

HAWAIIAN CULTURE AND HIGH SCHOOL BIOLOGY: SYMBIOSIS

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This study examines the effects of integrating a Hawaiian culture-based curriculum into a high school biology classroom. A mixed methods action research approach is used to collect data centered on student changes in perceptions of biology and science in two traditional units, genetics and ecology. The central findings of the study indicate that Native Hawaiian students are more effectively engaged in science and learning when Hawaiian language and cultural knowledge are embedded in the curriculum. The data show that a majority, about 75% of students, have increased positive perceptions of biology, have an increased understanding of themselves, and can more easily grasp biology concepts. Results suggest that it is imperative schools become more knowledgeable about students' cultures while teachers need to be more self-reflective in their teaching.

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Hawaiian proverbs, ‘ōlelo no‘eau, speak to the importance of understanding oneself and one’s place in the world, and recognizing diversity in thought. Proverbs underscore unique Hawaiian sensibilities and attitudes toward learning and education. ‘*A’ole pau ka ‘ike i ka hālau ho’okahi*, for instance, recognizes that there are many sources (different places and ways) for learning and celebrates diversity in learning. Another, *Kū i ka māna*, states that one should stand proud and firm in the ways in which one is taught. *Māna* is the nourishment and metaphorical knowledge passed from one generation to the next. A student is expected to demonstrate respect for those who have come before him by honoring the experiences and information received.

There is, however, a notable disconnect between the traditional Hawaiian appreciation of diverse approaches to learning and contemporary American education in Hawai‘i. By and large, the contemporary American system of education ignores the crucial role culture plays in student learning (Trumbull, Rothstein-Fisch, Greenfield, & Quiroz, 2001). Data consistently reveal “longstanding gaps in Native Hawaiian educational outcomes, ranging from lower achievement, attendance, and graduation rates combined with higher disciplinary and risk-taking behavior among youth” (Kana‘iaupuni, Ledward, & Jensen, 2010; Kana‘iaupuni, Malone, & Ishibashi, 2005).

This study examines what happens when Hawaiian culture is introduced into the formal American-style classroom setting. It specifically focuses on secondary (high school) biology and a unique indigenized curriculum taught to a student sample population comprised entirely of Hawaiian and part-Hawaiian students. The conclusions are extrapolated from an examination of qualitative and quantitative student response-based data, a mixed methods approach. Central findings of the study indicate that Native Hawaiian students are more effectively engaged in science and learning when Hawaiian language and cultural knowledge are embedded and included in the curriculum.

Historically, after many Native Hawaiians abandoned traditional ways in the school setting and adopted Western ways of conduct and interaction, the educational assimilation process left subsequent generations of Native Hawaiian learners paralyzed under Western cultural subjugation and bereft of traditional Hawaiian cultural ways of learning. Stueber (1981) says, “Hawaiian Schools were organized and operated by those who were not only alien to Hawaiian culture as it had been but continuously and consistently denigrated this culture, asserting

its inferiority to the cultures from which they, themselves, had derived.” Yet, for many Hawaiian families, adherence to the Americanized education system is viewed as the exclusive option for “success” in a rapidly changing society. The way Hawaiian students are educated in their homeland clearly indicates a severe deficiency of cultural and linguistic sensitivity. Moreover, there seems to be a general lack of cultural sensitivity in modern education for many of the immigrant cultures comprising large sections of Hawai‘i’s population as well (Stueber, 1981).

A resurgence of indigenous educational practices and the development of culturally relevant curricula show that when minority students are provided an equitable opportunity to engage in learning through their own epistemology, they are able to honor their own unique perspective of the world and grasp concepts, including science, more readily. In Hawai‘i, several institutions, schools, and programs have made a concerted effort to emphasize Hawaiian knowledge, values, traditions, and assessment in their learning outcomes. Most have had measurable success, from marked improvements in attendance to higher overall student morale and academic achievement (Tibbetts, Kahakalau, & Johnson, 2007). Numerous examples are found among the Hawaiian culture-based charter schools, Hawaiian language immersion schools, and enrichment programs such as Nā Pua No‘eau and Kamehameha Schools’ explorations series. All demonstrate high levels of success when Hawaiian culture is purposefully integrated into curricula.

Considering the powerful influence of culture on student learning in the context of Hawaiian history, it is increasingly important to find ways to successfully integrate cultural relevance into the teaching of all subjects in Hawai‘i. One particular area of limited research and thus an area of need for culture-based curriculum integration research is secondary science, specifically the biological sciences. This research explores how a culturally relevant approach can successfully be used to teach Native Hawaiian students biology more effectively at the secondary school level.

Hawaiian epistemology is defined as Native Hawaiian ways of knowing and understanding the world (Meyer, 2004). The infusion of Hawaiian values, language, and thought processes into the curriculum has the potential to positively alter not only the education statistics of Native Hawaiians but all learners in Hawai‘i who integrate these methods of instruction. According to a literature search, however, biology curricula centered on Hawaiian epistemology are rare.

Typical high school biology textbooks and curricula use terms, concepts, figures, and examples from a different place, time, and value system unfamiliar to students. Hawaiian students tend to have little relatable connection to the references and no context to understand them. Illustrations and references to squirrels, skunks, acorns, and oak trees offer students a not-so-hidden implication that mainstreamed American pedagogy is more valued than a localized Hawaiian pedagogical understanding of the world. In order to be culturally conscious and responsible to diverse learner needs, science educators in Hawai‘i should reconsider their curriculum in terms of what they teach and why, what cultural perspective(s) they teach from, where the information comes from and why, what methods are employed to teach, and what relevance it has to their students.

Native Hawaiians and the host culture of this land offer a wealth of knowledge, learning, experience, and wisdom to both the local and global education setting. Continual development of a culturally relevant curriculum and educational success among Hawaiian scholars encourages more work to be done in culturally relevant science. The Hawaiian language, for example, offers hundreds of specific rain and wind names, while English describes the same with single terms. A Hawaiian who resides in Hilo may refer to the wind names in his area, such as ‘A‘ala Honua or Uluau or to a particular rain as ka ua Kanilehua. One names and recognizes what one values. The rich biology and ecology of this unique place is wholly untapped in the average Hawai‘i classroom.

A HAWAIIAN CULTURAL APPROACH

A basic premise framing this study is that indigenous students (especially Native Hawaiians) excel when provided the opportunity to learn in culturally relevant ways. Hawaiian students experience marked increases in science skill recall, vocabulary recognition, self-esteem, and overall science performance (Meyer, 2004, 2009).

Kana‘iaupuni, Ledward, and Jensen (2010) described a set of relationships that link culture-based educational strategies to student outcomes. They showed that “culture-based education (CBE) positively impacts student socioemotional well-being (e.g., identity, self-efficacy, social relationships).” A culture-based curric-

ulum is the vehicle toward a holistic culture-based education. For the purpose of this article, the term *culture-based curriculum* is used to describe the indigenized curriculum integrated into secondary biology.

DEMAND FOR INDIGENOUS CURRICULUM DEVELOPMENT

From an indigenous point of view, several global examples show that curricula can and should be indigenized to suit the needs of children of indigenous ancestries (Feinstein, 2004; Haig-Brown, 1995; Hickling-Hudson & Ahlquist, 2003). A demand for indigenous curriculum development is evident in nearly all of the literature related to this topic. Curriculum philosophies have to be reassessed when teaching minority students (Hickling-Hudson & Ahlquist, 2003). Teachers should allow a diversity of voices to be heard in a facilitated classroom discussion (Haig-Brown, 1995).

Grounding Hawaiian students in their own cultural point of view helps them to view the world with more understanding (Kaiwi, 2006). When students can clarify their own cultural identity, they are better able to understand and learn about diverse topics. Student identity is also strengthened through indigenous learning experiences such as ecological outdoor experiences (Feinstein, 2004). Kaiwi (2006) argued:

By rooting Hawaiian students first in their own cultural perspective, we provide the lens through which they can view the rest of the world. A multicultural curriculum taught in Hawai‘i that is devoid of Hawaiian anything—by omission, obstruction, or obliteration—marginalizes Hawaiian culture. Because we are in our homeland, this type of omission affects our academic integrity. If we do not teach Hawaiian students who they are as Hawaiians, we devalue them and their *kūpuna* (ancestors, elders). This is Hawai‘i, and for that reason alone, as teachers we must use a Hawaiian philosophy of education that establishes Hawaiian literature as foundational before moving out to embrace a global perspective. (p. 27)

Science education has been a particularly important area for minority student voices to be heard (Gitari, 2003; Haig-Brown, 1995). Minority students are typically under-represented in the sciences in higher education settings as well as in employment. This could be due to a number of factors including the disconnection between the way minority students are taught science and their cultural backgrounds.

Students can benefit tremendously by a culture-centered curriculum (Feinstein, 2004; Haig-Brown, 1995; Hickling-Hudson & Ahlquist, 2003). Benefits to students include the ability to find relevance in learning biology concepts, forming relationships and making personal connections to the subject, and building positive identity and strengthened self-esteem.

Indigenous science also offers benefits to Western science. Michie (2002) points out that Western science has much to learn from indigenous sources, such as reconsidering how and what evidence is, the role relationships play, place-based learning, and a more holistic approach to science knowledge. He further argues that indigenous knowledge is far more complex than Western science credits.

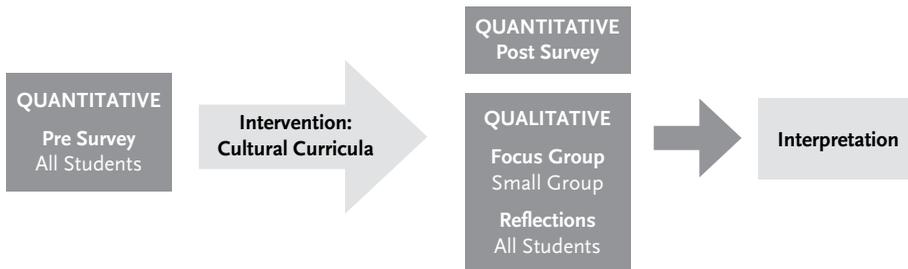
METHODOLOGY

This research examines the importance of a Native Hawaiian curricular perspective on Native Hawaiian students learning traditional secondary biology, looking into students' perceptions of how cultural relevance influences their understanding of biological concepts, and examining evidence of their science understanding through cultural curriculum links. The study utilizes a Native Hawaiian eleventh-grade student survey and focus group data collected from high school biology classes to investigate how the integration of cultural concepts into traditional curriculum impacts students' learning of science.

Data were gathered over a five-month period from 35 female and 35 male high school student participants. A majority of students were age 16 at the start, and most were age 17 by the end of study. Data were collected from a private school on Hawai'i Island, where all participants are racially part Native Hawaiian. Data collection began with a pre-survey to gauge students' perceptions of their science learning before being taught through a Hawaiian culture-based biology curriculum. An identical questionnaire was administered to students at the end of the

study, after being taught the Hawaiian culture-based curriculum, which served as the post-survey (see Figure 1). All survey questions and student responses are included in Appendices A and B.

FIGURE 1 Embedded design model of data collection and analysis



The Hawaiian culture-based curriculum focuses on two biology units, ecology and genetics. Over the course of the second semester, students are given one major pāhana (project) for each of the two units. The projects in both ecology and genetics focus around a common theme and convey biological concepts and standards through a Hawaiian cultural lens. Supplemental activities, mini lessons, class discussions, and homework accompany the projects.

In the genetics unit, the ‘ohana (family) is the focus of the learning (see Appendix C). Students are asked to create a visual and oral presentation that relates familial relationship examples of the genetic concepts that are being discussed. Students are also asked to put together a family tree that includes several specific details, including known dates of importance, photos, full names, and to the extent comfortable, inherited medical conditions or phenomenon related to genetics (twinning, colorblindness, albinism, etc.). Flexibility and differentiation are the keys to the assignment, so if students have a difficult time finding needed information or photos or choose not to share family information for various reasons, an alternative assignment is worked out on an individual basis. If preferred, a student could focus on the genealogy of Princess Bernice Pauahi Bishop or another well-known ali‘i (royal) genealogical line. The oral portion of the project provides students several presentation options, including ha‘i mo‘olelo (story telling), oli (genealogy chant), mele (singing or song composition), or the option to create their own presentation (hula, 3D model, etc.).

In the ecology unit, the pāhana centers on place-based learning (see Appendix E). Students are asked to choose a place of significance to their ‘ohana and themselves that they want to research and learn more about. The project requires research about the place of study to be organized into five sections: introduction, cultural background, ecological study, impacts on the ‘āina, and discussion and conclusions. The place of choice (frequently the student’s family ahupua‘a or land division using extending from the uplands to the sea) is used as the vehicle for understanding ecological concepts. Students are asked to give examples specific to their place, such as drawing a local food web, demonstrating feeding relationships (i.e., symbiosis, predation, competition, etc.) and noting examples of ecological succession that have occurred in their land area. Depending on the scope and sequence planning of the teacher, the project can be extended into a longer scientific research paper (10–15 pages) or condensed to a scientific abstract (250 words or less). Similar time for research is needed for either version.

FINDINGS

The ‘ōlelo no‘eau, *I ulu no ka lālā i ke kumu* speaks of the growth of a tree; branches, leaves, and flowers flourish when the trunk is firmly rooted. Similarly in a cultural context, many creative and productive results are fostered after a firm foundation is built. Ideas flourish when there is a strong cultural foundation.

To demonstrate that Hawaiian culture-based curriculum has a positive impact, the data must indicate that students recognize examples that support their learning and are able to describe the benefits to their learning of the subject content. Ideally, the data should also indicate why and how students found benefit. The quantitative and qualitative results help to confirm this positive impact on learning. Complete results can be found in Appendices A–G.

Secondary students recognized the indigenized biology curriculum. By the end of the study, 97% of students could name at least one example of Hawaiian culture-based curriculum. Students recognized, as anticipated, that the ecology and

genetics projects are examples of a Hawaiian culture-based curriculum in their respective biology units. The majority of students realized that the indigenized curriculum in both units has improved their understanding of biology.

Integrating Hawaiian epistemology through a culture-based curriculum has a positive impact on learning traditional biology for the majority of the students. The curriculum supports Native Hawaiian student learning, as evidenced by the triangulated results which include several types of quantitative and qualitative data. Five findings (See Table A3) demonstrate positive impact including:

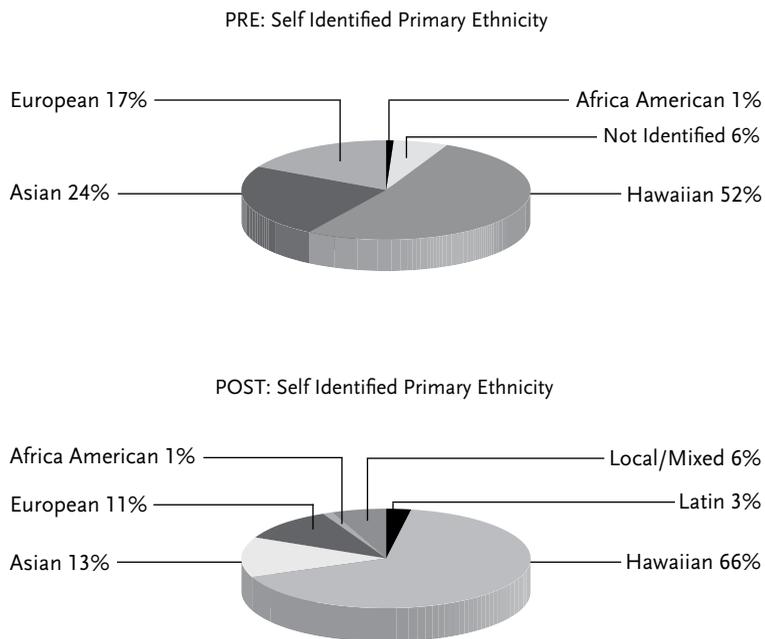
- 80% agreed that a Hawaiian culture-based curriculum is helpful to them learning biology concepts better.
- 75% reported that the Hawaiian curriculum integration helped them to learn better than in other classes.
- 69% reported that they are able to understand biology concepts more easily than with other teaching methods.
- 79% reported that they are able to make more connections between biology and themselves with the integrated curriculum.
- 84% reported that biology is more relevant to them when they can make cultural connections.

Students reported that as a result of the curriculum integration, they are able to make connections to the content, understand concepts easier, find relationship with the material, and learn and process complex biology concepts. In the pre- to post-survey comparison, students showed an increase in their understanding of biological concepts through the integration of Hawaiian culture. They were increasingly able to apply science to their context of self, family, community, and world.

Students strengthened their self-identification as Native Hawaiians and reported that biological concepts are easier to understand. When students were asked, for instance, to identify their “primary ethnicity,” the results showed a 14% increase (from 52% to 66%) of students who identified themselves as Native Hawaiian

from the pre- to post-survey. While ethnically all are part Hawaiian, by the end of the study students identified more with being Hawaiian. This reflects Hawaiian culture-based research in the literature which finds that students “report greater Hawaiian cultural affiliation” when teachers use culture-based educational practices (Kana‘iaupuni et al., 2010). The indigenized curriculum encourages students to have more pride in being Hawaiian. Figure 2 illustrates this increase in Hawaiian identification.

FIGURE 2 Self-identified primary ethnicity



As identity awareness shifts from the pre- to post-survey, students began to view themselves and “Hawaiian” things differently. An important observation from the data is that while the students’ viewpoint changed from the pre- to the post-survey in nearly every area, it especially changed in recognizing Hawaiian culture. Student

answers in the pre-survey, for instance, frequently referenced “the Hawaiians” or “them” to describe their family or cultural history, as one would reference an external or distant phenomenon. By the post-survey, student responses shifted to using personal pronouns or possessives such as “us,” “we,” “my kupuna,” or “my family” to describe the impact of the curriculum, rather than “the Hawaiians,” “them,” or “the ancient Hawaiians.”

Reflecting on their own culture is a complex internal process for students. The data reveal some very noteworthy and unexpected responses in student views of culture. Qualitative data showed that students see Hawaiian culture in some unexpected areas, such as the classroom discipline strategy, classroom rules, and so on.

The study clearly shows that there is a greater likelihood that integrating Hawaiian culture into the secondary biology classroom will help students learn better. By and large, a Hawaiian culture-based curriculum is shown to benefit the majority of Native Hawaiian students through its relevance, relationship, and connection to the content through context.

In addition to the benefits students reported, survey and focus group data show that the indigenized curriculum also affected students’ future interest in science. From the survey data, 14% more students were considering pursuing biology and/or science in the future, after the culture integration. Of the focus group respondents, 100% of students said they will consider taking more science courses and pursue more biology or science coursework in the future, if there is a cultural connection.

Three quarters of students said that the culture-based curriculum helps them to learn better. Table 1 shows student responses to ways in which Hawaiian culture-based curricula help support their learning. Twenty-five percent of students expressed some difficulty with it, and 20% of focus group respondents and 27% of written reflections expressed challenges in their projects. This is due to several factors, including lack of cultural background or genealogical information, as well as limited access to people who have cultural knowledge. This data set also suggests that perhaps not all students experience the same benefit from indigenizing the curriculum. While most Hawaiian students embraced the cultural relevance, a portion did not.

TABLE 1 Question 18 pre- and post-survey average top responses.
 What are ways that Hawaiian culture-based curricula help to support your learning?

Ways to support learning	Top responses (average)	Percentage
Connection	22	31
Relates to me or my culture	22	31
Helps with learning and processing complex concepts	19	27
Understand concepts better	17	24
Personal relevance, learned about self	16	23
Helps to remember or learn easier	11	16

Those students who did not indicate benefit from the cultural components are primarily students who, although part Native Hawaiian, identify primarily with another ethnicity. Often, these students commented that they are not raised in a Hawaiian culture or lifestyle. They are not taught from a Hawaiian worldview perspective and frequently taught from another primary ethnicity with which they identified. For these students, the projects may be far more difficult tasks to complete, as they need to learn the additional cultural and language components in addition to the new biology concepts. One student in the focus group commented, “I thought it [one of the projects] was more difficult. I had to learn two things instead of one.” For some students, all of the learning is foreign and a new knowledge acquisition for them, making learning more difficult instead of easier and more relevant. Many of these “culturally challenged” students explained that because they did not grow up with Hawaiian culture and values, they had to learn new biology concepts with the added challenge of learning culture and language as well. Another focus group student commented, “I’m not really close to my Hawaiian side and, well it’s good that we are [learning this way] because I’m learning more on my Hawaiian culture side.” For many of these students, while grasping two new sets of learning outcomes instead of one poses an additional challenge, they still welcome the cultural integration and appreciate learning more about their Hawaiian heritage.

DISCUSSION

For some students, “culturally challenged” doesn’t reflect the problem. Changing family values affect student outcomes. Reflecting on the genetics assignment where students compile a mo’okū’auhau (genealogy) project, some issues of note arise. An overwhelming trend in both student written reflections and in focus group data was that students did not know their family history or did not connect to the ecology and land because their families did not either. Nearly all students did not know the four-generation genealogy requirement for both parents on their own. They had to ask and research to find the needed information. Several did know three generations on at least one side, which included themselves. Frequently, students reported that this is due to parents and grandparents not knowing where they come from or their connection to place. Many students reported that their families do not retain family histories and cultural connections. Students noted that their families have a notable disconnection from who they are and a long history of hiding or abandoning it.

There are points of information that the family did not want to share or elaborate on for various reasons. In one student’s project written reflection, he commented,

I didn’t include all of the required information because I was told by my parents not to include for personal reasons. I did not include the pictures because we do not have possession of those pictures. For any other information that was not included on the board, I was told not to because my parents felt that nobody needed to see this information.

Alternatives have to be given in order to differentiate for varying student needs and family concerns. Students are asked to collect and record information to the best of their ability. Students are challenged to do the best they can to compile the information asked for in the project, but when all resources are exhausted, they can approach the teacher and explain limitations. On a case-by-case basis, students may be assigned to do more work on the known parent’s side, such as researching additional generations on their mother’s side and requiring less information about the unknown father’s parentage. In other instances, students are given an alternative assignment to research and document a known ali’i genealogy instead

of their own. Learning about Kamehameha's or Princess Bernice Pauahi Bishop's genealogy offers a different point of view and additional learning points in both biology and culture. Assignment deadline extensions are also provided based on the time students need to obtain photos.

RECOMMENDATIONS

Culture-based education incorporating language and indigenous values is a tested and recommended methodology that helps students learn subject content. Culture-based curricula should be integrated in schools. It is particularly *imperative* in schools with a student body comprised mostly or entirely of members of the host culture. The school setting may be the sole source of learning culture and identity building for them.

Culture-based curriculum is *rigorous* and must incorporate *higher order thinking skills*, such as those outlined in Bloom's Taxonomy (Bloom, Englehart, Furst, & Krathwohl, 1956). Learning can and should take on many facets, where students are able to compare and contrast, apply previously acquired knowledge, critically analyze, provide examples of their own, practice active inquiry, create representations of their understanding of concepts, and question why they think something. In response to how the curriculum helps to support learning, one student commented, "Because it makes me question why something is true." Another responded on the post-survey, "I can compare and contrast to help me better understand" concepts in reference to his ecology project.

Scientific *inquiry* should be incorporated into a culture-based curriculum when possible. Curiosity is a strong science protocol that can be approached from a cultural perspective. A hunger for exploration and observation has been essential to the survival success of many peoples around the world. Numerous examples of curiosity and exploration can be found in Hawaiian culture, with traditional navigation and voyaging being a central example of this. When possible, students should have opportunities to investigate creatively in order to problem solve.

Cultural curricula must include *differentiated learning* and embrace the idea of multiple pathways to a common outcome. It is important in cultural curricula as it provides students with choice and rigorous assignment options. Choice is important for students to express creativity and their varied intelligences, strengths, talents, and perspectives.

A culture-based curriculum minimally requires the incorporation of multiple intelligences (Gardner, 1999) to be effectively done. On the surveys, students consistently commented about the variety of visual, tactile, musical, and nature-inspired assignment options that helped them to learn. Instructors must be open to student creativity and alternate curriculum suggestions. One student proposed a creative alternative to photos that were difficult for him to get for the genetics project. He decided “instead of pictures I found out who my family was and found pictures in representation of them.” In another example, a student said, “for this project most of my information was already on Ancestry.com although due to the project I took the liberty of uploading photos and noting physical attributes and medical history for as many people as I could...I traced 7 generations back to the early 1800s.” A third student commented that because of the indigenized curriculum, she “learned things that I wouldn’t have learned in a textbook.”

Place-based learning is an important component of culture-based curriculum. It connects students with a sense of place, identity, and care for the land. Place-based learning provides a simple way to make learning come alive within the local context and culture. The literature also supports the important role of place in learning (Feinstein, 2004; Meyer, 2004; Tibbetts et al., 2007). The Hawaiian value of kuleana (responsibility) is incorporated into the ecology project through a service-learning component. Students are asked to search for a service that they can provide in their communities. Not only is there educational value for students in researching and learning about place, there is also exceptional learning opportunity in asking them to “give back” by providing a service to the community of study. Student interest and engagement is often increased and held via varied learning opportunities such as field study, huaka’i or field trips, guest speakers, service learning, and other activities that embed outdoor connections. As several students put it, learning should be “fun and interesting.” Sometimes learning can even be unexpected and unpredictable, so instructors should embrace “teachable moments” as they arise.

In this process, *self-reflection* is essential. Teachers must take the time to consider and reconsider why he or she teaches and relay these reasons and motivations to culture. Every educator teaches through a cultural lens or often multiple cultural lenses, but many are not cognizant of it and do not self-reflect on what effects these lenses have. There has to be a very conscious and deliberate approach to curriculum development and teaching from a Hawaiian perspective.

Educators not used to teaching through a conscious cultural perspective might argue that rigor will be compromised or that students may have a limited worldview. Science teachers in particular may criticize the validity of this kind of instruction by challenging its perceived bias. In the view of the author, it is inaccurate for any teacher to claim that they teach with no cultural bias. If not consciously realized, this fallacy can be a disservice to students. Educators must embrace that we all teach through one or more cultural lenses, and that this lens affects what we teach, our approach or methods to teaching, what we emphasize as important, and how students perceive and learn. Students naturally bring their own cultural diversity into classroom dynamics as well.

The culture(s) that one teaches through has an explicit and hidden curriculum embedded in it. Cultural integration can be so powerful that its absence can result in a severe lack of relevance and context in teaching, student confusion and distrust in the instructor, and potential student marginalization. While we believe that cultural-based education can benefit all students, those who do not have a strong cultural foundation may not initially value it. From the literature, the Kenyan example of indigenizing health curriculum suggests that all stakeholders must be careful not to adversely affect students' existing cultural understanding of the world, in favor of Western ideals that may not fit the place, values, or culture of the students (Gitari, 2003). The hidden curriculum in that article points to "experts," who are mostly foreigners, having the responsibility to know, solve, and control rather than the indigenous perspective of the responsibility lying within the self.

In this study, several students asked for teacher *transparency* by requesting examples from the instructor's own genealogy. It is a firm belief of this author, especially in a cultural context, that whatever is asked of students could and should be asked of the teacher as well. If students are asked to reveal their own personal information, then instructors need to be willing to reveal the same about themselves. From a Hawaiian cultural perspective, the teacher-student relationship can only grow stronger with increased mutual trust. When students see the teachers' humanity, it increases trust, builds rapport, and increases productivity on both sides.

CULTURAL BIAS

It is not sufficient for culture to be limited to only those subjects traditionally associated with ethnology such as the social sciences or language. Hawaiian culture is typically relegated to Hawaiian language, music, or history classes. Culture needs to be prominently taught through and integrated into instruction in all subject areas such as science, math, physical education, language arts, and the visual arts. In reality, culture does not exist in a bubble and should not be segregated in the education arena either.

Duality of Western Science Versus Indigenous Perspectives

In scientific thinking, objectivity is essential. Scientists constantly strive to limit or eliminate bias. Science does not, at its core, recognize the existence of something unless it can be empirically assessed. From a Hawaiian perspective, objectivity is impossible. Humans are unable to observe without their perceptions, influences, and filters affecting what and how they process. For many indigenous people, culturally significant phenomena cannot always be empirically measured. Areas such as spiritual growth cannot currently be measured accurately and thus, be recognized by science. This severely limits possible educational outcomes if they include cultural phenomena that cannot easily be measured, such as certain affective, relationship or identity building components.

Western views and traditional Hawaiian views of quality differ greatly. Occasionally, students will choose not to complete an assignment or will do an unsatisfactory job. In these instances, for the assignments given in this research, when students are pushed for deeper explanations, many times a shortage or avoidance of information prevented the proper completion of the assignment. There are lots of reasons why students do not want to share information or are ashamed, which a teacher must always approach with sensitivity. Often a Hawaiian student may, in traditional custom, choose not to do something if the child feels like their highest quality work cannot be produced. In Western cultural norms, this may conjure teacher perceptions of laziness or defiance; or alternatively, the teacher may reward a grade for any work submitted, no matter how substandard it is.

Students need to be held to high quality expectations. Instructors should never sway on the rigor of quality work. Students should always be expected to do the highest quality they are capable of. High caliber work is a Hawaiian cultural value

and expectation. An instructor should balance the differentiation cultural-based education requires with the expectation of high quality products. An expectation of high rigor and quality is essential, especially when the assignment is differentiated to meet the needs of all students.

In many traditional societies, imitation is not only encouraged, it is expected. Imitation is a means for ensuring rigor in cultural perpetuation, and is the expectation in many hālau hula (traditional hula schools). In a Western classroom, students usually find imitation met with discipline, as it is most often perceived as plagiarism or viewed as a barrier to creative expression.

CONCLUSION

Study findings indicate real benefits to students from providing a culture-based curriculum alternative for secondary students in biology. If successfully implemented, culture-based learning can provide students another way to learn that appropriately integrates their values, language, history, and culture. The literature also supports the urgent need for indigenized curriculum particularly in the areas of science and biology.

Culture-based learning must continue to be dynamic as well as change and evolve as the culture does. After completing the original study, the culture-based curriculum I employ continues to evolve, deepening inquiry skills, rigor, and project-based learning while expanding on place-based and differentiated learning. Students are now asked to take the next step by pairing their cultural and scientific knowledge in meaningful ways and applying it to real life situations. In the ecology unit, after students complete the individual study of place, they are given a real life scenario that asks them to problem solve around current environmental issues, such as building a geothermal facility or wastewater treatment plant in their moku (district). They must assess the viability of the scenario and construct a response through an Environmental Impact Statement (EIS) that considers the cultural, historical, and natural impacts they have researched. They are then asked to invite and present their EIS to actual stakeholders in their own communities.

In the genetics unit, students must now also reflect on, identify, research, and present findings on a specific genetic trend or anomaly that occurs in their 'ohana, especially as it relates to health. Students are asked to develop a personal and family plan of action related to the health trend they observe.

Ultimately, culture is a lens through which a group of people experience humanity and process the relationships in their environment. A culture-based curriculum offers students an opportunity to view the world through a lens that is closer and more relevant to their lives. Optimal learning occurs when Hawaiian students perceive that their own Hawaiian epistemological context is validated in their education, and they too feel validated and valued.

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ABOUT THE AUTHOR

Layne Richards, MEd, currently teaches biology and several science electives at Kamehameha Schools Hawai'i High School. He is also the Team Lead teacher of the Science and Natural Resources Academy. Richards resides in Waikahekahe, Puna, Hawai'i with his wife, Kahi, and their two children, Haweo and Halena. He is a 1995 graduate of Kamehameha Schools Kapālama and was an inaugural fellow in the First Nations' Futures Program.

APPENDIX A

FINDINGS: DATA TABLES AND GRAPHS

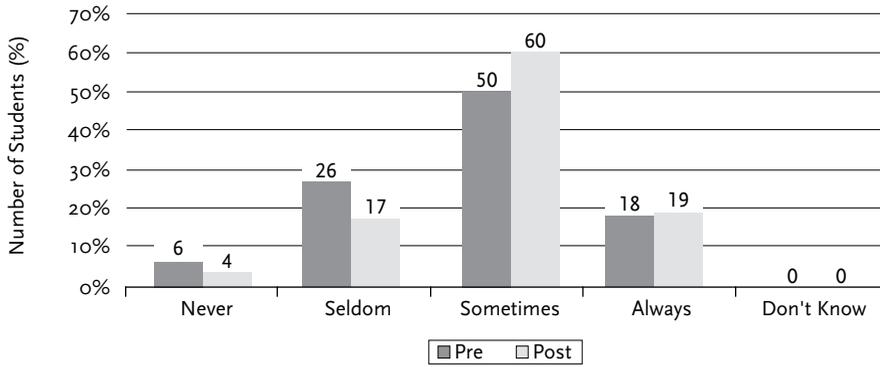
TABLE A1 Pre- and post-survey question outline of categories

Questions	Category	Data Type
1–4	Demographic information	Quantitative
5–8	Cultural background assessment	Quantitative
9–15	Cultural integration into Biology	Quantitative
16–18	Provide examples	Qualitative
19–20	Future interest	Quantitative

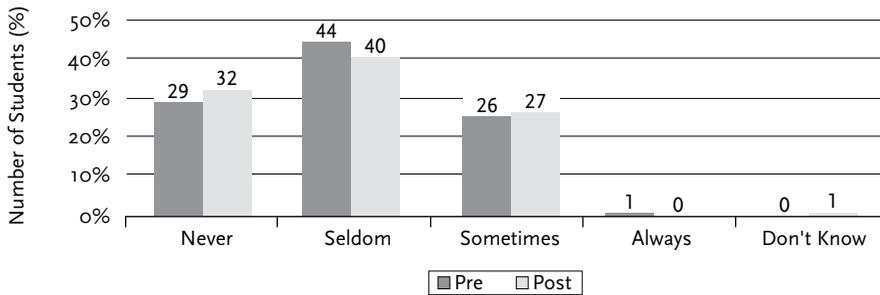
TABLE A2 Average Likert rating of pre- and post-survey data comparisons for cultural background (questions 5–8)

Questions	Pre	Post	Difference
5. My family and I practice Hawaiian values and culture.	2.8	3	0.2
6. I can communicate in the Hawaiian language.	2.1	2	-0.1
7. My family speaks in the Hawaiian language.	2.5	2.5	0
8. I choose to do or practice Hawaiian activities when possible.	2.8	3	0.2

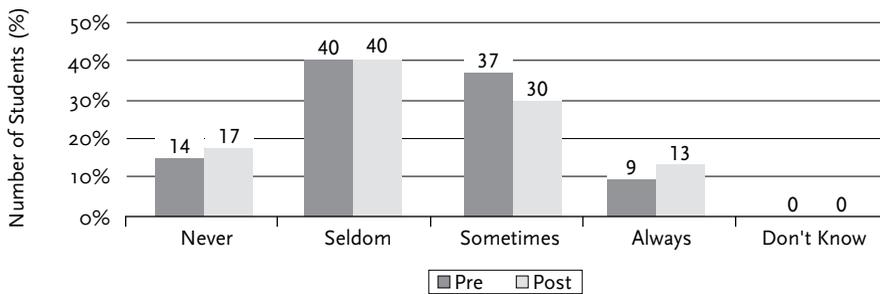
QUESTION 5 My family and I practice Hawaiian values and culture.



QUESTION 6 My family speaks in the Hawaiian language.



QUESTION 7 I can communicate in the Hawaiian language.



QUESTION 8 I choose to do or practice Hawaiian activities when possible (i.e. play or listen to Hawaiian music, play Hawaiian sports, weave, hula, etc.).

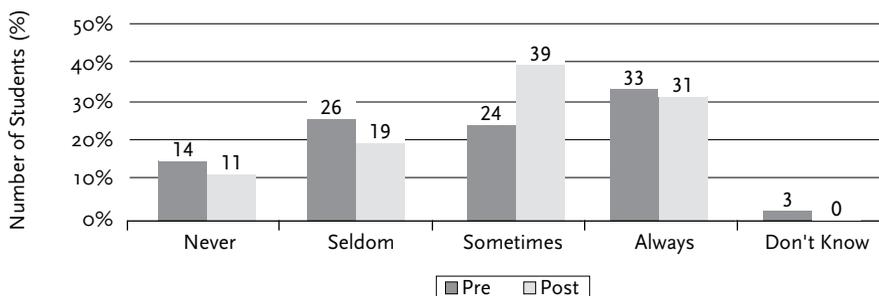
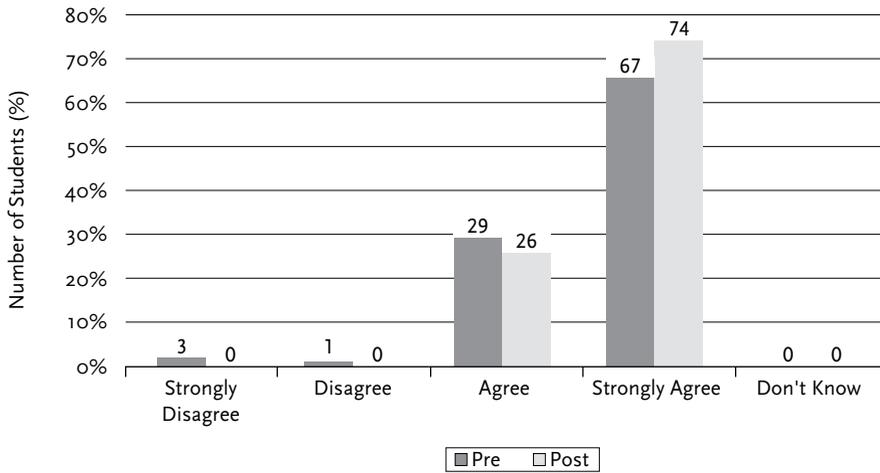


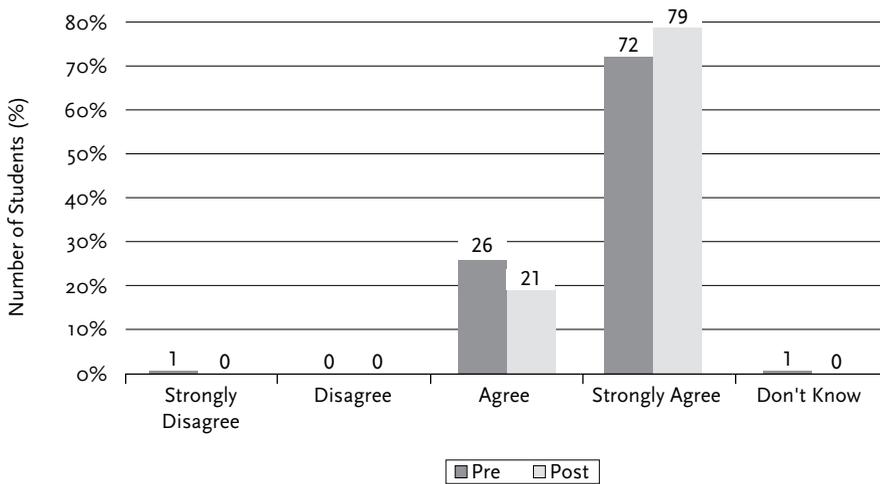
TABLE A3 Average Likert rating of pre- and post-survey data comparisons for cultural integration into biology (questions 9–15)

Questions	Pre	Post	Difference
9. This biology class is different than other science classes I have taken in the past.	3.7	3.8	0.1
10. This class uses Hawaiian culture-based curriculum.	3.7	3.9	0.2
11. Hawaiian culture-based curriculum helps me to learn better.	3	2.9	-0.1
12. Compared to other classes, I learn better in this class than in others because of the way that it is taught.	2.9	2.8	-0.1
13. I can understand biology concepts more easily than with other teaching methods.	3	2.8	-0.2
14. I can make connections between the biology material and my life more easily with culture-based learning.	3.1	3	-0.1
15. Biology is more relevant to me when I can see Hawaiian cultural connections.	3.1	3.2	0.1

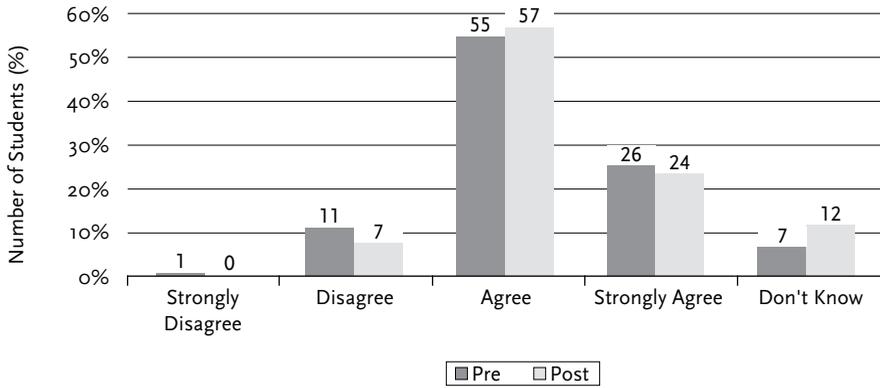
QUESTION 9 This biology class is different than other science classes I have taken in the past.



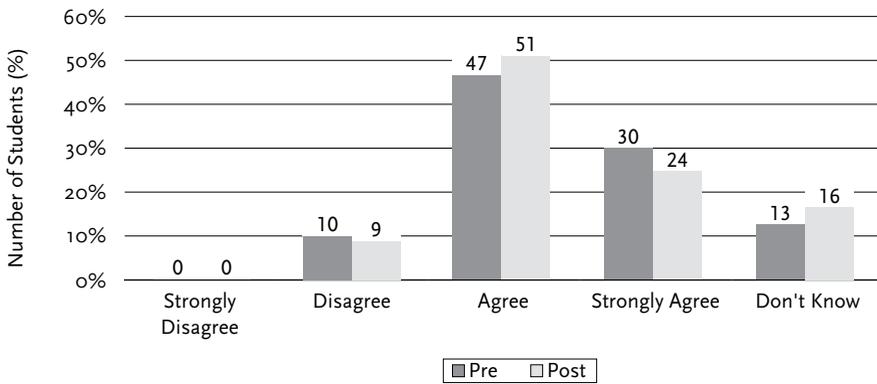
QUESTION 10 This class uses Hawaiian culture-based curriculum (Hawaiian language, values, stories, ways of knowing, etc.).



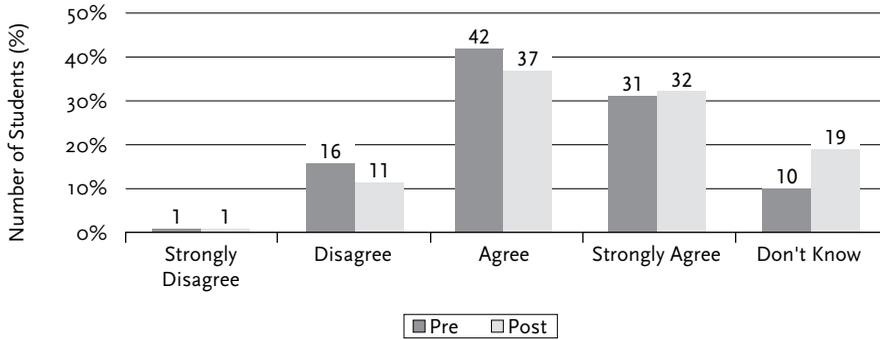
QUESTION 11 Hawaiian culture-based curriculum helps me to learn better.



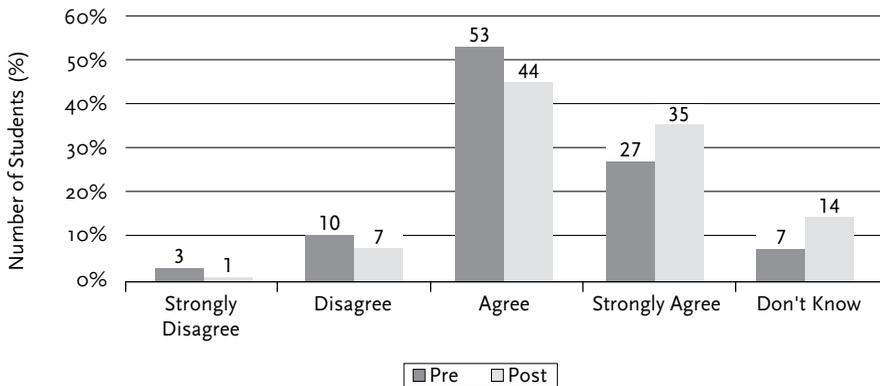
QUESTION 12 Compared to other classes, I learn better in this class than in others because of the culture-based way it is taught.



QUESTION 13 I can understand biology concepts more easily than with other teaching methods.



QUESTION 14 I can make connections between the biology material and my life more easily with culture-based learning.



QUESTION 15 Biology is more relevant to me when I can see Hawaiian cultural connections.

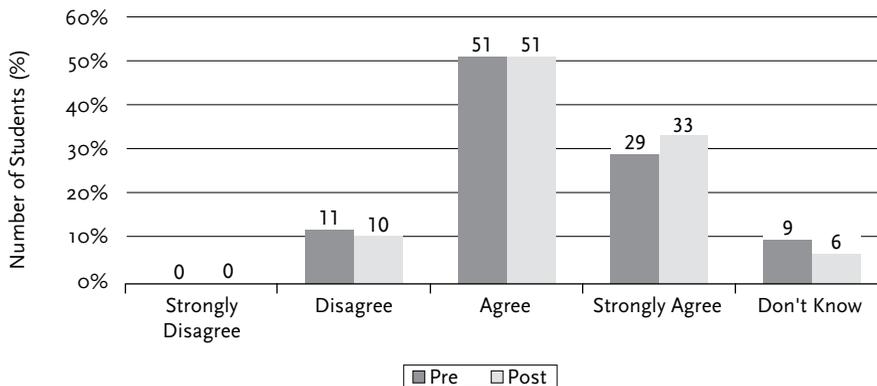


TABLE A4 Focus group question outline of categories

Questions	Category	Data Type
1, 3	Provide examples	Qualitative
2, 4	Cultural integration into Biology	Qualitative
5, 6	Future interest	Qualitative

TABLE A5 Focus group interview questions

Q1	What are examples, if any, of activities or assignments in biology (in this class) that you consider to be Hawaiian culture-based?
Q2	Are you able to understand or make connections to biology concepts easier (or harder) with Hawaiian cultural integration?
Q3	What are ways in which Hawaiian culture-based curriculum helps you to understand or learn?
Q4	Do you feel that biology is more relevant to you when Hawaiian cultural connections are made?
Q5	Would you take more science courses in the future if you are able to make cultural connections?
Q6	Is biology or science a field you would consider pursuing in the future?

TABLE A6 Focus group interview top responses

Category	Question	Top coded responses	Percentage of those who responded
Provide examples	1. What are examples, if any, of activities or assignments in biology (in this class) that you consider to be Hawaiian culture-based?	Genealogy	63%
		Family	50%
		Plants	38%
		Endemic Species	38%
	3. What are ways in which Hawaiian culture-based curriculum helps you to understand or learn?	Application	75%
		Relate It	50%
		Stories	50%
Curriculum integration	2. Are you able to understand or make connections to biology concepts easier (or harder) with Hawaiian cultural integration?	Project Based	50%
		Easier	70%
		Relevance	50%
		Good	40%
	Yes	30%	
4. Do you feel that biology is more relevant to you when Hawaiian cultural connections are made?	Yes	100%	
Future interest	5. Would you take more science courses in the future if you are able to make cultural connections?	Yes	100%
		Chemistry	29%
		New Learning	29%
		Relating	29%
	6. Is biology or science a field you would consider pursuing in the future?	Yes	50%
		Conservation	50%
		Ethnobotany	50%

TABLE A7 Focus group student quotation examples

Question	Quotations
1	<p>“The plants project that we did in the beginning, trying to find out if it was endemic, indigenous and what not, is Hawaiian related because we got to learn the uses of the plants and the medicinal properties and everything through our research...”</p> <p>“The ecology abstract because we had to choose a[n] ahupua’a that we had to do it on then...we had to research about the indigenous plants...”</p> <p>“...it just helps me learn about more different types of kalo and how to save the kalo and keep it going to future generations.”</p>
2	<p>“We’ve learned to take pride in what we do by incorporating our Hawaiian values and things that actually pertain to us and our homeland.”</p> <p>“I like to learn my Hawaiian culture and then at the same time learn biology...”</p> <p>“Through having more of a Hawaiian perspective of biology, I get to apply it more into real life kine situations ‘cause it’s a lot easier for me to remember.”</p> <p>“We already kind of understand a lot of things about our culture and so we could relate to a lot of the stuff that we were learning.”</p> <p>“We had a personal take on learning bio.”</p> <p><i>“Not really because I’m not really close to my Hawaiian side and, well it’s good that we are because I’m learning more on my Hawaiian culture side.”</i></p> <p><i>“I thought it was more difficult. I had to learn two things instead of one.”</i></p>
3	<p>“There’s many Hawaiian concepts that... allow us to relate to the topic at hand and it helps us to elaborate on each topic in a more defined, specific way.”</p> <p>“It gave us a more hands-on experience towards things”</p> <p>“The examples that were given for us to grasp the concept was easier [than the textbook].”</p> <p>“It opened more doors for us to do cool projects like the mo`oku`auhau and like Anuhea’s video...where we usually don’t learn a lot of stuff about ourselves.”</p>
4	<p>“...it’s a personal connection to our culture and therefore it’s our own take on it.”</p> <p>“It helped me because with the gene section and the dominant recessive alleles it helped me to learn more and understand.”</p>
5	<p>“I enjoy relating stuffs to my culture and it would be interesting to learn something new while learning about my culture at the same time.”</p> <p>“If Chemistry, I guess, was based on culture and used cultural examples it probably would be easier to learn.”</p>
6	<p>“You get to learn more about your culture and how to preserve natural resources and the environment so, it’s something I would like to pursue in the future.”</p>

TABLE A8 Student reflections—top themes

Coded Themes	Percentage of those who responded
Challenges or complications	56%
Proud of work or effort	50%
Learned a lot	44%
Understandability	33%
Enjoyed assignment	33%

Examples of Students’ Written Reflections

Proud of work/ Enjoyed assignment

- “I think that my presentation was the best project I have ever done.”“I really enjoyed doing this project because I found my family. This project was hard because I had to do a lot of research on my family, but it was worth it. I feel that I was really creative with my project. I came out of my comfort zone.”“Thank you Kumu for making this project. This helped me to get in touch with my family.”

Learned a lot

- “I learned not only about my family but about the importance of genetics and how I am who I am today. I could see the real physical understanding of why I look this way.”“...it was so worth the time. I learned a lot from doing this project, about my family and my history. I worked really hard on this project...”

Creative alternatives

- “I called my grams and papa and asked about the genealogy. I listened to their stories. I asked for help when needed. Instead of pictures I found out who my family was and found pictures in representation of them.”“For this project most of my information was already on Ancestry.com although due to the project I took the liberty of uploading photos and noting physical attributes and medical history for as many people as I could. Although I have all the requirements and more, other people probably had to work harder to find it. I traced 7 generations back to the early 1800’s (1814).”

Challenges or complications

- “This project helped me to learn more about my family that I didn’t know, such as where they came from. It was difficult trying to get all the pictures from both sides because my family does not get along that well. I have little communication with my father.”“On my father’s side, our genealogy is kept private. Anything that I wanted to share had to be cleared by the surviving family members and all of them said no.”“My dad didn’t know his great grandparents’ names and information. I couldn’t get pictures because I don’t know where I could find any.”“On my dad’s side, getting any kind of information was hard. I don’t have relations with my father and wanted to just leave him out of it. I couldn’t get any pictures or genetic info. For me, I’m proud of myself for even trying to get that information.”“I didn’t include all of the required information because I was told by my parents not to include for personal reasons. I did not include the pictures because we do not have possession of those pictures. For any other information that was not included on the board, I was told not to because my parents felt that nobody needed to see this information.”

APPENDIX B SURVEY INSTRUMENT

Hawaiian Biology Curriculum Questionnaire

Please answer the following questions honestly as there are no right or wrong answers. Take your time to answer questions thoroughly. The first seven questions ask for demographic information. **Circle one response for each item.**

	Male	Female
1. Gender	1	2

	Native Hawaiian	Non-Hawaiian
2. Ethnicity (optional)	1	2
3. What do you consider your primary ethnicity?		

	14	15	16	17
4. Age	1	2	3	4

	Never	Seldom	Sometimes	Always	Don't Know
5. My family and I practice Hawaiian values and culture.	1	2	3	4	9
6. My family speaks in the Hawaiian language.	1	2	3	4	9
7. I can communicate in the Hawaiian language.	1	2	3	4	9
8. I choose to do or practice Hawaiian activities when possible (i.e., play or listen to Hawaiian music, play Hawaiian sports, weave, hula, etc.)	1	2	3	4	9

The first seven questions refer to how you feel about your biology class. Please indicate your degree of agreement or disagreement with each item using the following scale: (1) strongly disagree, (2) disagree, (3) agree, or (4) strongly agree. Circle one response for each item.

	Strongly Disagree	Disagree	Agree	Strongly Agree	Don't Know
9. This biology class is different than other science classes I have taken in the past.	1	2	3	4	9
10. This class uses Hawaiian culture-based curriculum (Hawaiian language, values, stories, ways of knowing, etc.).	1	2	3	4	9
11. Hawaiian culture-based curriculum helps me to learn better.	1	2	3	4	9
12. Compared to other classes, I learn better in this class than in others because of the culture-based way that it is taught.	1	2	3	4	9
13. I can understand biology concepts more easily than with other teaching methods.	1	2	3	4	9
14. I can make connections between the biology material and my life more easily with culture-based learning.	1	2	3	4	9
15. Biology is more relevant to me when I can see Hawaiian cultural connections.	1	2	3	4	9

The next three questions ask you to provide specific examples for your answers given above. Write “do not know” if you cannot think of any examples.

16. What are examples of activities or assignments in biology that you consider to be Hawaiian culture-based?
17. What examples (if any) do you see in this biology class?
18. What are ways that Hawaiian culture-based curricula help to support your learning?

The next two questions ask you to provide specific examples for your answers given above. Write “do not know” if you cannot think of any examples.

	Yes	No	Don't Know
19. I plan to take more science courses next year (i.e., astronomy, ethnobotany, etc.)	1	2	9
20. I plan to pursue biology or science more in the future (i.e., in college, career, etc.)	1	2	9

APPENDIX C BSCS BIOLOGY GENETICS PROJECT

Pāhana: Ko‘u ‘Ohana

Mo‘okū‘auhau Project Requirements

The pāhana for unit 6 is the Mo‘okū‘auhau Project, which is comprised of two parts: a Family Tree and Presentation (mele, oli, or mo‘olelo). The following are the specific requirements for both parts. You may earn up to a 100 points total.



Part 1

‘OHANA CHART: FAMILY TREE

60 points possible

The following *must* be included in your family tree:

- Photos of 4 generations: yourself, parents, grandparents, and great-grandparents. You may choose to include a fifth generation (great-great grandparents) and/or siblings for extra credit.
- Full name, including first, middle, and last name. Use the maiden names of women.

- Any relevant dates: birth date, death date, marriage date, etc.
- Percentage of Hawaiian blood for each person
- Height, eye color, hair texture and hair color for each person

Be creative! You can do a traditional poster chart, a PowerPoint presentation, a mobile, or anything else you can think of to represent your family well. You have the flexibility to use whatever format you want, but you must have all of the required elements listed above. As Hawaiians, we honor the diversity of our families and recognize the social and cultural importance of hānai, adoption, and step parents, but because this is a study of genetics and inherited traits, the biological family needs to be the focus of this assignment. So don't forget, everyone represented on the chart must be a BLOOD RELATIVE! If this is not possible for you, or you have questions or limited information available, please speak to me and we will figure out an alternative assignment together.

To the extent with which you and your family are comfortable, you may want to include some of the following genetic traits, diseases, or abnormalities

• Twining or multiple births	• Colorblindness
• Albinism	• Dwarfism
• Sickle-cell anemia	• Cystic fibrosis
• Down syndrome	• Klinefelter's syndrome
• Turner's syndrome	• Mental illness (i.e. Alzheimer's, dementia, bipolar, etc.)
• Cancers	• Heart issues

Part 2

MO‘OKU‘AUHAU: GENEALOGY PRESENTATION

40 points possible

As Native Hawaiians, knowing who we are and where we come from is essential, thus, genealogy is a very important component of the culture. You have several options for part 2 of this project. Choose **one** that you are comfortable with presenting to the class.

1. **Create** your own option. If you can think of a relevant presentation, come discuss with me so we can figure out a viable option together. I am open to your presentation ideas.
2. **Mele:** Present a song about your family. You may choose to compose a song yourself, play a pre-recorded song with a specific story relating to your family and explain the words, or play an instrument if relevant to your family and explain.
3. **Mo‘olelo:** Share a story about your family that represents the importance of inheritance between generations. You may choose to tell a relevant story and explain how it relates, present hula related to your family, or share an article or book about your family.
4. **Oli:** Chant your genealogy. See the detail below.

You must memorize four generations of **one side** of your family’s genealogy: great-grandparents, grandparents, parents, and yourself. You are welcome to oli whatever you have been taught or in whatever style you choose. If you are not familiar with an oli mo‘okū‘auhau, you may use the following format. You are required to select **one** ancestral line (maternal or paternal) and trace it down from your great-grandparents to yourself. You can earn extra credit points by including any additional generations above that. For each person, you should include *full names* and where they are/ were from. Make sure to use only maiden names for wahine.

‘O _____ ke kane. No _____ mai ‘o ia. ‘O _____ ka wahine. No _____ mai ‘o ia.
 (FATHER) (PLACE) (MOTHER) (PLACE)

Noho pū lāua a hānau ‘ia ‘o _____.
 (NAME OF OFFSPRING)

Repeat for successive generations, ending with yourself. Don’t forget to start with the oldest generation and end with the youngest (yourself).



*** Be **prepared** to present both parts to the class on your due date: an oral presentation and a visual family tree presentation.

Hana Nui Deadline:

For Odd periods, Due _____

For Even periods, Due _____

**APPENDIX D
 GENETICS GRADING RUBRIC**

MO‘OKU‘AUHAU

Inoa _____ **Lā** _____ **Period** _____

PEER GRADE

Visual Presentation (60 pts.)

- Rubric was followed. Appropriate generations, names, dates, specific traits, and genetic anomalies were included. Visual was well displayed.

Oral Presentation (40 pts.)

Presenter chose an appropriate format: Mele, Mo'olelo, or Oli.

Mele

Composed a song, presented pre-recorded song with an explanation, or instrumental composition. Words and explanations were clearly related to family.

Mo'olelo

Shared relevant family story, article, or hula and explained connection.

Oli

Presented in a kepa style with good form, chose a specific inheritance line and shared a minimum of four generations.

Total: (100 points possible)

_____ points

Extra Credit (max 10 pts.)

Beyond requirement: expanded to older generations/ siblings.

_____ points

SELF GRADE

Visual Presentation (60 pts.)

- Rubric was followed. Appropriate generations, names, dates, specific traits, and genetic anomalies were included. Visual was well displayed.

Oral Presentation (40 pts.)

Presenter chose an appropriate format: Mele, Mo'olelo, or Oli.

Mele

Composed a song, presented pre-recorded song with an explanation, or instrumental composition. Words and explanations were clearly related to family.

Mo'olelo

Shared relevant family story, article, or hula and explained connection.

Oli

Presented in a kepakepa style with good form, chose a specific inheritance line and shared a minimum of four generations.

Total: (100 points possible)

_____ points

Extra Credit (max 10 pts.)

Beyond requirement: expanded to older generations/ siblings

_____ points

APPENDIX E ECOLOGY PROJECT

ECOLOGICAL STUDY OF PLACE

BSCS Biology Pāhana

Mokupuni, Moku, Ahupua‘a, ‘Ili, Lele, ‘Apana



Project Requirements

Your major project for our last unit will be a comprehensive study of “place” and the relevant ecological factors and relationships that affect this environment. This will be a quick and intensive research project on the place you call home. Your final project must contain both the abstract and very brief oral presentation as outlined below for full credit.

SCIENTIFIC ABSTRACT

60 points possible

In lieu of a scientific research paper, I am requiring that you conduct research about a place of significance in order to write a well constructed, well edited scientific **abstract**. An abstract is an abbreviated version of a final scientific report which usually appears at the beginning of the final report as well as on a display board for science fair. An abstract is a quick snapshot and allows people to determine if they want to read the entire report. Consequently, at least ten times as many people will read your abstract as any other part of your work. It's like an advertisement that encourages others to be excited about your research.

Since an abstract is so short, each section is usually only one or two sentences long. Consequently, every word is important to conveying your message. If a word is boring or vague, refer to a thesaurus and find a better one! If a word is not adding something important, cut it! But, even with the abstract's brief length, don't be afraid to reinforce a key point by stating it in more than one way or referring to it in more than one section.

Most authors agree that it is harder to write a short description of something than a long one. For a first draft, don't be overly concerned about the length. Just make sure you include all the key information. Then take your draft and start crossing out words, phrases, and sentences that are less important than others. Look for places where you can combine sentences in ways that shorten the total length. Put it aside for a while, then come back and re-read your draft. With a fresh eye, you'll probably find new places to cut. The result will be a tightly written abstract.

The abstract must be typed and no more than one page in length. It must be a very concise summary of a scientific paper which is double checked for spelling and grammar. The paper may not exceed a word count of 250 words total and must cover all of the major points outlined in the full research paper below as if the paper had actually been written. A sample abstract is provided below.

- Avoid jargon or any technical terms that most readers won't understand.
- Avoid abbreviations or acronyms that are not commonly understood unless you describe what they mean.

- Abstracts do not have a bibliography or citations.
- Abstracts do not contain tables or graphs.

SAMPLE ABSTRACT

As the size and complexity of today's most modern computer chips increase, new techniques must be developed to effectively design and create Very Large Scale Integration chips quickly. For this project, a new type of hardware compiler is created. This hardware compiler will read a C++ program, and physically design a suitable microprocessor intended for running that specific program. With this new and powerful compiler, it is possible to design anything from a small adder, to a microprocessor with millions of transistors. Designing new computer chips, such as the Pentium 4, can require dozens of engineers and months of time. With the help of this compiler, a single person could design such a large-scale microprocessor in just weeks.

SCIENTIFIC RESEARCH PAPER OUTLINE—Original Criteria

You are **NOT** writing an actual research paper. Below are the required criteria, if you were to write the full research paper. The research paper would include specific details, quotes and appropriate references.

Parenthetical references are recommended, but endnotes or footnotes are also acceptable. The paper is to be written in formal MLA style and double checked for spelling and grammar before drafts are handed in. A complete list of references should be given, to include the required sources. The paper should have a cover page and appropriate subheadings. The length shall be a minimum of 10 pages, with double the expectation for group projects. The cover page, attachments, and reference list will not count as a part of the 4 page minimum.

Introduction

2 pages

- Reason for selection of wahi (place)
 - What is personal relevance to you and your 'ohana?
- Inoa and mana'o of mukupuni, moku, ahupua'a ('ili, lele, 'apana, etc. if you know)

- Descriptions of the area
 - Labeled map of the area
 - Natural features (i.e., mauna, punawai, luapele, makani)
 - Man-made features (i.e., cultural sites, heiau, hula pā, school, gym, etc.)

Cultural Background

2 pages

- History and description of the place back to pre-contact
 - Include historical timeline or dates when possible
- Inoa and explanation of features: ua, makani, mauna, kahawai, waialele
- ‘Ōlelo no‘eau associated with the area (at least one)
- Oli, mele, and mo‘olelo associated with the area
 - Only explanations, references, or quotes of these items should be included in the paper, the actual documents should be considered attachments.

Ecological Study

2 pages

- Construct a local food web for your place
 - Write up outlining the relationships between flora and fauna in the area (3-2)
 - Include specific examples of producers, consumers, feeding relationships, competition, predation, and symbiosis.
- Describe the climate(s) in the area (4-1)
- Describe relevant biomes and explanation (4-3, 4-4)

Impacts on the 'Āina

2 pages

- Historical ecological succession of the land write up (4-2)
 - Photographs and descriptions of past and present
 - Use only a few important photos to highlight explanations
- Human impact (6-1)
 - Population and Human development and expansion

Discussion & Conclusions

2 pages

- My Kuleana: Service Learning Component
 - A short description of your active participation in a service learning project
- Reflection on project
 - What was something new that you learned about your place?
 - What is the possible future of your place considering all impacts?
 - How are you and your `ohana a part of the ecology of this place?
 - Identify specific relationships that occur in this place.

References & Attachments

- Oli, Mele, Mo'olelo, etc.
- Completed & signed Service Learning form
- Use proper MLA format
- You need to use at least 2 books, 1 website, and an additional source (video, cassette tape, periodical, etc.).

HŌ‘IKE: ORAL PRESENTATION

10 points possible

- Give place name and significance
- Something new you learned about your wahi

Abstract information modified from

http://www.sciencebuddies.org/science-fair-projects/project_abstract.shtml

APPENDIX F ECOLOGY ABSTRACT RUBRIC

“Well Grounded”: Criteria of Excellence(10 points)

		Scoring
Content	<ul style="list-style-type: none"> • Research is relevant to the assigned topic • Demonstrates knowledge of all key points of the paper: Introduction, cultural background, ecological study, impacts on the ‘āina, discussion and conclusions. • Ideas are well organized and concise • Information is compiled in a scientific manner through precise choice of words • Writing is complete and thorough • A variety of sources are used 	3 X __ Pts.
Formatting	<ul style="list-style-type: none"> • Total word count does not exceed 250 words • Single spaced • Typed 	2 X __ Pts.
Mechanics	<ul style="list-style-type: none"> • Grammatically correct • Spelling correct 	1 X __ Pts.
Presentation	<ul style="list-style-type: none"> • Shared place name and significance • Shared something new learned about wahi 	1 X __ Pts.

Possible points: 70 pts. Points earned:_____

*** Note: Bullets circled above indicate areas needing improvement.

Comments:

APPENDIX G STUDENT QUOTATIONS—QUALITATIVE RESPONSES

Qualitative Data from Survey Questions 16–18

Additional Student Response Examples

Question 16 and 17 Examples

- “I feel that Kumu always tries to tie in ‘Hawaiian’ into everything we do because he always tries to relate what we are doing to something cultural. I believe the hana nui that we do are the most culturally based.”
- “...the assignments we do, we have to connect it somehow with the Hawaiian values and ‘olelo no‘eau we learned...”
- “We learn about Hawaiian plants and animals. Also, Kumu gives us different ‘olelo no‘eau(s) that we apply to the experiments & lessons we do.”
- “We compare or look at ‘olelo no‘eau on write ups we relate to ourselves, community and Hawaiian people; look at the way we look or do things as Hawaiians or in Hawai‘i as”
- “Everything we do is based on Hawaiian culture in this class”
- “When we try to relate Hawaiian values like makawalu to our lives and try and see different points of view. We also try to see how biology and the Hawaiian environment is affecting the Hawaiian culture.”

- “Kumu uses Hawaiian words and relates culture often in lessons.”
- “The coqui frog activity was culturally based I thought, because we had to figure out a way to get rid of coqui frogs but try to preserve as much resources as possible and preservation and sustainability is a big Hawaiian idea.”
- “When we did our labs, it was always cooperative and Hawaiian-like. A sense of ‘ohana and ho‘ike.”
- “Everything, Hawaiians were the best ‘biologists’ in their time.”
- “An example of an assignment that involves Hawaiian culture is the [Ecology] Abstract. Learning about all living things and their connection to one another and the land.”
- “When we need to think of ways science can relate to our lives and our family/community/makawalu”
- “Family genealogy, helped trace genes and genetics from past to present.”
- “Having a Kumulipo group during our [Evolution] trial which helps us to see how our Hawaiian ancestors pictured/depicted the creation of the earth (universe)”
- “I believe that the genealogy, the family genetics unit project was biology and culture based because it is recognizing our ancestors and tracing back our Hawaiian.”
- “The use of Hawaiian language.”
- “Everything from the way it’s taught to the way we attack the problems.”
- “We relate to ourselves, community and Hawaiian people; look at the way we look or do things as Hawaiians or in Hawai‘i as to western ways.”
- “We used makawalu a lot which means having many different perspectives on things and how to question everything and dig deep to find answers.”

Question 18 Examples

- “Hawaiian culture based curricula helps me relate to things I already know in the Hawaiian culture.”
- “It helps to make a connection...”
- “It’s something that I can personally relate to.”
- “I can relate to them more easily by connecting with things I do regularly.”
- “I can relate it to my family.”
- “Hawaiian culture based curriculum help to support my learning because it gives me something ‘real’ to be able to relate it to.”
- “I can connect to things easier when you use real life examples.”
- “Makes me think from a different perspective.”
- “It helps me relate to the teaching more.”
- “I have a way to connect to my life, and how it benefits me.”
- “It helps me connect what I’m familiar with to something I don’t understand.”
- “It helps me to understand things more easily and feel more comfortable.”
- “It helps me connect biology with my own life, and the things that happen around me.”
- “It helps relate what I have learned to the world.”
- “It helps me to connect with my culture and have a better understanding of what I’m learning because of that connection.”
- “It helps me to feel connected to my culture. We see our Hawaiian culture all the time so I can relate to it.”
- “It makes it easier to understand because I can connect to the examples and lessons that are taught to me.”

- “Hawaiian culture based learning helps Hawaiian students to connect what they learn to everyday life, because of the diverse environment they live in.”
- “More relevant to me & therefore teach me more . . .”
- “It helps me relate things to my culture/ background. It helps me remember things easier because I can actually relate to it.”
- “They help me to connect science to something. I can relate too instead of it being just a bunch of stuff that I don’t understand.”
- “It’s easier to learn when the curriculum relates to our culture because we are more interested in it and can relate to it more than just learning the basic American standard curriculum.”
- “It gets me connected with my culture and makes me want to learn”
- “It keeps me interested in the subject and makes biology fun.”
- “Saw different ways of looking at things. Which reinforced everything that I learned like it helped me memorize or learn a lot better because there was more to know.”
- “It allows us to connect on a cultural base, which makes it a lot more interesting for a lot of students. Especially because most teachers don’t incorporate culture in lessons, so it’s not as easy to connect.”
- “HCBC helps me in the sense that I can relate to what I am learning and I have more interest in what I am learning because of the culture connection.”
- “Kumu teaches us about what our kupuna used to do in their time and connects it to modern day biology.”
- “It helps to make connections between science and Hawai‘i. Plus it gets me aware of environmental problems in Hawai‘i and that makes me want to learn about them so I can help to stop them.”
- “It makes the material more relevant to us because it’s something that we can personally connect to.”

- “It helps support my learning because I can use example in the Hawaiian community to better understand.”
- “It helps me to learn new things about my culture and apply in this modern world while still understanding ‘western’ concepts which is vital since the world today is based on ‘western’ concepts.”
- “It helps me to understand more because I may know an animal by a Hawaiian name than by its scientific name.”
- “Makes it more interesting and applicable to us. We remember it easier when it deals with Hawai‘i.”
- “Hawaiian culture based curricula helps to support my learning because it gives me the opportunity to find connections and use them in my learning process.”
- “learned about things that I wouldn’t have learned in a textbook”
- “Relatable and easier to understand”
- “Makes you feel more connected to your family and your culture which makes it easier to learn new topics that may be hard to learn otherwise.”
- “It helps me to be able to see a relationship.”
- “I can relate biology to my life which helps me learn and understand science better.”
- “Teaches me things that go on where I live and how my ancestors use to live.”
- “I can have a personal connection and reason as to why I’m learning what I’m learning.”
- “I can connect and understand the information more because I already know about some of the stuff we learn.”
- “People need to know where they come from and who they are so that they can make connections between their culture and what they learn.”

- “It helps me to connect science to real world experiences and situations.”
- “It helps me to understand and put together the pieces of what I learned.”
- “Respecting everything”
- “It gave me a reason to pay attention and created a fun learning environment.”
- “It helps me understand concepts because I am able to relate it to cultural things that I am familiar with.”
- “They help me to make a connection between something I don't really understand and something I am familiar with.”
- “Makes me motivated more to learn.”
- “I think in Hawaiian. I understand better.”
- “Because it makes me question why is something true.”
- “I am able to gain what I need while learning in a fun new way.”
- “Do things with quality not quantity.”
- “I feel that since it is a Hawaiian culture-based-curriculum that it is more relevant to myself and it helps me to connect better w/biology concepts.”
- “It makes it more down to earth.”
- “It is how I learned everything I learned this year.”
- “It gives me a connection that helps me understand.”
- “I knew some Hawaiian history and coming into this class trying something new with something I already knew make it a lot easier to understand.”
- “He would make connections with animals that I know live here. And I would know what the animals are like and understand what he's talking about.”

- “By involving Hawaiian curricula I learned from seeing it happen here.”
- “It is sometimes relevant to me when we talk about Hawaiian culture.”
- “It’s important to tie in our Hawaiian culture, it doesn't make it easier to learn, it’s just good to know.”
- “I’m used to Hawaiian aspects in learning, since I’ve been here since elementary.”
- “It helps relate it to my life because I am Hawaiian and I'm in a Hawaiian School that does many things that are Hawaiian.”
- “Can connect and understand my culture better knowing the information.”
- “Helps me embrace my culture.”
- “It helps me learn more about my culture and why things happened.”

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