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# ***Connected Science Learning: Linking In-School and Out-of-School STEM Educators*** Formative Evaluation Report

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National Science Teachers Association (NSTA) and  
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## Executive Summary

This report details the formative evaluation study conducted through collaboration with the National Science Teachers Association (NSTA) and the Association of Science-Technology Centers (ASTC) to inform the iterative development and piloting of the *Connected Science Learning: Connecting In-School and Out-of-School STEM Learning* journal. The journal was the result of an Early Concept Grant for Exploratory Research (EAGER) project funded by the National Science Foundation (NSF) to develop, disseminate and evaluate a new resource for connecting STEM education practitioners across settings and to the teaching and learning knowledge base. The study reported here focused on the following evaluation questions:

1. To what extent is the target audience aware of the *CSL* journal and the launch of the first pilot issue?
2. Overall, how satisfied is the target audience with the *CSL* journal and first pilot issue?
3. What do target audiences perceive as the potential value of the *CSL* journal?
4. What aspects of the *CSL* journal and first pilot issue were particularly successful and why?
5. How could the *CSL* journal be improved to better meet the needs and expectations of the target audiences?

The study used a mixed methods approach that included the following complementary data collection activities: A national survey, site embedded article surveys, focus groups conducted at professional conferences, think aloud interviews, and phone interviews with article contributors and peer reviewers.

We noted the following key findings synthesized from the data we collected:

- The journal has demonstrated initial success in reaching a range of STEM education professionals who work across varied settings;
- Overall, STEM education professionals had highly positive impressions of the journal and the pilot issue, suggesting the journal was well-received by the target audience;
- STEM education professionals noted the potential value of the journal, most notably that it fills a current void in the field by featuring education projects and partnerships that span traditional education boundaries;
- The journal has demonstrated the potential for creating connections and collaborative opportunities for STEM education professionals across settings;
- While STEM education professionals were highly satisfied with the journal and the pilot issue, they offered recommendations for refining and improving future issues of the journal;
- The STEM education professionals also offered additional suggestions for extending the reach of the journal and further facilitating connections across settings.

The feedback provided from participants of the formative evaluation study should inform improvements to the journal website and should be considered when developing and disseminating future issues.

## Introduction

While there is a wealth of research-based knowledge in STEM education, there is currently no easily accessible, user-friendly resource for practitioners that connects in-school and out-of-school education settings. With this need in mind, the National Science Teachers Association (NSTA), in collaboration with the Association of Science-Technology Centers (ASTC), applied for and was awarded a National Science Foundation (NSF) Early-concept Grant for Exploratory Research (EAGER). Through the initiative, the NSTA and ASTC would develop, disseminate and evaluate a new resource for STEM<sup>1</sup> education practitioners in both in-school and out-of-school settings.

The project aimed to:

- Understand the landscape of resources currently available to STEM education practitioners in a variety of settings;
- Identify existing gaps in the current pool of resources available to STEM education practitioners;
- Pilot a resource that connects STEM education professionals across settings and to the growing research and knowledge base about STEM teaching and learning; and
- Conduct an ongoing, iterative evaluation study that informs the development of the new resource as well as the resulting outcomes and impact on the field.

Ultimately, the goal of the project was to develop a resource for STEM education professionals that features highly effective programs and shares research that connects preK-12 STEM learning in schools and out-of-school settings, specifically highlighting successful mechanisms for collaboration.

Grant related activities to date included the assembly of an advisory board and completion of the initial phase of the project. This first phase of the project involved conducting a needs assessment and front-end evaluation study which determined there was a gap where the proposed resource could contribute and the target audiences were most interested in an online, peer reviewed journal. The findings of the front-end evaluation were used to inform the development of the online journal and the first pilot issue of *Connected Science Learning: Linking In-School and Out-of-School STEM Learning (CSL)*.

To assist the NSTA and ASTC in considering how to improve the journal to more effectively meet the needs of target audiences – STEM education professionals – we conducted a formative evaluation around the launch of the journal and first pilot issue. The formative evaluation was conducted in parallel to ongoing revisions and updates to the *CSL* website to allow for an iterative design. The evaluator worked closely with the project leadership at NSTA and ASTC to provide formative feedback during the piloting phase through informal reporting of findings during bi-weekly project team meetings. This report presents an overall synthesis of the formative study findings and offers recommendations to inform the design of the second pilot issue of *CSL* and improvements to the journal website.

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<sup>1</sup> For the purposes of this study, we use the term STEM education professionals rather than science educator because our study participants included educators who taught a range of STEM content areas (e.g., mathematics educators, engineering educators). While there have been ongoing discussions in our field about what constitutes STEM, in this study we refer to a STEM educator as any professional engaged in one of the STEM content areas.

## **STEM Learning Ecologies**

The project and associated evaluation study are informed by current thinking in the STEM education field around the notion of STEM learning ecologies. Ecologic perspectives consider learning as ongoing and distributed across settings, including contexts and opportunities that extend beyond traditional schooling, as well as across social groups and extending over time. In a report summarizing the “*STEM Learning is Everywhere*” convening, the National Research Council (NRC) offered the following definition: “A STEM learning ecosystem encompasses schools, community settings such as afterschool and summer programs, science centers and museums, and informal experiences at home and in a variety of environments” (2014, p. 17). In this view, learning takes place across varied physical, social and cultural contexts (Bevan, 2016).

Ecological views of STEM learning create a need for linking contexts to facilitate learning experiences that transcend traditional boundaries. Alongside the notion of STEM learning ecologies are calls for building community capacity in the STEM education field for creating and expanding learning ecosystems. However, the NRC (2014) report notes that while there is great potential for and interest in STEM learning ecosystems across the country, one barrier is that “people from one sector often do not know the people or organizations from other sectors” (p. 17). This grant-funded initiative and the resulting *CSL* journal aims to foster synergistic connections across learning contexts by linking STEM educators from in-school and out-of-school settings and sharing examples of successful partnerships. A key assumption of the project is that the *CSL* journal can serve as a mechanism for connecting educators across settings and providing models of successful collaborations and partnerships for supporting STEM Learning.

## **Evaluation Questions**

The formative evaluation study was designed to gain insight in to how the launch of the *CSL* journal and first pilot issue was perceived by target audiences in an effort to assist the project leadership in making data-driven decisions for revisions and improvements. Specifically, the formative evaluation study focused on the following questions:

1. To what extent is the target audience aware of the *CSL* journal and the launch of the first pilot issue?
2. Overall, how satisfied is the target audience with the *CSL* journal and first pilot issue?
3. What do target audiences perceive as the potential value of the *CSL* journal?
4. What aspects of the *CSL* journal and first pilot issue were particularly successful and why?
5. How could the *CSL* journal be improved to better meet the needs and expectations of the target audiences?

## **Methods**

The overall project and evaluation study has been framed by a logic model (Appendix A) that outlines the project inputs, activities and anticipated outcomes. The formative evaluation study aimed to document the quality of the project activities and outputs by measuring the target audiences’ satisfaction with the pilot issue of the journal. Moreover, the formative evaluation study sought to synthesize target audiences’ recommendations for improving the *CSL* journal and associated website.

We used a multiple methodology approach (Smith, 2006) to implement the evaluation study, in alignment with the recommendations detailed in the Common Guidelines for Education Research and Development (Common Guidelines for Education Research and Development, 2013). Specifically, the formative evaluation study consisted of design and development research using a convergent parallel mixed methods design (Creswell, 2013). Using this methodological approach, complementary data were collected using both quantitative and qualitative data collection efforts to gain insight to the overarching summative evaluation questions. Quantitative and qualitative data collection occurred concurrently and were used to confirm and corroborate the study findings.

### **Data Collection**

As part of the formative data collection efforts, the evaluator worked closely with the project leadership from NSTA and ASTC to provide iterative feedback from the target audiences during the launch of the pilot issue and as the website was updated and improved. The ongoing data collection aided the project leadership in making data-driven decisions for making changes to the website, in alignment with the target audiences' input and feedback.

We used the following evaluation data collection methods:

- A national, formative survey administered to target audiences through relevant professional organizations (e.g., NSTA, ASTC, NARST, AZA);
- Brief article surveys embedded on the *CSL* journal website;
- Focus groups at professional conference (AZA, NSTA, NARST);
- Think aloud protocol;
- Phone interviews with article contributors and peer reviewers of the pilot issue;

Each of these methods is described in more detail below.

**National Survey.** To gather input and feedback from the target audiences, we administered a national, online survey with STEM education professionals. The survey was developed in collaboration with NSTA and ASTC with questions aimed at collecting respondents' demographic data, satisfaction with the pilot issue and the journal website, recommendations for improvement as well as the potential value of the *CSL* journal. The survey was administered via the online application, SurveyMonkey, and included both Likert-scale items as well as open-ended questions. A link to the survey was emailed to individuals who had registered to receive updates about the *CSL* journal through NSTA and ASTC. Additionally, we sent out emails via the following relevant professional organizations with an invitation to respond to the survey:

- NSTA
- ASTC
- NARST
- National Marine Educators Association (NMEA)
- Association of Zoos and Aquariums (AZA)

**Site Embedded Surveys.** Brief surveys were also embedded on the *CSL* website to collect feedback related to specific articles in the first pilot issue. The article surveys included four short questions: three Likert-scale items asking respondents to rate various aspects of the article and a question that prompted respondents to provide open-ended feedback. A button with

a link to each respective survey was included on the page for each article in the pilot issue. However, the site embedded surveys had too few respondents to report on in this study.

**Focus Groups.** We conducted a series of five focus group discussions in conjunction with conferences of professional organizations engaged in STEM education. We conducted focus groups at these conferences to capitalize on a convening of members from the target audiences. In the fall of 2015, we conducted two focus groups at the AZA conferences to test some preliminary ideas ahead of the launch of the *CSL* journal and dissemination of the pilot issue. For example, we used the discussion facilitated at the AZA conference to collect initial reactions and feedback related to the journal title, *Connected Science Learning*. From the feedback that resulted from this focus group, we decided to include the sub-title, *Linking In-School and Out-of-School STEM Education*, to further clarify the aim and intent of the journal. Following the launch of the journal and pilot issue in spring of 2016, we also conducted two additional focus groups at NSTA (March 2016) and one at NARST (April 2016). These focus groups were designed to collect feedback about the pilot issue and suggestions for future improvements.

**Think-aloud Protocol.** For usability testing, we implemented a think-aloud protocol with five individuals who represented the target audience. Usability studies are designed and administered to understand the experience of a visitor to the website and to make recommendations for enhancing the website. The think-aloud provided data regarding visitors' interactions on the *CSL* website to understand the user experience. The think-aloud strategy asks participants to verbalize their thoughts and actions while they engage with the website and complete a series of pre-determined tasks. As participants think-aloud and complete the identified tasks, the evaluator observed how they interacted with the website, noting behaviors such as navigation and path through the *CSL* website and length of time to complete the tasks. We conducted the think-aloud interviews iteratively as changes and improvement were made to the website.

**Interviews with Contributors and Peer Reviewers.** Phone interviews were conducted with a randomly drawn sample of the contributors and peer reviewers from the pilot issue to gather feedback about the submission and review process. We used a semi-structured interview protocol that consisted of questions designed to elicit input and suggestions regarding the *CSL* contribution submission and peer review processes.

## Study Participants

The formative study included 305 respondents to the national survey, 43 participants in the focus group discussions, 5 participants in the think-aloud interviews, and 7 participants in the phone interviews with contributors and peer reviewers. For each data collection effort, we collected limited demographic information to understand the audience contributing feedback, particularly with regard to the settings in which they work.

**National Survey.** The survey contained a number of items designed to collect demographic information from respondents. For example, survey respondents were asked to indicate the number of years they have been involved as a professional in the STEM education field. The findings of this item suggests that participants had a range of experiences in the field (n=271):

- 9.6% (n=26) had 0-2 years of experience;
- 10.7% (n=29) had 3-5 years of experience;

- 18.5% (n=50) had 6-10 years of experience;
- 20.3% (n=55) had 11-15 years of experience;
- 12.2% (n=33) had 16-20 years of experience; and
- 28.8% (n=78) had more than 20 years of experience in the field.

Another question revealed that survey participants came from a variety of education settings including school-based settings, out-of-school settings, colleges/universities, and other education settings (e.g., government agencies, consulting firms). Findings from this question are presented in Table 1.

**Table 1. Education Settings**

(n=304)		# of Responses	% of Responses
<b>Formal, School-Based Education Professionals</b>	PreK-12 Classroom Teacher	n=84	27.6%
	District Science Coordinator	n=10	3.3%
	School or District Administrator	n=6	2.0%
	Instructional Coach or Professional Development Specialist	n=23	7.6%
	Curriculum Developer	n=31	10.2%
<b>Informal, Out-of-School Education Professionals</b>	Educator at a Museum or Museum-like Setting	n=50	16.5%
	Educator at a Zoo, Aquarium, Garden or Park	n=13	4.3%
	Community or Program Educator	n=34	11.2%
	Member of the Media	n=1	0.3%
<b>College/University Professionals</b>	College/University Faculty Member	n=89	29.3%
	College/University Staff	n=30	9.9%
	College/University Student	n=20	6.6%
<b>Other Education Professionals</b>	Government Agency Employee in Education	n=4	1.3%
	Business/Industry Professional in Education	n=5	1.6%
	Independent Consultant or Evaluator/Researcher	n=23	7.6%

\*Respondents could select more than one option.

In addition, participants represented a number of STEM education professional organizations or groups. We asked participants to indicate the top three organizations or groups with which they were engaged. Table 2 displays the organizations that survey respondents identified as the top three with which they are the most engaged.

**Table 2: Top Professional Organizations or Groups**

What are the top three professional organizations or groups in the STEM education field with which you are the most engaged? (n=265)					
#1 (n=265)		#2 (n=242)		#3 (n=198)	
National Science Teachers Association	40.0% n=106	National Science Teachers Association	19.0% n=46	National Science Teachers Association	16.7% n=33
NARST	10.9% n=29	Association for Science Teacher Education	8.7% n=21	Association for Science Teacher Education	5.6% n=11
Association of Science-Technology Centers	8.7% n=23	NARST	8.3% n=20	NARST	5.1% n=10
Association for Science Teacher Education	7.2% n=19	Association of Science-Technology Centers	2.9% n=7	American Educational Research Association	3.0% n=6
American Association of Physics Teachers	0.4% n=4	National Association of Biology Teachers	2.9% n=7	Association of Science-Technology Centers	2.5% n=5

Finally, the survey respondents indicated their highest level of education and the findings from this item are displayed in Table 3. Overall, there was a high percentage of respondents with advanced degrees which may be a result of a biased sample on the national survey. As a result, the findings of the national survey may not fully represent the target audiences' reaction to the first pilot issue. Despite this potential limitation, the feedback on the survey was generally positive and offered feedback for refining and improving future issues.

**Table 3: Survey Respondents' Highest Level of Education (n=271)**

College Degree	Graduate Degree	Doctorate Degree
12.6%	46.1%	40.2%
n=34	n=125	n=109

**Focus Group Participants.** The five focus group discussions included a total of 43 participants across a range of STEM education settings who were attending either the AZA, NSTA or NARST annual conferences. We conducted the focus group discussions in conjunction with these conferences to take advantage of a convening of professionals to ensure we had representations across a wide-spectrum of STEM education professionals. Across the focus group discussions, we had a total of 3 researchers, 13 school-based educators, and 27 informal, out-of-school educators.

**Think Aloud Participants.** We conducted think aloud interviews with a total of five participants. The think aloud interviews included the perspectives of two researchers, one school-based educator, and two informal, out-of-school educators.

**Interview Participants.** Phone interviews were conducted with a total of seven participants. Four of the participants were article contributors; three were from science museum settings and one was from a zoo/aquarium setting. There were also three peer reviewers include in the phone interview data collection activities. One was from a science center, another was a university faculty member and the final reviewer was an employee of a STEM education professional organization.

### **Data Analysis and Interpretation**

The quantitative data from the national survey were entered into the statistical software, SPSS, to generate descriptive and inferential statistics, as appropriate. The qualitative data from the focus groups, think-aloud interviews, and open-ended survey items were analyzed within the rigors of qualitative research. We used an inductive coding process to identify emergent themes. As we identified preliminary themes, they were checked against the data to look for confirming and disconfirming evidence to support our claims and assertions.

### **Study Limitations**

Although we made a concerted effort to broadly distribute the national survey through our partner organizations, there was a lower response rate as compared to the nationally distributed survey for the project's front-end study. This lower return rate, along with the high representation of respondents with advanced degrees, might have introduced a sample bias on the survey. In addition, due to the targeted recruitment efforts for the qualitative data collection efforts, the study was not designed to generalize the results. Ultimately, the study aimed to better

understand the successes of the first pilot issue and inform the continued refinement of the journal website and future journal issues.

## Study Findings

This section describes the results of the formative evaluation study, organized by each of the evaluation questions. As appropriate, the findings are further organized by each of themes that emerged from our analysis of the data related to each of these study questions.

### STEM Education Professionals' Awareness of the Journal

At the time they completed the national survey, 34.2% (n=93) of the respondents were aware of the new journal: *Connected Science Learning: Linking In-School and Out-of-School STEM Learning*. This suggests that efforts to advertise the journal prior to the launch of the first issue reached some STEM education audiences, primarily through the following strategies that were noted by respondents:

- NSTA e-newsletter (32.3%, n=30);
- Professional conferences including NSTA, ASTC, NARST and ASTE (19.4%, n=18);
- ASTC *Informer* email new bulletin (17.2%, n=18);
- NSTA website (17.2%, n=18);
- Email listserv (16.1%, n=15);
- From a colleague (15.1%, n=14);
- ASTC *Dimensions* journal (12.9%, n=12);
- ASTC website (8.6%, n=8);
- NSTA journals (5.4%, n=5); and
- Twitter (3.2%, n=3).

Based on the findings from the national survey, the NSTA e-newsletter, professional conferences, and ASTC's *Informer* email news bulletin were the most effective strategies for advertising the launch of the journal and first pilot issue.

The website analytic data further substantiates this assertion. As Figure 1 demonstrates, there were spikes in the number of sessions on the website associated with the following:

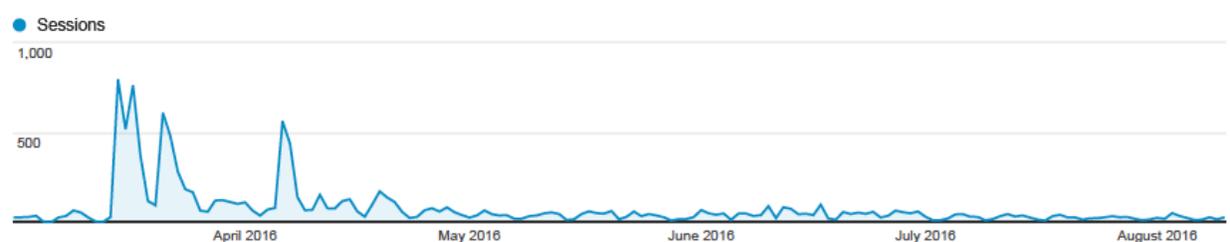
- The launch of the website and associated email announcements from NSTA and ASTC on March 15<sup>th</sup>;
- A mention in the NSTA press e-newsletter on March 21<sup>st</sup>;
- A feature in the April 6<sup>th</sup> edition of the NSTA Science and the STEM Classroom e-newsletter;
- Announcements at the NSTA and NARST conferences from March 31-April 3 and April 13-17, respectively;
- An email reminder to complete the formative survey on April 18<sup>th</sup>;

## Figure 1: CSL Website Analytics

March 8<sup>th</sup>-April 31<sup>st</sup>, 2016



March-August, 2016



While these strategies to announce the pilot issue of *CSL* have been effective, the data trends since May suggest a need for ongoing, continued marketing efforts to ensure a broader reach of the journal.

At the time of the survey, only 26.1% (n=71) of the respondents were subscribed to receive the journal. Of those who indicated they had subscribed to the journal, 60.6% (n=43) subscribed through NSTA, 21.1% (n=15) subscribed through ASTC and 2.8% (n=2) had subscribed through both organizations. We asked those who had not yet subscribed to indicate their reasons and most were not aware that they could subscribe (84.6%, n=110) and/or did not know where to subscribe to receive the journal (26.2%, n=34).

### STEM Education Professionals' Satisfaction with the Journal

To understand STEM education professionals' overall impressions of the journal, we asked a number of questions on the survey as well as during the think aloud interviews and focus groups discussions.

The findings from the survey offered evidence to conclude that our target audience — STEM education professionals — were overall very satisfied with the inaugural issue. On the survey, respondents were asked to provide their ratings of the journal on a scale from one to seven. The findings from the survey indicated respondents were highly satisfied with the first issue of *CSL* (mean score = 5.6/7.0, n=102) and very likely to recommend the journal to a colleague (mean score = 5.7/7.0, n=100). Moreover, respondents indicated they were very likely to continue following the journal as new issues and articles are released (mean score = 5.6/7.0, n=267). The following are illustrative comments offered by survey respondents when prompted to elaborate on their overall ratings of the journal:

*The articles seem to be more related to my work than articles you typically find in teaching journals.*

*This is EXACTLY the type of resource/information that I am seeking to help me develop my programs and business.*

*This is a needed topic (connecting informal and formal education). I appreciate the new venue for publishing articles and that the articles are written to be accessible and useful to a wide audience of practitioners and researchers.*

*It is nice to see articles and shared practice involving the interrelationships between formal and informal education settings.*

*The website was easy to navigate and the articles were well written and intriguing.*

*I only read a few of the articles, but I was impressed with them and satisfied with the content. I live in Denver, and it was great to read about how schools in Denver are integrating STEM and working with partners in the community to advance STEM education for students, while focusing on ideas for teachers.*

*I really enjoyed the first issue, and could not stop until I read it completely.*

Participants in the focus groups echoed these ideas. During the discussions, participants noted that they were excited about the concept of the journal and especially that CSL covered a variety of perspectives and from across a broad range of locations. The STEM education professionals who participated in the focus groups explained that the diversity of topics and locations of programs featured meant that there was “*something for everyone*” (NSTA focus group).

The participants also noted that the journal “didn’t feel too academic” and was accessibly written for all STEM education professionals. For example, participants explained:

*It seems quite engaging...it’s very easy to see something you want to read. So, it felt like it wasn’t a heavy kind of journal where you instantly saw it and thought, ‘how long is it going to take to read the article?’ (NSTA focus group).*

*As a professional, they [educators] need to be up on current research...it [the CSL journal] helps to translate the research for them. And sometimes research is written so high, that that’s why they don’t want to do it. That language, is not the educational language they’re used to. But I appreciated that this is not a journal that panders to the lowest common denominator. It doesn’t pander. And that’s the thing. There’s that sweet spot in between the two and I think this [the CSL journal] captured that sweet spot. (NSTA focus group)*

Further, participants in our data collection efforts found the format and layout of the journal to be novel and engaging. As one participant in the NSTA focus group commented, “*My first impression was I liked the look. It seems very easy to just start reading and get in to.*” This was also mentioned in the NARST focus group as a participant commended the use images to engage readers, “*I liked the use of images a lot in it. It made it more engaging to just look through the pictures and get a sense of what the articles were about and to think about what would be of interest to pursue further. And I haven’t seen anything really like that when I’ve looked at a journal website before and it was refreshing to see it laid out in a different way*” (NARST focus group). When prompted, survey respondents also suggested that they were highly satisfied with the online format of the journal (mean score = 5.8/7.0, n=84). Focus group participants provided

more details regarding the format, describing that they were especially pleased with the online journal because “it is convenient,” will make “finding past articles easier” in the future, and will have “less impact on the environment” (NSTA focus groups).

Comparing across the data collection strategies, there was compelling evidence to conclude that STEM education professionals overall were highly satisfied with the journal and inaugural issue. These participants in our data collection efforts generally found the journal engaging, accessible, and novel.

### **The Potential Value of the *CSL* Journal**

The evaluation study aimed to assess the potential value of the *CSL* journal as perceived by STEM education professionals. For example, we asked an open-question on the survey that prompted respondents to consider the journals’ potential value and impact on the STEM education field. Our focus group guide also included a question designed to elucidate participants’ perceptions of the journal’s value. The following themes related to the potential value of the journal emerged from our analysis of the data: offers practical application of STEM education research, addresses a current need in the STEM education field, acts as a potential mechanism for connecting STEM educators, and provides a voice to informal STEM educators. Each of these themes is expanded on more fully in the following sections.

**Offers Practical Applications of STEM Education Research.** One potential benefit of the *CSL* journal is that it offers exemplary models of applying research to practice. The following are comments regarding the potential value of the journal that support this theme:

*The journal offers a blend of research and practice for an emergent area of practice in science education.* (National Survey)

*It is one more accessible resource for practitioners that may not have the ability or means to gain some of this knowledge via higher education, larger institutions or networking via conferences.* (National Survey)

*A value of the journal is to promote the importance of research to practice, highlighting that research is not for its own sake. Rather, research can and should be designed with a real life, immediate application in mind.* (National Survey)

*I think that writing this from a teacher’s perspective, clearly, there are teachers that have been involved in developing this because it really does speak to what teachers need and not just what researchers wanted to say.* (NSTA focus group)

In particular STEM education practitioners were pleased to see a publication that provided practical applications of research in ways that were accessible and easily relatable. Moreover, researchers noted that they appreciated the emphasis of the journal on using research to inform practice.

**Addresses a Current Need in the STEM Education Field.** Another added value of the journal noted among the participants was that the journal addresses a current need and fills a niche in the field. The following comments from the survey, focus groups, and interviews exemplify this theme:

*I think this is a really important thing for the field. I think in-school and out-of-school collaborations are timely and topical and important. I think that’s all a good thing. I love that this journal exists, I love that it’s out there and is addressing that.* (Author interview)

*I found [the journal] very attractive, inviting and the articles I read inspiring! It certainly seems to fill a niche. (NSTA focus group)*

*I think it's filling a niche where examples of research or collaborations that are happening that don't fit into [a typical category] like 'this is a high school, formal or this is a museum,' but there's a lot of cross-connecting stuff that is happening and I think [CSL] is filling that niche. (NARST focus group)*

*There [are] very few places to publish work that goes across formal and informal science education and this will be helpful for disseminating findings that bridge these areas. (National survey)*

*Its focus on connections between formal and informal environments is a key difference and the value added of the journal. (National survey)*

As reflected in the comments, STEM education professionals thought the journal filled a niche specifically because there was no similar resource (at the time of the journal launch) to the *CSL* journal that featured partnerships and collaborations across education settings.

**Potential Mechanism for Connecting STEM Educators.** The STEM education professionals also identified that the journal had added value by offering a potential mechanism for connecting STEM educators across the learning ecosystem. For example:

*I hope to be connected through the journal with other informal learning sites and more relevant formal educational partners. (National survey)*

*It has the potential of making connections. (National survey)*

*It has value in helping form connections between education communities and researchers. (National survey)*

*I think [the journal] is important for demonstrating and showcasing how and why the intersection of informal with formal is critical, as well as how and why museums are poised to do this work with the formal system. (National survey)*

*The potential collaboration between formal and informal education providers is a value [of the journal]. (National survey)*

While there has been limited evidence of these connections happening to date (all of the data collection activities occurred within three months of the journal launch) it is important to note that the target audience perceived this as a potential value added by the *CSL* journal.

**Provides a Voice to Out-of-School STEM Educators.** And, finally, out-of-school STEM educators in particular believed that a potential value of the journal was to give them a voice for participating in the national conversation regarding STEM education. The out-of-school STEM educators who participated in the evaluation described:

*I'm excited that the importance of informal STEM education finally gets a journal! (National survey)*

*This offers potential for contribution and an opportunity for informal educators to be an active voice in this exciting, growing field (National survey)*

*The journal provides more visibility for free-choice learning. (National survey)*

*I love the focus on informal STEM education. I feel like our value is often overlooked in favor of formal education when we have a lot to offer as science educators. (National survey)*

*It verified the work that we are doing as [informal educators.] (NSTA focus group)*

These illustrative comments offer promising evidence and demonstrate the potential of the journal for empowering out-of-school educators by giving them a space to share their work and a way to engage in broader conversations around STEM education.

### **Successful Aspects of the Inaugural Issue**

Through the formative evaluation efforts, we also wanted to gain insight regarding what aspects of the inaugural issue were particularly successful to build off of these strengths in future issues. All of the data collection activities prompted study participants to identify the particularly successful aspects of the first issue of *CSL*. For instance, the focus group discussion guide included a question that asked, “*What do you believe are the strengths of the journal and the inaugural issue?*” In a parallel fashion, the interview protocol asked contributors and peer reviewers to identify particular strengths of the *CSL* publication and peer review process.

The following are the key strengths of the journal and inaugural issue that emerged across the data we collected:

- Visual aesthetics of the journal issue and website;
- Positive website user experience;
- Article topics and quality;

Each of these themes are further explored in the next section.

**Journal and Website Aesthetics.** The input across all of the data collection strategies suggested that the inaugural issue was visually appealing which STEM education professionals viewed as a key strength of the *CSL* journal and website. On the national survey, respondents were asked to rate on a scale from 1 to 7 their satisfaction with the look and design of the journal website. The responses indicated that STEM education professionals who responded to the survey were highly satisfied with the look and design of the *CSL* journal (mean score 5.8/7.0, n=85). When prompted to elaborate on the rating, one respondent noted, “*The layout [of CSL] and graphics are appealing.*” Another respondent commented, “*It is a very polished journal, and appeals to professional teachers. I would recommend to others based on the quality of the issue.*” An additional survey questions prompted respondents to indicate their satisfaction with the journal logo design, using the same satisfaction scale. Overall, respondents were very satisfied with the *CSL* logo (mean score = 5.9/7.0, n=82).

We used the feedback from participants in the focus groups and think aloud interviews to complement the data from the survey. The following illustrative quotes made during the focus groups and think aloud interviews build on this finding from the survey:

*I like how simple this is at top [of the home page...you know websites tend to be little messy and it's definitely easy to navigate...it's not too cluttered, yeah, it's more of a simple design. (Think aloud interview)*

*[The CSL website] looks nice. Like, it doesn't look like how some websites look. Like, it's beautiful. (Think aloud interview)*

*[The website] is very clean, well-organized...I really like that it's a very clear, white background. I don't have to worry about colors in the back making reading the text a little more difficult. There is some nice use of color even within the presentation [of the journal]. Issue one is highlighted with the blue, the blue bars marking figures has been fine. If I was scrolling through it helps to identify that area very quickly. (Think aloud interview)*

*I thought the website was super clean. (NSTA focus group)*

*I did find the website very clean. I do remember when I first opened it liking it. It didn't seem too busy and I liked the white background, I liked the contrast of the white background. (NSTA focus group)*

The participants were particularly drawn to and pleased with the imagery on the journal website and throughout the articles. For example, participants explained:

*I like the big, prominent images...the imagery is very attractive. (Think aloud interview)*

*The graphics are nice and bright, well-chosen. They align well with the topics of the articles. (Think aloud interview)*

*I like the imagery...it's just nice and bright. It's clear. The quality of the images is high. (Think aloud interview)*

*I liked that there were pictures on the homepage so you could get the gist of what was happening. I liked the images and that format. (NSTA focus group)*

*I liked the look. It seems very easy to read and just get in to. The headings seemed quite clear and it seems quite engaging with the images (NSTA focus group)*

Collectively, these statements by the STEM education professionals who engaged in the evaluation data collection efforts highlight the look and aesthetics of the journal as a key strength.

**Website User Experience.** Another key strength that emerged across the feedback we collected was the website user experience. In general, STEM education professionals had positive rating and comments about many aspects of the website user experience including the ease of use and website navigation. A question on the broader, national survey was designed to gather feedback regarding specific aspects of the user experience and Table 3 illustrates these findings. All aspects of the user experience were rated favorably by the survey respondents (Table 3) and only the item, “It is easy to understand the organization of the journal” received a mean score less than 6.0.

**Table 4: Website User Experience Ratings**

Please rate the extent to which you agree with each of the statements below regarding your experience accessing and viewing the journal: (n=80)		Mean Score
<b>The format and design of the journal conveys a professional look and feel</b>	n=80	6.0
<b>The pages load quickly and uniformly</b>	n=80	6.2
<b>The images loaded quickly and uniformly</b>	n=80	6.3
<b>The videos loaded quickly and functioned correctly</b>	n=79	6.1

<b>The journal website did not freeze or crash</b>	n=79	6.4
<b>The articles were easy to download and print</b>	n=77	6.2
<b>The journal website was easy to navigate</b>	n=79	6.0
<b>It was easy to understand the organization of the journal</b>	n=78	5.8

\*(On a scale from 1-7 where 1 = “strongly disagree” and 7 = “strongly agree”)

In a parallel fashion, comments on the open-ended items and during the focus groups and interviews further suggested that the journal was easy to use and navigate:

*...[The] journal seemed easy enough to navigate.* (National survey)

*It was easy to navigate, to the point where it's like, you get a sense of each articles with the pictures and whether or not you wanted to delve in to it and if you liked it, you can click on it and read more and if you didn't like it you keep scrolling and get to the next one fast. So, it was easy to go through the issue.* (National survey)

*It's definitely easy to navigate.* (Think aloud interview)

*[The website] is real easy to navigate and it has these nice little synopsis of the article and then if you want to know more about it then you can read more. So, if it's something that you're looking for you can zero in on that...instead of just page after page after page after page.* (NSTA focus group)

This feedback indicates that the target audience had a positive user experience and highly rated several aspects including ease of navigation, speed and uniformity of pages, images, and videos loading, and ease of downloading articles.

**Article Topics and Quality.** The article topics and quality also emerged from the corpus of data collected as a strength of the first issue of *CSL*. For example, when asked to rate the quality of the article writing, the mean rating of survey respondents was 5.9 on a scale of 1 to 7 (n=82). The respondents were also satisfied with the variety of articles in the first issue (mean score = 5.9/7.0, n=82). Finally, the survey respondents noted that the length of the articles was appropriate (mean score = 5.7/7.0, n=84).

When asked to rate individual articles, the survey respondents were overall pleased with each of the articles featured in the inaugural issue of *CSL* (Table 5). All of the articles received a mean rating above 5.3 on a scale from 1 to 7 and respondents rated the “*Zoo Academy*” and “*STEM Learning Ecologies*” articles the highest (Table 5).

**Table 5. Inaugural Issue Article Ratings**

Please rate your satisfaction with each of the following articles in the inaugural issue: (n=95)		<b>Mean Score</b>
<b>Editorial: Bridging the Gap with STEM</b>	n=81	5.7
<b>Editorial: Monday Night Science</b>	n=81	5.4
<b>Taking an Ecosystem Approach to STEM Learning</b>	n=81	5.8
<b>Zoo Academy</b>	n=80	5.9
<b>Working at the Intersection of Formal and Informal Science and Literacy Education</b>	n=81	5.7
<b>When Spider Webs Unite, They Can Tie Up a Lion</b>	n=80	5.7

<b>Bridging Neuroscience and Education Through Museum-School Partnerships</b>	n=81	5.6
<b>STEM Learning Ecologies</b>	n=81	5.9
<b>STEM Pathways</b>	n=81	5.7
<b>Science Club</b>	n=80	5.5
<b>NASA SMD Diversity Resources</b>	n=80	5.3
<b>STEM Smart</b>	n=79	5.6
<b>Full STEM Ahead</b>	n=80	5.5

\*(On a scale from 1-7 where 1 = “very dissatisfied” and 7 = “very satisfied”)

A question on the survey further prompted respondents to indicate whether or not they shared an article from the inaugural issue with a colleague. Roughly a third of respondents (32.6%, n=28) indicated that they shared an article with a colleague. When further prompted, they indicated specifically sharing one of the following articles: *Zoo Academy* (n=4), *Working at the Intersection of Formal and Informal Science and Literacy Education* (n=4), *Bridging Neuroscience and Education through Museum-School Partnerships* (n=3), *STEM Learning Ecologies* (n=3), *Taking an Ecosystem Approach to STEM Learning* (n=3), *STEM Pathways* (n=2), *When Spider Webs Unite, They Can Tie Up A Lion* (n=1), *Science Club* (n=1), *Full STEM Ahead* (n=1), and *NASA SMD Diversity Resources* (n=1).

The following were comments offered about specific articles in the inaugural issue:

*I LOVE the idea of Monday Night Science!* (Monday Night Science Editorial, National survey)

*Wow! What an inspiration to all science educators. [The Spider Webs Unite] article helped me realize that there are ways to get and keep students motivated to learn and be a part of the science network. I like the notion of having the community and families more involved in our students’ science education.* (When Spider Webs Unite, They Can Tie Up A Lion, National survey)

*I liked [the Science Club article] and that it included evaluation and impact information!* (Science Club, National survey)

*I really enjoyed [Taking an Ecosystem Approach to STEM Learning]. I just thought that was very exciting because I never thought of learning like that before. So I’m glad there’s like different things, unexpected [topics] and not the same old topics you usually see in NSTA journals.* (Taking an Ecosystem Approach to STEM Learning, NSTA focus group)

*After I read the Monday Night Science article, I was like, ‘Oh, this is what the journal is about. This is why this is a journal.’ It [CSL] made a lot more sense after reading that [the editorial.]* (Monday Night Science, NSTA focus group)

During the focus group discussions and think aloud interviews, STEM education professionals noted that they were particularly pleased and excited about the *Diversity and Equity* column:

*I like the diversity and equity column. You don’t see that very often. And we think about that a lot, how to increase access and equity. I enjoyed that this was a novel feature.* (NSTA focus group)

*I liked the topics. You don’t blatantly see diversity and equity in most journals EVERY time. At least I don’t, cause they [other journals] usually have a special issue about*

*diversity and equity, but not in EVERY single issue. That was one of the things that I really liked. (NARST focus group)*

*I love that the Diversity and Equity column is there. I think that's a really important issue in our field and I just think that's great to see that represented here. (Think aloud interview)*

*I'm stoked that there's a diversity and equity column. I think that's really cool. And I'm excited to see what continues building there because I know that the STEM pipeline and STEM fields, there's so many people doing work to diversify that and so it will be really interesting to see things that are featured there. (Think aloud interview)*

All of the feedback from STEM education professionals across the data collection efforts provides evidence that article topics and quality were viewed as a strength of the *CSL* journal and inaugural issue.

### **STEM Educators' Suggestions for Improvement**

Our final research questions aimed to gather feedback from the target audience for improving the journal and future issues of *CSL*. The STEM education professionals who participated in the evaluation study offered a number of suggestions for improvement to better meet their needs and interests. While many of these suggestions were idiosyncratic, there were several trends that emerged from the feedback we collected. We categorized these suggestions which included the following:

#### **Journal Identity**

- STEM education professionals noted that the identity of the journal remained unclear. They suggested clarifying the specific audiences who would contribute to the journal as well as those who would be the targeted readership:

*"I feel like the journal should be better, needs to be more upfront about who this is for. Like who is the target audience...just like, 'this is for teachers, or this is for educators.' More than the "about." Especially in its inaugural year it might not hurt to like be really up-front about this is who this is for and this is what this it is about. And make it sound really exciting...really call out the uniqueness about it."* (Think aloud interview)

*"I'm still trying to figure this out. Maybe you can help answer. Who is your targeted authors? It isn't clear to me who is going to submit to this. Who are the contributors supposed to be?"* (NARST focus group)

*"Who is the geared to? What is the big picture of it [the journal]? I wasn't quite sure what the whole picture of it is. So I actually tried to go to the [tabs] at the top to see, 'is there a mission statement or is there an about section?' you know, to get the context. And I saw the tab, but it just takes you back to the NSTA page."* (NSTA focus group)

#### **Terminology**

- Many of the participants who provided feedback suggested that NSTA and ASTC clearly define and justify particular uses of terminology in the journal.

Specifically, they pointed out the varied uses of the acronym, “STEM,” in the education field and the need to clearly define the journal’s use of the term.

*“It seems they definitely want this to be a STEM-focused journal. So, I find that to be a little bit of a conundrum, right? Is it science or is it STEM? If it’s really a ‘STEM’ resource and you want STEM people to find it, I think that needs to be a little bit clearer.”* (NSTA focus group)

*“I want to make a comment about a term that we’ve been using too loud [in the journal]. We use the word ‘STEM’...STEM, I’ve found out that STEM has SO many meanings to so many different people and groups. They interpret it differently. And if I saw STEM, personally I see STEM as, almost like an integration of Science, Technology, Engineering and Mathematics within that lesson, there’s all of those things. Other people see it as Science, Technology, Engineering OR Mathematics... And I think that’s difficult for anyone coming in to the journal if they see it as ‘STEM’ collective and then them being disappointed when they find that not all of those elements are there...there needs to be something in the author guidelines and review form that focuses on that particular term.”* (Peer reviewer interview)

*“Operationalize what you mean by STEM. You know, ‘We, for the sake of this publication, we are referring to STEM as any of those disciplines, uniquely on their own, they don’t necessarily have to be interconnected.’ Something like that...define it, own it.”* (Think aloud interview)

- Some of the STEM education professionals expressed potential confusion related to the use of “connected.” At least some of the target audience initially thought this term referred to connections with technology and blended learning environments. However, they explained that the tagline helped to clarify the use of “connected” and recommended it appear with the title in all branding and journal materials.

*“When they say ‘connected,’ I’m instantly thinking about online, internet...blended learning and all those sorts of things. I don’t know whether that’s going to form a part of this [journal] or if there’s going to be much on it but that is my initial sort of impression...But, I’m not sure that really would resonate with what the actual content is.”* (NSTA focus group)

## **Website Organization**

- Many of the STEM education professionals were generally pleased with the overall website organization. However, some suggested that the columns of the journal should be made more explicit to emphasize that they will repeat with each issue. They recommended either creating a drop-down menu of columns or a table of contents for each issue.

*“The tabs on the homepage. My questions was, are the articles down here exactly like, there’s going to be one editorial, one featured, there’s one about that, one about that, in future issues? I don’t think it’s obvious that those are columns.”* (NARST focus group)

*“I guess my question is, are these different categories of the journal? Will they always be the same like is that's something as a repeat user I would maybe would want to come back and be like oh 'my focus is diversity and equity is really important to me' and I would always want to go there or would these change?...you know like when you go to the buttons up at the top and there is a drop-down [of the columns]? That's always helpful to me.”* (Think aloud interview)

- Another suggestion was to provide a brief abstract or short summary of the article on the journal homepage, rather than simply displaying the first few sentences of the article. STEM education professionals explained that this would help them quickly assess the content of each article to determine whether it fit their professional interests and needs.

*“I sort of wish there had been the title of the article and then a little overview of the work so I could see, like a really short abstract, to say 'Okay, this is what this article is about' whereas I didn't really care for having to open and read the first few sentences of the article before I really got a sense for what the article was about.”* (NSTA focus group)

*“The way in which the articles are laid out (picture with an incomplete first sentence underneath) makes it difficult to know whether or not the article will be of personal interest to me. I would be more likely to read an article if it had a brief summary underneath.”* (National survey)

## **User Experience**

- The formative study aligned with the launch of the CSL journal and website. Throughout the formative study period, the evaluator (Riedinger) worked closely with the project teams at NSTA and ASTC to provide iterative feedback as the website was updated and improved. Many of the initial issues related to the user experience have been resolved throughout this process (e.g., issues with scrolling, sharing articles, website search tool, emailing article authors).

## **Past Issue Archive**

- There were many STEM education professionals who had questions about how articles and issues would be archived as new issues are published.

*“I had a question while, more like a thought question, when I was looking through it about when there is more content on the website, it is something I was wondering is, so you know you'd click on one of these things at top and the articles would come up. So, what's going to happen when there's more and more articles? Is it just going to be something where you have to swim through the sea of articles to find something that's interesting to you? Do have to click through, alright, page 1, page 2, page 3, page 4 of [previous articles], or is there going to be some kind of search engine or something that would kind of consolidate things. Like, 'if you're interested in this, read these [articles.]' Cause I was thinking, alright so I'm reading through these first few articles here but if there were 10 or*

*15 or 100 that I have to sift through, this would get really old really quick just scrolling through everything. So I was wondering if there has been any thought to this yet.” (NSTA focus group)*

- STEM education professionals recommended search and filter capabilities to easily find previous articles and issues. Further, they suggested using a tagging method such as keywords by context (e.g., museum, zoo, afterschool, nature center) to easily find all articles relevant to their work. Moreover, they noted that the use of tagging can provide analytics for the editor regarding interest in and readership of particular topics.

*“I think would quite like to see tag words in that initial reading section. Like keywords. So if it was an article about zoos, it’d have ‘zoos’ keyword or if it’s about engineering it would have ‘engineering.’ Like three or four words, you’d get an idea of what that article is going to be about...then that becomes a searchable feature.” (NSTA focus group)*

*“As the site populates, for a certain audience to jump to [topics of interest] tagging might help. Or some other way to sort things on the website. If I was an afterschool practitioner, I may not really be interested in some of the museum stuff, as cool as it may be. I will want to jump to any afterschool article and find out specifically what I can do in this area to grow myself or to help my kids.” (NSTA focus group)*

## **Contribution and Peer Review Process**

- Contributors were generally pleased with the submission and publication process but asked for greater clarity regarding the supplemental materials. Specifically, they requested clearer criteria and expectations for supplemental materials (e.g., accepted media types, recommended file format and size, strategy for sharing materials, criteria for creating captions).

*“It was a lot of dialogue back and forth trying to figure out, I guess what I’m saying is I think some of the guidelines for the supplemental materials need to be clearly articulated. Everything from file type, to pixel size [images], to purpose, whatever so that authors can sit down when they’re ready to figure out how best they can supplement their narrative in a way that’s going to meet the needs of the journal.” (Author interview)*

*“I think that the other piece that was really challenging for us was thinking about the supplemental materials and how in the world to share those. There was some confusion about what are the right file types, how big can they be, video in particular can be quite large, PowerPoint, especially you have any embedded video sound, can be quite large or even if you just have large collection of slides you want to share with people can be quite large after a while. And, so, in the original submission it’s just the cover letter, manuscript, names removed, no supplemental resources. And I kind of felt a big part of what we were trying to do was show the instructional tools we created as a collaborative group...and to not be able to share those in the original manuscript was really confusing.” (Author interview)*

- The contributors also requested more information up-front regarding the peer review and publication timeline and process.

*“I think it would be helpful to know what the timelines are for these submissions. Once the reviewer looks at something, we got a few different [suggested edits.] But often the turnarounds on those things were really short, a week to turn around something, that for a collaborative project put me in a difficult position of, ‘Oh goodness, I need to get in touch with my co-authors to get their buy-in on this’ because I didn’t want to be an author that is putting something out there as final that the institution hasn’t approved, that the other authors didn’t get a chance to approve. Some more time between those two. And, I would say a timeline that defines it [the process] so you could set-up meetings ahead of time between collaborators, with everybody who is a co-author or if there’s organizations that need to have an approval process followed, like if you knew in advance between this time and this time, we’re gonna ask you to make any changes, so you might want to plan a meeting’ and then ‘this is the second draft window, you may want to have another meeting planned around this timeframe.’ Not knowing meant we had to do catch-up once we got the draft and ‘hey, we need this back in a week or so.’ I would want to know the dates ahead of time, if I could.” (Author interview)*

- The reviewers were overall highly pleased with the peer review process and only offered the suggestion of transitioning to an online submission and review system.

*“It would be nice to have an electronic review system versus using email, but otherwise everything was great.” (Reviewer Interview)*

## **Marketing and Dissemination**

- Another suggested was related to the visibility of the first issue of the journal. Several survey respondents indicated they were not aware of the journal. Across the data collection efforts, STEM education professionals also questioned how much the first issue of the journal had been marketed beyond the NSTA and ASTC communities and suggested broader dissemination of the journal by leveraging relevant STEM education organizations (e.g., Afterschool Alliance, NAAEE, ASEE).

*“I was not aware of the journal.” (National survey)*

*“I did not know of the journal’s existence.” (National survey)*

*“I don’t know how much this was marketed or put out there, unless you’re an NSTA person...I feel like there could have been a lot more push about it. I didn’t hear anything about the journal and the article and that was kind of a red flag about whether people even know this is out there.” (Author interview)*

*“The problem with it being largely an NSTA push is for people like me, if I have a limited number of conferences or presentations and my focus isn’t on teachers specifically, I won’t, even though there’s an informal strand at NSTA, there’s other places where I can get a lot more of that, right? So, I feel like that there’s a*

*lot of us in the informal world that would really benefit from this resource, who may or may not be connected with NSTA, but could, in some ways, without paying to market, be distributing this in some ways. I do think there's a number of strategies and other organizations that could be leveraged."* (Author interview)

### **Inclusive of all STEM Educators**

- The STEM education professionals also recommended ensuring that future issues of the journal are inclusive of a broad range of settings (e.g., rural schools, small museums, nature/environmental centers, afterschool programs, youth serving organizations, science camps) and meet the needs of all educators (e.g., environmental educator, early childhood STEM educators).

*"Please include more about rural schools. Most of these stories were about inner city schools that have many public sources for support and engagement. I was hoping for articles about small schools like mine and resources I could use...Reading about their programs is nice, but not an option for us."* (National survey)

*"I have only done limited reading so far. I also did not see, but am hopeful, this journal will include all who work in non-formal STEM learning areas--youth-serving organizations, camps, other OST staff and programming, and not just focus on those who are in the informal science learning settings such as museums, tech centers or nature centers."* (National survey)

### **Connecting STEM Educators**

- Many of the STEM education professionals interpreted "connected" as indicating the journal would provide opportunities to connect with colleagues in other education contexts to create partnerships. They are interested in specific opportunities and ways to connect to other professionals through the CSL journal.

*"This is mainly a question: is this going to be a place for people to connect?...I don't remember where I saw it but I remember explicit language that said something about connecting to the broader community. I don't know if they have a plan for that eventually but I think that the impression is it's supposed to be eventually. I think that it would be good for them to clarify if it's going to be more than just a journal. If somehow there's going to be other resources attached that allow community or practitioners to engage in broader conversations."* (NSTA focus group)

*"I wonder if, well when I looked at it [the journal], I imagined the target audience using it would probably be researchers and informal science education institutions, maybe. I wonder if a practicing classroom teacher would use it. Perhaps a way to grow that audience in the future would be to have a connections place to like look for institutions in the area that are looking for partners. Ways to physically connect with other professionals. I more dynamic way to or active way to connect beyond just reading the article or emailing the author."* (NARST focus group)

The wealth of input and feedback provided by STEM education professionals has potential implications that NSTA and ASTC could consider for future improvements to the *CSL* journal and related website to better meet the needs and interests of the targeted audiences.

## **Conclusions and Recommendations**

Overall, this formative evaluation study provided compelling evidence that the launch of the *CSL* journal and pilot issue was well-received and highly rated by STEM education professionals. Further, the *CSL* journal has promise as an important contribution to the STEM education field.

This formative evaluation study was driven by the following questions:

1. To what extent is the target audience aware of the *CSL* journal and the launch of the first pilot issue?
2. Overall, how satisfied is the target audience with the *CSL* journal and first pilot issue?
3. What do target audiences perceive as the potential value of the *CSL* journal?
4. What aspects of the *CSL* journal and first pilot issue were particularly successful and why?
5. How could the *CSL* journal be improved to better meet the needs and expectations of the target audiences?

In this section, we outline how the findings address each of these evaluation questions.

### **To what extent is the target audience aware of the *CSL* journal and the launch of the first pilot issue?**

The NSTA and ASTC have been moderately successful at reaching STEM education professionals through the launch of the pilot issue of *CSL*. Strategies such as sessions and announcements at professional conferences as well as through NSTA and ASTC e-newsletters and email listservs appear to an extent to have been successful at reaching the targeted audiences. This was evidenced by increased traffic on the *CSL* website in alignment with each of these advertising efforts. There were, however, some indications from the participants of the data collection activities to suggest that additional strategies, such as leveraging relevant professional organizations, could help to broaden awareness of the journal.

### **Overall, how satisfied is the target audience with the *CSL* journal and first pilot issue?**

The formative evaluation findings reveal that the target audience – STEM education professionals – were highly satisfied with the *CSL* journal and pilot issue. The target audience's satisfaction with the journal and pilot issue was demonstrated by survey findings which suggested respondents offered high ratings of the journal, were highly likely to continue following future issues of the journal, and were highly likely to share the journal and articles with a colleague.

### **What do target audiences perceive as the potential value of the *CSL* journal?**

In the feedback provided through the various data collection strategies, it was clear that STEM education professionals viewed the *CSL* journal as an important contribution to the field. Through our synthesis and analysis of the evaluation data collected, we noted the following themes identified by STEM education professionals related to the potential value of the journal

to the field: offers practical application of STEM education research, addresses a current need in the STEM education field, acts as a potential mechanism for connecting STEM educators, and provides a voice to informal STEM educators.

### **What aspects of the *CSL* journal and first pilot issue were particularly successful and why?**

From the evaluation feedback collected, it was clear that there were many successful aspects of the *CSL* journal launch and first issue. Collectively, the data collected suggested that STEM education professionals identified the visual aesthetics of the journal issue and website, the website user experience, and article topics and quality as the key strengths of the first issue.

### **How could the *CSL* journal be improved to better meet the needs and expectations of the target audiences?**

Although STEM education professionals in general were very satisfied with the *CSL* journal and first issue, they offered input regarding how best to improve the journal and future issues to best meet their needs and interests. Specifically, they recommended:

- Clearly detailing the identity of the journal as well as articulating the targeted readership and contributors;
- Define relevant terminology and justify the use of relevant terms (e.g., STEM, connected);
- Make the journal columns and content more evident on the journal website;
- As the website populates with new journal issues, implement strategies for archiving and searching previous issues;
- Provide clear expectations and guidelines for submitting supplemental materials as well as a predicted timeline for the publication process;
- Broaden advertising efforts to extend the reach of the journal;
- Consider themes for future issues that are inclusive of all STEM educators (e.g., rural schools, small museums, early childhood STEM education, 4H programs, science camps, nature/environmental education centers).

The evaluation findings revealed possible changes for NSTA and ASTC to consider that might improve the website and future journal issues.

### **Recommendations**

While overall the *CSL* journal and website launch was highly successful and perceived as a valuable contribution to the field, STEM education professionals offered suggestions for improvement. Based on compilation and analysis of this feedback, we offer the following actionable recommendations:

#### **1. Continue to build on the success of the *CSL* journal launch and first issue.**

The formative evaluation data offered strong evidence to suggest that the journal launch and first issue were highly successful. There is emerging evidence that the journal will have an impact and value added to the field. We recommend moving forward by continuing with a similar approach that builds on the success of the journal launch and pilot issue.

**2. Articulate the journal identity and define relevant terms for the target audience.**

Among the STEM education professionals, there was a perceived lack of clarity regarding aspects of the journal's identity and relevant terms, particularly the use of "STEM" and "connected." NSTA and ASTC have taken initial steps to address this concern expressed by participants in the evaluation study by making more prominent the "About" section on the journal's website and descriptions of the journal on the NSTA and ASTC websites. We also recommend considering the strategies suggested by the STEM education professionals for clearly defining the use of these terms such as through an editorial in a future issue, a glossary of terms, or hyperlink common terms to show the journal or author's definition.

**3. Build greater awareness of the journal through continued advertising efforts.**

A perception among the STEM education professionals was that there could be more of an effort to advertise and disseminate the *CSL* journal. This notion was corroborated by the data from the national survey which suggested that only about a third of respondents (34.1%) were aware of the journal. As with any new initiative, it will take time to build awareness among the target audience. We recommend continuing with the strategies which have demonstrated success such as the NSTA e-newsletters, ASTC email announcements, CAISE blog post, and sessions at conferences while also expanding these efforts to include new opportunities. Consider leveraging connections and partnerships with related STEM education organizations to create new opportunities for announcements and blog posts (e.g., blog post on "Afterschool snacks" through the Afterschool Alliance, announcement from "EE News" through NAAEE). Additionally, we recommend considering the advisory board's input for building awareness of the journal and increasing traffic to the website: host podcasts with authors or twitter chats, continue to advertise on the CAISE website, share articles and posts through social media outlets, and encourage contributors to create dialogue in the "comment" section of their article on the website.

**4. Consider potential improvements and modifications to the journal and website based on suggestions from the target audience.**

The STEM education professionals offered many suggestions to improve the *CSL* journal and website. We recommend that NSTA and ASTC discuss the suggestions and consider potential implications of the input gathered through the evaluation study. The NSTA and ASTC should consider potential modifications and improvements to the journal and website such as (but not limited to) strategies for archiving and searching past issues, including a menu of journal columns, and providing a table of contents for each journal issue. In addition, NSTA and ASTC should consider the suggestions offered by contributors and peer reviewers for improving the submission and publication process. Specifically, we recommend considering an online submission system and adding additional details regarding expectations, timelines and supplemental materials in the "submission guidelines" section on the website.

**5. Implement strategies for connecting STEM education professionals.**

An initial aim and predicted outcome of the *CSL* journal initiative was to create synergy between STEM education communities resulting in increased dialogue and collaboration

among STEM education professionals. While there has been some preliminary evidence of these connections emerging, such as readers emailing article authors, we recommend continuing to think about how the journal can serve as a mechanism for creating these connections. The ideas mentioned above such as podcasts with authors, twitter chats, and encouraging engagement in the comment feature may help increase awareness of the journal while also fostering connections between STEM education professionals.

**6. Conduct summative evaluation and research to measure the impact and outcomes of the *CSL* journal on the STEM education field and professionals.**

Over time and as additional issues are released, it is predicted that the *CSL* journal will result in outcomes for STEM education professionals and have an impact on the field. There was preliminary evidence of this in STEM education professionals' perceptions of the potential value of the journal that were articulated in the formative evaluation data collection activities. We recommend a summative evaluation and research study to measure and document the outcomes of the journal, especially around facilitating connections between professionals in the STEM learning ecosystem.

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## Appendix A: Project Logic Model

The logic model for the project outlines the specific inputs, activities and outputs for the project and identifies the predicted outcomes for the various targeted audiences. The logic model visually depicts the project activities, theory of action, and key indicators of success that will be used to measure the impact of the project. The logic model will guide the summative evaluation study.

### NSTA-ASTC EAGER Project: *STEM Education Practitioner Resource*

