to these feedback points we could tap into the strengths of the workshop when doing it again in the future, that are friendly and clear delivery of the materials and the discussion process. In addition to maintaining the amount of discussion in such workshops, we could also utilize other approaches such as activity-based learning both to the workshop and the dialogical learning materials, and inviting lecturers that specialize in conservation education specifically in Indonesia.

Graph 5. What are your main challenges to participate in every session of this workshop?
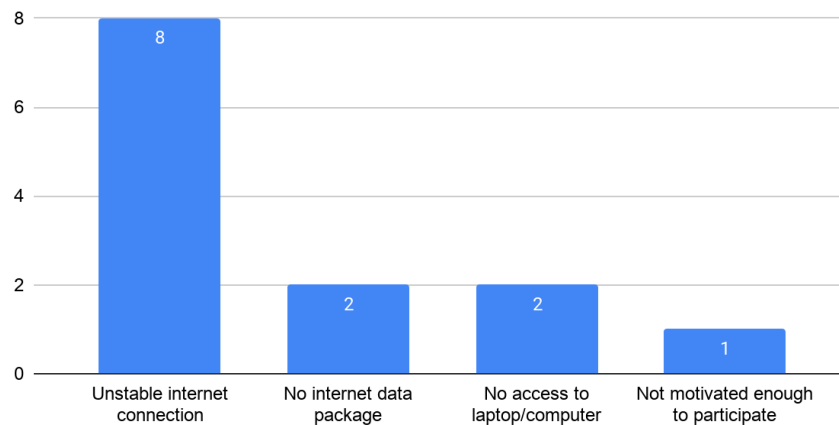
From the quantitative survey results we can further elaborate the feasibility of these dialogical learning materials as tools to develop learners' environmental literacy and possibly give some hope of its fidelity in becoming an effective tool. The results here are divided into the descriptive data from the full sample of participants that filled the survey and the data from selected participants that attended all sessions of the workshop. Both differ in their compliance rate of the treatment being the workshop. Generally results in both samples showed a promising trend of increasing overall environmental literacy that is mostly contributed by their increased knowledge on wildlife conservation and illegal trade.

The results differ between the samples however, as the participants' attitude and concern about wildlife conservation and illegal trade (affect dimension) only increase by around 0.438 points out of the 20 maximum score, which only represent a 2.19% increase for the full sample. The result for the selected sample is even worse, as their affect dimension score decreases after the workshop. Although, if we interpret the ENVAWARE measurement more as a measurement of their attitude, then the result is the opposite of that as both samples showed positive increase after the workshop. But, if we interpret ENVAWARE more as a measurement of knowledge, then the workshop and the dialogical learning materials need to be thoroughly revised to be able to have a meaningful impact on this dimension. One explanation might be that Lesson Plan 2 that

utilizes a photovoice activity that is the main part that targets the effect component, was not given enough time. Therefore, participants didn't have enough time to take photos and reflect on the meaning of the experiences they capture in their photos.

Another possible explanation can be taken by looking more closely at which item in the survey makes their score in this dimension fall. There are two questions that showed that pattern, The first one is "I'm not interested in consuming (reading, watching, listening, etc.) more information about illegal wildlife trade in any medium." This might relate to the qualitative comment mentioned earlier about how the word "information" is unclear here, which proves a validity concern for this item. It might also be because learners might feel overwhelmed with the amount of information they are receiving on this topic especially if they are already studying or working in this field. The other item is "I don't think that protecting wildlife from extinction is worth all the trouble it takes". The language for this item might also be confusing as it cannot be translated to Indonesian directly so the sentence structure was changed. Based on the discussion during the workshop, participants might also feel that being hopeful about this problematic issue is more important to motivate them to pursue a career in this field rather than continuously worrying and concentrating on the negative sides of it. These 2 items need to be reevaluated and revised.

A similar result is also shown in the behavioral dimension of the environmental literacy assessment. The full sample showed a small increase of just 0.063 points that represents only 0.315 percent increase out of the 20 maximum score. Meanwhile, a larger decrease than the affect dimension can be observed here. There are also 2 items that showed a decreasing score in their response. The first one is "I talk to my family and friends about what they can do to help protect endangered (rare) animals." The second one is "I want to have a job that can help protect the endangered (rare) animals in the future." One possible explanation is that the complexity of the problem presented through all the discussion and other activities discouraged them to think that their families and friends can understand it too just by talking to them and discouraged them to think that a career in this field can have a meaningful impact.

This might also be because the workshop didn't simulate Lesson Plan 3 that brings local panel speakers to show them career options in the field of wildlife conservation, we only asked them to watch the recording of the Earth Day Live Event. Just watching that recording raises three problems including the language barrier, reduced interactivity, and lack of local context. From the discussion during the workshop, participants had a problem in understanding the panel because it is in English, which is understandable because English is not their first language and even college students in Indonesia still have problems in understanding English. A strength however is that the participants think of the lesson plan three's design as giving learners opportunity to ask questions directly to people in the wildlife conservation field, thus a recorded video takes away that interactivity. The other strength of the design of lesson plan three is the way it invites local figures to further contextualize the content of their learning to the specific region where learners live. Thus following through the third lesson plan completely in design, production, and implementation will show stronger results in future.

Another disclaimer is that the pattern might change when we collect data from a larger sample size. Minimum sample size would be to implement it with 30 students during future pilots or formal studies evaluating these dialogical learning materials, to get data with normal distribution

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for quantitative validity and reliability tests of these measurements. Although, more complex evaluation will require larger sample size too.

Table 1. Summary of Pre-Post Tests Results

Variables	Pre-Test Average	Post Test Average	Difference
Environmental Literacy (full sample)*	48.375	49.875	1.5
- Knowledge (full sample)	13.5	14.5	1
- Affect (full sample)	17.562	18	0.438
- Behavior intention (full sample)	17.312	17.375	0.063
ENVAWARE PISA (full sample)	7.25	8.625	1.375
Environmental Literacy (selected sample)**	52.5	53.75	1.25
- Knowledge (selected sample)	15	17	2
- Affect (selected sample)	19	18.75	-0.25
- Behavior intention (selected sample)	18.5	18	-0.5
ENVAWARE PISA (selected sample)	7.5	8.25	0.75

*Full sample of the pre test is n = 16. Full sample of the post test is n = 8.

**Selected sample is the 4 participants that attended all sessions up to the end of the workshop

From the thematic analysis of the group discussion on the feedback participants have on each lesson plan we discovered some points to further explain the result we see in the other parts of the results. Overall we found 3 themes across the 3 lesson plans, that are technicalities of the implementation, what might make the activity work in achieving their objectives, and what might not work. The feedback on the technicalities should be incorporated in revising the lesson plans document and planning programs in the future. Based on what works, there are several things that we could emphasize further in our lesson plans. For the first lesson plan, we could add a brief presentation by the facilitator on the parallel of the context of the information in the film to the context where the curriculum and discussion guide is implemented. For example, the facilitator could give a brief presentation on the comparison between Garamba National Park and Gunung Leuser National Park to show the similarities and differences between both. We can also point out which part of the film each discussion question is connected to. For the second lesson plan, it would be better if we give more opportunity for students to discuss their photos and facilitators can also help asking some questions to keep the discussion going. This is important so that students don't just share surface observable information about the photos like what objects are in the photos, where they took them, and why they took them. Instead, we could guide students to ask each other about how the experience represented in the photo means to their life and what they would like to do about it. For the third lesson plan, we should really give

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more time and opportunity to every student to ask questions so a conversation can happen between the students and the speakers, not just among the speakers. Based on what does not work, the biggest concern that every participant expressed is the issue of age appropriateness of this curriculum. Many of them think that this curriculum is more feasible and relevant to be implemented on high school students, but not middle school students. This might be caused by the fact that we used the discussion questions from the discussion guide rather than the questions from the curriculum, and points to the possibility that we should adapt the discussion guide in future for younger learners.

Table 2. Thematic analysis of the lesson plans feedback group discussion

Lesson Plan	Theme	Frequency	Sample Quotes (translated from Indonesian language)
Lesson Plan 1: Animal Talks - A Guided Discussion	**Technicalities**		
	Technicalities of the implementation	4	Is the worksheet for Lesson Plan 1 need to be printed? When will it be implemented? Which part can be done with all the other facilitators and which part can be done independently? Can we do it outdoors?
	What works?		
	Relevancy of the film and discussion	4	After watching the film, continued by the discussion helped us to understand the content of the film and understand the case that actually threatens wildlife. It is very relevant to the limited knowledge on conservation and endangered animals in Indonesia.
			The film and the discussion helps in making it relevant to ourselves.
			Maybe the relevancy of the film depends on the facilitator on how he/she connects it to the film. ... Maybe in explaining the film so we can explain what has been done by our colleagues on saving those animals. We can also briefly show like clips of photos and videos from our area. ... It would be better to do it after we watch the film. It would be better to show the visual from other countries, the animals there, and then we show the connection to our place. So that it will increase their love of animals. So that it will prevent the same things that happened in those countries from happening in our own places.
			Share the discussion questions before watching the film so students are better guided.
	Fun, 2 directional,	2	

	not monotone		
	What does not work?		
	The film might not be appropriate for secondary school students.	3	Usually children of that age when watching a film that long, they will not focus, their mind will already wander elsewhere, they will not focus on the discussion anymore. That's it for this method of learning because the film is quite long. The language used might be, for students in junior or high school, not all of it can be well-received or processed. But for this discussion method, it's good. So it's good so everyone can voice their thoughts, express their opinions, critiques, and suggestions, and also to immediately practice what has been discussed.
Lesson Plan 2: WildLife, Your-Life - A Photovoice Class Project	**Technicalities**		
	Technicalities of the implementation	5	For this question, it depends on the people. Some people have their photos organized, so everyone needs a different amount of time. The same apples with the amount of time they need to reflect on it. For me personally, i grouped the photos I take in one place so the time to find it is quick
			The time is sufficient, except if we are asked to take new photos.
			Yea, it's appropriate, I think 1 day is enough (to take new pictures)
			(the time) depends on the theme. So if the object that we want to take for the theme is far away, 1 day might not be enough.
			For those of us who will do this curriculum in-person, not through Zoom like this. Do we need to do the (group) discussion in rooms or not?

	Interpretation process of the meaning and of the photos	1	How to interpret the images correctly? Are there any tips and tricks in interpreting the theme and interpreting the pictures? Children will be confused what kind of pictures to take.
	What works?		
	Impact of the lesson plan	2	Maybe, in my opinion, this lesson plan is good too. Maybe the discussion between one photo to another earlier, then there's also a discussion for instance between, for instance, everyone can have different meaning from each photo and everyone can get new information.
			It can be good to dig the concerns from people
	Relevancy of the photovoice and discussion	1	From my experience when taking the earlier photo and looking at everyone's photo, it seems that from the photo and the discussion, there's one thing that we want to express. So whether the photo helped us identify our relationship with nature, yes. From my own experience, I can see how human activities impact nature.
Lesson Plan 3: Meet The Experts & Supplementary Writing Assignments	**Technicalities**		
	Speakers choice	3	I think young activists and researchers are suitable to be invited (as speakers) because actually from what I see, at least in Medan, in Medan or in North Sumatra, for senior or junior high school students rarely get to listen to seminars. Listening to events like that is too rigid for them. So if we invite young activists or researchers with a lot of experiences, it would be good there. ... Those who are olders might be seen as teachers, but young activists or researchers with a lot of experience will be more suitable.

			People from the field who can share stories from the field, The local conditions.
			Local conservationists. It can be from NGOS like OIC in North Sumatra or FKL and HAkA in Aceh. ... Maybe if we share stories from those who lived the experience directly will be more impactful compared to those who just share stories from theory.
	What works?		
	Impact of the lesson plan	3	Students can interact more directly. Compared to the first lesson plan when students can only watch. Here (in the Lesson Plan 3) students can ask directly (to the speakers).
			The most important thing is so we can direct children to love and take care of the environment, whatever their career goals are. We can introduce local animals so that they love those animals more. What are the animals that can be found in Leuser?
			Sometimes senior high school students can be unsure on what major to take in college, this can help.
	What does not work?		
	Format and age appropriateness	4	Seminar is more appropriate for senior high schoolers, but for junior high schools might not be suitable. ... Maybe for junior high school students, we can use methods like story telling or other methods that can be more understandable.
			Actually we can do it for senior high school students, but maybe we can choose easier themes. Even for us who are in college can still sometimes get confused. Maybe we can choose basic topics that are more understandable.

			Can we suggest activities after the pandemic so children can play in the conservation sites. Would it be possible to have a case study or a field study directly to the conservation location? So that they can learn and play.

3. Specialists and Scientists (lead-Horwitz):
    How can we support experts who have dedicated their careers to stopping poaching and the wildlife trade?

    Prominent conservation biologist Samuel Wasser of University of Washington, Seattle, appears throughout *The Last Animals* film as both a researcher and public intellectual working to render wildlife crime more evidence based, place based and effective. We partnered with a team of U.S. and international government agencies led by Dr. Wasser to produce an application ("app") for law enforcement around the world working on illegal wildlife trade. It provides interactive ivory seizure information to such professionals so that they can more effectively and accurately apprehend and prosecute the heads of transnational crime organizations responsible for driving the poaching of elephants and sale of ivory. This network draws connections between seizures based on genetic matching of tusks, a method pioneered by Dr. Wasser, and physical evidence, compiled by his law enforcement colleagues. We produced the networks in Python and made them interactive using RShiny. Further description of methods and display of the output application are not possible at this time, as a paper based on this work is currently in review for publication in a scientific journal. Moreover, data used to produce the application are confidential due to the sensitive nature of the study. We instead speak to and reflect upon the collaborative efforts involved with application design and development.
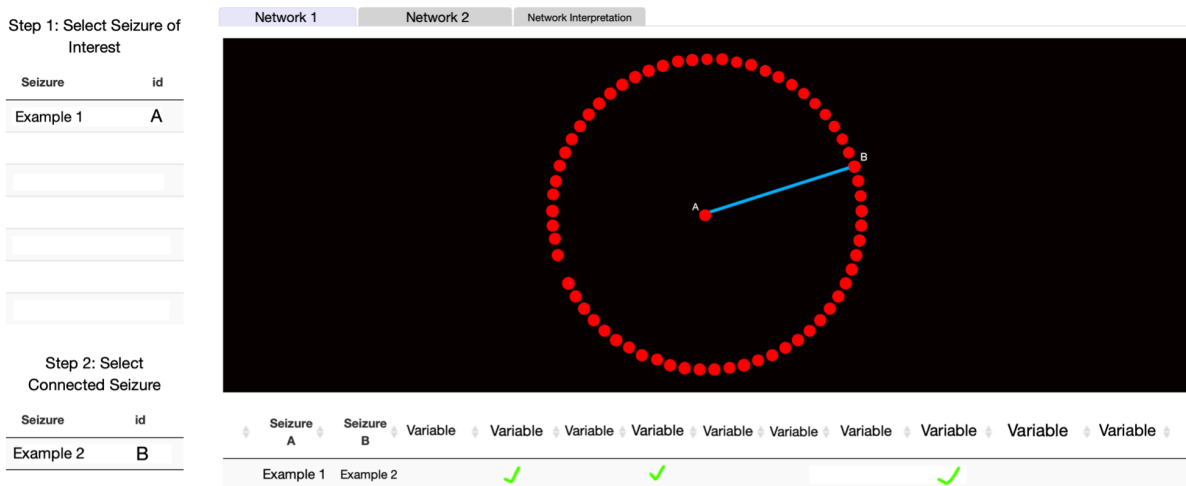

    Image 2. Heavily sanitized version of the app's user interface.

    The collaboration emerged as a result of Dr. Wasser's connections to *The Last Animals*, Brooks, and our advisor, Dr. Rebecca Hardin. These long standing connections proved vital in providing us the opportunity to set up a meeting with Dr. Wasser to discuss the potential for collaboration as, being a leader in his field, he is extremely busy. As such our collaboration unfolded on a highly incremental basis, from innovation to innovation.

    In our meeting, Dr. Wasser presented to us his past work – which we had already familiarized ourselves with through reading his past publications – and his ongoing work. At the end of the presentation, he asked if we had any ideas for how we can use our knowledge and skills to assist him in his ongoing research. We asked for some time to think about this answer, wanting to digest all of the information he had provided.

We recognized that there was – and still is – a real need for the type of evidence-based, data-driven crime prosecution work Dr. Wasser has pursued in the past. However, we also had to consider the fact that, frequently, this type of work is misused to victimize individual, low-level poachers who are often members of marginalized groups and only participate in the trade to financially support their families. We wanted to make sure that our work for Dr. Wasser would only assist in ensuring accurate prosecution of the high-level kingpins who drive the wildlife trade, not vulnerable poachers with fragile livelihoods. We spent the next few days combing through Dr. Wasser's presentation slides and researching network visualization and analysis methodology. We were set on developing a proposal that would advance Dr. Wasser's work in dismantling the ivory trade while also taking into account the complex justice issues inherently linked to it.

Our biggest barrier in developing a proposal to achieve this goal was the fact that the data were confidential. Until we were actively working on a project with Dr. Wasser where we needed to use the data, we did not have permission to see it. Without information about the data such as data structure, file format, or dataset size, we were unsure of whether any of our ideas were possible. We ultimately decided to propose three ideas to Dr. Wasser instead of one to account for this uncertainty.

Shortly after, Dr. Wasser informed us that he was interested in pursuing one or more of the proposals and that we should set up a second meeting. More urgently, however, Dr. Wasser let us know that he was in the process of submitting a paper on his genetic matching work, and felt our proposals showed that we were capable of producing those figures, assuming we were interested. We were.

Our second meeting was not spent discussing the proposals, but rather creating a plan for production of figures for his paper. Still, the knowledge we gained from preparing the proposals was undoubtedly useful during this meeting as we had a better understanding of what tools we could use to create complex, yet easily interpretable visualizations of a multinational ivory seizure network. We also had a better grasp on how we could properly and justly use those tools.

Following the meeting, Dr. Wasser sent us the data. Viewing the data for the first time was crucial as it helped us settle on the coding language we would use to visualize the networks (Python) and the specific modules we wanted to use (NetworkX, among others). Further, it enabled us to evaluate whether our work could be misused by misguided parties to target vulnerable individuals. We determined that the data were too general to realistically convict low-level poachers, and had little utility beyond convicting high-level kingpins who have their hands in multiple places, across multiple shipments of ivory. For this reason, we felt comfortable collaborating with Dr. Wasser on this project.

We spent the next several months producing and updating ivory seizure network figures. We were in daily communication with Dr. Wasser. We were also in communication and had meetings with his law enforcement colleagues who assisted Dr. Wasser in compiling the dataset we used to produce the networks.

Four months after we began this work, we finalized a few figures for submission to an academic journal with written methodology on how we created the figures. The school year began and our

communication with Dr. Wasser slowed significantly as we waited to hear back from journal reviewers. However, our work for his paper did not.

Taking an advanced geovisualization course, we were asked to produce an RShiny application for our final project. Previously, Dr. Wasser had expressed interest in turning our static network figures for the paper into an interactive application to be used as a tool by law enforcement professionals. The geovisualization final project was perfect for developing a prototype. By the end of the course, we had developed a working prototype and sent it to Dr. Wasser for feedback.

Before Dr. Wasser could provide feedback, the peer review from the academic journal returned. The journal was still interested in publishing if we resolved all reviewer comments. However, two out of three reviewers found all figures in the paper, including the ones we made, too confusing and unnecessary. It was disheartening to read that the work we spent all summer developing was more or less useless, since it was our main contribution to the paper. We worried that we would be dropped from the paper.

However, that night, Dr. Wasser sent us an email. He was blown away by the interactive prototype we created and felt certain it would quell reviewer concerns.

We spent the next five months refining the application. Once again, communication with Dr. Wasser was daily (though more frequently hourly). While it could be grueling at times (e.g. spending 48 hours in a debate over colors), we were proud of the resulting product.

The second draft of the paper is set to be submitted shortly. By the time it is submitted, we will have created more than one hundred versions of the application and more than one hundred figures from the application displaying thousands of individual networks. The draft contains 17 of our figures displaying 135 individual seizure networks pulled as screenshots from our application. We look forward to wider publication of the data and wider use of the app. They will serve as teaching tools and discussion tools to reference these scientific processes as they make wildlife protection both more effective and more just.

Discussion and Conclusion

Now that these dialogical learning materials and data visualization tools have been developed, where and how do we see them being used in the future? What are our next steps?

1. <u>Media and Public engagement (lead - Joint)</u>

   The StoryMap is intended to both supplement the curriculum and discussion guide. It can also serve as a standalone case study for media professionals and engaged members of the public interested in spurring change. It will additionally accompany film screenings and can be used to inform policymakers.

   The Discussion Guide is being distributed by Gooddocs, and featured on the TLAF website.

   TLAF is pursuing the Encounter Edu model now, with events planned for Endangered Species Day 2021, pursuing the kind of content and engagement model we piloted for Earth Day 2020.

2. <u>Curricular and Facilitation Tools (lead - Benyamin)</u>

   The dialogical learning materials utilizes the hybrid learning environment catalyzed by the pandemic, blending high and low-tech alternatives to scale and locally adapt ESD innovations, through nested educational partnership strategies that include local NGOs in wildlife-rich ecosystems of Leuser in Indonesia. The nested partnerships showed that implementing such curricular innovation required a four-staged work: (1) skilled translation of film resources into local languages; (2) assessing the capability for hybrid modes of learning to reach students without access to technology but also leverage networks with students and learning environments around the world; (3) semi-structured interviews about how to adapt the curriculum to local needs; and (4) workshops that showed a potential for these learning materials to increase the knowledge dimension of learners' environmental literacy, but not the affect and behavioral dimension without revising the lesson plans.

   This practicum is definitely only the beginning of actually seeing any real impacts from any materials we developed, therefore further studies are necessary. Some ideas of future studies include conducting fidelity and effectiveness studies, as well as scaling the implementation to similar context but with larger scope. The data presented in this report is all just descriptive data based on a very small sample size. Future fidelity study should see more closely on students compliance for receiving the treatment at random and differentiate the effect from the intention to treat as in being assigned to participate in the implementation of the learning materials, and actually following through all the sessions of the curriculum. We also need to more rigorously evaluate the validity and reliability of the measurements of Environmental Literacy in Indonesian context. As for the effectiveness evaluation of the learning materials, we need to use a more rigorous design such as Randomized Controlled Trials (RCT) with control and experiment groups, or difference-in-difference studies expanding from the pre-post design. This is so that we can more convincingly establish a causal relationship of participating in the implementation of the learning materials and the achievement of their objectives. After building the confidence that these materials really work effectively, then we can start scaling up its implementation to other

sites that are highly threatened by poaching and illegal wildlife trade, and are the places where TLAF has previously worked.

3. Interactive Network Application (lead - Horwitz)
    The network application is in the process of being deployed online for use by law enforcement personnel. It has already been used during international conferences, for instance, at the 9th OECD TF-CIT Conference. While the paper is still undergoing the submission process, we are certain that our figures are useful and tell a compelling story about how ivory seizures across the world are connected, and can assist prosecutors in ensuring the heads of transnational crime organizations are held responsible for their role in the illicit ivory trade.

4. Justice Considerations

    In April 2021 we presented this project in its entirety for an audience of environmental justice and conservation-oriented peers at Yale University's New Horizons in Conservation conference. Questions and conversation from that engagement have shaped our thinking and writing. In this section, we recognize issues of justice that arose as we completed our practicum, and the way in which we responded to those issues.

    How do you make sure that your educational materials and partnerships are not just a new form of colonization?

    There are definitely things that we hope we could do more to decolonize these partnerships and materials as we originally planned to do a more ethnographic style study by going directly there and work with learners and partner organizations day to day. Instead, we tried to simulate that interaction through late night whatsapp chat, especially with the education program manager of Leuser Conservation Forum. We also held periodical Zoom meetings. But, even Zoom meetings can be challenging as these conservation leaders often go to the field, deep in the forests of the Leuser Ecosystem where there is spotty or no internet connection. We consulted with them from the beginning, thinking about whether *The Last Animals* film fits with their conservation and education priorities. We considered which kind of activities need to be included and how to ensure they build on the existing content of their current conservation education program. We also brainstormed on the best ways to implement the pilot of these materials and also its implementation in the long term.

    We put a lot of effort into dubbing The Last Animals film to Indonesian. A large part of the project involved applying to multiple grants so that we could create the dub of the film. We then reviewed the result of the dubbing to confirm the translation was appropriate and easily understandable for the target age of the audience, which is 14 years and older. The film has been translated to many other languages as well. We also translated the educational materials that we develop to accompany the film to Indonesian so that teachers or people who are interested in using it in general don't need to be fluent in English. We put all of this effort to make the film more accessible. So that not only english-speaking audiences or bilingual audiences can watch it. So that not just literate audiences that can read subtitles can watch it.

    We acknowledge that this issue is an international issue. Wildlife trade both legal and illegal connects countries from different parts of the world. It might contradict the spirit of

decolonization if we are not acknowledging how wealthy consumers are exploiting the lives of poachers and rangers that might even die in their clashes in relation to these animals and to the warfare and other illicit businesses that drive them. We also draw connections from the similarities between the Northern White Rhinos and the Sumatran Rhinos in a way that both of these species' populations are really low so that assisted reproductive technologies are so important.

This is also why we choose the dialogical learning approach as an integral part of all of our learning materials. We want to make the learning process bidirectional in a way that we're not just lecturing them as most ecology or science subjects are taught, especially because we're not just targeting to increase their knowledge, but also their attitude toward these issues and their motivation to pursue alternative career paths. We learn as much from the students on what are the conditions of poaching and wildlife trade there, as much as we share about how it is connected to other countries and how it is such a global issue. This way of learning is also important because most of the film is focused on African rhinos and elephants with contexts that might be different from Indonesia. So the discussion and also the reflective process might allow students to see the similarities and differences with the contexts that they experience in their own lives.

How do you (Aditya) deal with your identity and positionality when implementing the learning materials?

First of all, I do acknowledge that even though I am from Indonesia, I am not originally from the Leuser ecosystem. Even the first time I went to Aceh province, one of the two provinces where the Leuser ecosystem is located, I was identified by people there as a Chinese person, as in someone from mainland China. That may have caused people to be reluctant to approach me and not sure if I speak Indonesian. This reality shows some parallel and informed the way I position myself when interacting with the local partners. In one of my conversations with them, they even say that because of COVID, a negative sentiment toward foreigners is worsening. That is why this partnership is really important. The education program manager of the Leuser Conservation Forum is always the one that communicates with the people. The facilitators are undergraduate students or recent graduates from the Aceh province, not me.

Do you feel like the ivory seizure network application is attentive to decolonization?

It is important that we acknowledge that we developed this application as an outside party to be used by individuals with countries and cultures different from our own. However, our goal in creating the application was to synthesize information and present it to our partners – who are from those countries and cultures – abroad. It is ultimately their choice to use the tool we developed. We do offer our own interpretations on trends we see in the application (for instance, if we see particular ports being used as major hubs to traffic ivory). Ultimately, however, we are not the people prosecuting the heads of transnational crime organizations. We only support those individuals who do prosecute TCO kingpins, should they want it.

Thinking more broadly about the wildlife trade, there is no single people, culture, or country responsible for driving the trade. It is an international trade. For example, the U.S. is one of the largest importers of ivory and a major driver of the trade. As much as our app development group has gone into a culture different from our own – which we certainly have – as a

multinational collaborative group, we all come from places responsible for and affected by the wildlife trade. Taking a close look at our own cultures' role in the trade, we feel we have a responsibility to help stop it.

How do you make sure that the network application is not furthering criminalization and militarization? How do you prevent the application from being used to target traditionally marginalized groups that are often considered "outsiders"?

To say the data is not susceptible to any misuse would be incorrect. However, the data is too general to be used to target specific poachers or other low-level drivers of the ivory trade, who often only participate in the trade to support their families. The application considers variables such as locations of ports and shipping companies, not identities of individuals. The nature of the ivory trade, in terms of how many hands products through before reaching their final destination, would make it difficult to link a single poacher to specific seizures of ivory. The application is only able to link heads of transnational crime organizations to multiple seizures of ivory because these kingpins are connected to each level of the trade, giving orders. They have their hands in everything.

Why did you (Ryan) choose to work with elephants in Africa while there are major conservation issues in the United States that you could address?

I entered my master's program knowing that I wanted to do work with wildlife. I love animals and find them fascinating. I also knew I wanted to work with data. I love programming. I love solving puzzles and identifying trends in data. This project melds two academic interests that I love. I never envisioned myself working with elephants. I have always been hesitant to work with "charismatic megafauna." I like to be different. I also never pictured myself studying an area outside of the United States. Including issues associated with working in another culture, I am not a huge fan of airplanes. However, when I saw this project, it resonated with me. There is a real need for the type of work we are doing. While there are of course justice concerns with the project – as there are with most issues in conservation – I trusted my advisor, clients, and project partner to help me recognize them and navigate them to the best of my ability. And I think that they have helped significantly, though I still have more to learn. This project has been a life-changing experience and I am grateful to have had the opportunity to work on it.

Acknowledgements

Appendices

Appendix 1. Budget report summary

Details	Costs	Funding
Input		
SEAS Practicum Funding		$3,000
International Institute Research Award		$6,500
Spending		
Support for personal computing devices, internet connection, etc	$3,000	
Film dubbing to Indonesian Language	$5,909.20	
Discussion guide and curriculum facilitators remuneration, implementation cost compensation (printing handouts, internet data package, and incentive for participating secondary school students)	$590.8	
Total	$9,500	$9,500