

Driven To Discover: Citizen Science Inspires Classroom Investigation

Mid-Year Evaluation Update

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Project Background

Driven to Discover: Citizen Science Inspires Classroom Investigation

The Driven to Discover: Citizen Science Inspires Classroom Investigation project (D2D2) aims to impact instruction, curriculum, and student outcomes in the life sciences both at the middle school and high school levels. The project is focused on developing teacher and student citizen science (CS) skills, as well as engaging teachers and students in scientific investigations through CS. Project activities include: an intensive summer program that supports teacher professional development (PD); ongoing support for CS-related science activities in the classroom throughout the school year; and student research presentations in public venues, including a project-sponsored ecology fair.

Goals and Objectives

The project's two main goals are:

- 1) To engage secondary students and their teachers in ecology-based citizen science and science practices; and
- 2) To build connections between ecology-based citizen science programs, STEM curriculum, and students' lives.

The project's three primary objectives are:

- 1) To incorporate science content and methods appropriate for secondary students into classroom instruction via existing citizen science projects;
- 2) To promote students' and teachers' competence in scientific practices, such as reading about scientific studies, writing about science, and engaging in quantitative reasoning; and
- 3) To support teachers in meeting the needs of diverse students, including English language learners and students with disabilities.

MID-YEAR FINDINGS

SURVEY DATA

Ninety percent of the respondents to the Mid-Year Implementation Survey reported they had used components of the D2D2 curriculum to teach the scientific method and/or citizen science activities in their classroom, and 80% of the respondents reported that their students had completed a mini or full investigation.

PARTICIPANTS' VIEWS

"I think the biggest challenge for most science teachers to implement CS is to collect data, and interpret the data with their students. I think the dropper/popper data was a great reference point for analyzing and discussing what the data show. This could then be applied to 'messier' citizen science projects."

"[Small Reflective Group meetings] have been amazing. It's helping me to keep bringing my focus back to the process and incorporating the D2D2 ideas into my plans (because everyday school planning tends to drift back to the familiar). Having colleagues to talk over common issues is one of the best things about the program. (Thank you for that)."

What is citizen science?

Citizen science refers to partnerships that are formed between citizen volunteers and scientists to answer real world questions. Researchers benefit from having more data to analyze and increasing the public's interest in science. In this project, four existing CS programs were used to foster a deeper connection to the processes of science for both students and teachers. The four CS programs were:

- 1) The Great Sunflower Project (www.greatsunflower.org), which engages citizen scientists in the collection of pollinator data in real world settings (e.g., gardens, parks, and so forth).
- 2) Migratory Dragonfly Partnership (www.migratorydragonflypartnership.org), which uses data from citizen scientists to study dragonflies in wetlands and other habitats.
- 3) Nature's Notebook and the Minnesota Phenology Network, which engages citizens in phenology data collection.
- 4) eBird (www.ebird.org), which is a CS project focused on understanding the ecology of birds in natural habitats.

Methods

Evaluation Purpose

The four-year, phased evaluation of the Driven to Discover: Citizen Science Inspires Classroom Investigation project (D2D2), conducted by researchers from the Center for Applied Research and Educational Improvement (CAREI), includes both formative and summative data collection to assess the effectiveness of project implementation as well as student and teacher outcomes. Using qualitative and quantitative data, the evaluation team is investigating: (1) the impact on teachers' understanding of science concepts and attitudes toward science, (2) teachers' instructional practices before and after participation in the summer PD, and (3) student outcomes.

The purpose of the evaluation is to assess the extent to which PD resources, activities, and support promote implementation of D2D2 activities and also to determine whether or not there are barriers that might impede full implementation. Evaluation results will inform the ongoing improvement of the D2D2 activities in an effort to maximize the project's impacts on student and teacher outcomes.

The D2D2 participant population is drawn from ten school districts in the Twin Cities region and southern Minnesota. The participant pool is comprised of 29 science educators or science specialists.

Evaluation Questions

Project impact is evaluated across five levels of PD evaluation (Guskey, 2002).¹ To measure change in these five levels, the evaluation team is collecting data to answer the questions listed in Table 1.

Table 1. *Evaluation Levels and Evaluation Questions.*

Evaluation Level	Evaluation Question	Instrument
Level 1. Participant perceptions and attitudes	<ul style="list-style-type: none"> ▪ What are participants’ perceptions of the training? ▪ To what extent do participants value CS as a means to embed the process of scientific research in their teaching? 	<ul style="list-style-type: none"> ▪ Implementation Readiness Survey ▪ Post-PD Survey
Level 2. Participants’ acquisition of knowledge	<ul style="list-style-type: none"> ▪ Is there measurable change in participants’ confidence in teaching science concepts and in using science process methods? ▪ To what extent do participants understand how to use research design methods in their classrooms? 	<ul style="list-style-type: none"> ▪ Classroom Observations (pre/post) ▪ Post-PD Survey ▪ Mid-Year Group Discussions ▪ Mid-Year Implementation Survey
Level 3. Project and institutional support	<ul style="list-style-type: none"> ▪ What is the level and nature of district support? ▪ To what degree do participants perceive benefits of Small Reflective Groups, project, and district support? 	<ul style="list-style-type: none"> ▪ Implementation Readiness Survey ▪ Post-PD Survey ▪ Mid-Year Group Discussions ▪ Mid-Year Implementation Survey ▪ Post-Implementation Survey*
Level 4. Use of new knowledge and skills (implementation)	<ul style="list-style-type: none"> ▪ To what extent do participants use CS to embed the process of scientific research into their teaching? ▪ Were participants more likely to integrate the full process of research into their lessons than they did before participation or than their non-participant counterparts? 	<ul style="list-style-type: none"> ▪ Classroom Observations (pre/post) ▪ Post-PD Survey ▪ Mid-Year Group Discussions ▪ Mid-Year Implementation Survey ▪ Post-Implementation Survey*
Level 5. Measureable student outcomes	<ul style="list-style-type: none"> ▪ To what extent did students learn science process and the content of their CS project? Change their attitudes about science, scientists, and themselves? Make sociocultural connections with CS? 	<ul style="list-style-type: none"> ▪ Mid-Year Group Discussions ▪ Mid-Year Implementation Survey ▪ Post-Implementation Survey* ▪ Student Outcome Measures*

*These instruments will be administered later in spring 2016.

¹ Guskey, T.R. (2002). Does it make a difference? Evaluating professional development. *Educational leadership*, 59(6), 45-51.

Instruments

A summary of the evaluation instruments used during this period of the evaluation, the number of respondents, and response rates are provided in Table 2.

Table 2. *Summary of Instruments and Levels of Participation*

Instrument	<i>n</i>	%
Mid-Year Implementation Survey	21	72%
Winter Workshop and Small Reflective Group Follow-Up Survey	16	55%

Mid-Year Implementation Survey (November 2015)

The Mid-Year Implementation Survey is administered at about the midpoint of the school year. Its purpose is to collect participants' feedback on the progress of CS implementation including both the successes and challenges encountered. The survey also collects participant attitudes and perceptions about the Small Reflective Groups (SRGs). The survey was administered electronically in December 2015. Twenty-one of 29 participants who participated in the summer PD completed the survey, for a response rate of 72%.

Winter Workshop and Small Reflective Group Follow-Up Survey (February 2016)

The purpose of the Winter Workshop and Small Reflective Group Follow-Up Survey is to collect participants' perceptions after the D2D2 Winter Workshop and to collect additional data from participants around their perceptions of the Small Reflective Groups (SRGs). The survey was administered on February 2, shortly after the Workshop. Sixteen teacher participants completed the survey, a 55% response rate.

Summary of Findings

All data tables for the Mid-Year Implementation Survey (the "Mid-Year Survey") are found in Appendix A and all data tables for the Winter Workshop and Small Reflective Groups Follow-Up Survey (the "Workshop Survey") are found in Appendix B.

Mid-Year Implementation Survey

Implementation

Ninety percent (90%) of the respondents to the Mid-Year Survey reported they had used components of the D2D2 curriculum to teach the scientific method and/or citizen science activities in their classroom (see Table A1, Appendix A). One of the teachers who responded *no*, stated that they were planning to use the curriculum to teach the scientific method and/or citizen science activities in spring 2016. The other teacher who responded *no*, indicated that they were not a classroom teacher (see Table A2, Appendix A).

Curriculum Group Participation

Based on the Mid-Year Survey responses, respondents were distributed evenly across the four curriculum groups (Pollinators, Birds, Dragonflies, and Phenology). Three respondents indicated that they were planning to use elements from more than one curriculum in their classrooms this year (see Table A3, Appendix A).

Mid-Year Evaluation Update

Planned Use of D2D2 Components

Over three-fourths of the 21 respondents to the Mid-Year Implementation Survey reported that they had *used or planned to use* the following D2D2 components in their classrooms this year (see Table A4, Appendix A):

- Claims, Evidence, and Reasoning (CER)
- Taking Students Outside for the Purpose of Citizen Science
- Teaching the Scientific Method (Process of Science)
- Graphing and Visual Analysis of Data

Over half, but less than three-fourths, responded that they had *used or planned to use* the following D2D2 components in their classrooms this year:

- Teaching about Citizen Science (what it is, why it is important, etc.)
- Mini-Investigation
- Science Behind the Scenes
- “I Wonder” Post-it Board
- Reporting Results (via presentations, papers, PowerPoints, or poster)
- Collecting and Uploading Data to a Citizen Science Website

Fewer than half the respondents indicated that they had *used or planned to use* the following D2D2 components in their classrooms this year:

- Creating a Science Journal
- Downloading and Analyzing Data from a Citizen Science Website

Citizen Science Activities Used So Far In Current Year

Eighty percent (80%) of the Mid-Year Survey respondents reported that their students had completed a mini or full investigation. About two-thirds of respondents (65%) stated their students had collected citizen science data (see Table A5, Appendix A). Thirty percent of respondents (30%) stated they had submitted data collected by students to a citizen science project this year (see Table A6, Appendix A).

Assessment Methods

Sixty percent (60%) of the Mid-Year Survey respondents indicated that they had *not* used an assessment to evaluate student learning following implementation of the D2D2 curriculum in their classroom. The remainder of the respondents (40%) who did use an assessment to assess their students’ progress, used the following methods for these assessments (see Table A7, Appendix A):

- Graded student presentations
- Administered pre/post assessments
- Administered paper and pencil tests
- Evaluated Claims, Evidence, and Reasoning (CER) guides
- Graded students’ mini-investigations.

Implementation Obstacles

Mid-Year Survey respondents were asked to identify the biggest obstacles, if any, to implementing the D2D2 curriculum. The obstacle viewed by most respondents as the greatest was inadequate time to plan, prepare, or to implement CS in their classrooms (for a full list of responses, see Table A8, Appendix A).

Table 3. *Biggest Obstacles to Implementation*

Biggest obstacle to implementation	Count
Inadequate time (planning and implementing)	10
Timing (seasonal. i.e., no dragonflies, phenology)	3
Lack of school support	2
Standards pressures	2
Learning curve to teach new unit	2
Equipment, instruments, or tools	1
Costs for purchasing resources (Unable to “front” the money and be reimbursed later)	1
Student ability levels	1
How to integrate into curriculum	1
Too many D2D2 assignments	1

Value of Additional Supports

Respondents identified three areas of support that they believed would be most helpful and supportive. The percentages provided here indicate the combined percent of respondents who ranked these supports as *helpful* or *very helpful* (see Table A9, Appendix A for a complete list of additional supports).

- Additional funding (81%)
- Curriculum materials that can be modified (80%)
- Support in the classroom from researchers or content experts (76%).

Most Helpful Support in Implementation

Teacher participants were asked, “*To date, what is the most helpful support or resource you have received to implement the D2D2 program?*” The three most helpful supports identified were:

- Small Reflective Groups,
- Summer professional development, and
- Collaborating and talking to peers.

(See Table A10, Appendix A for a complete list of additional supports.)

Table 4. *Summary of the comments regarding support for implementation*

Supports	Count
Small Reflective Groups	5
Summer professional development sessions	5
Collaborating/talking with peers	5
Curriculum guide	4
Pollinator group	1
Summer course	1
Updates and reminders	1
Support (undefined)	1
Science process flow chart	1
Collaborating using Google Drive	1

School and District Support

Seventy-two percent of respondents (72%) viewed the level of support they receive from their district or schools as *supportive* or *very supportive* (see Table 11). In general, D2D2 participant responses suggest that they are receiving tacit support from their schools and/or districts for implementing the D2D2 program (see Table A12).

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Level of Confidence to Teach CS in the Classroom

Respondents were asked to rate their level of confidence regarding implementation using a 4-point scale (*not at all confident, slightly confident, confident, and very confident*). A high percentage of the respondents said they were *confident* or *very confident* in their abilities to:

- Integrate citizen science into their classroom (85%),
- Include Claims, Evidence, and Reasoning into their classroom (90%), and
- Incorporate scientific articles into their classroom (80%) (see Table A13).

Level of Agreement about the Curriculum

Similarly, a high percentage of the respondents *agreed* or *strongly agreed* with the following statements about the D2D2 curriculum:

- The D2D2 curriculum includes the resources I need to teach the scientific method (95%), and
- The D2D2 curriculum is engaging to students (86%) (see Table A14).

Small Reflective Groups

Eighty-six percent of respondents (86%) have participated in the SRGs (Table A16), and 78% of respondents indicated that the SRGs were either *helpful* or *very helpful* (Table A17). According to most respondents, the best part about participating in the SRGs was the discussions and problem solving. Suggestions for improving the SRGs included:

- Eliminating the readings (not considered to be especially helpful),
- Focusing to an even greater extent on problem-solving, and
- Reducing the overall number of meetings (see Table A18, Appendix A for all responses).

Winter Workshop and Small Reflective Group Follow-Up Survey

The summary of findings that follow were collected from responses to the Workshop Survey administered shortly after the January 2016 Winter Workshop. All D2D2 participants received this survey. Eighty-seven percent of respondents reported they had attended the January Workshop (Table B1, Appendix B). The complete set of survey results can be found in Tables B1- B7, Appendix B).

Session Relevance

Respondents who attended the workshop reported the popper data collection activity (91%) and the ICAN Identify and Interpret Strategy sessions (91%) were either *quite helpful* or *extremely helpful* in improving their understanding of data use and improving their implementation of CS lessons in their classes (see Tables B2 and B3).

Respondents indicated that there was a large time commitment to participant in the SRGs, but the opportunity to meet and exchange ideas with other teachers was valuable to them (Table B4). All respondents to the Workshop Survey reported that they had met in their SRGs one to four times (Table B5). The most common purposes for the groups, as reported by respondents, were to exchange strategies for teaching science process, to share student work, and to discuss CS implementation (Table B6). Respondents reported a high level of satisfaction with the January Workshop (see Table B7).

Conclusions and Considerations

Here, we summarize some of the most salient findings from the most recent D2D2 evaluation activities.

Teacher-participants feel confident and have a high degree of interest in including CS activities in their teaching.

- Participants indicate a high level of confidence to implement D2D2 activities.
- Based on participant responses, most teachers either have incorporated or plan to incorporate components of D2D2 curricula into their classrooms this year.
- The D2D2 elements that most closely correspond to core elements of general science instruction (i.e., teaching the process of science; understanding claims, evidence, and reasoning; and conducting investigations) are those that have been most often incorporated into the classrooms of D2D2 participants.

The summer professional development sessions, support from peers, and Small Reflective Groups provide strong support for the implementation of D2D2 activities.

- Small Reflective Groups and the summer professional development weeks were considered to be the most helpful elements of D2D2 activities, according to respondents.
- In addition, participants who attended the workshop reported the popper data collection activity (91%) and the ICAN Identify and Interpret Strategy sessions (91%) were either *quite helpful* or *extremely helpful* sessions in improving their understanding of data use and improving their implementation of CS lessons in their classes.

Some obstacles to an even fuller implementation include the lack of ongoing support for implementation, curricula that are flexible and easily adaptable to a variety of settings and circumstances, and effective methods for assessing student learning.

- Participants reported that the biggest impediments to implementation were the lack of time to plan for implementation and the lack of time for implementation. Participants stated that three ways to support implementation would be to:
 - Provide additional funding,
 - Share curricula that are more easily adaptable to a variety of settings, and
 - Provide research and content expert support in the classroom.
- Many participants report they receive only tacit support from their district and building administrators.
- More than half of the participants (60%) who implemented one or more elements of the curriculum reported they had not used an assessment to evaluate student learning following D2D2 activities.

Appendices A and B

Appendix A: Mid-Year Implementation Survey

Table A1: Since attending the D2D2 summer professional development, have you used the D2D2 curriculum to teach the scientific method and/or citizen science activities in your classroom?

Answer Choices	Response (n=21)
Yes	90%
No	10%

Not Yet Implementing

Table A2: If you have not yet incorporated D2D2 activities into your instruction, please tell us the primary reason why you have not. (Select one)

Answer Choices	Responses (n=2)
I intend to integrate D2D2 activities into my instruction in spring 2016.	1
I do not have the resources (time or money) that I need to properly integrate D2D2 activities into my instruction.	--
My administrator or district has not provided sufficient support for integrating D2D2 activities into my instruction.	--
D2D2 staff has not provided sufficient support for integrating D2D2 activities into my instruction.	--
D2D2 activities do not align with the science standards I need to teach in my classroom this year.	--
At this time, I do not feel comfortable integrating D2D2 activities into my instruction.	--
Other (please specify): Not a classroom teacher	1

Curriculum Group Participation

Respondents were distributed fairly evenly across the four curriculum groups, however, three of the 20 respondents planned to use two or more curricula in their classrooms this year.

Table A3: Please tell us the D2D2 curriculum group you planned to use in your classroom this school year.

Answer Choices	Responses (n=20)*
Pollinators	35%
Birds	35%
Dragonflies	25%
Phenology	40%

*Three respondents selected two or more curriculum groups.

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Table A4: Please select all D2D2 components that you have used or plan to use in your classroom this year. (Check all that apply)

Answer Choices	Responses (n=21)
Claims, Evidence, and Reasoning	86%
Taking Students Outside for the Purpose of Citizen Science	81%
Teaching the Scientific Method (Process of Science)	81%
Graphing and Visual Analysis of Data	76%
Teaching about Citizen Science (what it is, why it is important, etc.)	71%
Mini-Investigation	67%
Science Behind the Scenes	62%
"I Wonder" Post-it Board	57%
Reporting Results (via presentations, papers, PowerPoints, or poster)	57%
Collecting and Uploading Data to a Citizen Science Website	52%
Creating a Science Journal	43%
Downloading and Analyzing Data from a Citizen Science Website	29%
Other (please specify)	14%
<ul style="list-style-type: none"> ▪ <i>I have been working on incorporating these items in the district curriculum</i> ▪ <i>We are taking a break until January.</i> ▪ <i>Involving colleagues in their own citizen science work for their own professional growth and that we can later incorporate into lessons with students.</i> 	

Table A5: Please indicate whether or not you have completed the following D2D2 activities this school year.

Answer Choices (n=20)	% Yes
Had your students complete a mini- or full investigation	80%
Had your students collect citizen science data.	65%
Had your students verbally explain their findings to peers	60%
Had your students analyze citizen science data (e.g., calculate the mean, produce bar graphs, etc.)	55%
Collected citizen science data personally for your own professional growth	45%

Table A6: For this year, have you submitted data collected by students to a citizen science project?

Answer Choices	Responses (n=20)
Yes	30%
No	70%

Comments:

- CoCoRaHS, Nature's Notebook
- Nature's Notebook
- Bumblebee watch.org
- CoCoRaHS (rain gauges), WxCoder (frost tubes), Journey North (Tulip Test Gardens), eBird, Nature's Notebook, Christmas Bird Count
- eBird

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Table A7: For this year, have you used an assessment to evaluate student learning following implementation of the D2D2 curriculum in your classroom?

Answer Choices	Responses (n=20)
Yes. And if yes, how did you assess students learning?	40%
No	60%

Responses:

- *Student presentations focused on claim, evidence, reasoning*
- *Used the CER guide for assessing their understanding of other student's data/projects.*
- *Not yet*
- *Pre and post assessment on writing multiple hypotheses*
- *Paper pencil test*
- *CER - poster of bird study*
- *I graded student's mini-investigations.*

Table A8: Please describe your biggest obstacles, if any, to implementing the D2D2 curriculum (n=19 responses). Please also describe your solutions to any obstacles.

<i>2 obstacles: Dragonflies weren't present in my area and equipment for the project. I know that I have been offered \$500, but have to foot the bill first and I AM A TEACHER. I DON'T HAVE 500 EXTRA DOLLARS. LOL ;-) Perhaps we could order through you? Then you know exactly where the money is going.</i>
<i>Time, varying student levels</i>
<i>Planning time and deciding how to incorporate it</i>
<i>Time to conduct investigations/analyze data/report findings. Sometimes I feel we are so content driven to complete state standards to prepare for the MCA there is not enough time for students to "design" their own meaningful investigations. Also, the ecology unit is taught in the spring in my district so hopefully I will be able to spend time doing citizen science in April.</i>
<i>Time constraints.</i>
<i>Planning time to really figure out the timing of activities and coordinating with assessments. I did not have time to do everything I wanted to do.</i>
<i>Biggest obstacles are the time and energy it takes to change the way you administer standards and concepts. Some smaller obstacles were, lack of principal and colleague support.</i>
<i>Time</i>
<i>Fitting in seasonal projects into very different units and seasons.</i>
<i>Learning new curriculum. By the end of the year, it should be easier to implement D2D2 work.</i>
<i>Scheduling time to work with small science project groups - solutions include coordinating with science, using Foundation class time (sort of like study hall) watching for opportunities daily. Working with a pre-determined science curriculum. But we're making progress.</i>
<i>Do not have time within the curriculum to devote to Citizen Science</i>
<i>No obstacles at this point.</i>
<i>Phenology making key observations throughout the school year. Unfortunately making these key observations can't always be scheduled conveniently into the school year. - No solutions yet, other than making observations as frequently as possible. One possible solution is the Tulip Test Garden. Planting time is very flexible, as long as it's a few weeks before freezing ground (easy this year!). Also the tulips should come up on their own in the spring. We planted them close to where students come in and out of the building every day, so we'll be sure to see the first emergence and first blossoms. Phenology requires a lot of background knowledge.</i>

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<p><i>One solution is to start with “birthday phenology” - Organize students chronologically through the year. Ask students to describe the weather/plants/animals on their birthdays. There should be some variability and some similarities. (Tip: This trick doesn't work as well with older folks who don't care as much about their birthdays). Another solution is to have students make observations on paper, and then enter the data “collectively” on Nature's Notebook while viewing the data entry on a large, projected screen. Students can discuss differences in observations, how that should be reported, and how that reflects the real science process. Another option would be to create a Google Form resembling Nature's Notebook and asking students to make observations there as an “intermediate” step. The teacher then verifies student observations and submits the “official” data for the class. Many Citizen Science observation tools, like eBird and Nature's Notebook require an internet connection, yet this isn't available in many outdoor school applications. One solution is to use paper forms and enter when internet is available. eBird has an off-line checklist that can be conveniently uploaded when internet is available. This solution is IDEAL!</i></p>
<p><i>Time to cover all other content and merge D2D2 with content better</i></p>
<p><i>Time and a team unwilling to make changes</i></p>
<p><i>Time and understanding, I have not received the training to do the math things that you seem to expect we all know and are comfortable with. I am not versed in the analysis of the data. It wasn't a part of my education and I haven't had the need of it till this class. Time---I still have to teach a certain curriculum and work to improve test scores. That is not to say that it can't be done...I learned a lot that works in my classroom and am using. Still if you want me to be able to do and teach the data analysis I need more training and more time.</i></p>
<p><i>Time to plan</i></p>
<p><i>Too many D2D2 assignments and questionnaires that stress me out, instead of letting me just teach, enjoy teaching, and make good lessons for my students. Too many follow-up time commitments! Additional support offered is great, but adding too many becomes a burden. I also am trying to apply for the garden grant to implement future D2D2 curriculum, but that application is WAY too long. My principal remarked that he'd just rather just “give me the \$1000” than to see me have to do so much work for it.</i></p>

Table A9: If additional supports were available, please indicate how helpful each of these would be to implementing D2D2 activities.

	Not Helpful At All	Slightly Helpful	Helpful	Very Helpful
Additional funding (n=21)	0%	19%	38%	43%
Curriculum materials that can be modified (n=20)	0%	20%	40%	40%
Support in the classroom from researchers or content experts (n=21)	0%	24%	62%	14%
Common D2D2 summative assessment to evaluate student learning (n=20)	10%	35%	40%	15%
Outreach from project leaders to building administrators (n=21)	14%	33%	38%	14%
Co-teaching/modeling of instruction (n=19)	26%	21%	47%	5%
Professional development booster sessions (n=19)	16%	37%	47%	0%
Instructional Coaching (n=20)	15%	45%	30%	10%
Support from Small Reflective Group meetings (n=19)	16%	16%	28%	11%
Additional administrators support (n=19)	21%	42%	32%	5%

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Comments:

- *Coming away from my 2 week class with a unit already in place. A skeleton was created, but I didn't feel it was enough for me to start.*
- *None*
- *It would be awesome to have an "expert" come in and teach my very young (5th graders) all about the different ways to use graphs to support the data they have been collecting.*
- *Grant money.*
- *Education and support for the math portion of this course.*
- *I can do this - I don't need any other help! :)*

Table A10: To date, what is the most helpful support or resource you have received to implement the D2D2 program?

<i>My small group</i>
<i>Collaborating in the small groups during the school year.</i>
<i>The prepared curriculum books</i>
<i>meeting with my small pollinators group and Sarah</i>
<i>The summer course.</i>
<i>Curriculum Guide</i>
<i>access to all the curriculum guides, and talking to other teachers about their successes</i>
<i>Small Reflective Group feedback.</i>
<i>Reflective Groups</i>
<i>Consistent updates and reminders - so I don't forget.</i>
<i>Support</i>
<i>The science process flow chart and the collaboration among teachers and instructors.</i>
<i>The training this last summer, the curriculum, access to help from D2D2 people.</i>
<i>Last summer's training.</i>
<i>Completing the mini-investigations at Cedar Creek.</i>
<i>peers in my class</i>
<i>Time to collaborate with others using D2D2 and we created a google drive to share info</i>
<i>Getting together with other teachers. (small group meetings) Hands on in the field with the experts.</i>
<i>can't think of just one- almost all very helpful</i>
<i>summer classes</i>

Table A11: Please indicate the level of support you feel you have received from your district/school regarding your involvement in D2D2.

Answer Choices	Responses (n=21)
Not supportive at all	0%
Slightly supportive	29%
Supportive	43%
Very supportive	29%

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Table A12: How has your district/school supported your integration of D2D2 in your classroom?

<i>Not well this year, but in the past they have.</i>
<i>My district and principal have allowed me to implement the curriculum, but there has not been additional support beyond permission</i>
<i>PLC members allowing me flexibility to implement different activities from citizen science.</i>
<i>They have been very supportive.</i>
<i>They are very supportive and willing to let us experiment.</i>
<i>There are some indications from the principal that this is a good way to go but it's always with tongue in cheek, and may need me to take even more initiative to make it happen.</i>
<i>Somewhat</i>
<i>Allowed me flexibility and some additional funding.</i>
<i>I believe it varies by building</i>
<i>They are happy to hear what I am doing, but not providing any additional support.</i>
<i>School has given me the freedom to try out different models and projects, science department has been very supportive as well.</i>
<i>Time PTSA support</i>
<i>My supervisor went to Cedar Creek last July. There are 5 other SPPS teachers in D2D2 this year - very helpful having a district-level cohort!</i>
<i>flexibility</i>
<i>[District Support staff] has given us some freedom to try things</i>
<i>Allows me to add Citizen Science to the Curriculum.</i>
<i>Staff development opportunities, admin support, parent volunteer support...</i>
<i>They have encouraged me to sign up and do investigations.</i>

Table A13: Rate your response.

Item	Not at all confident	Slightly confident	Confident	Very confident
How confident do you feel in your ability to integrate citizen science into your classroom? (n=20)	0%	15%	55%	30%
How confident do you feel in your ability to include Claims, Evidence, and Reasoning into your classroom? (n=20)	0%	10%	55%	35%
How Confident do you feel in your ability to incorporate scientific articles into your classroom? (n=20)	0%	20%	55%	25%

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Table A14: Please rate your level of agreement with the following statements about the D2D2 curriculum.

Item	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
The D2D2 curriculum includes the resources I need to teach the scientific method. (n=20)	0%	0%	0%	5%	65%	30%
The D2D2 curriculum is engaging to students. (n=21)	0%	0%	0%	14%	38%	48%
The D2D2 curriculum aligns well with the science standards I am obligated to teach in my classroom. (n=20)	0%	5%	0%	30%	45%	20%
The D2D2 curriculum is easy to integrate into my classroom instruction. (n=20)	0%	5%	0%	35%	45%	15%
I can easily modify the curriculum to make it appropriate for the students I teach. (n=20)	0%	5%	0%	35%	50%	10%
The D2D2 curriculum takes an appropriate amount of time to complete. (n=18)	0%	6%	6%	33%	44%	11%

Final Comments

Table A15: Please provide any additional comments or feedback regarding the D2D2 curriculum.

<i>I have a 4th/5th grade classroom so it was a bit more difficult to adjust to the appropriate level, although it worked out fine.</i>
<i>Students are feeling more confident this year about their ability to grasp the scientific method than in past years.</i>
<i>My opinions may shift as the spring comes and I will be able to make the projects happen in a more real way.</i>
<i>I feel that some aspects of the integration have progressed very slowly, but I'm encouraged by our continual progress this year.</i>
<i>Thank you!</i>
<i>It would be great to learn more about how to access data from Citizen Science programs (especially our own data) and interpret that data to look for meaning in the results :) The Christmas bird count data was very useful last Saturday session in November. Could we do something like that with a D2D2 participant's eBird data, or Nature's Notebook data (etc.)?</i>
<i>I have really enjoyed bringing what I have learned into the classroom...Students love most of it.</i>

Table A16: I have attended a D2D2 Small Reflective Group meeting

Answer Choices	Response (n=21)
Yes	86%
No	14%

Mid-Year Evaluation Update

Table A17: Please rate how helpful you believe the D2D2 Small Reflective Groups have been for helping you integrate the curriculum into your classroom instruction.

	Not helpful at all	Slightly helpful	Helpful	Very Helpful	N/A
Responses (n=18)	0%	22%	28%	50%	0%

Table A18: What is the best part of attending the D2D2 Small Reflective Groups meetings?

<i>Helping one another integrate their curriculum into their classrooms.</i>
<i>Checking in with others and seeing student work</i>
<i>Time to see how others are implementing as well as a good reminder of what I should be doing</i>
<i>seeing what other people are doing in their classrooms</i>
<i>The discussions.</i>
<i>Getting to hear about how the curriculum is being implemented in other classrooms</i>
<i>Sharing ideas</i>
<i>The comradery, ideas that are shared are awesome. I also have appreciated the instructor knowledge and understanding of the ideas that were presented in the summer. The food is also great.</i>
<i>Getting feedback from other teachers</i>
<i>Checking in with other teachers.</i>
<i>Time to talk to others about what they are doing</i>
<i>Sharing ideas and finding ways to improve implementation.</i>
<i>Bouncing ideas off the other participants, hearing how they have solved various challenges in their own schools. I come back with lots of ideas and a more general perspective of how all this works.</i>
<i>Meeting with colleagues</i>
<i>Hearing about their implementation efforts.</i>
<i>Working through the kinks together. Hearing from each other how things are going (what works, what doesn't work). Networking together to have some common projects and share materials.</i>
<i>Being able to talk and compare note with the other teachers.</i>
<i>reflecting on ideas and gathering new ideas</i>

Table A19: How can the D2D2 Small Reflective Group meetings be improved?

<i>Our group is great! No changes, at this time.</i>
<i>More time to problem solve how to fit things into the classes we are teaching.</i>
<i>Give us more time to problem solve and discuss and less time reading additional articles</i>
<i>N/A</i>
<i>I don't think the reading was helpful.</i>
<i>No improvements on my part except expect all participants to share their successes using the protocol method.</i>
<i>Meet more often?</i>
<i>Less of them or with a more specific and unified project - one that everyone is contributing to regardless of classroom differences.</i>
<i>No ideas at the moment. Very good.</i>
<i>Run it more like a PLC</i>
<i>Fine the way they are presently.</i>

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I don't think the article review was very helpful. Keep it focused on what the teachers are succeeding at and being challenged by.

I don't know.

maybe not as many - 4 along with the 3 large (7 total) is very time consuming, would rather it be 2 small and 2 big (4 total)

General Comments

Table A20: Based on your D2D2 experiences to date, please provide any general comments you would like to convey to D2D2 staff.

I have enjoyed this immensely and will continue to advertise this opportunity to colleagues. Thanks so much for a great learning experience!

Thank you so much for this wonderful opportunity! This has been one of the best experiences and has improved my teaching greatly. My students and I have both benefited so much from this class.

Excellent work!

I'm glad I went to the workshop!

Thanks for all your help and understanding as we learn!!!!!!

Keep up the great work!

D2D2 is having a huge effect on our curriculum and my own teaching, and I think the key lies in great curriculum, excellent training, extremely helpful and knowledgeable staff you are always willing to help and advice, and that we are all keeping in touch.

Thank you for the support!

Y'all are great!

Thank you.

I wish I had more time to do more.

Thanks you for renewing my own personal science experience and helping me to improve me teaching repertoire, as well as your continued support throughout this process! YOU ROCK!!

Appendix B: Winter Workshop and Small Reflective Group Follow-Up Survey

Table B1. Did you attend the D2D2 Winter Workshop on Saturday, January 30, 2016?

Answer Choices	Responses (n=15)
Yes	87%
No	13%

Session Relevance

Table B2. Please rank the following activities based on their usefulness in improving your understanding of data use in your classes.

Answer Choices	Not helpful	Slightly helpful	Somewhat helpful	Quite helpful	Extremely helpful
Popper data collection activity (late morning with Nancy) (n=11)	0%	9%	0%	18%	73%
ICAN: Identify and Interpret Strategy, (afternoon session 1 with Nancy) (n=11)	0%	0%	9%	36%	55%
Curriculum session (in the morning with Ami) (n=12)	0%	25%	8%	33%	33%
ICAN: Identify and Interpret Strategy, (afternoon session 2 with Nancy and staff) (n=11)	0%	0%	18%	36%	45%

Table B3. Please rank the following activities based on their usefulness in improving your implementation of CS lessons in your classes.

Answer Choices	Not helpful	Slightly helpful	Somewhat helpful	Quite helpful	Extremely helpful
Popper data collection activity (late morning with Nancy) (n=11)	18%	0%	9%	18%	55%
ICAN: Identify and Interpret Strategy, (afternoon session 1 with Nancy) (n=10)	10%	0%	20%	20%	50%
ICAN: Identify and Interpret Strategy, (afternoon session 2 with Nancy and staff) (n=10)	10%	0%	30%	10%	50%
Curriculum session (in the morning with Ami) (n=12)	8%	33%	8%	17%	33%

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Table B4. Please provide any other feedback you have about the January D2D2 Teacher Workshop.

<i>I think the biggest challenge for most science teachers to implement CS is to collect data, and interpret the data with their students. I think the dropper/popper data was a great reference point for analyzing and discussing what the data show. This could then be applied to “messier” citizen science projects.</i>
<i>It all went very well and time seemed to go by more quickly than I thought it would for a Saturday workshop! Thanks</i>
<i>Great workshop! Please keep up the great work!</i>
<i>I appreciated the time to review the curriculum and would have liked even more time to think about how to fit it into my current curriculum.</i>
<i>Appreciated the shorter time period and extended lunch time to reconnect with colleagues also, enjoyed the hands-on activities that have practical application - with items available on the Google Docs thank you! :)</i>
<i>The time we are spending together is very helpful---getting to know and becoming comfortable with the teachers in my groups really encourages me to share and ask questions. It also is so encouraging to hear how it is working for others in their middle and elementary classrooms. (it is also nice to hear from the high school teachers as well)</i>
<i>I was only there for the afternoon sessions, however, I feel comfortable in implementing citizen science. I feel the follow-up sessions are just a lot of filler sometimes.</i>
<i>Nice to connect with others in the small groups again. It would be nice to have a preview of expectations for the next session.</i>

Small Reflective Groups

Table B5. How many times has your D2D2 small reflective group met since September 2015?

Answer Choices	Response Percent (n=12)
0	0%
1-2	42%
3-4	58%
5 or more	0%

Table B6. Please select how often your D2D2 Small Reflective Group has served as a forum for...

Answer Choices	Never	Rarely	Sometimes	Often	Always
Exchanging strategies for teaching science process (n=14)	-	7%	21%	29%	43%
Sharing student work (n=14)	-	-	43%	36%	21%
Discussion or assisting with CS implementation in your district/school (n=14)	7%	7%	21%	50%	14%
Discussing how best to incorporate science standards (n=14)	-	7%	43%	36%	14%
Discussing how to meet project goals (n=14)	7%	7%	21%	50%	14%
Discussing or trouble-shooting the use of data (n=14)	7%	21%	29%	29%	14%

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Table B7. Please provide any other feedback you have about D2D2 Small Reflective Groups.

<i>This is where the rubber meets the road. Very helpful to have a cohort for implementation.</i>
<i>Really enjoyed the discussions with my small reflective group.</i>
<i>helpful to have a more intimate setting - small group discussion is informative and meaningful</i>
<i>They have be amazing. Helping me to keep bringing my focus back to the process and incorporating the D2D2 ideas into my plans. (because everyday school planning tends to drift back to the familiar) Having colleagues to talk over common issues is one of the best things about the program. (Thank you for that)</i>
<i>There are too many meeting times. If everyone completes the Citizen Science projects in the fall, the first two meetings discuss the results and then it really does not feel like there is a need to meet. If the Citizen Science projects are done in the classroom in the spring, we are meeting without any student work- again a waste of time. One follow-up meeting after everyone has completed the Citizen Science project would be enough.</i>
<i>We are all different places in our implementation. Since I did all of my implementation before we ever met as a small group, I don't feel it was worth it. Also, it is a HUGE task to get 5-6 working moms/grandmoms to agree on dates and times that work for them.</i>
<i>[D2D2 research staff member] is awesome- so knowledgeable!</i>