THE AUTHENTICITY PROJECT

EXPLORING THE ROLE OF AUTHENTICITY IN INFORMAL STEM LEARNING

Dr. Jim Kisiel, California State University, Long Beach

Dr. Martin Storksdieck, STEM Research Center, Oregon State University

Kimberly Preston, STEM Research Center, Oregon State University

Kathleen Westervelt, California State University, Long Beach

Jill Stein, Reimagine Research Group

Please do not cite without permission of authors.
For more information, please contact us at j.kisiel@csulb.ediu

THE AUTHENTICITY PROJECT

EXPLORING THE ROLE OF AUTHENTICITY IN INFORMAL STEM LEARNING

Museums, science centers, zoos and other informal science education institutions often focus on providing authentic objects as central to a particular learning experience, from the Field Museum's T-Rex Sue to the California Science Center's Endeavor Space Shuttle. Such attractions, in the form of objects (large and small), settings and activities, are seen as a way to engage, inspire or inform the public. It seems that 'The Real Thing' has been seen by educators, exhibit designers and program developers as a driver for public engagement in these places—yet there is some questions as to this long-standing perspective relates to *learning*.

For this NSF-funded project, we sought to develop a better understanding of the role of authenticity in informal science learning by first looking at what researchers and other experts in education and adjacent disciplines like tourism, marketing, and cultural studies, have learned about the role of authenticity and its influences on interest, attitude, and even learning. We hoped that this exploration of scholarly literature might help us better understand the role of authenticity in learning.

The first phase of our project involved examining existing literature reviews (syntheses of different research efforts and topics) as well as books and other existing publications that might provide us with underlying ideas and agreed-upon assumptions. Yet as we started this dive, one thing became clear very quickly—our assumption that authenticity can be viewed as a clear-cut feature or characteristics was wrong. Our first step then became clarifying just what makes something *authentic*.

WHAT IS AUTHENTICITY?

Across the literature, we found a variety of different perspectives on authenticity or what makes something authentic. Some referred to refer to authentic as a characteristic of something that possesses *originality in design*, being the *first of its kind*, and *not a copy or imitation* (Gilmore & Pine, 2007.) Yet, others suggest that authenticity is not a binary concept (Lovell & Bull, 2018) but rather a continuum. Also, throughout the literature, there is discussion of the subjectivity of authenticity--that is, the idea that authenticity is a social construct or at the very least, a perception determined by the individual.

UNPACKING AUTHENTICITY

As we dug into the literature, it became clear that not everyone had the same conceptualization of authenticity. Gilmore and Pine (2007), for instance, refer to authenticity as that which possesses originality in design, being the first of its kind, and not a copy or imitation. Evans, Mull, and Poling (2002) similar describe authenticity, from a child's perspective, in terms of what it is ('real', first of its kind, awe-inspiring) as well as what it isn't (not a fake, not an illusion, not simulated.)

However, other researchers and authors suggest that authenticity is not a binary concept (authentic or not) but rather a continuum. Geurds (2013) suggests that "Objects and their interpretation are so pliable as to eventually overcome being branded 'inauthentic' by achieving a 'sufficient' degree of authenticity…instead creating degrees of authenticity." Similarly, Lovell and Bull (2018) posit that "Authenticity isn't 'black and white'; rather there are gradations that separate authentic from fake." In each of these cases, the underlying assumption is that the

authenticity (and perhaps subsequent value of authenticity) is dependent on the individual--their background, beliefs, experiences and motivations.

Throughout the literature, there is discussion of the subjectivity of authenticity--that is, the idea that authenticity is a social construct (Smith, 1999) or at the very least, a perception determined by the individual. Gilmore and Pine (2007) suggest that "the sole determinant of the authenticity… is the individual perception of the offering. Because our experiences with offerings happen inside of us, we become the sole arbiter of what is authentic for us." The concepts of 'cool authenticity', referring to the 'genuine-ness' of an object, environment, experience as determined by an external expert and based on scientific/historical knowledge, and 'warm authenticity', involving personal or subjective feelings related to an individual's or community's beliefs about the authenticity of a practice or experience in which they engage, reflect drastically different approaches to the concept of authenticity (Khanom et al., 2019.)

For some, authenticity is examined in terms of power. Who determines what is "authentic" identity, cultural production, or traditional practice? Who has the "authority to authenticate?" (Bruner, 1994.) This includes looking at how people construct and define authenticity to serve specific purposes, and how these constructions of authenticity can be linked to identity (for example, who or who is not considered an authority of authentic cultural knowledge or practices).

Along this line, numerous authors appear to argue that a sense of authenticity can be curated or enhanced by surrounding objects with robust context: "The story makes an object 'real' or authentic--even if the object is not entirely real (e.g. reconstruction of a whale in a museum.) However, without context or history of scientific information, the object lacks cachet and may not be seen as 'authentic' or important" (Payne 2019, p184).

As we continued our exploration of the research and attempted to examine how authenticity (of an object, a setting, an activity) might affect learning, or any outcome for that matter, it became clear that the individual played a critical role. It would seem that the perception of authenticity, as defined by the individual and shaped by experience, expectation, or environment, is what counts. With all that in mind, we might define authenticity as:

> ***A quality assigned when a person makes a judgment that something feels 'true to life,' conforming with one's prior conceptions about a place, activity, person or thing.***
> **Or possibly**
> ***A quality assigned (to an object, setting, activity, etc.) when a person makes a judgment that something is 'real', or real enough to be meaningful.***

AUTHENTICITY IN INFORMAL SCIENCE ENVIRONMENTS

For purposes of this project, we were interested specifically in the qualities of authenticity as they relate to objects, settings or activities—key elements often key to informal learning environments. By *object*, we refer to a physical or virtual (digital) 'thing': a fossil, a telephone, an animal, a virtual representation/hologram, etc. *Settings* refer to physical or virtual spaces/places at which something occurs, is designated to occur, or has occurred. Settings can be designed (simulated rainforest in a zoo, a dinosaur exhibit or a virtual space station online) or 'natural' (an actual rainforest, an archaeological excavation.) Finally, we consider *activity* to be task or series of tasks in which someone participates. The activity might involve particular objects (e.g. using a microscope, excavating a replicated fossil) or occur in a particular setting (e.g. speaking with an actor in a historical home, gathering water samples in a local stream as a scientist might.)

WHAT WE DID

Given how the question (or assertion) of the importance of 'authentic' showed up again and again in discussion of practice in informal science education, we wanted to see just what was known about authenticity and learning. We also recognized that because the study of informal learning is distributed across many disciplines, we would need to look beyond what has been studied in education and museum studies. We conducted a systematic review of published literature, examining both theoretical perspectives, presented in books and reports and literature reviews, as well as peer-reviewed published research and evaluation work that examined authenticity and its effect on learning (and other outcomes.)

This systematic review of literature involved two phases. Phase I focused on prior literature reviews and syntheses, as well as 'gray' literature that included published reports, books and chapters, and related information sources (both peer-reviewed and non-peer reviewed). The initial Phase I search yielded overarching ideas related to the topic of authenticity and how it is conceptualized across different disciplines and different contexts. These claims and perspectives began to shape (and reshape) our ideas of authenticity as well as clarify how the concept is addressed in different disciplines such as tourism and consumer studies. Critical articles and book chapters identified from this first phase of review (i.e. those that generated relevant claims) were examined to generate a list of common keywords that could be used for a targeted search of empirical (research-focused) literature. After some adjustments, search parameters for Phase II were identified.

Phase II, our deep dive into the empirical literature, started with sixteen separate searches using the Web of Science database and the key words identified from Phase 1. Further refinement of the almost 1000 articles initially identified, involved a review of titles and abstracts (and sometimes a deeper look at research findings) using a rubric to determine whether the paper examined one of three *contexts of authenticity* (object, setting, activity), whether it presented *research* (as opposed to a review or synthesis, or position paper, for instance) and whether it examined *outcomes* of some kind. Articles failing to meet all three of these criteria were removed. Additional analysis at this level involved coding articles in terms of 'dimensions' of learning, based on the six-strand model developed in the National Research Council's report *Learning Science in Informal Environments* (2009.) This volume presents informal science learning outcomes along six different strands: interest/motivation development, conceptual understanding, science process skills, science as a way of knowing, participation in science, identity development. In addition to these more specific outcomes, more general outcomes (e.g. satisfaction, return visit, behavior change, etc.) were also examined. Coding efforts were discussed among two reviewers to improve reliability. A final count of 167 research-based articles were identified for in-depth analysis.

A summary form was developed to identify key findings and claims from this list of articles, as well as to capture details related to research design (qualitative vs. quantitative), context, project goals, and types of outcomes examined (learning vs. affect/satisfaction.) Subsequent analysis of these summary forms by the research team led to the development of key findings and a preliminary model explaining the role of authenticity in an informal science learning setting.

WHAT WE FOUND (OR DIDN'T FIND)

Our efforts to understand what was already known about authenticity revealed that there were generally more assumptions as to how authenticity impacts learning than research to back them up. More specifically:

There are only a handful of published research studies that examine authenticity in museum or informal learning settings. While a few of these look specifically at learning outcomes (Carsten Conner & Perin, 2020; Eberbach & Crowley, 2005), others are focused on visitors' perceptions of authenticity and how it changes their interest or attitudes toward an object. (Schwan & Dutz, 2020; van Gerven et al., 2018.)

There is a more prominent discussion of authenticity in the field of tourism. These researchers examine how authenticity, or lack of authenticity, affects outcomes such as satisfaction, interest, and likelihood of return visit, among others. Perhaps unsurprisingly, none of these studies attempted to link authenticity and learning or knowledge-building. Nevertheless, this work points to the idea that authenticity may affect engagement with an object, setting or activity. Such findings have implications for informal learning where engagement and interest can be seen as starting points for deeper learning experiences.

Authors established and referenced a variety of definitions for what they consider to be authentic or real. As discovered in our Phase I analysis and mentioned in the work of Chhabra (2008), Gilmore and Pine (2007), Geurds (2013), Hede & Thyne (2012), Lovell and Bull (2018), and van Broekhoven (2013) researchers used different perspectives and frameworks for examining authenticity.

Few studies examined the impacts of authenticity, especially related to learning. Many examined broad outcomes such as satisfaction, while others examined perceptions of authenticity (e.g. which object or experience seemed more authentic to visitors.) Nonetheless, such studies, along with those that looked explicitly at learning outcomes, helped us to develop a way to think about how authenticity or the perception of authenticity might influence an informal learning experience.

MAKING SENSE OF IT ALL

As we continued syntheses of these studies, it became clear that it wasn't necessarily the *authenticity* of the object, setting or activity that would affect learning, but rather the *perception of authenticity* by the learner (or visitor) that had the potential for impacting their experiences. By examining *perceived authenticity* (Hede, 2014), we are able to take into account the different, sometimes nuanced, ideas around the importance or relevance of authenticity held by learners. This approach may provide a more accurate interpretation of the effects of interactions with 'the authentic' on learning and behavior while avoiding a more authority-laden or unquestionable conceptualization that could ultimately discount the learner's voice and prior experience.

Our work around this topic led to the development of a preliminary model that would not only help explain factors that can influence a learner's or visitors perception of authenticity, but also explain how these perceptions might influence engagement, and subsequently, learning.   This 'authenticity lens' attempts to center the learner (visitor, participant) amidst different influences or factors that subsequently shape their perceived authenticity, which in turn guides their engagement with the object/setting/activity centered in their informal learning experience.
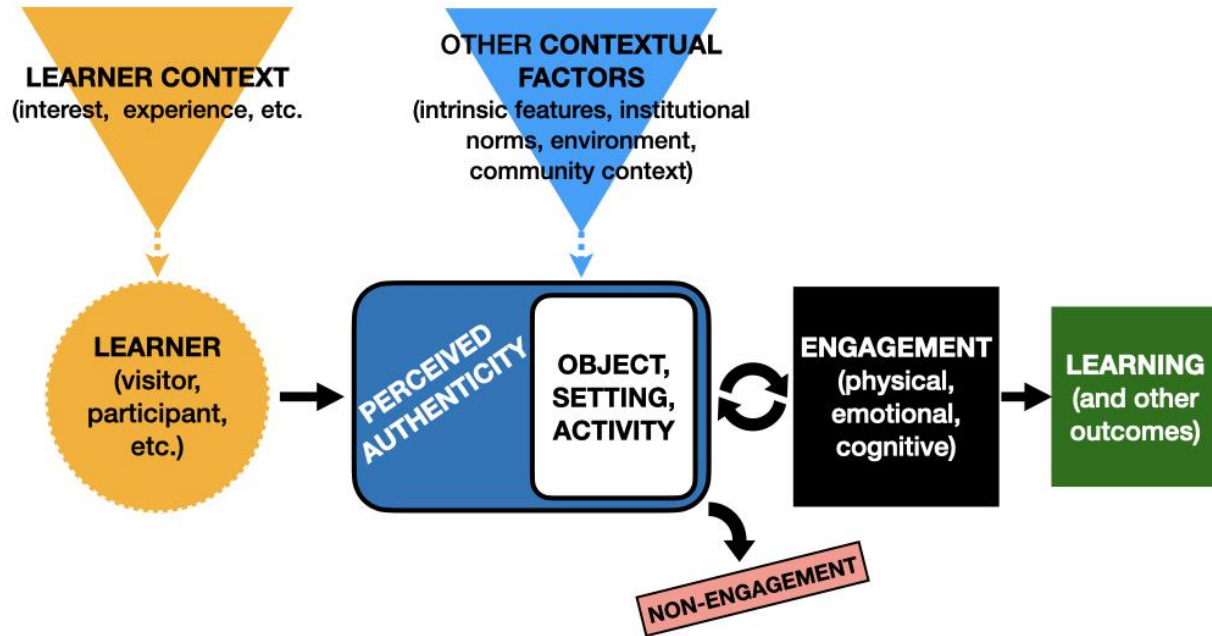
Figure 1. Proposed Model for Visitor Interactions with Authenticity in Informal Settings

LEARNER CONTEXT

Whether a learner perceives something to be authentic in a particular situation is influenced by a variety of personal variables, including prior knowledge and experience, expectations related to the experience (Beverland & Farrelly, 2010; Hede et al., 2014; Schwan & Dutz, 2020; Walter, 2016), as well as their personal definition of authenticity, and subsequent value for this characteristic. Furthermore, the importance of authenticity, more generally, may vary with different situations and experiences.

OTHER CONTEXTUAL FACTORS

Our research also suggests that the experience of authenticity can also be shaped by several contextual factors related to the object/setting/activity itself. For instance, the ***intrinsic characteristics*** of the object or setting (its relative size and scale, whether virtual or real, quality of replication) can influence perceived authenticity (van Gerven et al., 2018). Related to this is the ***physical space*** where the experience takes place. How an object is presented—where or how it is situated within an exhibition space (touchable vs. behind glass)—can impact perceptions of authenticity and ultimately relevance to the learner (Di Franco et. al., 2015). ***Institutional context***, including desired (learning) outcomes for a particular exhibit or experience, as well as institutional mission and even organizational norms or traditions may also influence how an individual perceives an object, setting or activity within their museum experience (Chhabra, 2008; Hede & Thyne, 2012, Van Broekhoven, 2013.) Finally, it is important to consider the ***cultural context*** within which both the institution and the learner are situated. While an object or activity may be presented in a way that contributes to the perceived authenticity of one visitor, another visitor, for which the object or activity holds a different cultural significance, may perceive these as inauthentic by virtue of how they are displayed or how their importance is communicated or not communicated (Field, 2009.)

This may be especially true in situations where exhibits are linked to imperialist practices of the past, and brings to question of who has the authority to authenticate (Bruner, 1994)

ENGAGEMENT

A learner's initial perception of authenticity will influence how they engage (or don't engage) further with an object, setting, or activity. Engagement, in this case, is defined very broadly as a physical, cognitive or emotional interaction or connection. Furthermore, the act of engagement may itself influence the learner's perceived authenticity through their negotiation of the different factors (prior knowledge, physical space, institutional context, etc.) that may have initially affected their ideas about the value or relevance of the object or activity. In other cases, however, the initial assessment of authenticity (or rather inauthenticity) may simply turn the learner away from any meaningful engagement, blocking the opportunity of the object, setting or activity to mediate any meaningful learning (Bruner, 1994; DeLyser, 1999; Jones, 2010; Schwan, et. al., 2016, Walther, 2016.)

LEARNING

As mentioned, there are limited studies that examine whether perceived authenticity of an object, setting or activity specifically or explicitly impact learning. However, there is a larger body of literature that considers how perceived authenticity impacts broader outcomes such as return visits (Loureiro & Blanco 2021; Fu 2019), satisfaction (Girish & Chen 2017; Hernandez-Mogollon, Campon-Cerro & Alves, 2013), engagement and positive recommendations (Curran 2018; Kaur & Kaur 2020). We would suggest that such outcomes, especially those involving positive affect and extended engagement, might be considered *precursors* or *essential conditions* needed to support learning in informal settings.

The NRC report (2009) suggests that science learning in informal environments 'places special emphasis on providing entrée to, and sustained engagement with, science—reflecting the purview of informal learning—while keeping an eye on its potential to support a broad range of science-specific learning outcomes'(p 24.) Using this framework, we might consider positive experiences, extended engagement and satisfaction, as described in our model, as antecedents to learning outcomes, providing fertile ground for eventual entry into science sense-making.

KEY DISCOVERIES

In this section, we examine several significant findings from the literature that both support long-held assumptions, as well as point out contradictions that may challenge long-held views of the role or importance of authenticity within the visitor experience.

CONSUMERS (LEARNERS, TOURISTS, VISITORS) GENERALLY VALUE AUTHENTICITY
They seek, desire, and appreciate real or realistic objects, settings and experiences.

IN DIFFERENT MUSEUM TYPES

A large sample (n=703) of visitors to science & technology centers, natural history museums, and cultural history museums agreed that authentic objects give weight and depth to an exhibition theme (Schwan &

Dutz, 2020). They are lasting, tell stories, give visitors a sense of how it truly was, help them understand, and make them curious. That said, replicas contextualized within the exhibits did not detract from the visitors' experiences. So, in this study, it is not necessarily an object's 'realness' that matters but its perceived authenticity.

AT A DINOSAUR EXHIBIT

Children (ages 8-12) ranked authentic fossils higher than replicas when asked what objects belong in a museum (van Gerven et al., 2018). The reasons children gave for valuing the real fossils included their appearance, ideation (real is better), association (real fossils remind them of real dinosaurs), and contagion (a real fossil has the past 'attached' to it).

AUTHENTICITY CAN BE LINKED TO POSITIVE OUTCOMES
These include satisfaction, motivation to return or share with others, increased engagement, and identity development.

USING VINTAGE RADIO AND TELEVISION BROADCASTS

An ethnographic study by Cliffe et al. (2021) describes how audio augmentation of a 1950's television and vintage radio expanded the piqued visitor interest and attention, improved understanding of the objects' cultural significance, helped users connect to personal memories, and encouraged a desire to know more.

WITH A SUMMER LAB EXPERIENCE

As part of a museum-based science education program, diverse high school students from New York City demonstrated greater competence in several science skills after spending a summer working alongside museum scientists (Habig & Gupta, 2021). Participants also believed that they were more competent in those skills and maintained an interest in scientific research over time and used their new skills with greater frequency outside the program. Researchers described the museum-based program as an authentic activity.

THROUGH VISITS TO 'COOL MUSEUMS'

According to people who visit museums frequently in the United Kingdom (n=308), one factor that makes a museum cool is its authenticity, its use of energetic exhibits that stay true to the museum's "roots and essence." Visits to 'cool' museums can generate feelings of self-worth and achievement, or *authentic pride*, and authentic pride can inspire a passionate desire to revisit the museum (Loureiro & Blanco, 2021).

'AUTHENTIC' MAY NOT BE BETTER
Although authentic objects/settings/experiences may afford certain outcomes that replicas/simulation cannot, the reverse may be true as well.

ANCIENT ARTIFACTS AT A HISTORY MUSEUM

For museum visitors examining ancient artifacts, having the real object in front of them was not as helpful or engaging as having the real object *combined* with 3D replicas and 3D digital reconstructions. Visitors could touch 3D replicas to understand how they might be held and used. Using VR, they could rotate objects, use color changes to interpret texture, and zoom in on features that sparked their curiosity. While visitors made size misjudgments when exploring objects in VR, their engagement was higher, leading to more self-guided exploration. (Di Franco, P., Camporesi. C., Galeazzi, F., & Kallmann, M., 2015)

THE GREAT BARRIER REEF

Virtual reality snorkeling at the Great Barrier Reef inspires the same emotional connections as actually snorkeling at the Great Barrier Reef, with or without interpretation. Emotional connection to the natural environment inspired limited intentions to adopt conservation behaviors – in the virtual reality group, not the group that visited the reef. (Hofman, K., Walters, G., & Hughes, K., 2022)

A PERMAFROST TUNNEL EXHIBIT

Families engaged in more conceptual talk at a replicated permafrost tunnel at a science museum in Oregon compared to families at the real research-based permafrost tunnel located in Alaska. The content of the conceptual talk was very similar at the two locations, connecting back to information in the tours provided at each site. In contrast, the real tunnel, however, afforded more perceptual talk—discussions built from sensory experiences such as odors and temperature. This rare comparison study suggests different contexts (authentic vs. replicated) can afford learning in different ways. (Carsten Conner, L. D. & Perin, S. M., 2020)

VISITORS MAY NEGOTIATE WITH THE INAUTHENTIC TO CONSTRUCT THEIR PERCEPTION OF AUTHENTIC.
This process may occur when it enhances their experience, supports expectations, or promotes desired outcomes.

TO UNDERSTAND HILL TRIBE LIFE IN THAILAND

Many visitors to a staged hill town in Thailand expected objective authenticity only to be disappointed by the commercial feel of the site, high prices for souvenirs, and the modern behaviors of the hosts. Other visitors, however, negotiated with the idea of authenticity by accepting inauthentic elements of the staged site as true to how its residents balanced modern life with efforts to preserve historic hill town culture. (Walter, 2016)

TO UNDERSTAND THE CULTURE OF HAKKA KUNGFU

Negotiating with the inauthentic may begin with curators and institutions. Kungfu masters who keep the traditions of Hakka Kungfu alive through public demonstrations are increasingly rare, so curators of a Hakka Kungfu exhibit had to reconsider what constitutes an authentic Kungfu experience. To capture the fading art form in a lasting and transportable exhibit, designers situated virtual reality experiences and

holographic displays among old photos, short documentary films, and real weapons. Researchers found that visitors preferred the virtual and digital technologies and that the blend of real with not real afforded "active engagement with an intangible culture." (Lo, P., Chan, H., Tang, A., Chiu, D., Cho, A., See-To, E., Ho, K., He, M., Kenderdine, S., & Shaw, J., 2019)

WHERE DO WE GO FROM HERE?

MORE STUDIES ARE NEEDED

Based on project findings, as well as feedback from practitioners, there are several areas of interest that could be fruitful opportunities for future research, including:

Explicit examination of learning outcomes. While we found a solid body of literature around how authenticity might be conceptualized and while we found some evidence how authenticity might influence enjoyment, participation, or recommendation to others, we found little direct evidence on how the degree or presence of 'authenticity' impacts learning outcomes.

Comparison studies. A traditional experiment allows for comparison of outcomes under different treatments, such as examining the different learning outcomes when using a real fossil vs. a 3D virtual replica. Only a handful of studies throughout the literature have attempted such comparisons between authentic and inauthentic objects/settings/activities. Such work would further strengthen our understanding of whether having the real thing influences or enhances learning.

Authenticity and Living Collections. Discussions that arose during the Los Angeles practitioner workshop pointed to questions related to trade-offs between making the spaces more authentic or "nature-like" versus making it easier for visitors to see the organisms, unencumbered by context.

Testing the model. The proposed model suggests multiple factors that can influence learners' perceptions of authenticity as well as their engagement. Research to better understand these influences, via both quantitative and qualitative means, would help confirm or reshape our ideas regarding this authenticity-lens on learning.

IMPLICATIONS FOR PRACTICE

How might key ideas from this synthesis inform decision-making for educators, designers, and curators in the field of Informal (Science) Education? For example, how might a designer incorporate some of these ideas into their decision-making when designing an exhibition around space travel. Are artifacts that have made their way to space (and back) needed to convey the key messages?   Are visitors more likely to visit the proposed exhibit, which allows them to engage with content or science messaging, if objects were genuinely used by astronauts?

The shift from research (or research synthesis) to practice is not trivial. Not only does it require thoughtful application of new ideas to current procedures and ways of thinking, but it must also overcome years or decades of assumptions and traditions that are pervasive in these institutions. The synthesis described in this report reveals that there are limited empirical data around how the characteristic of authenticity might impact learning

outcomes—this may suggest that few are willing to question (or have time to question) assumptions around authenticity and its role related to learning in informal settings.

In some ways, this project has introduced more questions than answers related to the role of authenticity in informal science learning environments. A dissemination meeting with educators and other museum professionals in February 2023 resulted in a range of practice-related questions, including:

- Does the inauthentic nature of live animal exhibits hinder learning?
- Is there a way in which virtual reality experiences can supplement objects that cannot be touched or held without being too distracting?
- How can I ensure that students have authentic experiences?

Embedded in each of these questions are different definitions of 'authentic', influenced by experience, institutional traditions, and even new ideas from the workshop. And each of these questions, if answered adequately, has the potential to support new practices.

Clearly, more work is needed to apply the key ideas from this project to improve practice. However, it would seem that there are two essential messages for practitioners in informal settings that emerge from this synthesis. First, if authenticity is subjective and based on the perception of the individual, then it is important to *revisit assumptions* regarding how authentic objects or settings actually support learning. This may very well involve some data-gathering to look at how authenticity impacts the visitor experience—specifically as it relates to learning. At the very least, it might entail conversations with visitors and other stakeholders to better understand their perspectives. Second, it would seem that the importance of authenticity may depend on the kind of learning *outcomes desired* for a given exhibition or program. For instance, if the goal is to help visitors understand how an animal skull of an ice-age animal provides clues to what they might have done to survive, it may not be necessary to have the original fossilized skull—a replica may be fine for developing such understanding. Hopefully, additional research and evaluation related to the role of authentic objects, settings, and activities, coupled with a willingness to balance visitor interests ('I want to see the original') with institutional goals ('Visitors should learn,' 'Visitors should feel connected to the museum,' 'Visitors should return') will further our understanding and practice related to 'the real thing.'

REFERENCES

Beverland, M. B., & Farrelly, F. J. (2010). The quest for authenticity in consumption: Consumers' purposive choice of authentic cues to shape experienced outcomes. *Journal of consumer research*, *36*(5), 838-856.

Bruner, E. M. (1994). Abraham Lincoln as authentic reproduction: A critique of postmodernism. *American anthropologist*, *96*(2), 397-415.

Bunce, L. (2019). Still life? Children's understanding of the reality status of museum taxidermy. Journal of Experimental Child Psychology, 177, 197-210.

Carsten Conner, L. D., & Perin, S. M. (2020). Learning from the real versus the replicated: a comparative study. International Journal of Science Education, Part B, 10(3), 266-276.

Curran, R., Baxter, I. W., Collinson, E., Gannon, M. J., Lochrie, S., Taheri, B., ... & Yalinay, O. (2018). The traditional marketplace: serious leisure and recommending authentic travel. The Service Industries Journal, 38(15-16), 1116-1132.

Chhabra, D. (2008). Positioning museums on an authenticity continuum. Annals of Tourism Research, 35(2), 427-447.

Cliffe, L., Mansell, J., Greenhalgh, C., & Hazzard, A. (2021). Materialising contexts: virtual soundscapes for real-world exploration. Personal and Ubiquitous Computing, 25, 623-636.

DeLyser, D. (1999). Authenticity on the ground: Engaging the past in a California ghost town. Annals of the association of American geographers, 89(4), 602-632.

Di Franco, P. D. G., Camporesi, C., Galeazzi, F., & Kallmann, M. (2015). 3D printing and immersive visualization for improved perception of ancient artifacts. Presence: Teleoperators and Virtual Environments, 24(3), 243-264.

Eberbach, C., & Crowley, K. (2005). From living to virtual: Learning from museum objects. Curator: The museum journal, 48(3), 317-338.

Evans, E. M., Mull, M. S., & Poling, D. A. (2002). The authentic object? A child's-eye view. *Perspectives on object-centered learning in museums*, 55-77.

Field, L. W. (2009). Four kinds of authenticity? Regarding Nicaraguan pottery in Scandinavian museums, 2006–08. American Ethnologist, 36(3), 507-520.

Fu, X. (2019). Existential authenticity and destination loyalty: Evidence from heritage tourists. *Journal of Destination Marketing & Management*, *12*, 84-94.

Geurds, A. (2013). Culture sketching. The authenticity quest in ethnographic museums. 2013). Creating Authenticity: Authentication Processes in Ethnographic Museums, 42.

Gilmore, J. H., & Pine, B. J. (2007). Authenticity: What consumers really want. Harvard Business Press.

Girish, V. G., & Chen, C. F. (2017). Authenticity, experience, and loyalty in the festival context: evidence from the San Fermin festival, Spain. Current Issues in Tourism, 20(15), 1551-1556.

Habig, B., & Gupta, P. (2021). Authentic STEM research, practices of science, and interest development in an informal science education program. International Journal of STEM Education, 8, 1-18.

Hede, A. M., & Thyne, M. (2012). A journey to the authentic: Museum visitors and their negotiation of the inauthentic. In New Horizons in Arts, Heritage, Nonprofit and Social Marketing (pp. 95-113). Routledge.

Hede, A. M., Garma, R., Josiassen, A., & Thyne, M. (2014). Perceived authenticity of the visitor experience in museums: Conceptualization and initial empirical findings. European Journal of Marketing, 48(7/8), 1395-1412.

Hernández-Mogollón, J. M., Campón-Cerro, A. M., & Alves, H. (2013). Authenticity in environmental high-quality destinations: A relevant factor for green tourism demand. Environmental Engineering & Management Journal, 12(10).

Hofman, K., Walters, G., & Hughes, K. (2022). The effectiveness of virtual vs real-life marine tourism experiences in encouraging conservation behaviour. Journal of Sustainable Tourism, 30(4), 742-766.

Jones, S. (2010). Negotiating authentic objects and authentic selves: Beyond the deconstruction of authenticity. *Journal of material culture*, *15*(2), 181-203.

Kaur, S., & Kaur, M. (2020). Behavioral intentions of heritage tourists: Influential variables on recommendations to visit. Journal of Heritage Tourism, 15(5), 511-532.

Khanom, S., Moyle, B., Scott, N., & Kennelly, M. (2019). Host–guest authentication of intangible cultural heritage: A literature review and conceptual model. Journal of Heritage Tourism, 14(5-6), 396-408.

Lo, P., Chan, H. H., Tang, A. W., Chiu, D. K., Cho, A., See-To, E. W., ... & Shaw, J. (2019). Visualising and revitalising traditional Chinese martial arts: visitors' engagement and learning experience at the 300 years of Hakka Kungfu. Library Hi Tech, 37(2), 269-288.

Loureiro, S. M. C., & Blanco, T. M. (2023). Museum coolness: creating the desire to revisit. Tourism Recreation Research, 48(1), 94-109.

Lovell, J., & Bull, C. (2017). Authentic and Inauthentic Places in Tourism: From Heritage Sites to Theme Parks.

National Research Council. (2009). *Learning Science in Informal Environments: People, Places, and Pursuits.* Committee on Learning Science in Informal Environments. Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder, Editors. Board on Science Education, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Pyne, L. (2019). Genuine Fakes: How Phony Things Teach Us About Real Stuff.

Schwan, S., & Dutz, S. (2020). How do visitors perceive the role of authentic objects in museums?. Curator: The Museum Journal, 63(2), 217-237.

Schwan, S., Bauer, D., Kampschulte, L., & Hampp, C. (2016). Representation Equals Presentation?. Journal of Media Psychology.

van Gerven, D., Land-Zandstra, A., & Damsma, W. (2018). Authenticity matters: Children look beyond appearances in their appreciation of museum objects. International Journal of Science Education, Part B, 8(4), 325-339

Van Broekhoven, L. (2013). Authenticity and curatorial practice. Creating Authenticity: Authentication Process in Ethnographic Museums, 151-61.

Walter, P. G. (2016). Travelers' experiences of authenticity in "hill tribe" tourism in Northern Thailand. Tourist Studies, 16(2), 213-230.

PRESENTATIONS AND WORKSHOPS

Authenticity in Practice: Examining the Perspectives of Informal Educators. Poster presentation at the *Visitor Studies Association (VSA)* Annual Meeting (July 2022).

Does the Real Thing Matter? Making Sense of Authenticity in Informal Science Learning. Panel discussion with participant breakout sessions at the *Association of Science and Technology Centers (ASTC)* Annual Meeting (Sept 2022)

Exploring Authenticity in Informal Learning: Findings from a review of research and an examination of implications for practice. Invited practitioner workshop for Southern California practitioners (education, exhibit design, curators), featuring discussion of Authenticity project findings and exploration of how these might be applied to practice. Half-day workshop held at the Columbia Memorial Space Center, Downey, CA (Feb 2023)

Rethinking 'authenticity', learning, and the visitor experience. Conference presentation at the *Visitor Studies Association (VSA)* Annual Meeting (July 202**4**).

CREDITS

PROJECT TEAM
Dr. Jim Kisiel (PI), Professor of Science Education, California State University, Long Beach
Dr. Martin Storksdieck (Co-PI), Director, STEM Research Center, Oregon State University
Kimberly Preston, Researcher, STEM Research Center, Oregon State University
Kathleen Westervelt, Graduate Student Researcher, California State University, Long Beach
Jill Stein, Consultant, Reimagine Research Group
Dr. Shawn Rowe, Oregon State University

GRADUATE STUDENT ASSISTANTS, CSU LONG BEACH
Zoe Allen
Janel Ancayan
Alyssa Bjorkquist
Justin Fournier
Rick O'Connor
Maira Rodriguez
Jerren Smith
Nikki Wyrick

LIBRARIAN, CSU LONG BEACH
Norah DeBellis

WEBPAGE
Seth Meyer
Daniel Ames

PROJECT ADVISORS
Andee Rubin
Dr. Jessica Luke
Dr. Margaret Evans