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Brian Yamamoto  
*Kauai Community College*

K.W. Bridges  
*University of Hawaii at Manoa*

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# **How many ways do I use thee? – Academic applications of GigaPan technology**

**Brian Yamamoto**  
Kaua`i Community College  
btyamamo@hawaii.edu

**K. W. Bridges**  
University of Hawai`i at Manoa  
kim@hawaii.edu

## **ABSTRACT**

GigaPan technology has many roles in the higher-education environment. Some of these roles are intrinsic to the technology: students can see the “big picture” and also view details. In other situations, the GigaPan technology lets students explore the many facets of plants in their environment. These are just starting points. In this paper we review a variety of applications involving GigaPan photography in the biological sciences. We include public and administrative examples of academic activities as we have found that GigaPan images are not limited to uses in the classroom.

## **Keywords**

GigaPan, biology, classroom, field trip, ethnobotany, Hawaii

## **INTRODUCTION**

Biology classes have long used photographs to illustrate a variety of topics under study. GigaPan technology adds to the photographic repertoire in important ways.

The importance of GigaPan technology becomes evident when one compares a single close-up image of a subject, such as a plant. The close-up image focuses on the details. What is lost is context and surroundings. By looking at a wide angle panorama one gains context but loses detail. Both of these image scales individually provide for relatively passive interaction through observation. GigaPan technology has combined the detailed information of a macro image and the context of a panorama. Shifting between these scales allows a student to have an active interaction with the information stored in the image. This provides a valuable tool in education. The following are examples of how GigaPan panoramas are utilized as classroom tools.

## **METHODOLOGY**

Gigapan panoramas were created using GigaPan Systems Epic (<http://www.gigapansystem.com/>) robot. Images which are intended for interactive viewing were uploaded to the GigaPan site (<http://www.gigapan.org>) where they are available for viewing at a variety of scales. Large prints were made from GigaPan images by a commercial printer (Copy Express, Honolulu, HI). These images are printed on vinyl for durability and longevity.

## **RESULTS**

### **Example 1: Detail and Context:**

#### **Maui Nui Botanical Gardens**

(<http://www.gigapan.org/gigapans/39750/>) (Author: Brian Yamamoto).

Beginning ethnobotany students are introduced to the native plants of Hawai`i and to those plants that the Polynesians introduced to Hawai`i. This is an interactive lesson in which students can focus on individual details of a single plant and



identify morphological features such as number of petals, flower arrangement, leaf arrangement, fruit type, and seeds. Students can also focus on the context such as soil type, leaf litter, surrounding plants, size of material and pollinator. The interactive nature is that students can move from plant to plant observing detail and context by zooming in and out of the panorama.

Snapshots in this panoramic image, which were taken by the instructor (BY), provide a directed starting point for student exploration. The snapshots were taken of specific plants and each has a set of questions embedded: what are the genus and species, the Hawaiian name, the family name, and ethnobotanical uses. These directed questions focus beginning students to what is important, but without providing the answers. Only six snapshots are provided. The students are asked to find and identify at least 15 plants in

this image.

This exercise provides students with direction that they need to apply later to new scenarios. The inclusion of Tara (the gardener) is important as it creates a human perspective in the garden. It also shows the students her “ownership” of the garden; this is her garden and she interacts with these plants on a daily basis. Part of the lesson is that good gardens require such “ownership.”

### Example 2 – Introduction to Species:

#### Maui Nui Botanical Gardens Coastal Strand Ecosystem

(<http://www.gigapan.org/gigapans/39825>) (Author: Brian Yamamoto).



Students in Botany 130 – *Plants in the Hawaiian Environment* – use this GigaPan image to learn about coastal plants before going on a field trip to observe a coastal strand environment. Seven snapshots are used in this panorama to highlight key

species. In this case, there are no embedded questions. The snapshot only indicates that this is a plant of interest. This provides some direction but allows students flexibility on what information they would need to observe.

A botanical garden was selected as the site of the image instead of a panorama of an actual coastal ecosystem because the layout at the garden provides a variety of plants in a context where the students can better see individual plants. This lets them learn about the individual species before focusing on context and interactions. This is an important experience in preparation for an actual field trip. Students find that an image of an actual field site location can be overwhelming if they are not ready for the situation. This garden layout provides a number of species in a relatively small area. This allows an opportunity to focus on comparative morphology between several genera and it is a good place to introduce and illustrate convergent evolution.

### **Example 3 – Ethnobotany:**

#### **Maui Home Garden**

(<http://www.gigapan.org/gigapans/39749/>) (Author: Brian Yamamoto).



This image started as a personal record for my (BY) family to capture my children's grandfather in his element. Grandpa Hashizume spends most of his day tending to his backyard garden. This garden is typical of many in Hawai'i as it contains a large diversity of species which are grown in a complex setting. This is an opportunity for ethnobotany students to carefully dissect this complexity.

This image does not contain snapshots taken by the author. Students are directed to first determine the diversity of species in the image. They are then asked to arrange the identified species into use categories such as food, medicine, and aesthetics. The students then select representative samples and determine botanical information about these plants and their country of origin. The last assignment is to determine which plants in the garden have cultural significance to Mr. Hashizume based on interviews with him.

**Example 4 – Field Trip Briefing:**

**Pihea Forest**

(<http://www.gigapan.org/gigapans/7225>) (Author: Kim Bridges).



A GigaPan image cannot replace an actual field trip to a site for direct observation. However, field trips to remote sites are expensive. These trips require considerable planning and the resulting complexities usually allow for usually only a few such excursions during an academic semester, even in a place like Hawai`i. Once at the site, weather conditions or logistical requirements limit the time that is available to fully observe and document the field information.

The fragility of many of the field sites and the fact that they often contain very rare species further limit on-site activities. All of these attributes argue for fully preparing students before they venture into the field.

GigaPan images can provoke each student to think carefully about the field situation before undertaking the actual field experience. Students can anticipate what they will see, evaluate the size of the task at hand, become familiar with the logistic requirements for data collection and pre-delegate responsibilities to their student colleagues.

The GigaPan image also serves as a post reflection of the field experience and can generate many discussion questions. What information was collected? What problems were encountered but not anticipated? Was the GigaPan panorama representative of what was actually seen? What was learned?

Panoramic images can also be used in a classroom situation where some students are not able to participate in the field trip experience due to personal commitments or physical ability. GigaPan images, while certainly not a substitute, can provide a kind of active access to the site. The immersive nature of the GigaPan images provides a student with an alternative way to interact with the field site even though he or she was not able to experience the field trip in person.

GigaPan images taken periodically at a field trip site provide a chronological documentation of change that may not be detected if comparative imaging was not available. This approach is particularly valuable in a conservation context. Students will be able to search for important processes such as changes in species abundances, the invasion of alien species, damage due to storms, and other dynamic events.

**Example 5 – Decorative Images:**

**The Pihea Forest Trail**

(<http://www.gigapan.org/gigapans/12948/>) (Author: Kim Bridges)



GigaPan prints have been used to decorate hallways as “educational wallpaper.” These pictures have been seen to generate conversations, initiate new ideas, and create future partnerships. These hallway panoramas have been printed on vinyl and are generally eight to fifteen feet wide. The prints at the University of Hawai`i at Manoa are attached to the hallway walls at strategic locations, such as an elevator lobby and across from a laboratory entrance. Panoramic images have also been placed in offices, such as the Botany Department mailroom. They make a bold statement where every they are used.

At Kaua`i Community College, the GigaPan Pihea Forest Trail panorama is on display at the One Stop Center. This building is where all students interact with Counseling & Advising, Financial Aid, Admissions & Records, the Business Office and Administrative Services. This image projects the importance of both science and technology on campus. Our department gets equal number of inquiries about the natural environment captured in this image and how did we make this picture. The image has initiated collaboration between the Science and the Digital Media Departments on campus. Science will provide training in GigaPan technology to digital media students and the students will use the technology to illustrate science examples.

Large GigaPan panoramic prints have been used as gifts to other institutions. Similar to the role of these prints on campus, these gifts have generated conversations, provoked new initiatives, and suggested future partnerships. An example is the presentation of the large Pihea Forest Trail vinyl print to the University of the Ryukyus COE (Center of Excellence) program to illustrate island biodiversity. The COE program displayed the panorama as the entrance image for Kaua`i during the conference “The Future of Living Things in Okinawa – Addressing Environmental Problems on Islands of Rich Biodiversity” held at the Okinawa Prefectural Convention Center.

A large print of the Pihea Forest Trail GigaPan panorama has also been given to the Mayor of Ishigaki as a protocol gift between Kaua`i and Ishigaki, both sister islands. The panorama was used above the Kaua`i booth entrance in the Ishigaki Island fair last October. Many of the participants commented on the beauty of the natural environment on Kaua`i and how we are so much alike in our natural beauty.

The Pihea Forest Trail panorama is also located in the main conference room of the Okinawa Prefectural College of Nursing. It was presented as a gift during the 10<sup>th</sup> anniversary celebration of Okinawa Prefectural College of Nursing (OPCN) from Kaua`i Community College as sister institutions. It has generated interest in student study abroad each year from OPCN to Kaua`i.

## **DISCUSSION**

The use of GigaPan images in a college setting is still in its infancy. We have been interested in integrating this technology into the classroom in a variety of ways.

A primary lesson we have learned is that the images need to be created, or chosen, very carefully. It is important that a student have enough complexity to make the image (and lesson) interesting and realistic, but that it is sufficiently clear that

the important details are not overlooked. As curriculum developers, we will need to practice the craft of creating good GigaPan images and seek out peer and student evaluations to make sure that these images meet our educational objectives.

We need to examine the ways that GigaPan images can leverage academic activities that previously have been challenging. For example, will a class take more actual field trips if substantial student preparation for field trips can be done with GigaPan panoramas? Can students become actively engaged in conservation studies if they are involved in repeat photography using GigaPan images? Our early evidence is that GigaPan images may help in such situations.

GigaPan images, whether viewed on a computer monitor or as a large vinyl print, can provide compelling documentation of places. This can act as an “attractor” in many ways. It can help us recruit students into the sciences and technology. It can also provide a way to involve the public.

We’ve just started examining the ways that we can use GigaPan panoramas and have already found some interesting, and perhaps unexpected, applications.

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