

Assessing Learning Impact in Science Centres

A Canadian Perspective

Executive Summary • CASC Board of Directors

About This Review

Learning impact is the most frequently cited goal in science centre mission and vision statements, and one of the hardest things to measure. To help CASC member organizations navigate this challenge, we conducted a scan of peer-reviewed literature on how informal science learning (ISL) environments assess their impact.

Our search criteria:

Focused on learning or learning-related constructs (e.g., engagement, science identity, attitudes toward STEM)

- Excluded studies based exclusively in the United States, to build a picture more relevant to the Canadian context
- Yielded 65 peer-reviewed publications; 14 were directly relevant to learning and learning proxies

The result is a focused scan of what the evidence base looks like for Canadian and internationally comparable informal science learning contexts.

What Is Being Studied?

Researchers outside the U.S. are examining a broad range of constructs related to learning in science centres and ISL programs. The most common areas of inquiry include:

- Science literacy and how centre visits improve public understanding of science
- Science identity, self-efficacy, and belonging, meaning whether people see themselves as “science people”
- Attitudes toward STEM and STEM careers, particularly among youth and underrepresented groups
- Engagement behaviours which are used as observable proxies for learning and meaning-making
- Outcomes of specific ISL programs, including after-school STEM clubs and facilitator-led experiences

Importantly, engagement in this context means observed visitor behaviours that signal learning is occurring, not simply attendance or satisfaction.

Who Is Being Studied?

Most studies focus on one of three audience groups:

- Adults 18+ visiting science centres
- General visitors and families
- Children and youth under 18 in after-school programs, school visits, or exhibits

Sample scope varies considerably, from single-site case studies to international multi-centre datasets spanning 13 countries. Some studies narrow scope further by gender (e.g., Reznik et al., 2023, focused exclusively on women's experiences). In some cases, data comes not from participants but from program providers and facilitators.

How Is It Being Studied?

Common Methods

A range of methodological approaches appear in the literature, from simple to complex:

- Exit surveys and questionnaires (visitors and/or staff)
- Structured and semi-structured interviews
- Direct observation of visitor interactions and facilitator behaviours
- Focus groups with specific audience segments
- Path analyses and structural equation modelling using multi-centre datasets
- Systematic reviews and meta-analyses

A Key Methodological Challenge

Measuring learning in informal settings is inherently difficult. Formal evaluation tools such as pre-posts tests and surveys can actually undermine what makes ISL distinct: free choice learning and exploration, and intrinsic motivation. Incorporating control variables is difficult when the learning experience is open-ended.

Additionally, determining “dosage” (how much of a program a visitor actually experienced) is a persistent challenge. Approaches relying on self-reported exposure can introduce bias.

More recent methodological developments — quasi-experimental designs, counterbalanced approaches, and tools like the DoVE Adjective Checklist — are helping address some of these limitations.

The Longitudinal Problem

Evaluating short, one-off ISL visits tend to show limited long-term impact. Repeated and sustained program engagement produces more lasting results. Yet longitudinal studies face compounding challenges: attribution (isolating one program’s effect when learners have multiple ISL experiences), attrition (drop-off over time), data collection complexity, and choice of analytical model.

We Don’t Need to Look South

A key finding of this review is that Canadian science centres do not need to rely on U.S.-based research consortia or evaluation frameworks. Empirically sound, practical research tools developed for the Canadian context already exist.

Canadian-developed tools and frameworks with demonstrated relevance to CASC members include, but are not limited to:

- Visitor-Based Learning Framework by Barriault & Pearson (2010)
- Facilitator Framework for Maximizing Learning Engagement (Machado-Corral, Pisani, Monteiro & Barriault, 2021)
- Canadian after-school STEM program evaluation (example of Duodu et al., 2017)

CASC has the opportunity to build collective impact infrastructure using homegrown expertise, suited to the Canadian bilingual, multicultural, and geographically diverse context.

Gap to Address	Empirically sound, practical, and accessible evaluation tools focused specifically on learning impact are still missing from the Canadian ISL collective impact landscape. This is an opportunity for CASC leadership.
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Practical Implications for CASC Members

Not all methods are created equal, and not all are feasible at the organizational scale of most Canadian science centres. Creating a practical guide of effective, evidence-based and empirically informed evaluation and research for all CASC members would be a valuable contribution to the association’s goal of assessing our collective impact.

Summary

This literature scan confirms that the field is actively grappling with how to define and practically assess science learning in informal science settings. There is no single gold-standard approach because the right method depends on what a centre wants to know and the resources it can bring to bear.

What the evidence does suggest is that:

- Engagement behaviours are useful, observable proxies for learning
- Longitudinal and multi-site studies add power but require significant resources
- Some Canadian-developed tools already exist and are underutilized across the sector
- A shared evaluation infrastructure, built collectively through CASC, could meaningfully strengthen the field

This executive summary is based on a peer-reviewed literature scan conducted by Laurentian University's Science Communication graduate program in collaboration with CASC. Full references and the annotated article assessment are available upon request.