

## Research Question and Topical Categories

**Supercategory: What unique learning outcomes are fostered by ISE settings/experiences?**

### **Design Principles to Support Learning and Learners**

- **Subcategories:**
  - “Narrative” as example
  - Choice & Control
- What content or experiences are available for STEM learning that are accessible, approachable, effective and enticing?
  - What opportunistic experiences can we design STEM learning around?
- How does framing affect STEM learning and beliefs?
- Given the web is not a fulfilling alternative experience to ISE, how do we leverage the fact that people are ONLINE to get them involved in the learning stands?
  - How do we creatively connect this audience to physical ISIs or other ISE experiences?
- What kind of ISE FACILITATION affects six LSIE strands of learning?
- Can we identify best practice youth development programs and translate their success into practices for other institutions to model?
- How do ISE DESIGNS affect six LSIE strands of learning?
- How does format of media (screen size, channel of distribution, etc.) impact STEM learning and interest?
- How is storytelling and narrative adapted across informal STEM media formats?
- How do ISIs capitalize on their unique resources to enrich the lives of the general public?
  - Phenomena
  - Collections
  - Active science research
- How does media affect emotions and/or arousal in support of or motivation for learning STEM?
- How do different media formats impact science information seeking?
- What kinds of experiences connect people to nature and human impacts on nature?
- How should ISE media use arts, fiction, humor, satire, animation to communicate science?
- How do storytelling mechanisms (choices) such as metaphor, analogy, linearity, simulation, character, fiction vs. nonfiction, and/or fantasy affect STEM learning?

- What models of online experiences are most effective:
  - For bringing in new audiences?
  - For engagement with audiences?
  - For generating new kinds of connections to the ISI/experience?
- How does the physical learning environment influence the quality of informal STEM learning experiences?
- Authentic contexts, and (objects, settings, people) practices
- How does ISE media foster awareness, interest, and understanding in STEM?

#### Ecology and Change Over Time (of Learning)

- What are the values and programmatic priorities of stakeholders (providers/practitioners, funders, parents, students, etc.) in a region's educational ecology? How do the competency values and priorities influence interactions across stakeholders?
  - Design question: How can true observations be used to effectively design access points that enact broader principles on multiple levels of engagement?
- How have research studies on the relationship between social and cultural capital, socioeconomic status, and educational attainment informed the design of access points to a region's educational ecology?
- How does STEM media spread and circulate?
- How does STEM learning develop over time, place, and content? What is the unique or common or important contributions disproportionality provided by ISE?
- How do different STEM experiences impact transfer of learning to different settings (both near and far transfer)
- What is the role of context (location) in STEM learning and perceptions of STEM?
- What are the long-term impacts of ISE experiences?
  - Initial impacts lead to subsequent learning in new contexts
  - Impacts on STEM-related identities
  - Enculturating children

#### Interest, Motivation, and Curiosity

- How does media inspire, motivate, raise curiosity in STEM content/activities?
- How do informal science experiences activate learners to seek out more science learning experiences?
  - Inclusive of self-directed experiences (like bird watching)
- How do we effectively measure behavioral change as informal science learning outcomes?
- How does media impact science process learning?

## Identity

- How do people interpret STEM media through their core values?
- What kinds of working or volunteering experiences in museums or science centers correlate with young peoples' ability use evidence on scientific processes to make decisions on choice and/or solve problems in their lives?
- How does media support or hinder science/STEM identity?
  - Via role models
  - Influencing career awareness
  - Influence confidence/self-efficacy
- What kinds of working or volunteering in science centers or museums correlate wit young peoples' ability to see themselves as people who can understand the natural or technological worlds?
- What are the differences in scientific discourse and identity display online and "IRL?"
  - Do place-based motivations map to online ISE spaces?
- How does participation in a citizen science project enhance participants' identity as someone who understands and uses STEM (LSIE strand 6)

## Understanding Learners and Learning

- **Subcategories:**
  - Underserved and uninitiated
  - School audiences
- How do families support their own STEM learning or discourage such learning? What needs to be designed in order to better support family STEM learning?
- What do we know about under-researched or audiences in general...
  - i.e. not school audiences
  - young children
  - older adults
  - K-12
  - 16+
  - adults
  - systems
- How does ISE learning work for audiences that are NOT school children?
  - Undergrads
  - Adults
  - Older adults
  - Young children
  - Systems
  - Social groups
  - Etc.
- How does ISE media support community SETM learning?
- How does media effectively reach diverse and underserved audiences?
- How does diverse distribution of science media impact audience research?

- How do ISE media experiences provide critical access/pathways/gateways to STEM equity?
- How can ISE experiences and FORMAL EDUCATION experiences be DESIGNED to be mutually supportive?
- What pieces of a comprehensive STEM education are not prescribed by the Next Generation Science Standards?

#### Methods, Instruments, and Assessments

- What methods/measures validly and reliably measure valued ISE outcomes?
  - What are some exemplary models?
- How do we rigorously and validly assess interest, motivation, emotion, identity, values, clarification, etc. as immediate, long-term, outcomes both as dependent and independent variables (non-disruptive settings appropriate)

#### Capacity Building

- What would PD need to look like in order to increase capacity for the field in research and practice
  - In service
  - Pre-service
  - Levers for compliance
  - Others, etc. etc. etc.
- How is the practice of STEM-based professionals affected/influenced by engaging publics in citizen science projects related to their research?
- What is important about the role of mentors in engaging youth in out of school time (OST) programs, experiencing excitement and/or interest in STEM?
- What are effective professional development strategies for ISE staff?
  - For practitioners?
  - For researchers?
  - For facilitators?
  - For designers?
- What do we already know about STEM learning and is there an accessible way to disseminate a digestible version of this information for practitioner use?
- What collaborative processes have effectively linked researchers and practitioners in achieving a joint goal(s) in the past? Are these processes different across disciplines (e.g. education vs. science)
- How do partnerships impact media construction and dissemination?
- How can ISE generate scientific knowledge for scientists?

#### 21<sup>st</sup> Century Civics/Citizens/Residents

- **Subcategory:**
  - Societal issues and relevance
- How does science media promote science literacy?

- How does engaging with informal science learning experiences lead to increased scientific thinking and perspectives?
  - Nature
  - Science center
  - Film
- How does media promote science careers and literacy?
- In what ways do ISE experiences help people address challenges to society?
  - What are the upstream leverage points and how to use them
  - How to help people value informed decisions and engage in controversy?
- What STEM learning experiences impact life choices: career, finance, purchasing... and what type of knowledge or experiences are critical for behavior change?
- Where does the public turn to learn?
- How can the public come to view the landscape of learning more broadly?
- How can these places be networked for maximum productive effect?
- How do ISE media experiences make STEM life relevant
- How does media influence the growth, acquisition, of visual-spatial abilities required in STEM careers?
- How does ISE media stimulate productive public discourse (conversations: national, regional, community) about STEM
- How does informal science learning influence how people perceive the impact of science and society
- How do we support learning that is personally meaningful, relevant and consequential (even if it doesn't align neatly with common STEM categories)
- How nimble (effective) is media in addressing current STEM news?