

Understanding the Needs of Student Users of Digital
Smithsonian Resources (vol. 7 of 7)

Technical Specifications for Future Development of the Smithsonian Learning Lab

Prepared for
The Smithsonian Center for Learning and Digital Access

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Smithsonian Center for
Learning and Digital Access



NAVIGATION NORTH



Smithsonian Center for Learning and Digital Access

The Smithsonian Center for Learning and Digital Access (SCLDA) uses all the Smithsonian offers to empower learners to explore their interests and collaborate with others to bring ideas to life. The organization creates models and methods that make the Smithsonian a Learning Laboratory for everyone. Guided by the Smithsonian's mission of the increase and diffusion of knowledge, SCLDA was established to re-imagine and ultimately reinvent the way students, teachers, and lifelong learners interact with and use the Smithsonian's resources in the 21st century. Recognizing most will never visit Smithsonian museums, SCLDA set out to identify how it might best enrich education by making Smithsonian experts and collections accessible to everyone regardless of where they live.

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Background

Since 2011, the Smithsonian Center for Learning and Digital Access (SCLDA) has strived to better understand and address the needs of educators utilizing digital assets through a variety of research and user testing studies that have led to the creation of a new digital learning platform, the Smithsonian Learning Lab (SLL)¹. The Smithsonian Learning Lab provides access to the digital resources from across the Smithsonian's 19 museums, 9 major research centers, and the National Zoo, to be used as real-world learning experiences. With a repository of over 1.6 million objects, and a new resource being digitized and added every 6 seconds, the Learning Lab provides specialized tools to aid in the discovery and creative use of its rich digital materials. For students using the Learning Lab, it is designed to aid in building lasting knowledge and critical skills that take learners from simply finding resources to thoughtful selection, examination, organization, and creation of new resources.

The SLL, as it currently exists, was largely informed by the input and practice of diverse and effective educators.² The goal of this larger research effort, *Understanding the Needs of Student Users of Digital Smithsonian Resources*, assimilates findings from variety of sources to address some key questions around methods or requirements for enhancing student motivation and engagement with digital content and tools.

1. What are the ways that students engage with digital content in academic settings?
2. What are the motivations for student use of digital content?
3. What are the interface requirements/scaffolds needed to enable and enhance student engagement with rich digital resources?

Informing the recommendations in this document are findings from the five components of this project:

- A Literature review of research, studies, and reports on the topic of digital learning trends and strategies for youth (Vol. 1)
- Environmental scans of both digital learning environments and social media platforms used by youth (Vols. 2–3)
- Analysis of existing usage data for Smithsonian Learning Lab users ages 13-17 (Vol 4.)
- Classroom testing and observations with youth across diverse school environments (Vols. 5–6)

¹ Milligan, D., and M. Wadman, M. 2015. "From Physical to Digital: Recent Research into the Discovery, Analysis . . ."

<<http://mw2015.museumsandtheweb.com/paper/from-physical-to-digital-recent-research-into-the-discovery-analysis-and-use-of-museums-resources-by-classroom-educators-and-students/>>

² "smithsonian-digital-learning - Teacher Toolkit (Research Findings)." 2013. 28 Sep. 2016

<[https://smithsonian-digital-learning.wikispaces.com/Teacher+Toolkit+\(Research+Findings\)](https://smithsonian-digital-learning.wikispaces.com/Teacher+Toolkit+(Research+Findings))>

Summary of Findings

The following information represents a compilation of findings from each of the above elements. These findings helped the project team to distill a series of features and strategies to test with students and determine potential areas for further development to the Smithsonian Learning Lab to support the needs of student users.

Literature Review

The Literature Review referenced over 100 pieces of research, case studies, reports, and journal articles. In reviewing the general trends that emerged from this review, the following represent a summary of key findings and strategies that have substantial research support.

- Learning flow is more consistent and more readily supports achievement when there is a high level of correlation or alignment between content, objects/resources, visual supports or media, and tasks to aid in persistence and minimize cognitive load.^{3,4}
- Developing and sustaining an online learning community focused on inquiry and learning is crucial in helping students access both their instructors and peers.⁵ Sharing their thinking, their findings, and their learning processes, and having access to those of their peers, helps validate work approach, keeps students engaged, and provides an opportunity to blend social, cognitive, and teaching dynamics.⁶
- Students' engagement and performance levels increase when quality content and activities are developed by a learner's own teacher.⁷
- Mutual problem-solving or co-development of learning products helps young students make more meaningful connections to their learning and to one another through the establishment of relationships focused on learning outcomes.⁸
- Presenting students with open-ended, deep, interesting questions and keeping those questions central and accessible to students throughout their inquiry process⁹ helps guide their progress through complex tasks online.¹⁰

³ Mayer, Richard E., and Richard B. Anderson. 1992. "The Instructive Animation: Helping Students Build Connections Between Words and Pictures in Multimedia Learning." *Journal of Educational Psychology*. 84.4: 444.

⁴ Moreno, Roxana, and Richard Mayer. 1999. "Cognitive Principles of Multimedia Learning: The Role of Modality and Contiguity." *Journal of Educational Psychology* 91.2: 358.

⁵ Ito, M. "Living and Learning with New Media - Digital Youth Research." 2008. <<http://digitalyouth.ischool.berkeley.edu/files/report/digitalyouth-WhitePaper.pdf>>

⁶ Higgins, S. 2012. "The Impact of Digital Technology on Learning." <[https://v1.educationendowmentfoundation.org.uk/uploads/pdf/The_Impact_of_Digital_Technologies_on_Learning_FULL_REPORT_\(2012\).pdf](https://v1.educationendowmentfoundation.org.uk/uploads/pdf/The_Impact_of_Digital_Technologies_on_Learning_FULL_REPORT_(2012).pdf)>

⁷ Squire, K. D., et al. 2003. "Designed Curriculum and Local Culture: Acknowledging the Primacy of Classroom Culture." *Sci. Ed*.

⁸ Marks, Ronald B., and Stanley D. Sibley and J. B. Arbaugh. 2005. "A Structural Equation Model of Predictors for Effective Online Learning." *Journal of Management Education* 29.4: 531-563.

⁹ Kapa, Esther. 2007. "Transfer from Structured to Open-Ended Problem Solving in a Computerized Metacognitive Environment." *Learning and Instruction* 17.6: 688-707.

¹⁰ Welch, Wayne W., et al. 1981. "The Role of Inquiry in Science Education: Analysis and Recommendations." *Science Education* 65.1: 33-50.

- Having timely feedback on performance,¹¹ from an instructor or even just in the form of external validation of task completion, serves as a key motivator and aids student persistence.¹²
- Students bring specific expectations to digitally-supported learning environments, including a desire to personally define how accessing and organizing resources and information works for them, flexibility in qualifying the expertise of their instructor and peers, and the freedom of individual demonstration of knowledge.¹³
- In the area of personal inquiry and progress monitoring,¹⁴ visual indicators that document a learner's progress towards completing online tasks and assist in monitoring that progress can help young students keep on track, stay motivated, and allow them to share their efforts.

¹¹ Winters, Fielding I., and Jeffrey A. Greene and Claudine M. Costich. 2008. "Self-Regulation of Learning Within Computer-Based Learning Environments: A Critical Analysis." *Educational Psychology Review* 20.4: 429-444.

¹² Wolters, Christopher A., and Paul R. Pintrich. 1998. "Contextual Differences in Student Motivation and Self-Regulated Learning in Mathematics, English, and Social Studies Classrooms." *Instructional Science* 26.1-2: 27-47.

¹³ Chung, Janine, and Felix B. Tan. 2004. "Antecedents of Perceived Playfulness: An Exploratory Study on User Acceptance of General Information-Searching Websites." *Information & Management* 41.7: 869-881.

¹⁴ Hattie, John, and Gregory C. R. Yates. 2013. *Visible Learning and the Science of How We Learn*. New York: Routledge.

Environmental Scans

Scan of Learning Tools and Platforms:

The system category receiving the most tools and development effort across all **Digital Learning** platforms reviewed were those directed towards **Resource Management** with the average system addressing 61% of the assessed features. Sub-elements within this category included:

- Resource Discovery
- Resource Selection
- Resource Sharing
- Resource Storing/Saving
- Resource Systems Integration/Interoperability

*Subsequently, **Learner Management** tools and features were also significant with the average system addressing 60.9% of the assessed features.*

Scan of Social Media Platforms:

The system category receiving the most tools and development effort across all **Social-Media** platforms reviewed were those directed towards **Community Collaboration Tools** with the average system addressing **49.6%** of the assessed features. Sub-elements within this category included:

- Group Tools
- Discussion Tools
- Communication Tools
- User Activity Management Tools

Classroom Observations and Prototyping

Student-Use Trends That Were Supported During Observations:

- + Majority of students made use of digital note-taking tools when available. (Chico cohort)
- + Majority of students preferred in-system questions and guidance instead of paper-based worksheet when both were available. (Chico cohort)
- + Majority of students were able to set up personal accounts to record information and submit to teacher when made available. (Chico cohort)
- + Data suggested that the overall engagement was higher if activities were based on student- or teacher-created SLL collections. (Pittsburgh cohort)
- + Students' overall engagement was higher when completing an activity by using different means than the SLL (Pittsburgh cohort)

Student-Use Trends That Went Unsupported During Observations:

- Majority of students DID NOT opt to work collaboratively when allowed.
- Majority of students DID NOT take advantage of reviewing peers responses or contributions when provided access.

Student-Use Trends That Were Inconclusive During Observations:

Students use of progress monitoring for self-tracking and/or as visual indicator to others was not effectively tested. Additionally the duration of the tasks were not sufficient to model use-cases found in the Literature Review in which students were engaged in projects that spanned multiple class periods or multiple weeks of sustained coursework.

Proposed Technical Development

The following tables present key findings from four separate instruments that made up the *Understanding the Needs of Student Users of Digital Smithsonian Resources* project. Information includes the specific finding, the instrument(s) that supported the finding, and proposed development to improve the Learning Lab for young learners. While any one instrument might have generated a number of other findings, those reported below represent elements that could feasibly be addressed through increased features, new tool development, or design enhancements to the platform.

Summary of findings, features, or strategies to improve youth engagement with Learning Lab	Lit. Review	Env. Scan	Student Testing/Obsv.	User Data Analysis
Finding 1: Young learners expect navigation, search and discovery to require minimal effort, and a system that can anticipate search terms and provide quality results or related suggestions.	X		X	X
Proposed Development: <ul style="list-style-type: none"> ❑ Enable predictive text that anticipates learner’s search terms. Use predictive text feature to also aid in auto-correction of spelling of search terms. ❑ When resulting resources/collections are limited, provided related resources/collections based on similar searches and/or metadata correlations. ❑ An analysis could be performed to consider if the search filters for both resources and collections should be modified to better align with terminology more accessible for young learners. 				

Summary of findings, features, or strategies to improve youth engagement with Learning Lab	Lit. Review	Env. Scan	Student Testing/Obsv.	User Data Analysis
Finding 2: Young learners remain more engaged and persistent in completing online learning content when their progress is acknowledged and visual indicators track completion of certain benchmarks within the learning content.	X	X		
Proposed Development: <ul style="list-style-type: none"> ❑ Create an automated in-system tracking layer applied to Learning Collections that provides the learner a visual indicator of their progress as incremental steps connected to the number of resources within a given Learning Collection or some other related metric. ❑ An additional approach or feature could be to allow an educator to prescribe their own benchmarks at either the Learning Collection or Assignment level to validate learner’s progress in configurations more uniquely tied to the learning design as opposed to merely tied numerically to number of resources within a collection.(ie, number of questions accomplished) <p><i>*Would be important to tie this feature to assignments so that differentiated benchmarks and progress indicators could be applied to different learner audiences as Assignments generated from a single master Learning Collection.</i></p>				

Summary of findings, features, or strategies to improve youth engagement with Learning Lab	Lit. Review	Env. Scan	Student Testing/Obsv.	User Data Analysis
Finding 3: Young learners benefit from receiving regular feedback on tasks and contributions they complete within their online learning environments from their educators, peers, or other members of the learning community.	X	X	X	
Proposed Development: <ul style="list-style-type: none"> ❑ Develop a feature that allows educators or designers to create follow-up responses to given questions that will automatically appear to learners upon submission of their own answers. Responses can obviously be additional guidance for wrong answers on T/F or Multiple Choice or acknowledgement of correct answers. For open response questions, feedback can take the form of an expected response or key items/concepts the educator was hoping to capture so the learner can self-reflect on proximity to the desired response. ❑ Create a feature that ties into progress monitoring* that allows an educator or designer to create and include feedback to a learner when various completion points or benchmarks are reached within the learning collection. ❑ Provide a feature that allows educators to comment upon given learner responses to questions when reviewing and a means for learners to receive those comments. <i>*Can be constructed as an aligned element to Progress Monitoring solutions identified in Finding 2 above.</i>				

Summary of findings, features, or strategies to improve youth engagement with Learning Lab	Lit. Review	Env. Scan	Student Testing/Obsv.	User Data Analysis
Finding 4: Young learners benefit when provided the means to annotate or record notes that document their thinking, findings, and questions when engaging learning content.	X	X	X	
Proposed Development: <ul style="list-style-type: none"> ❑ Develop a feature that provides learners a persistent note-taking utility that can carry guiding questions posed by the learning collection or teacher, provides a space to type or copy content related to their thinking/learning/discoveries while accessing multiple resources both within and beyond the Learning Lab (externally linked resources). ❑ Preferably, learners could elect to make all or parts of their documentation private or shared to peers, community, or teacher. 				

Summary of findings, features, or strategies to improve	Lit.	Env.	Student	User Data
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youth engagement with Learning Lab	Review	Scan	Testing/Obsv.	Analysis
Finding 5: Young learners, given opportunities to engage their peers in collaborative discovery and shared findings, are more engaged in extended reflection on their own thinking and conclusions.	X	X		
Proposed Development: <ul style="list-style-type: none"> <input type="checkbox"/> Develop features that allow learners to select peers as collaborative partners for note-taking, collection assembly and authoring, or in answering questions and completing assignments. <input type="checkbox"/> Develop features that allow an educator or designer to optionally activate questions that can be addressed by teams of students. <input type="checkbox"/> Develop a feature that allows an educator or designer the option of exposing learners to the responses of their peers to a given question before or after submitting their own response. 				

Summary of findings, features, or strategies to improve youth engagement with Learning Lab	Lit. Review	Env. Scan	Student Testing/Obsv.	User Data Analysis
Finding 6: Young learners can more readily engage in self-regulated learning and show increased performance on tasks when content, tools, and inquiry are closely aligned to minimize transactional distance.	X		X	
Proposed Development: <ul style="list-style-type: none"> <input type="checkbox"/> While the Learning Lab has taken initial design steps to align guiding questions and annotations visually with the primary learning resources, additional analysis should be performed to look for further improvements. <input type="checkbox"/> Consider solutions that would allow learners persistent access to guiding questions and the means to respond or note-take when visiting external resources. Tools that travel with a learner when accessing an external resource, or that allow a learner or educator to pull key content or media from an external resources back into the digital learning environment could be considered. 				