

Documenting and Assessing Learning in Informal and Media-Rich Environments:

Documenting and Assessing Learning in Informal and
Media-Rich Environments

Jay Lemke, UC San Diego

Robert Locusay, UC San Diego

Mike Cole, UC San Diego

Vera Michalchik, Stanford University

Contents

Contents	1
Introduction	3
Outcomes and Levels	5
A Framework of Basic Concepts	8
Review of the Literature	11
Afterschool & Community Centers	11
5th Dimension: A Broad-based Enrichment Program	14
Learning to Program in a Computer Clubhouse	17
Digital Storytelling & Media Production Programs	19
The Digital Underground Story Telling Youth Project (DUSTY).....	19
Data Visualizations in Online Networks: iRemix and YouMedia.....	21
STEM-focused Community Based Programs	26
Emergent Learning in a Community Garden Program	26
Colorado Hybrid School-Community STEM Project.....	27
Metacognition in an Amusement Park Physics Program.....	28
Museum-based Programs and Projects	29
GIVE: Facilitating Group Inquiry in Science Museums.....	29
TOBTOT: Assessing Museum Learner Talk Over Time	30
The Zydeco Tool: Inquiry in Museum and Classroom.....	32
WINS: Career Support in a Science Museum Afterschool Program	33
Computer-based and Online Activities	34
TEXT BOX: A Digression on Evidence-Centered Design	34
Stealth Assessment in Commercially Available Games	35
Assessing Learning in the Scratch Community Website	37
Learning Analytics In Computer Programming.....	39
Ethnographic Studies of Online and Gaming Communities	40

Lineage, World of Warcraft, and Second Life	40
Whyville	41
Additional Studies of Interest	43
Epistemic Games and Epistemography in Digital Zoo	43
Evaluating Quest to Learn	46
Highlights of the Expert Meetings	50
Conclusions and Recommendations	54
General conclusions	54
TEXT BOX: A Comment on Standardized Testing	56
Promising Directions and Recommendations.....	57
References	59
Appendix A: Expert Meeting Participants	65
Appendix B: Bibliography	67
Appendix C: Online Resources: Assessment, Funding, Research	91
Examples Out-of-School Learning Projects.....	92

Introduction

In 2010, authors of this report were asked to review the relevant literature and convene a series of expert meetings to make recommendations regarding the state of the art and outstanding challenges in documenting and assessing learning in informal and media-rich environments.

For some years now, efforts such as the MacArthur Foundation's Digital Media and Learning (DML) initiative have supported the development of a range of educational activities, media, and environments outside the classroom and its formal curriculum. The DML Connected Learning Research Network has elaborated the principles underlying the evolution of an openly networked learning ecology and is conducting studies to further define opportunities that support learning across contexts (Ito et al., 2013). Other large-scale efforts, such as the National Science Foundation-supported LIFE Center (Learning in Formal and Informal Environments), have also emphasized the complementarity of school and non-school learning experiences and the potential for educational reform to benefit from knowledge gained in the study of learning outside school. In a similar vein, the National Research Council produced a consensus report reviewing the knowledge base regarding science learning in informal environments (Bell, Lewenstein, Shouse, & Feder, 2009) and the Noyce Foundation commissioned a report describing the attributes and strategies of cross-sector collaborations supporting STEM learning (Traphagen & Trail, 2014). Across these efforts, there is agreement that the success and expansion of out-of-school initiatives depends on our ability to effectively document and assess what works and what doesn't, where, when, why, and how, in informal learning.

This report summarizes an extensive review of the literature on assessment of learning in informal settings, with a focus of the following types:

- **After-school programs**, where activities are not directly meant to serve school-based academic functions (example: playing an educational computer game and making innovative use of it for fun, with ancillary learning)
- **Community center programs**, where activities are negotiated between learners and providers, and which may have specific learning objectives but changing approaches to the goal (example: tele-mentoring and use of computer simulation of electric circuits, together with an onsite coach familiar with the student, but not responsible for the content)
- **Museum-based programs**, where visitors can choose to manipulate hands-on materials in the context of questions and explanations of phenomena observed/produced (example: young visitors connecting a battery to various electric devices to see the results of completing a circuit, with a coach, and showing the results to a parent; a group of young visitors extracting insects from a bag to feed to a pet as part of a longer term project, and one overcoming a reluctance to touch the insects)
- **Online communities and forums**, where participants ask and answer questions on a specific area of competence or expertise and evaluate one another's answers or contributions, and where they may also engage in joint activity in a virtual space or mediated by tools and social interactions in that space

(example: modding in World of Warcraft; learning to build in Second Life; “theory-crafting” to identify technical characteristics of computer games by systematically playing many options within them; raiding as joint play for a goal).

The research review generated an extensive bibliography from which we selected for description and analysis a subset of studies and projects to illustrate both the diversity of approaches to assessment of learning in informal activities and good assessment practices.

“Informal learning” is both a broad category and a shorthand for a more complex combination of organized activities in face-to-face or online settings other than formal schools in which particular features are especially salient. Characteristically, participants choose and enjoy an informal learning activity for its own sake, often engaging in it intensely of their own accord and remaining committed to it of their own accord. The power relations within informal learning settings typically allow for relatively equitable negotiation of learning goals and means within those settings. The learning goals pursued by participants are generally open-ended, dependent in part on available resources and re-purposed ways to use those resources. Overall, because of the flexibility involved, and the complexity of relationships, means, and ends that emerge over time within the activity, many significant learning outcomes may be unpredictable in advance of learner’s participation in the central activities undertaken in non-formal environments.

These features may in principle occur in both school and classroom-based learning and in other settings, but in different combination and to different degrees. Each setting and perhaps each kind of learning activity will tend to have a particular combination and degree of each feature. Various literatures may name activities or settings where these features are present, dominant, constitutive, or highly significant (“interest-based learning,” “free-choice learning,” “nonformal learning,” “learning in passion communities,” etc) as well as making distinctions among these based on role relationships or types of institutional goals and constraints.

In addition to reviewing the literature, the authors convened three expert meetings involving a total of 25 participants to discuss key issues, identify successful approaches and outstanding challenges, and review summaries of prior meetings in the series. The results of these wide-ranging discussions are summarized in this report and were highly influential in formulating our recommendations.

Our aim is twofold: first, to offer to those who design and assess informal learning programs *a model of good assessment practice*, a toolkit of methods and approaches, and pointers to the relevant literature; and second, to offer program staff, funders of projects, and other supporters *recommendations* concerning good practice in project assessment and identifiable needs for developing improved assessment techniques.

The members of our expert panels strongly urged us to deal with fundamental questions such as the purposes of assessment and the kinds of valued outcomes that should be considered. From discussions with the panel members and analysis of the research literature, as well as our own experience and judgment, we constructed a basic assessment model that encompasses at least ten general types of valued outcomes, to be assessed in terms of learning at the project, group, and individual levels. Not all levels or all outcome types will be equally

relevant to every project, but we strongly believe that all assessment designs need to begin by considering a conceptual model at least as comprehensive as what we propose here.

This is particularly important because the valued outcomes of informal learning tend to be less predictable and much more diverse than those of formal education. Formal education is designed to strongly direct learning into particular channels and produce outcomes that are specifiable in advance and uniform across students. Informal learning experiences build on the diverse interests and curiosity of learners and support their self-motivated inquiries. The valued outcomes of informal learning are often particularly rich in contributions to social and emotional development, to identity and motivation, to developing skills of collaboration and mutual support, and to persistence in the face of obstacles and inquiry on timescales of weeks, months, and even years. Informal learning activities also often result in products and accomplishments of which students are justly proud and for which product-appropriate measures of quality are needed.

In the remainder of this introduction, we will display our Outcomes-by-Levels Model for comprehensive assessment and briefly provide some definitions, distinctions, and principles as a general framework for what follows. We will then provide a review of selected and representative research studies and project reports in order to illustrate a wide range of useful techniques for documenting and assessing informal learning across varied settings and to identify issues and challenges in the field. Finally, we will provide our overall conclusions and recommendations.

Outcomes and Levels

It was universally agreed in our expert panels and extensively illustrated in the research literature that simple declarative knowledge is only one valued outcome of learning and is too often over-emphasized in assessment designs to the exclusion or marginalization of other equally or more important outcomes. Likewise, assessment designs too often focus only on outcomes for individual learners and neglect group-level learning and project-level or organization-level learning. Documentation and assessment need to be able to show how whole projects and supporting organizations learned to do better, or didn't. The kinds of documentation and data of value for organizational-level improvement are not limited to those that document individual learning.

Even individual learning is not simply a matter of domain-specific knowledge. As an aspect of human development—at the individual, group, or organizational levels—the learning that matters is learning that is used. This type of learning plays a role in constructive activities: from posing questions to solving problems, from organizing a group to building a simulation model, from exploring a riverbank to producing a video documentary. In all these cases what matters is *know-how*, and *know-that* matters only insofar as it is mobilized in practice. Such learning is consequential, and underlies movement, organization, and change.

Activities of practical value usually require interaction and collaboration with other people. *Know-who* is as important as know-how to getting things done. Social networking and coming to understand who is good at what and how a group of particular people can work together effectively is an essential outcome of learning.

Nothing of value gets undertaken unless people are motivated to act and feel comfortable with the domains of know-how and the kinds of collaboration with others needed to get things done. A key outcome of learning is the development of identification with ideals, goals, groups, tools, media, genres, and styles that constitute our changing identities and motivations for action. Equally important is our social-emotional development in learning how to use our feelings, our emotional relations to others, and our emotional reactions to events for constructive purposes.

Collaborative groups learn, develop, and change over time. Membership may change; agreed goals, processes of interaction, interpersonal feelings, agreed procedures, and informal ways of doing things all change. In many cases they change adaptively so that the goals of the group are more effectively pursued. Just as individuals learn how to better function in collaborative groups, so groups learn how to make better use of the contributions of individual members. Or they don't.

Whole projects, online communities, and larger organizations also learn, change, and adapt. Or they don't. Documenting and assessing organizational learning is equally as important as assessing group and individual learning and development. It is likely, though not well understood, that learning processes at these three levels are linked and that we cannot expect to understand why learning was successful or unsuccessful at any one of these levels unless we also have data about learning at the other two.

From these and similar considerations we developed the following basic *Outcomes-by-Levels Model for Documentation and Assessment*:

Exhibit 1. Outcomes-by-Levels Model for Documentation and Assessment

Level of Analysis

Outcomes	Project/Community	Group	Individual
Social-Emotional-Identity Development	Developing Social-Emotional Climate; Community/Project Ethos, Goals, Local Culture; System of Roles & Niches	Mutual support, challenge, inspiration; Joint enjoyment & engagement	Comfort & sense of agency in domain; Engagement; Long-term interest and persistence vs. obstacles & frustration
Cognitive-Academic (Know-how)	Developing strategies for organizing and distributing know-how; Work practices, division of labor	Shared, distributed know-how; Collective intelligence; Dialogue and cooperation skills, explanation skills	Knowing how to go forward in the domain; Knowing how to mobilize and integrate know-how across domains

In addition to this basic outcome-types by levels matrix, we also need to emphasize the importance of taking into account in assessment design the incorporation of relevant knowledge about the history of the project, the community, and participating organizations and knowledge of the current wider institutional contexts (e.g., goals, organization, leadership, resources, limitations).

We further identified a more specific set of outcomes as relevant within this overall model, which we have organized into four clusters emphasizing different aspects of learning. First is the personal increase of comfort with and capacity to participate in activities that involve inquiry, investigation, and representation of phenomena in a widening range of domains. This set of outcomes emphasizes progressive attunement to the types of discourse and practices commonly associated with knowledge within a given domain, leading to an increased sense of agency and ability to further leverage resources for learning. Second is the improved ability to act collaboratively, coordinating and completing tasks with others, assisting them, and using affective sensibilities productively in doing so. Third is learning to critically reflect on the nature and quality of products and other goal-oriented objectives, becoming able to more successfully iterate towards high-quality outcomes. And fourth is mobilizing social resources, networks, and capital, including across tasks and settings, to reach goals that may take extended periods of time to achieve.

For each of these four clusters, we include examples outcomes at the project, group, and individual level in the exhibit that follows.

Exhibit 2. Clusters of Informal Learning Outcomes by Level, with Examples

Outcomes	Project	Group	Individual
Increasing comfort with and ability to conduct independent inquiry across a widening range of domains, including evaluating sources and contributions.	Colorado Hybrid Project's cultural responsiveness promotes girls' identification with STEM practices.	Families' scientific-sense making at a marine park demonstrated by TOBTOT.	Use of Zydeco for "nomadic inquiry" of content across learning settings.
Improving ability to learn and act collaboratively, including relevant understanding of and support for learning partners.	GIVE project prompts groups of intergenerational museum visitors to engage in inquiry.	Children engage in mutual helping behavior at 5 th Dimension sites.	Collaborative problem-solving for success <i>Lineage</i> and other MMORPG play.
Improving quality of products, including ability to critically reflect on the quality of one's own and others' productions.	Digital Zoo designed for development of students' engineering epistemic frames	Youth shape one another's programs in Computer Clubhouses.	DUSTY participants develop agentive capacity in creating their digital life-stories.
Increasing range of social resources and networking to achieve goals.	Programming at 5 th Dimension sites is sustained through partnerships and scaling of practices.	YouMedia participants work with peers to create products relevant to their shared interests.	WINS participants in museum program draw on resources to help support STEM career paths.

The research projects summarized in the review of the literature were selected for inclusion because they provide examples of methods for documenting and assessing one or more of the above outcome clusters at one or more of the three levels of analysis. In the review, we specify at the beginning of each project summary the outcomes and levels assessed in each project.

A Framework of Basic Concepts

The discussions in our expert panels frequently focused on emerging re-conceptualizations of key concepts pertinent to documentation and assessment design for informal learning activities. There was broad consensus across the three expert meetings on how to employ the terms elaborated below, but the report's authors assume responsibility for the specific formulations provided here. Some key terms in the individual project studies reviewed in this report will be used differently from how we use them. We will try to make this difference clear in each case, while maintaining our own consistent usage of the following terms otherwise.

Learning: Learning that matters is learning that lasts, and learning that is mobilized across tasks and domains; our notion of learning includes social-emotional-identity development as well as know-how and know-who; it should also include learning by groups and communities or organizations as well as by individuals.

Knowledge: *Knowledge that matters* is knowing how to take the next step, for which declarative knowledge is merely one subsidiary component and greatly over-emphasized in current assessment; *know-that* matters only insofar as it is mobilized as part of know-how; *know-how (cultural capital)* matters for career futures and social policy only when effectively combined with *know-who (social capital)*; the social networking aspects of relevant knowledge are under-emphasized in current assessment.

Know-how and other aspects of knowledge also need to be defined for groups and communities as well as for individuals. *Groups and communities always know more*, collectively, than any individual member, and collective intelligence and problem-solving skills, creativity, and innovation are also generally superior to what individuals are capable of.

Assessment: The production of knowledge useful for individuals, groups, and communities to improve practices toward valued goals; to be distinguished from evaluation.

Evaluation: Judgments made regarding how well goals are being achieved and how valuable the totality of all outcomes is.

Documentation: The collection of information useful for assessment, evaluation, and/or research.

Research: The production of knowledge useful for the design of activities and communities capable of reaching stated goals and with enhanced potential for producing valuable outcomes beyond stated goals.

Assessment, Evaluation and Research all build on Documentation, but may require different modes and foci of documentation. In more traditional terms, assessment aims at locating outcomes; and evaluation aims at judgments about effectiveness and directions for improvement; research aims at generalizable knowledge that may be used for future design.

Engagement: Affective involvement in and commitment to an activity, goal, practice, group, or community which enhances the quality and quantity of participation despite obstacles, setbacks, or frustrations; distinguished from Enjoyment.

Enjoyment: The positive feeling accompanying an activity that makes it worth doing for its own sake. Both *Engagement* and *Enjoyment* are important aspects of learning and should be documented in assessment, while recognizing that negative feelings may also play a significant role in engagement and in learning.

Agency: A term that has different meanings, including: actual effectiveness; a disposition toward taking action; a feeling of self-efficacy; or an aspect of one's identity as someone who can produce desired effects. All these

meanings are task- and/or role- and domain-specific, and also often group- or community-specific. The notion of agency also extends to what a group or community believes it can accomplish or can actually accomplish.

Outcome: Conventionally, a (sometimes naïve) attribution of a valued condition to some specific cause (e.g., to an intervention). Rarely, however, are valued learning goals the outcome of discrete, identifiable causes. Moreover, posited “outcomes” observed at some moment in time or over a short interval do not necessarily persist or ground further development. They are frequently transitory phenomena, artificially produced by the procedure used to “measure” them. We will instead use the term outcome to refer to *socially and personally valued, on-going processes which emerge in the milieu of some community and its activities*. Note that we regard evidence of learning-in-progress as equally important with evidence of completed or stabilized learning.

Unit of Analysis: What should be the unit in focus in assessment design? We believe that it should be a *system of activities and practices over time*, which includes the actions of individual learners, but also the roles of other participants, including mediating tools and semiotic media as well as local conditions directly relevant to and supportive of (or obstructing) the learning activities. The unit of analysis needs to be extended peripherally to wider contexts that make the learning activity possible institutionally, but with decreasing detail as their relevance to the specifics of learning trajectories decreases. Assessment at the level of individuals, groups, and whole projects are necessarily inter-dependent and assessment design needs to include all three and their relations to one another.

FOR THE COMPLETE TEXT, SEE:

<http://mitpress.mit.edu/books/documenting-and-assessing-learning-informal-and-media-rich-environments>