Kaulele Hawaiian Indigenous Pop-Up Science Center:
Kapa Exhibit Evaluation

INPEACE Evaluation
Supported by Kamehameha Schools

September 2022

For more information please contact:
Ciera Pagud, cipagud@ksbe.edu
Rashelle Chauhan, rslee@ksbe.edu

Award #2002729

Table of Contents

1. Executive Summary 3
2. Section 1: Key Findings 4
    1) Understanding of and interest in STEM 5
    2) Knowledge of and interest in Hawaiian culture 7
    3) Intersection between culture and STEM 9
    4) Application of Knowledge 11
    5) Exhibit Relevance 12
    6) Exhibit Feedback 13
3. Section 2: 18
    1) Background & Methods 19
4. Appendix 24
    1) Coding Matrix 25

Executive Summary

Historically, Native Hawaiian and Pacific Islander (NHPI) communities have applied systemic observations and scientific principles in their daily lives allowing them to thrive in their island environments. And yet, these populations remain underrepresented in STEM fields. The Kaulele Kapa Exhibit was developed to explore the effectiveness of a Hawaiian culture-based framework and approach in increasing learner engagement and depth of knowledge in STEM among NHPI learners. The exhibit utilized hands-on and interactive activities, coupled with scientific and cultural information, to create relevant learning experiences for these communities.

To determine the effectiveness, exhibit attendees were invited to complete a survey that asked about how the exhibit influenced their interest and understanding of STEM and Hawaiian culture, as well as collected feedback to inform the iterative process of refining the exhibit. A total of 378 individuals participated across the various exhibit sites – 134 students, 36 community youth, and 208 community adults.

Overall, outcomes and feedback from participants were overwhelming positive across all demographic groups (ethnicity, age, and site visited). **Majority of participants enjoyed their experience at the exhibit and felt it was very informative and easy to understand.**

Interestingly, when exploring differences in responses among youth who visited the exhibit with their ‘ohana compared to youth who attended while in school, it was common that **youth with their ‘ohana were more likely to strongly agree across all analyzed survey questions**. This could be due to differences in experiences while at the exhibit based on who they attended with, though it’s hard to say without qualitative data that explores that more.

Findings from the survey also show that **Native Hawaiians were more likely to strongly agree that the exhibit increased their interest in STEM and Hawaiian culture, knowledge of Hawaiian culture, and understanding of the intersection of culture and STEM** compared to non-Hawaiian participants. Data also showed that **Native Hawaiians felt the exhibit was more relevant to their lives** than their non-Hawaiian counterparts, potentially demonstrating a seamless integration of cultural perspectives in the exhibit.

SECTION 1

Key Findings

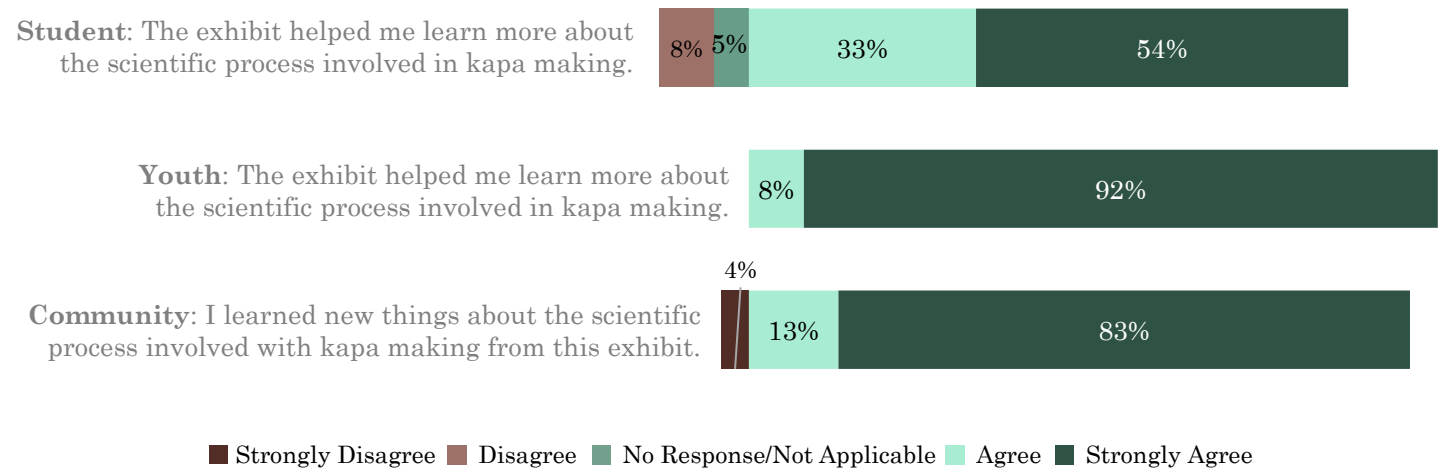
1: Participants increased their understanding of and interest in STEM

Most respondents (94%), felt that the exhibit helped them learn about the scientific process involved in kapa making.

Understanding of the scientific process involved in kapa making varied slightly across participant groups.

A higher percentage of youth that came to the exhibit with their ‘ohana *strongly agreed* that they learned more about the scientific process involved in kapa making compared to youth that saw the exhibit with their school (92% vs. 54%). All youth respondents that came with their ‘ohana strongly agreed or agreed.

Fig. 1 Increased Understanding of the Scientific Process – All Participants



1: Participants increased their understanding of and interest in STEM

Most youth (82%) indicated that the exhibit increased their interest in science.

The exhibit had varying degrees of influence in increasing interest in science across the youth participant groups.

A higher percentage of youth that came to the exhibit with their ‘ohana *strongly agreed* that their interest in science increased as a result of this exhibit compared to youth that saw the exhibit with their school (83% vs. 39%).

A larger proportion of Native Hawaiian youth indicated their increased interest in science as a result of the exhibit compared to non-Native Hawaiian youth (85% vs. 75%).

Fig. 2 Increased Interest in Science – Youth Participants

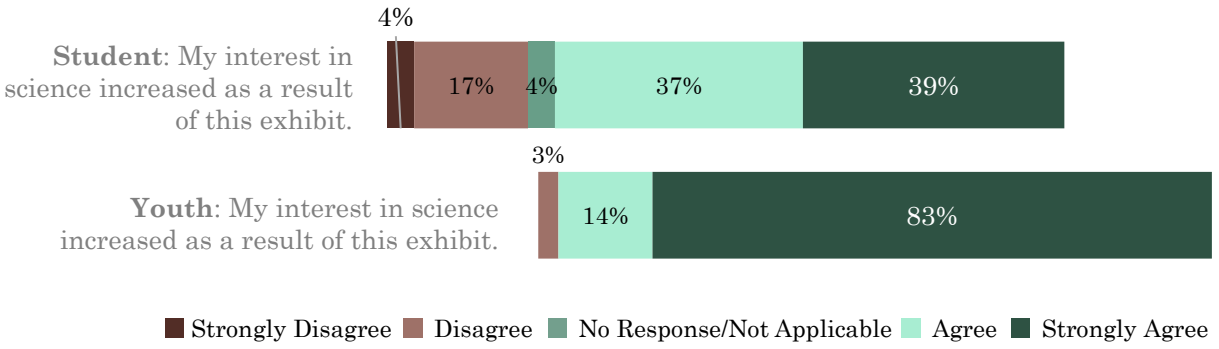


Fig. 3 Increased Interest in Science – Native Hawaiian Youth v Non-Hawaiian Youth

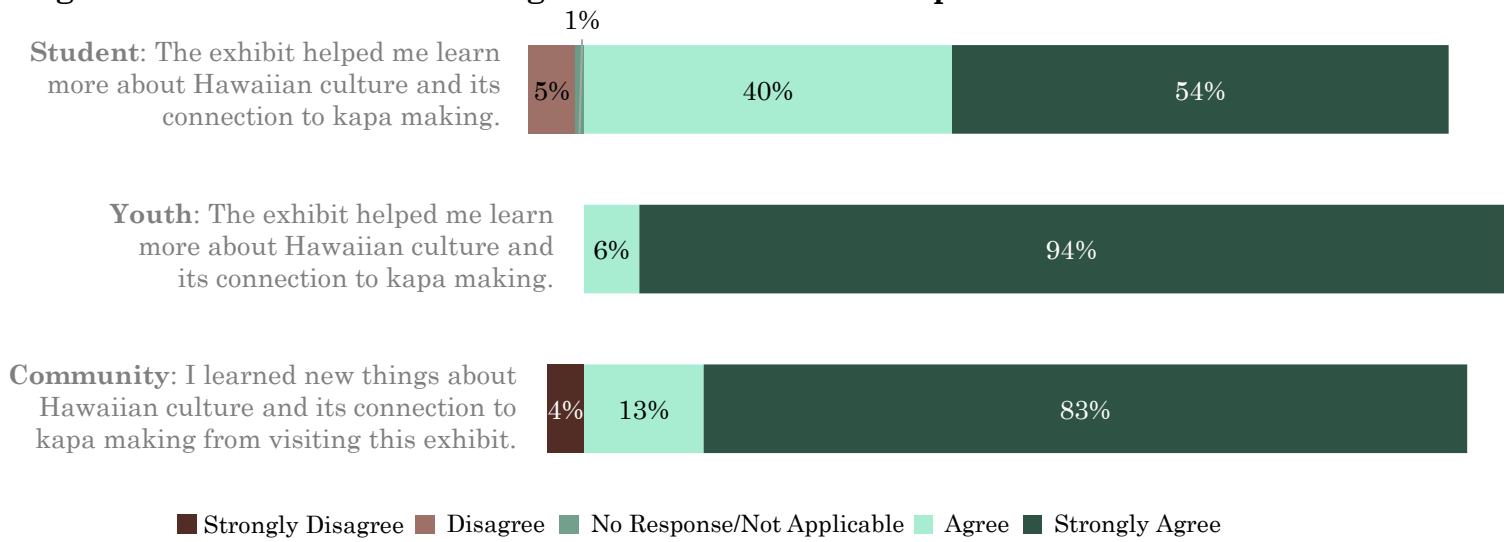
2: Participants increased their knowledge of and interest in Hawaiian culture

Almost all participants (96%) indicated that the exhibit helped them learn more about Hawaiian culture.

Like previous findings, results on increased knowledge of Hawaiian culture varied slightly across participant groups.

Particularly, a higher percentage of youth that came to the exhibit with their ‘ohana *strongly agreed* that they learned more about Hawaiian culture compared to youth that saw the exhibit with their school (92% vs. 54%). All youth respondents that came with their ‘ohana strongly agreed or agreed.

Fig. 4 Increased Understanding of Culture – All Participants



Comments from youth participants also provide evidence of increased knowledge of Hawaiian culture. When asked what they enjoyed most about the exhibit, youth respondents reported learning more about Hawaiian culture.

“How we got to know more about Hawaiians culture and how it was done back in the days”

“Learning something about my culture that I didn’t already know.”

2: Participants increased their knowledge of and interest in Hawaiian culture

Most participants (91%) indicated that the exhibit increased their interest in Hawaiian culture.

Like the results around the increase interest in science, the exhibit had varying degrees of influence in increasing interest in Hawaiian culture across youth participant groups.

A higher percentage of youth that came to the exhibit with their ‘ohana *strongly agreed* that their interest in Hawaiian culture increased as a result of this exhibit compared to youth that saw the exhibit with their school (92% vs. 45%).

A larger proportion of Native Hawaiian youth indicated their increased interest in Hawaiian culture as a result of the exhibit compared to non-Native Hawaiian youth (93% vs. 80%).

Comments from participants also provide evidence of increased interest in Hawaiian culture. When asked what they would do with what they learned, respondents reported wanting to learn more about Hawaiian culture.

“Learn more in depth about our Hawaiian culture”

“More research into native Hawaiian plants & how the Hawaiians used it.”

Fig. 5 Increased Interest in Culture – All Participants

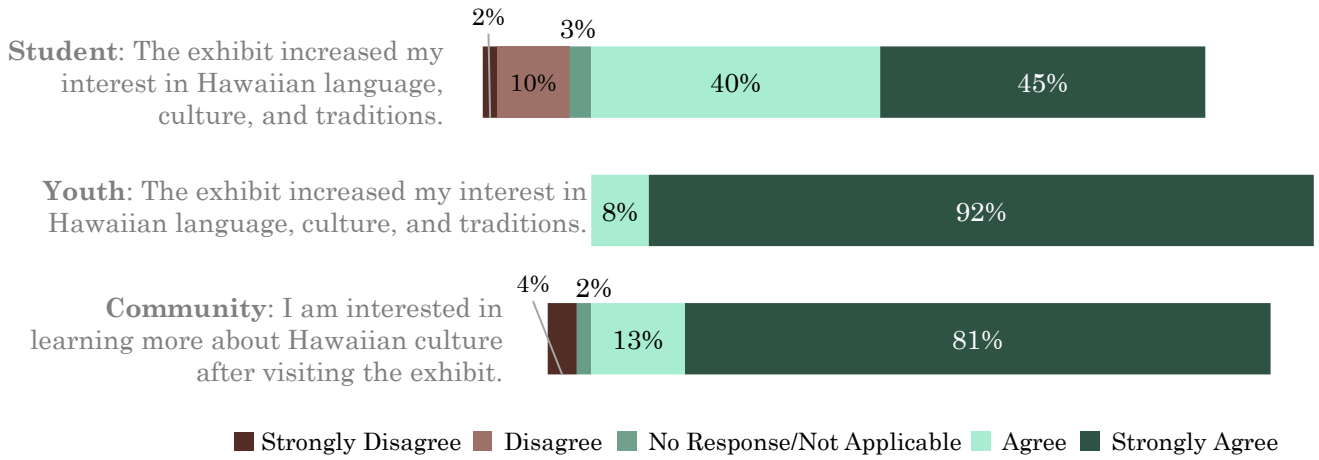


Fig. 6 Increased Interest in Culture – Native Hawaiian Youth vs Non-Hawaiian Youth

3: Participants increased their understanding of how cultural practices and science intersect

Most participants (91%) indicated that the exhibit increased their understanding of the intersection between science and Hawaiian culture.

Similar to previous findings, the exhibit had varying degrees of influence in increasing understanding of the intersection between science and Hawaiian culture.

A higher percentage of youth that came to the exhibit with their ʻohana *strongly agreed* that the exhibit increased their understanding of science in Hawaiian culture practices compared to youth that saw the exhibit with their school (83% vs. 48%).

A larger proportion of Native Hawaiian youth indicated their increased understanding in Hawaiian culture as a result of the exhibit compared to non-Native Hawaiian youth (92% vs. 80%).

Fig. 7 Increased Understanding of the Intersection of Culture and STEM – All Participants

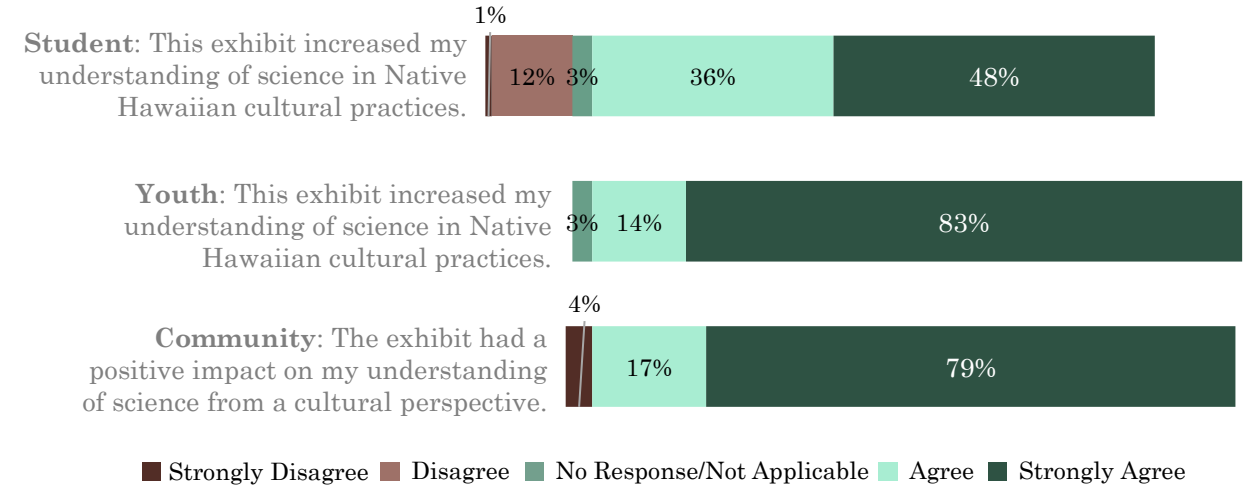


Fig. 8 Increased Understanding of the Intersection of Culture and STEM – Native Hawaiian Youth vs Non-Hawaiian Youth

3: Participants increased their understanding of how cultural practices and science intersect

According to comments by many participants, the exhibit helped them understand how cultural practices, like kapa making, and science intersect. When asked what they liked about the exhibit, many shared how the exhibit had a positive impact on their understanding of the science from a cultural perspective and talked about how they understood how the two processes, that of making kapa and the scientific process work together.

"I love the connection to Native Hawaiian scientists and what it means and how by engaging in the process of observation and exploration we are scientists too. That is such powerful statement and it came across really clear."

"Hawaiian culture is important to learn and share with everyone. We want to have our culture alive through science."

"The science component of our culture and how much we were innovative with the resources around us"

"The science component of our culture and how much we were innovative with the resources around us"

"Hawaiian Culture is important to learn and share with everyone we want to have our CULTURE ALIVE through science."

"The beautiful blend of cultural info and stories, with technical info about process of kapa making"

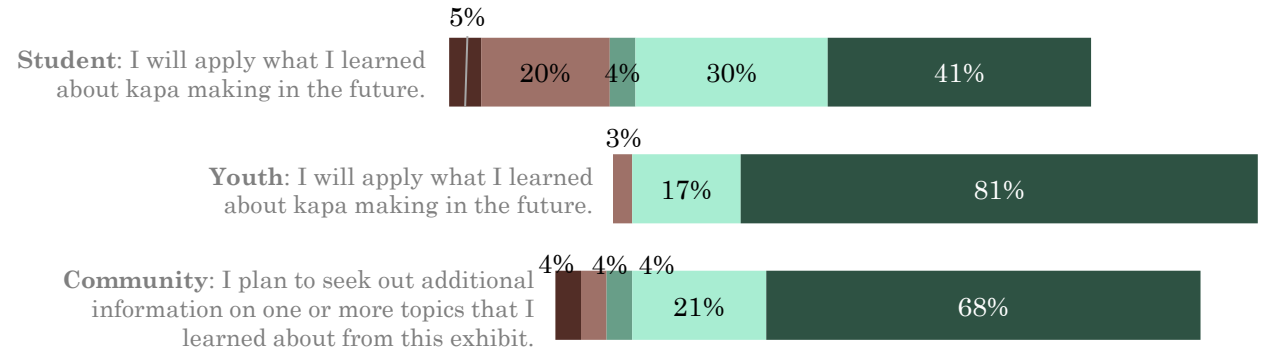
4: Participants intend to use what they learned about kapa in the future and seek out additional knowledge.

Nearly all participants (96%) responded that they will either apply what they learned about kapa in the future or continue to seek out new knowledge.

Like previous findings, more youth who attended the exhibit with their families *strongly agreed* that they would apply what they learned about kapa making in the future compared to those who visited during school (81% vs 41%).

Just over two thirds, 68 percent, of community members indicated that they plan to seek out additional information on one or more areas they learned about from the exhibit, further demonstrating their interest in the content of the exhibit.

Fig. 9 Application of Learning – All Participants



When asked what they would do with the knowledge they gained from the exhibit, community members discussed their desire to share, learn more, and apply what they learned in the real world.

"Try my best to share this with fellow colleagues and implement this into my own STEM classroom"

"I can be on the lookout for the plants used in this exhibit to make my own kapa to perpetuate Hawaiian culture."

"I will do more research into the Hawaiian history of making kapa because I found it very interesting.

5: Participants agree that the exhibit was relevant to their lives.

Just over three quarter of participants (78%) felt the exhibit and the information shared were relevant to their lives.

Feelings of relevance varied significantly among the three participants groups. Adults were more likely to *strongly agree* that the exhibit was relevant to their lives and their ‘ohana, compared to overall youth, student and community (79%).

Youth who attended with their families were also more likely to *strongly agree* that the exhibit was relevant compared to youth who attended in a school setting (56% vs 22%).

When looking at both students and community youth collectively, a larger proportion of Native Hawaiian youth felt the exhibit was relevant to their lives compared to their non-Hawaiian peers (79% vs 54%).

Only student and youth participants commented on the relevance of the exhibit in their open-ended responses when asked what they liked most about the exhibit.

“We get to see what was back in the day to now.”

“To learn new things that relate to my ethnicity.”

Fig. 10 The Exhibit and Information was Relevant – All Participants

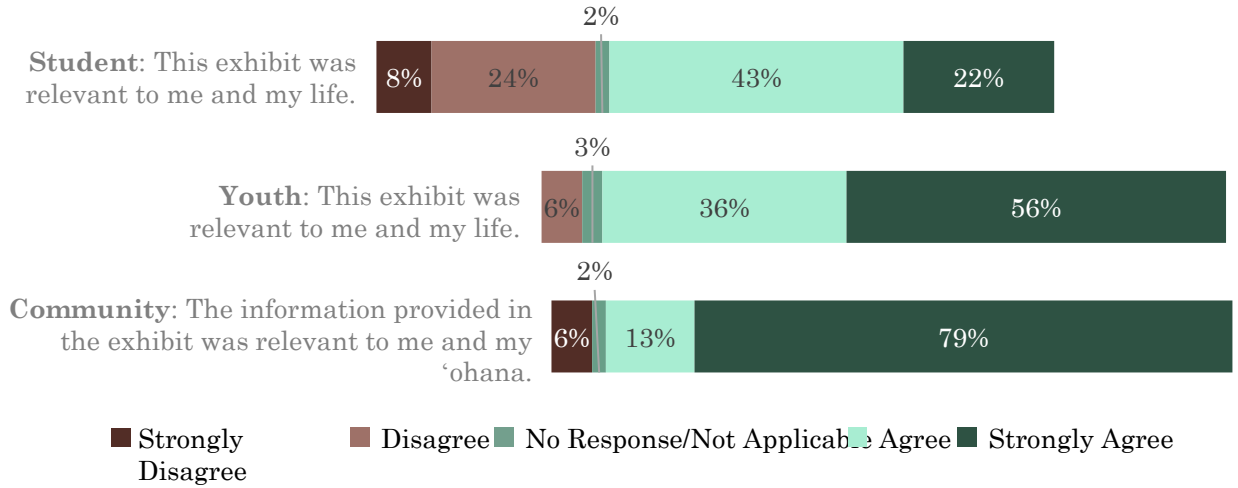


Fig. 11 The Exhibit and Information was Relevant – Native Hawaiian Youth vs Non-Hawaiian Youth

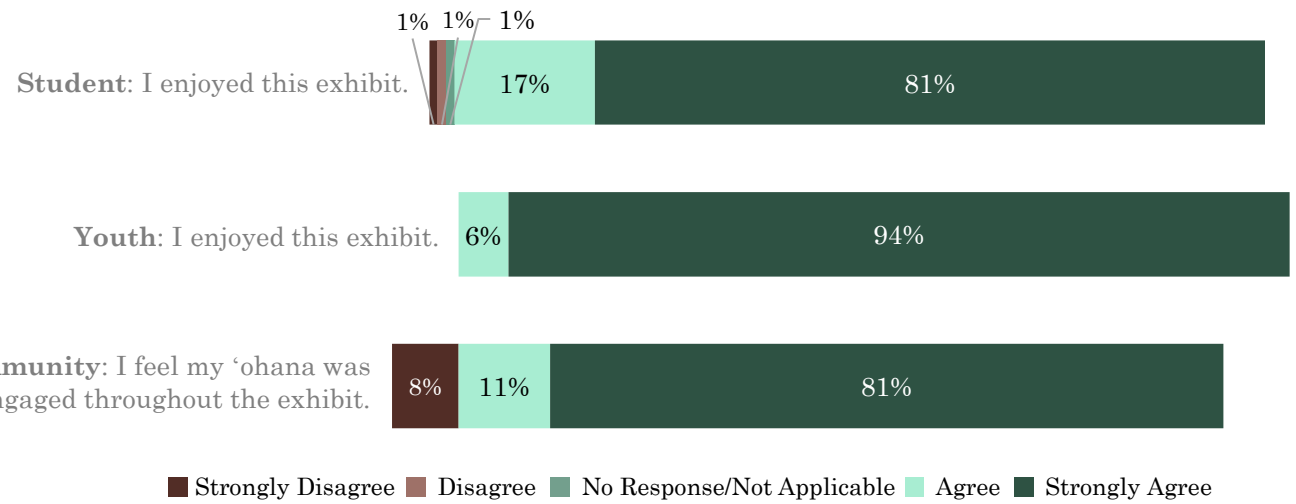
6: Exhibit Feedback – Participants enjoyed the exhibit.

Most participants (97%) enjoyed the exhibit and felt engaged throughout their experience.

As with the other findings, there were slight variations in engagement across the participant groups. More youth who attended the exhibit with their families *strongly agreed* that they enjoyed the exhibit than their school peers and adults in the community (91% vs 81% and 81%, respectively).

There were no notable differences in responses between Native Hawaiian and non-Hawaiian respondents, which suggests that the materials, information, and activities were well received by most of the attendees.

Fig. 12 The exhibit was engaging and enjoyable – All Participants



When participants were asked what they liked most about the exhibit or what they felt was most beneficial about the exhibit they discussed feeling involved and engaged with the different activities.

“The integration of science and culture really invites curiosity and engages.”

“The way they made learning fun!”

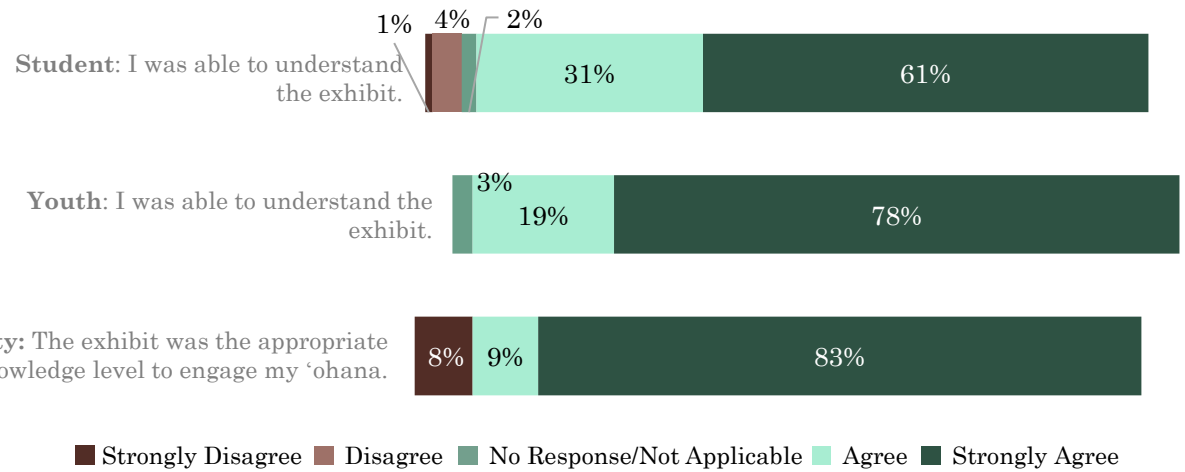
6: Exhibit Feedback – The exhibit information was easy to understand.

Almost all participants (95%) agreed that the information provided in the exhibit was easy to understand.

As with the other findings, there were variations in engagement across the participant groups. More youth who attended the exhibit with their families *strongly agreed* that they enjoyed the exhibit than their school peers and adults in the community (91% vs 81% and 81%, respectively).

There were no notable differences in responses between Native Hawaiian and non-Hawaiian respondents, which suggests that the materials, information, and activities were well received by most of the attendees.

Fig. 13 The information was easy to understand – All Participants



When asked to choose what was the most benefit to their visit a few participants discussed how the information shared was easy to understand across all age groups.

“Seeing how such a complicated topic could be made accessible, understandable, and interesting to all ages and abilities.”

“The activities were great, and the boards were easy to understand and follow.”

6: Exhibit Feedback – Participants appreciated the thoughtful design of the exhibit and its activities.

Participants across all exhibit sites and age groups appreciated the design and functionality of the kapa exhibit. When asked what they liked most about the exhibit, many discussed how the interactive and hands-on activities created an engaging and enjoyable experience for all regardless of age and ethnicity.

Fig. 14 Participants who provided positive feedback on the design of the exhibit

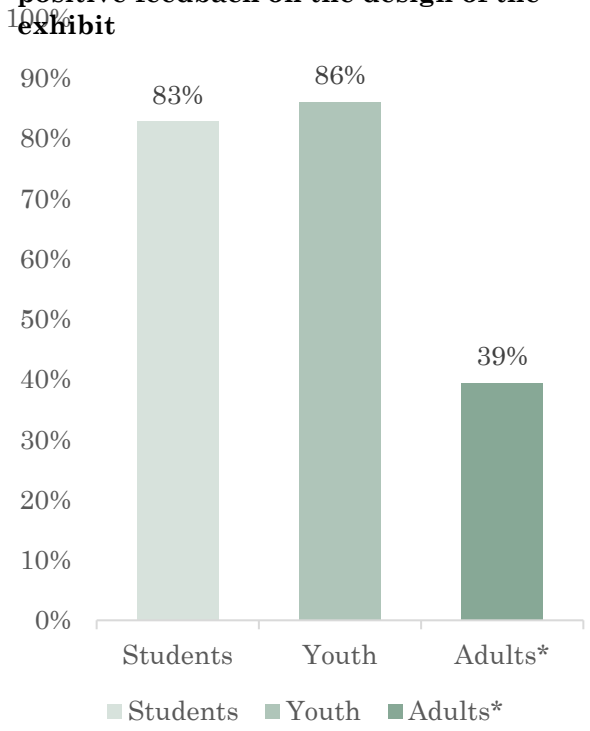


Exhibit Activities

Youth were more likely to list the activities that they enjoyed, such as pounding the kapa/clay, the ink station, using the microscope, and the smelling station. But a handful of youth respondents also described the functionality of the different activities in more detail. As one participant stated, *"I liked the microscope because I could see the individual fibers."* Another participant described the kapa pounding activity as follows, *"I liked stamping the kapa on the paper and creating my own design. I also liked pounding the clay to get a visual of what it was like to pound and design the kapa."*

Hands-on & Interactive

Responses among adults in the community differed from youth responses. These participants discussed the interactive and hands-on activities and how that played a large role in engaging their families, especially their children, in learning more about the practice and process of making kapa. Some of the feedback they shared include, *"My daughter learning about her culture while playing. Kids learn extremely fast while playing and this set up was excellent for her creativity"* and *"Love the hands-on experience and being able to involve my 'ohana."*

Statements like these begin to reflect how the exhibit was in fact successful in sharing the process of making kapa. Overall, the feedback was overwhelmingly positive. Participants recognized the thought and intention that went into planning and developing this exhibit and appreciated the opportunity to visit and participate. As one participant noted, *"Love the displays and thought process in this exhibit. I can tell a lot of research and hands went into this display. Mahalo nui."*

6: Exhibit Feedback – Participants would attend the exhibit again and recommend it to others.

Nearly all participants (96%) indicated that they would visit this exhibit again, while a majority (87%) would recommend the exhibit to others.

Like previous findings, those who attended the exhibit at the various community sites, both youth and adults, were more like to *strongly agree* that they would want to participate in similar activities than those students who attended while in school (97% and 85% vs 69%, respectively).

Similarly, those in the community were more likely to recommend the exhibit to their friends or family (83% of youth and 81% of community adults), while only 54% of students *strongly agreed* that they would recommend the exhibit to others.

Many who attended in community with their families described the exhibit as amazing and great, and wanting to share the opportunity with others – families, friends, and students.

"Sharing with 'ohana. A great opportunity for quality time."

"It was an amazing exhibit, would love to take my students here!"

Fig. 15 Participants would like to do similar activities or visit similar exhibits – All Participants

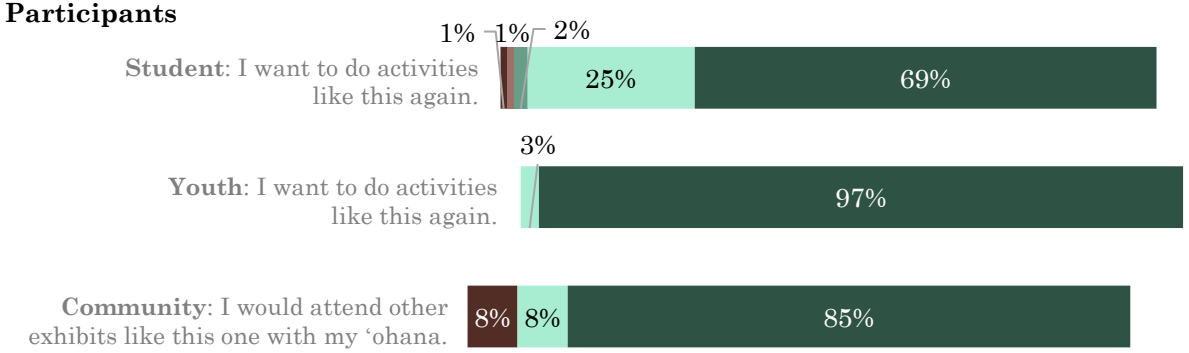
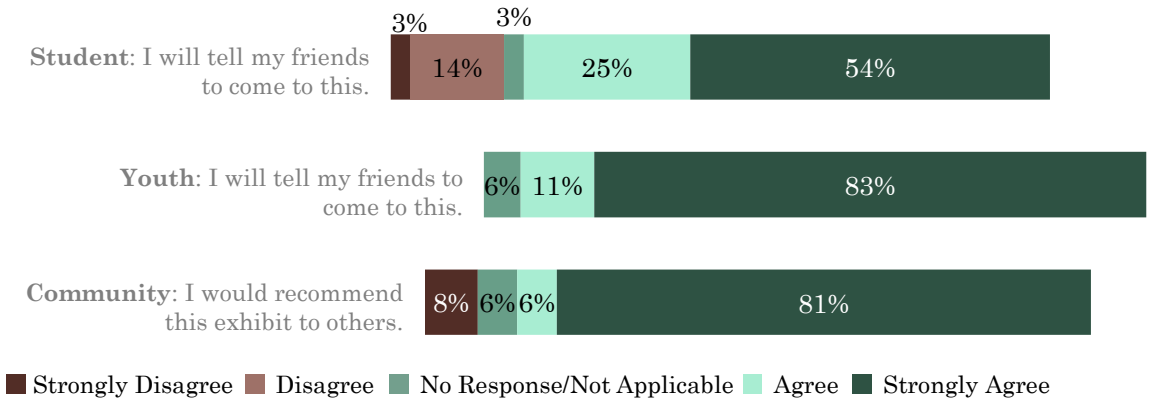


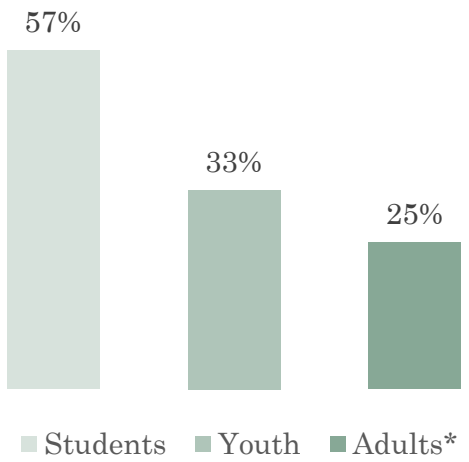
Fig. 16 Participants would recommend the exhibit to others – All Participants



6. Exhibit Feedback – Areas of Improvement

Though the feedback from participants about the exhibit design and set up were predominantly positive, there were a handful of survey respondents, students, youth, and community adults alike, that discussed areas they felt could be improved. These areas (1) Functionality of the Activities, (2) Length of the Exhibit, and (3) Spacing.

Fig. 17 Participants who provided feedback regarding areas of improvement.



*These responses are only among those adults who completed the long survey at the CLCM site.

Functionality of the Activities

Feedback about the activities were primarily from youth who were usually listing the two activities they liked least – the smelling and shape stations, as well as the microscope activity. Those that provided more details share about the kapa activity. They described the ink and clay being difficult to work with.

Length of & Time at the Exhibit

Participants in the community described how they wished the exhibit were open to the public for a longer period at the different community sites so more people could attend.

Some students who attended the exhibit while in school also commented they didn't have enough time to experience all the activities.

Spacing

Feedback regarding spacing of the different activity rotations of the exhibit all came from students who visited the exhibit. Since the space was small, they described the activities being close together and other students being "bunched up" and not being able to social distance. The size of the room may also have affected how sound travelled, as some students also mentioned that it was loud from the kapa pounding activity.

SECTION 2

Background
Methods

Background & Methods

BACKGROUND

Native Hawaiian and Pacific Islander (NHPI) people have a long history of utilizing systemic observations and applying complex scientific principles to thrive in the most remote islands on earth and understand the world around them. Despite this history, NHPI are consistently underrepresented in STEM fields and Native Hawaiian learners experience comparatively lower achievement rates than their non-Hawaiian counterparts (Ka‘akua, 2014; Silva, 2017). These gaps can be addressed by intentionally bridging cultural values and knowledge with scientific knowledge systems and contemporary technology.

Research has shown that NHPI communities benefit from learning experiences that are hands-on, exploratory, and aligned with indigenous epistemological context (Meyer, 2013). Additionally, culturally relevant and grounded learning environments that also foster and encourage discussions at the individual, family, and community levels, strengthen connections to cultural identity, application of stewardship, and modern STEM learning (Gibson & Puniwai, 2006; Kana‘iaupuni, Ledward, & Jensen, 2010; Maynard & Martini, 2005; Tibbetts & Johnson, 2007).

Applying a culture-based approach in STEM learning offers NHPI learners an opportunity to view the world through a lens closer and more relevant to their lives and allow them to process the relationships in their environment in a way that makes sense to them. Thus, the Kaulele Hawaiian Indigenous Pop-Up Science Center project was developed to better understand the following question,

> “How can a Hawaiian culture-based framework be utilized to design STEM hands-on exhibits and increase learner engagement and depth of knowledge of STEM concepts?”

The overall project explores strategies of designing an effective hands-on, STEM learning experience for NHPI learners and their families that would integrate traditional NHPI scientific concepts, cultural values, and informal learning with modern STEM foci to help learners understand how to utilize STEM to successfully contribute to thriving island environments and economies.

Specifically, the project created informal STEM learning experiences through interactive activities and makerspaces grounded in culture-based education and indigenous science and technologies relative to the cultural practice of making kapa. Kaulele designed, built, and tested prototypes of interactive museum-grade exhibits through a collaboration of science experts, teachers, students, and cultural practitioners. These exhibits were designed for and delivered to public audiences of all ages, with a strategic focus on NHPI youth ages 4 through 14 and featured informal learning experiences that engaged learners of all ages.

METHODS

Exhibit attendees and participants were invited to share about their experience at the Kaulele. Participants are classified in the following groups:

- **Students**: Youth participants who attended the exhibit at Waiʻanae Intermediate School Site with their classmates; all are middle school students.
- **Community Youth:** Youth participants, < 18 years old, who attended the exhibit in the community (KS' Community Learning Center in Māʻili, South Shore Market Place, or Windward Mall).
- **Teachers**: Individuals whose profession is teaching and attended the exhibit either at Waiʻanae Intermediate School or in the community (KS' Community Learning Center in Māʻili, South Shore Market Place, or Windward Mall).
- **Community:** Adults (18+ years old) who attended the exhibit in the community (KS' Community Learning Center in Māʻili, South Shore Market Place, or Windward Mall).

Instruments

Data was collected via a survey: Youth Survey, Community Survey (Full), Community Feedback (Short). The survey and interview/focus group guides were modified for each participant group. These instruments were developed based on evaluation tools used by INPEACE in prior exhibits and events and revised based on feedback from the Advisory Committee.

The surveys captured demographic data from all participants about their gender, ethnicity, grade level (for students and youth), grade level they teach (for teachers), and teaching experience (for teachers). In addition to demographic data, the survey also collected participant feedback on the exhibit including what they found most and least interesting, what components they understood or didn't, suggestions for improvement, levels of interest and engagement, and a self-assessment of whether the exhibit increased their interest in STEM and cultural activities. This information was gathered in the form of Likert and yes/no scales.

Participants

Student participants were selected based on their enrollment in Waiʻanae Intermediate School's eighth grade classes. All students were provided the opportunity to participate in the study. Students who provided assent (along with parental consent) were asked to complete a survey after attending the exhibit (n=134). Additionally, the study team recruited other teachers from the school beyond the participating classes. The study team was provided access to all teachers by the school's principal, who notified teachers of the opportunity to attend the exhibit and participate in the study.

Teachers who consented to participate (n=3) were asked to complete a survey. Waiʻanae Intermediate was chosen by the PI and project team based on existing relationships and connections with the school and staff and their interest in the project. The exhibit was also open to community members and families at three different sites: Kamehameha School's Community Learning Center in Māʻili, South Shore Market Place, and Windward Mall. Community participants were recruited from the pool of exhibit attendees and participation was open to all.

Participants in community included youth (n=36), adults (n=208), and teachers (n=3). Due to the small sample of participating teachers, their data was not included in the final analysis and reporting to protect their identities and maintain their confidentiality. A breakdown of participant demographics can be found on the following page.

Community Youth (n=36):

Variable	Feature	Number	Percentage
Gender	Female	16	44%
	Male	19	53%
	Prefer not to say	1	3%
Ethnicity	Native Hawaiian	35	97%
	Non-Hawaiian	1	3%
Grade Level	Elementary	18	50%
	Middle	9	25%
	High	6	17%
	No response	3	8%

Community (n=208)

Variable	Features	Number	Percentage
Site	CLCM	53	25%
	South Shore Market	105	50%
	Windward Mall	50	24%
Gender	Female	144	69%
	Male	60	29%
	Non-Binary	2	1%
	Prefer not to say	2	1%
Ethnicity	Native Hawaiian	125	60%
	Non-Hawaiian	83	40%

Student (n=134):

Variable	Feature	Number	Percentage
Gender	Female	63	47%
	Male	66	49%
	Non-Binary	2	1%
	Prefer not to say	2	1%
	No response	1	1%
Ethnicity	Native Hawaiian	94	70%
	Non-Hawaiian	40	30%

Analysis

Survey data was collected using Google Forms and the dataset was analyzed using Excel to measure whether the exhibits and activities generated motivation in the target population to engage in STEM activities beyond the Kaulele activities. Open-ended responses were analyzed using NVIVO and coded and themed to generate common sentiments and inform the iterative process of improvement to the exhibits.

Additionally, the analysis team suppressed cell sizes in cases where sample sizes broken down by demographic categories are less than five participants by various participant groups to reduce chances of deducing identity.

APPENDIX

Coding Matrix

Coding Matrix: Exhibit Feedback

Construct	Subconstruct	Description
Engagement	Engagement	Participants felt engaged in the exhibit; enjoyed the exhibit; were absorbed in the exhibit; captivated by the exhibit
Informative, Educational	Informative	Participants describe the information provided as educational; informative
	Easy to Understand	Participants described the information provided as easy to understand; not confusing; made sense
	Relevant	Participants described the exhibit as relevant, related, or applicable to their lives.
	Age-appropriate	Participants described the information provided as appropriate age for keiki who participated; as appropriate for keiki's knowledge level.
Design	Design	Participants provide feedback of the design, set up of the exhibit (i.e., interactive, hands on, discusses the activities, etc.)
	Functionality	Participants provide feedback on how the interactive components/experiments that were part of the exhibit worked

Coding Matrix: Outcomes

Construct	Subconstruct	Description
Increased knowledge	Increased knowledge (general)	Participants described that the exhibit increased their knowledge but did not specify in what way
	Hawaiian culture	Participants described how the exhibit increased their knowledge on Hawaiian culture
	Science	Participants described how the exhibit increased their knowledge around science topics
Application of Learning	Find out more	Participants indicated/described how they would find out more information about the topics/information provided in the exhibit
	Share knowledge	Participants indicated/described how they would share information about the topics/information provided in the exhibit with others
	Use knowledge	Participants indicate intent to apply or use knowledge in their daily life either with their ʻohana, in the workplace, or generally. The key here is intent to use knowledge
	Other	Participants described how they would apply what they learned from the exhibit in other ways (not finding out more or sharing knowledge with others); generally, discuss the possibility of using the knowledge

Coding Matrix: Outcomes

Construct	Subconstruct	Description
Interest in Science	Interest in science	Participants describe how the exhibit changed their interest, passion, or view of science.
Interest in Hawaiian culture	Interest in Hawaiian culture	Participants describe how the exhibit changed their interest, passion, or view of Hawaiian culture.
Increased understanding of the intersection between science and Hawaiian culture	Understanding of the intersection between science and Hawaiian culture	Participants describe how the information provided in the exhibit increased their understanding of how science and Hawaiian culture are related
	Relation to daily life	Participants describe how the information provided in the exhibit is relevant to their daily lives; ʻohana, culture, community