Learning Activity Design Final Project:

Collaborative Mapping Technology in Environmental Education

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Project Overview

The use of collaborative mapping technologies such as Google My Maps allows students to create and share customized maps, as well as work collaboratively to create maps as a group. Students can pin geographic locations and add information such as text, photos, and video to these pins. Map layers can be used to organize pins by topic. These layers can be viewed separately to focus on one theme, or overlapped to show the interactions and connectivity between themes. As a tool in environmental education this type of technology is very useful. For example students can pin information to maps of their local environment, share their observations with classmates and teachers, and create maps on different factors in the environment. These activities employ a social constructivist approach to learning design; learners assemble or construct knowledge with others within a social environment facilitated by the teacher (Piccano, 2017). Students are also required to engage with higher order thinking skills such as analysing, evaluating, and creating. Within the context of Blooms Digital Taxonomy, these skills are demonstrated through validating and posting information, by filming and photographing themselves, their peers, and their environment, and by collaboratively creating an original online resource (Sneed, 2016). Collaborative online mapping activities provide inquiry-based experiential learning opportunities for students to gather and share information from their ecological surroundings. Maps are by nature a place-based resource, and the activity of creating a map requires engagement with place, which develops deeper connections between students and their local environment and community.

Learning Goals

The learning goals for this mapping activity are from the BC Environmental Science 12 curriculum. From the ministry curriculum guide comes the big idea: Human actions affect the quality of water and its ability to sustain life. This big idea will be the main theme of the learning activity. Students will learn about and observe in their environment the human impacts on water quality and accessibility. They will share their learning and observations with their classmates through an interactive map, creating a class repository of information on the local environment. In doing so, students will develop the core competencies of communication, collaboration, and critical thinking, as well as personal and social

responsibility and awareness. This activity also engages curricular competencies specific to sciences such as: planning and conducting, processing and evaluating data and information, evaluating, and communicating.

Learning Context

The learning context for this activity is a class of grade 11 or 12 high school students at Stelly's Secondary school in Central Saanich, BC. This class will meet in person, in a traditional classroom setting, with opportunities to take the class outside for walks and field trips into the local environment. Students in this class will vary in background and interest from those who are passionate about the environment to some who are only interested in getting an upper level science credit. It is important to note that 15% of the student population at Stelly's has Indigenous heritage or background. The traditional science classroom setting can be viewed as a barrier for engaging Indigenous learners in upper level science classes.

All Stelly's students have Google accounts through their school email, and most are quite proficient at using the suite of applications for education. Most students have a phone or other device that can take pictures and upload them to Google drive; those who do not can borrow devices from the school. The physical environment will be an important design constraint in this activity: students will need to get out and observe water and human impacts in their environment. The areas directly surrounding Stelly's are perfect for this; a large stream runs by the school. This stream can be observed in a natural setting in a nearby park. Human impacts are also evident when the stream is diverted into culverts and ditches around agricultural and developed areas.

Learning Activity Design

The learning activity will consist of students creating informational pins on a class map of the local environment. Each pin will relate to the theme of human actions affect the quality of water and its ability to sustain life. Students will be asked to find observable examples of this theme in their local environment, then record and communicate them through images, text, audio, or video. The map will then become a class resource that allows students to share their observations with peers and develop a

broader understanding of the environment around them. This resource will be developed over the course of the school term. It can be used to record and display learning activities from class such as field trips, data from water sampling, and videos of guest speakers. The map can also be a learning tool for species identification, habit mapping, and monitoring changes in the environment. After working on the map together as a class, students will be able to choose an issue or area for further inquiry, then record and display their learning through pins on the map. Presentation and discussion of each student's works will be used as a culminating activity for an environmental science class.

Proper scaffolding will be critical to student success in this activity. Students will need to have background knowledge on the scientific method, water quality issues and how they are measured, as well as ecological and human impacts on water quality. They will also need to know how to effectively use the Google My Maps program, and be able to record and upload data, images, and video. Classes will be structured to provide students with direct instruction on these issues and skills, followed by supported exploration, before asking them to work independently.

To begin this project, the class will work together to brainstorm human impacts on water sources. Then, after a tutorial on the features of Google Earth Pro, students will use this program to view places around the world where significant human impact has occurred. Virtually exploring locations like the Hover Dam or the Panama Canal, students will be asked to consider the scale of human influence on the earth's water, and to weigh the benefits and detriments of these impacts. Using historical imagery on Google Earth Pro allows users to view changes to a location over time. This can demonstrate the effects of development, urban sprawl, or deforestation, and can even show the drop in water levels in lakes and reservoirs, or the recession of glaciers. During this exploratory activity, students will be encouraged to view photos and other user created data on Google Earth, and to consider what makes an interesting and informative pin on a map. To conclude this lesson, students will be asked to share their findings in a group discussion.

Another component of the learning design for this activity is bringing in local experts, community members, and knowledge keepers to speak with students. This might include but is not limited to:

municipal water/utilities managers, biologists or ecologists, farmers, conservationists, and members of local First Nations. By incorporating these voices and viewpoints from outside the classroom, students will gain understanding of the diverse perspectives involved in environmental issues. This exposure to new ideas may provide inspiration and new avenues to pursue for their inquiry project. Incorporating Indigenous perspectives is especially important for this project, as their oral histories predate European contact and can provide an idea of what the environment was like prior to colonization. Indigenous knowledge of plant and animal life could be studied and documented in this project, as long as cultural protocols and procedures are followed. For example, an ethnobotanist from one of the local First Nations could be invited to lead the class on a nature walk along the local creek to identify indigenous plant species. Students could then take pictures of the species they find and pin their location on the map. This should only occur after receiving permission to record this information and providing an honorarium and gift of appreciation to the speaker in return for their time and knowledge according to local Indigenous protocol.

Structured exploration into the local watershed and how to use the mapping technology will be vital to student success in this project. An activity that can build student familiarity in both contexts would be a nature walk through the local park, where students will be asked to take photos showcasing human interactions or impacts on water. Back at school, students will be given class time in the computer lab to upload their photos to a shared Google photos album, and the teacher can demonstrate how to import these photos to a My Maps project. Students can then edit the map, adding titles and descriptions to the photos, and exploring the information their classmates have provided. This model would work for field activities, such as water quality assessment or kick net sampling, where students could then upload data tables, charts and graphs to their maps. As students gain confidence with mapping technology and the skills and processes of science, they will be able to work more independently and can transition into a free or minimally guided inquiry project as the culmination of their learning.

Assessment

Formative assessment occurs throughout this project, starting with the initial brainstorm and exploration of Google Earth. The instructor can listen to student ideas on water systems and provide feedback to direct students in their virtual explorations. The class discussion at the end of this activity can be used to develop criteria for map pins. Later these criteria can be applied to evaluate and provide feedback on student pins from structured exploration activities like the nature walk. As the course progresses, students can be asked to provide peer assessment to their classmates. This requires them to think about the qualities of an informative and useful mapping project contributions. For the final inquiry project, creating an evaluation rubric as a class will ensure that students are aware of and engaged with the criteria expected in their work. This also allows for flexibility in designing the requirements for the final project, accommodating for student preferences and interests, and allowing for the course to follow different directions based on feedback throughout the term. Students will share their inquiry projects with the class and receive a summative assessment based on the rubric developed in class.

Review of Related Literature

Student mapping projects are utilised by educators to build connections between students and their environments as well as their communities (Mears, 2012). Mapping activities are applicable to many curricular areas from sciences to social studies. They serve to showcase the connections and interactions between physical, geographic, political, and social factors in real world applications (Bozin and Anastasio, 2006). This means that within the context of a given topic or learning objective, students can create connections to other subjects of interest to them and relate their learning to their lives. Mapping activities develop critical and multidimensional thinking skills. Students are required to categorize and interpret information, analyse and evaluate, and make inferences (Sinton and Bednarz, 2007 as cited in Langram and Dewitt, 2020). These skills align with the core competencies of the BC curriculum, as well as higher order thinking skills as described in Bloom's taxonomy (Sneed, 2016). Furthermore, maps are tools for visualizing and scaffolding place-based learning; by studying and creating maps of the local environment, students are building their connection to place (Langram and Dewitt, 2020). These

connections can foster greater student engagement with their learning, and hopefully build greater social and environmental responsibility beyond the school setting.

Advances in technology have greatly expanded the learning opportunities that mapping projects provide. Geographic Information Systems (GIS) allow users to select different layers of spatially referenced data, which can be displayed over maps for evaluation and analysis. As a learning resource GIS can be used for inquiry-based environmental investigations. This allows students to spatially visualize data, compare and contrast data layers against each other, and track changes over time (Bozin and Anastasio, 2006). Google Earth and Google My Maps are two applications of GIS that are extremely user friendly and can be utilised as learning tools for environmental education. Google Earth provides visual and spatial connections between local features and the greater environment, for example; how a pond is one part of a larger watershed system (Bozin, 2008). Google My Maps allows for the creation of pins linked to geographic locations, where students can add photos, video or text information. There are many examples from educational literature of this technology being used in environmental education. On the California coast, marine biology educators and students are mapping the ocean dune ecosystem, sharing information on the unique species, habitats, and human impacts in the area (Neely and Swensrund, 2011). A middle school in Ohio created a map of their schoolyard and the impacts it had on the health of their local watershed. Students observed and documented examples of runoff, erosion, and pollution, and made connections to the social and ecological impacts these factors have on the greater community (Rees, 2019). A biology class used Google My Maps to compile species sampling data around their school, allowing them to analyse plant species biodiversity for different environments, and to present this data in tables and graphs (Doup, 2018). In each case mapping technology gave students an active role in collecting and evaluating data and information, allowing for creative collaboration, and encouraging connections and inferences beyond the area of study.

Collaborative mapping projects provide opportunities for expression of worldviews and perspectives beyond those of the traditional curriculum. As Langran and Dewitt (2020) point out, maps are not objective resources, and most maps reflect the colonial cultures that created them. Student created

collaborative mapping projects then provide an avenue for students to bring their culture and background into the curriculum, and to share this information with teachers and peers. This project is also an excellent opportunity to incorporate Indigenous content into learning, as Indigenous connection to place is deeply rooted in traditional language and place names. According to Claxton (2015), "place names serve as a constant reminder of the cultural, spiritual, and social connection between the land and the people. Place names illustrate and express the deep connection to all living things in the environment" (p.79-80). Incorporating these connections into a science course puts Indigenous knowledge at the forefront of the curriculum, while making learning relevant to the local environment and community and building student connection to place. An environmental science course allows for teachers and students to move away from a traditional learning style, to one where students are encouraged to be more connected to the land, which is an important aspect of Indigenous learning.

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