Tinkering with Maker and Chemistry-based Activity Facilitation Frameworks

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From Research

ChemAttitudes

ChemAttitudes is an NSF-AISL funded design-based research project intended to generate educational activities and materials that have a strategic impact on attitudes about learning Chemistry:

- **Interest**
- **Understanding and perception of relevance**
- **Feelings of self-efficacy**

The project examined three aspects of the hands-on chemistry activities designed for informal education settings: content, format, and facilitation. Here we focus on the learning framework underlying the facilitation codes developed by the research team and how the research team's work was used for the Research and Practice Guide.

To Knowledge

Recommendations

Using a framework for facilitation can articulate learning and engagement goals in powerful ways for those studying informal learning. It is important for others in the field to use frameworks to understand learning in both research and practice contexts. Based on our experience, the research team feels that the framework developed to understand and support facilitation impacts in *Let's Do Chemistry* activities would also work for other inquiry activities.

However, it is important to consider where learning goals diverge among informal learning experiences. The research team took a compelling learning framework built around one set of learning goals (making and tinkering) and worked to adjust it for a different project context (inquiry-based chemistry activities), and think other researchers and practitioners can use a similar process to adopt and customize existing frameworks if needed.

And Practice

Learning Frameworks for Facilitation

The research team modeled the ChemAttitudes coding framework on the Exploratorium's *Facilitation Field Guide* for tinkering and making activities (above), based on the idea that facilitation impacts learning. It also overlapped with our educators' descriptions of techniques they used with visitors while facilitating activities.

Tinkering Studio Framework	ChemAttitudes Facilitation Framework
Spark initial interest →	**Invite Participation:** introduces an activity and engages all members in a group.
Sustain participation by following the learner's ideas →	**Support Exploration:** maintains visitor engagement in both thinking and physical step-by-step processes of an activity.
Deepen understanding through making connections →	**Deepen Understanding:** provides supplemental information and reflects on the "why" and "how" to encourage further exploration and meaning-making.

Development of the Research and Practice Guide

Consistent with the project's design-based research approach, which integrates research and practice throughout the process of creating and studying an educational intervention, the team created a guide that reports on the findings and insights of the project's research and educational activity development. The guide is designed to be a tool for informal educators, chemists familiar with educational outreach, and others that are planning and implementing hands-on programming activities. It is complemented by a variety of practical training tools, which put the ideas contained in the guide—and the activities developed by the project team—into practice.

Facilitation techniques to encourage positive attitudes towards chemistry

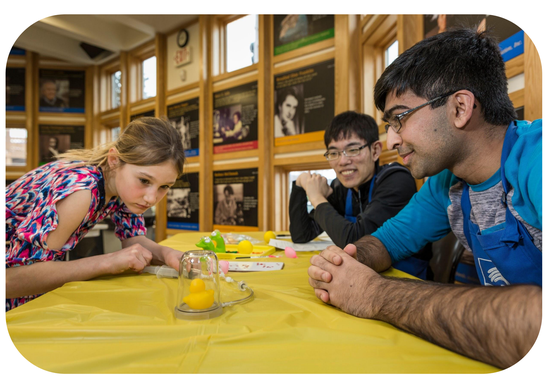
Invite participation
- Greet participants
- Start with the basics
- Model what to do
- Engage the whole group
- Have fun!

Support exploration
- Let participants do activity
- Be flexible and attentive
- Ask guiding questions
- Be a good listener
- Support through challenges
- Offer positive feedback

Deepen understanding
- Ask discussion questions
- Make connections
- Share your experience
- Wrap up

Learning outcomes of positive attitudes towards chemistry

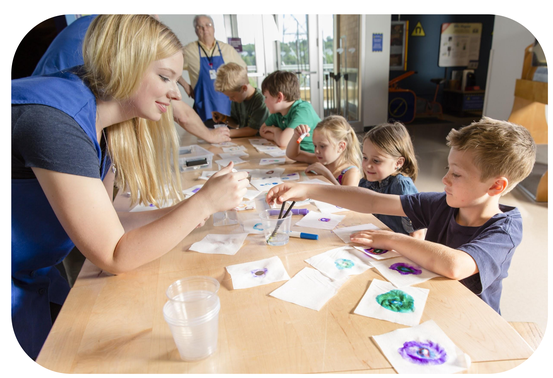
Increased **interest** in chemistry
Increased **relevance** of chemistry to their lives
Increased feelings of **self-efficacy** about chemistry



Nature of Chemistry Activity Facilitation

Modifying the Exploratorium's Facilitation Framework revealed similarities and differences between *Let's Do Chemistry* and *Tinkering Studio* in terms of facilitation moves and the content and format of different types of activities (tinkering vs. inquiry-based).

Shared Characteristics	Inquiry-based activity facilitation	Adaptations For Chemistry Activities
• Practiced in ISE • Facilitation moves observed across activities • Facilitation occurs in similar but not uniform progression • Learner/ing focused • Creative problem solving • Highly interactive	• End-goal driven, facilitator determined • Activity content and format pre-designed • Bound to specific learner outcomes • Facilitation maintains momentum to support end-goal • Facilitation to avoid failure • Deepened understanding focused on topic • Facilitation sparks interest in activity • Facilitation driven by structured linear activity design	• **Invite participation** occurs throughout the activity to keep things going through transitions between activity stages. • **Support exploration** invites visitors to engage authentically with the materials and explore the process. • **Deepen understanding** prompts reflection, meaning making, and connections. • ***Deepen*** and ***Support*** are more dependent on the facilitator than on the visitors or activity outcomes.



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