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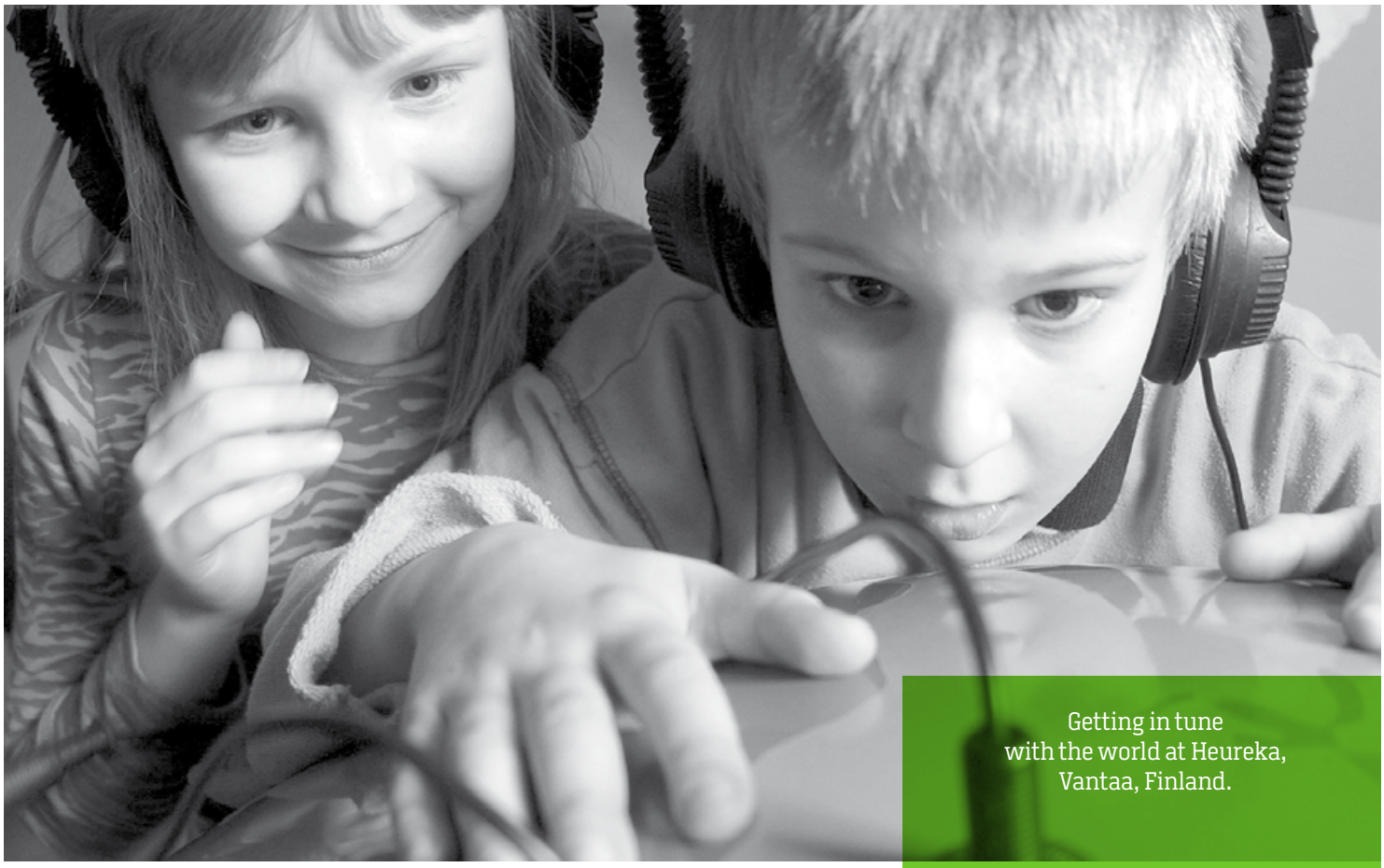

Getting in tune
with the world at Heureka,
Vantaa, Finland.

Evidence of Impact: Results from the International Science Centre Impact Study

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Hundreds of millions of children and adults visit science centres across Europe, Asia, North America, Latin America, Australia, and other regions yearly. Their programming is diverse; visitors of all ages engage in science through short-term school and family excursion experiences, as well as intensive long-term programs and partnerships. Although science centres have asserted they play a critical role in supporting public science learning, and there is evidence demonstrating their contribution (e.g., ASDC, 2008; ASTC, ND; Bell et al., 2009; Falk & Needham, 2011; McCreedy & Dierking, 2013; Salmi, 2002), comprehensive data supporting these claims are limited. Most investigations have involved single institutions and/or self-selected populations with limited generalizability. Robust evidence is sparse and little comprehensive international data exists.

The International Science Centre Impact Study (ISCIS), a self-funded collaboration of 17 science centres from 13 countries was designed to remedy this situation. (See Table). The goal of the research was to determine if, how, and under what circumstances science centre experiences contribute to the publics':

1. **knowledge and understanding of science and technology;**
2. **interest in science and technology;**
3. **engagement with science and technology both in and outside of formal education and the workplace;**
4. **creativity and problem solving abilities; and,**
5. **adoption of science and technology-related vocations and avocations.**

Methodology

Given the complex and cumulative nature of science learning, we utilized an "epidemiological" research approach rather than a randomized control trial (RCT) approach. RCT designs involve randomly assigning subjects to a "treatment" and a "control" group. Learning in and from science centres does not lend itself well to this approach, particularly if the goal is to understand a wide range of outcomes over long periods of time. In the real and messy world of science centre learning, it is nearly impossible to appropriately define or delimit the possible "effect" of learning sufficiently to ensure that resulting outcomes are solely the result of using a science centre. All users arrive, most often in social groups, with pre-existing interests, knowledge, opinions, and motivations, all which directly influence learning (Falk & Dierking, 2013). Likewise, learners build their understanding and appreciation for science and technology over time using multiple resources (Falk & Needham, 2013).

Epidemiological research designs deal with just such complexities by utilizing large samples and sophisticated correlational statistics to analyze and distinguish between competing factors and relationships (Rothman, 2002). The results from an epidemiological study do not support causal statements such as, "As a result of a science centre experience, this individual youth became more interested in science." Instead such an approach enables an investigator to state with specific statistical certainty that certain factors do or do not contribute to an outcome: "Individual youth who used science centres were significantly more likely to be science and technology literate and engaged people."

INSTITUTIONS AND SAMPLE SIZES

Institution	Country	Adult	Youth	Total
Canada Science and Technology Museum	Canada	250	250	500
Heureka	Finland	379	336	715
International Centre for Life	UK	424	384	808
Maloka	Colombia	406	469	875
Patricia and Phillip Frost Museum of Science	USA	256	253	509
Museo Interactivo de Economía (MIDE)	Mexico	384	384	768
National Museum of Natural Science	Taiwan	521	590	1111
National Museum of Science and Technology	Sweden	287	319	606
Ontario Science Centre	Canada	250	250	500
Pavilion of Knowledge–Ciência Viva	Portugal	321	319	640
Questacon	Australia	381	278	659
Science Centre Singapore	Singapore	412	333	745
Science North	Canada	385	322	707
Technopolis, the Flemish Science Centre	Belgium	388	382	770
TELUS Spark	Canada	392	253	645
Universeum	Sweden	258	308	566
VilVite–Bergen Science Centre	Norway	395	362	757
Total		6,089	5,792	11,881

Project researchers, working in collaboration with cooperating science centres developed, pilot tested and administered a questionnaire in each of the 17 communities to a large sample representative of each community – children ages 14–15 and adults ages 18 and over (Table). The research team used local census data (percentages of people of particular ages, gender, race-ethnicities, annual incomes, etc. living in the country/region/city) to determine the percentages of "types" of people to be included in the sample.[1] Roughly half of the 14- to 15-year-old children (47%) and less than half of all adults (44%) in the combined sample had visited one of the science centres at least once during their lifetime. All instruments, entry and analysis forms, training and data analysis were implemented by the research team. All data were collected and entered by institution staff, volunteers or contractors. Data were collected over the first six months of 2013; during analysis all data were weighted by age and income census data from each of the 17 communities to ensure as close an approximation to a random sample as possible.

Findings

Results strongly support the contention that individuals who use science centres are significantly more likely to be science and technology literate and engaged citizens.

Specifically:

- For both children and adults, using science centres significantly correlated with increased: Science and technology knowledge and understanding; Science and technology interest and curiosity; Engagement with and interest in science as a school subject (children); Engagement with science and technology-related activities out-of-school; and personal identity and confidence in science and technology. In other words, individuals who used science centres had a greater likelihood than those with no or limited science centre experience to understand and be interested in science and technology, have an enhanced science and technology identity, and be more likely to engage in scientific behaviors.
- Although results were strong for both youth ages 14-15 and adults 18 and above, the effect sizes were almost universally stronger for adults, suggesting that the magnitude of the difference in these measures between science centre users and those who do not use them or do so infrequently, was most pronounced for adults.
- The more frequent, the longer, and the more recent the science centre experience, the greater the likelihood of these outcomes.
- For adults in general and children relative to interest and curiosity, there was a threshold effect with the strongest correlations seen when individuals engaged between two and four times a year, but not more. Similarly, correlations were relatively flat for experiences up to four hours, but then increased markedly after five hours.
- In general, using a science centre increased the likelihood of significant effects regardless of the specifics of the experience. The major exception was adults whose typical science centre experience was a school field trip; they reported minimal impacts.

Like any research, this study raises as many questions as it answers. Probably the major question, given that there were strong correlations between science and technology interest and the other key outcome variables is whether self-selection was a factor – did positive science and technology outcomes emerge because of science centre experiences or did they merely arise because people predisposed to these outcomes disproportionately visit science centres? Although we suspect that both explanations are likely true (and equally valuable), as stated earlier, epidemiological research designs do not answer these types of causal questions.

What the study does provide however is strong evidence, based on a large representative international sample that the presence of one or more healthy and active science centres within a community, region, or country represents a vital mechanism for creating and/or maintaining a scientifically and technologically informed, engaged and literate public. These institutions do make a difference.

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1 The study also included a smaller "best case" scenario of frequent users. Those data will be reported elsewhere.

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