



PLUM LANDING

Explore Outdoors: At-Home Study



2020

SUBMITTED TO

WGBH BOSTON

SUBMITTED BY

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About Concord Evaluation Group (CEG)

CEG is a woman-owned, small business in the Boston area.

We use a variety of evaluation research methods to assess the impact of educational programs and media.

Our mission is to use our evaluation expertise to help improve learning outcomes and enhance the quality of life, especially for underserved communities.

CEG works with a range of audiences--from preschoolers through adults--within the US and abroad.

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Background

Problem Statement

The planet needs help and children are our best chance.

All across the globe, communities are grappling with the need to prepare for and respond to climate change. The United Nations calls climate change “the defining issue of our time,” and the Intergovernmental Panel on Climate Change points to shifting weather patterns, rising sea levels, and melting ice caps as evidence of a profound environmental upheaval that is threatening ecosystems from the Amazon rainforest to the Arctic tundra (Qin et al. 2013). Acknowledging that children are the next generation of change agents, it is imperative to instill in them an understanding of the workings of our natural environment, as well as a sense of stewardship, if we hope to chart a new course.

Nature connectedness is good for children and the planet.

Recent research has demonstrated that positive experiences with nature, both structured and unstructured, can build children’s environmental knowledge and skills and provide opportunities for positive emotional experiences that foster a sense of connection with the environment (Ballard, Dixon, & Harris, 2017; Clayton et al., 2011). This sense of environmental connectedness, can, in turn, establish children’s behaviors related to environmental stewardship for improving ecological health (Barrable & Booth, 2020).

At the same time, research shows that spending time in nature can contribute to children’s health and well-being. Benefits of time spent outdoors include reduction in obesity, anxiety, ADHD symptoms, and stress, and increases in immune system functioning (Cleland et al., 2008; Taylor & Kuo, 2011; Park et al., 2009; Li et al., 2007; Li et al., 2009). Nature connectedness is also generally linked with a decline in behavioral and emotional issues in children (Barrable, 2019).

Thus, for both environmental health and child health reasons, it is vitally important to provide our youth with opportunities to spend more time outdoors engaging in educational, nature-based activities.

Nature connectedness can start at home.

Nature-based, environmental science activities may be effectively provided by schools, nature programs, and other out-of-school-time organizations (Paulsen & Andrews, 2019; Paulsen, 2013). However, parents and children also have an opportunity to learn together at home. At-home learning is especially salient at the time of this writing—during the COVID-19 pandemic when most families worldwide are facing an extended period of sheltering-in-place and virtual schooling.

Prior research indicates that family engagement in at-home STEM activities can promote joint exploration of core disciplinary ideas and practices (Lavigne et al., 2020; Silander et al., 2019). Having a parent teach or facilitate learning at home can be powerful, as it lays the necessary educational groundwork for a child's confidence and proficiency in other settings such as classrooms (McClure et al., 2017).

Media may help support parents in facilitating nature connectedness at home.

Despite the potential for joint exploration, many parents are not confident in teaching their children science. Research suggests that parents are more supportive of children's reading and math skills than science, due to their personal perception and low self-efficacy regarding science (De Lurdes Cardoso, 2002; Solomon, 2003). Studies have also found that parents from low-income communities, in particular, cite a lack of ideas and resources as a barrier to doing science with their children (Silander & Silander, 2020; Goldstein et al., 2017).

Media can play a critical role in giving parents ideas and structure for exploring STEM with their children and in helping parents develop the confidence they need to teach their children. A recent study by Sheehan et al. (2018) compared learning among young children with parents who had STEM careers versus parents who did not and found that educational media connected families to information and activities that they would not otherwise have access to and supplemented their child's knowledge of math and science, regardless of the parent's

understanding of STEM. Additional studies have found that learning programs that include enjoyable and interactive educational media can augment a child's learning experience by keeping both parent and child engaged (Lavigne et al., 2019; Lavigne et al., 2020). Interactive technologies like digital games and mobile apps can play a unique role in enriching cognitive development and encouraging the growth of skills like problem-solving and nature connectedness in young children. Because they often provide parents and children opportunities to collaborate, these technologies encourage them to discuss and share what they have learned. Additionally, instructional apps tailored to families can provide education for children and benefit parents by giving background on STEM content and highlighting strategies for engaging their children (Kucirkova & Falloon, 2016; Silander et al., 2018).

PLUM LANDING

One media-based project developed to teach young children about nature and inspire them to take care of their environment is PLUM LANDING. PLUM LANDING is a digital media PBS KIDS series that is funded by the National Science Foundation. The project uses videos, games, apps, and hands-on activities to motivate six- to eight-year-old children to investigate the natural world. Over the last several years, content developers from WGBH Boston and researchers from the Education Development Center (EDC) used an iterative research and design process. The project team went through multiple cycles of implementation and revision to create the PLUM LANDING Explore Outdoors Toolkit. The Toolkit includes digital media resources (animated stories, live-action videos, an online badging system, a digital game, and an app for families), hands-on science activities, and support materials for parents, caregivers, educators, and program directors—all developed to help urban children reap the educational, mental, and physical health benefits of actively exploring nature. In 2020, Concord Evaluation Group (CEG) conducted an independent evaluation of PLUM LANDING. The evaluation included a self-directed, at-home study, which is the focus of this report.



Methods

Study Objectives

CEG conducted an independent evaluation of the PLUM LANDING Explore Outdoors Toolkit in the spring and summer of 2020. The evaluation was designed to assess the extent to which an at-home family exploration program using the PLUM LANDING Toolkit materials contributed to children's overall feeling of connectedness to nature, defined as observing enhanced children's environmental habits of mind (i.e., questions you need to ask when investigating an ecosystem); motivation to explore the environment; improved attitudes about nature; and increases in environmental science knowledge. In addition, CEG investigated the extent to which the PLUM LANDING Toolkit supported parents in becoming more motivated to explore environmental science with their children, in becoming more comfortable exploring environmental science with their children (including knowing how to find nature in local neighborhoods), and in spending more time exploring nature with their children.

The at-home study was designed to explore the following outcomes:

Kids' Outcomes

Expected Impact 1: Kids' environmental **habits of mind** (i.e., questions you need to ask when investigating an ecosystem) will be enhanced as a result of using the PLUM Toolkit.

Expected Impact 2: Kids' **motivation** to explore the environment will increase as a result of using the PLUM Toolkit.

Expected Impact 3: Kids' **attitudes** about nature, including appreciating nature in their local environments and feeling more connected to nature, will be more positive as a result of using the PLUM Toolkit.

Expected Impact 4: Kids will learn environmental **science content** as a result of using the PLUM Toolkit.

Parents' Outcomes

Expected Impact 5: Parents will be more **motivated** to explore environmental science with their kids as a result of using the PLUM Toolkit.

Expected Impact 6: Parents will be more **comfortable** exploring environmental science with their kids, including knowing how to find nature in local neighborhoods, as a result of using the PLUM Toolkit.

Expected Impact 7: Parents will spend more **time** exploring nature with their kids as a result of using the PLUM Toolkit.

Study Design

The study was designed to collect data from a sample of 32 families who used the PLUM LANDING Explore Outdoors Toolkit over two to four weeks. Upon enrollment in the study, each parent-child dyad (referred to as a "family" from here forward) participated in a video conference call with a CEG senior researcher who conducted a pre-test interview with both the child and the parent. After conducting the pre-test interview, CEG instructed families to explore the Toolkit with specific program instructions about which activities and media to use (all materials were publicly available at no cost from the PLUM LANDING website). The program instructions asked parents to begin by watching a two-minute video about exploring nature with their children and a one-minute video designed to introduce them to the PLUM LANDING story and characters. Next, CEG encouraged parents to review a series of training tips for parents available via video or downloadable PDF. Families were then asked to try out five different explorations (each consisting of an introductory animated video and follow-up outdoor activity) throughout the study. Finally, families were also encouraged to use a digital game highlighting nature in the city, a mobile app designed to build the habit of active outdoor nature exploration, and a badging activity in which families complete outdoor missions to receive digital rewards (collectible, virtual "badges").

When families were done with the program, they contacted CEG. At this point, parents completed an online survey and scheduled their final family interviews. The last family interview enabled CEG to compare responses across time and look for trends in their children's environmental science-related habits of mind, motivation, attitudes, and content knowledge, as well as the parent's motivation, comfort, and time spent exploring nature with their children. In addition, the final interview enabled CEG to gather evaluative feedback on the PLUM LANDING Explore Outdoors Toolkit resources.

Recruitment

CEG reached out to over 2,000 families nationwide who have previously indicated an interest in participating in a research study with CEG to let them know about the upcoming study. Families that were interested in participating completed a screening survey online to determine their eligibility. Participants were qualified for the study if they had: (1) At least one child between the ages of six and eight years old, (2) access to the internet, and (3) the ability to communicate in English to participate in video conference interviews. Families were offered an incentive of \$100 to participate in the study.

Participants' Backgrounds

A total of 32 families participated in the study. Participants were from 19 different states and all regions of the country. Children's ages ranged from six to eight years old, with 13 six-year-old participants, 12 seven-year-old participants, and seven eight-year-old participants. Fourteen of the participants were female, and 18 of the participants were male. Six of the families reported their household income as low income, 14 of the families reported low to middle incomes, and 12 of the families reported they had middle incomes (we allowed families to define income levels in comparison to other families they know, rather than using strict numeric criteria).

Of the children's ethnicities, 13 were white or Caucasian, seven were Black or African American, two were Asian, two were Indian or Middle Eastern, two were Latino, and three parents preferred not to respond to this optional question. Of the parents' ethnicities, 11 were white or Caucasian, nine were Black or African American, four were Latinx, one was Asian, one was Indian or Middle Eastern, and five parents preferred not to respond to this optional question.

Table 1:
Family Background and Demographic Characteristics
(N = 32)

Characteristics	Count and Percent (to nearest tenth)
<i>Child Age</i>	
Six years old	13 (40.6%)
Seven years old	12 (37.5%)
Eight years old	7 (21.9%)
<i>Child Sex</i>	
Male	18 (56.2%)
Female	14 (43.8%)
<i>Child Race/Ethnicity</i>	
White or Caucasian	13 (40.6%)
Black or African-American	7 (21.9%)
Asian	2 (6.3%)
Indian or Middle Eastern	2 (6.3%)
Latino/a	2 (6.3%)
Prefer not to respond	3 (9.4%)
<i>Parent Race/Ethnicity</i>	
White or Caucasian	11 (34.4%)
Black or African-American	9 (28.1%)
Latino/a	4 (12.5%)
Asian	1 (3.1%)
Indian or Middle Eastern	1 (3.1%)
Prefer not to respond	5 (15.6%)
<i>Self-reported Household Income Status</i>	
Low to middle income	14 (43.8%)

Characteristics	Count and Percent (to nearest tenth)
Middle income	12 (37.5%)
Low income	6 (18.8%)
<i>State</i>	
Massachusetts	4 (12.5%)
Arizona	4 (12.5%)
California	3 (9.4%)
New York	3 (9.4%)
Florida	2 (6.2%)
Connecticut	2 (6.2%)
Hawaii	2 (6.2%)
Illinois	1 (3.1%)
Indiana	1 (3.1%)
Alabama	1 (3.1%)
Maryland	1 (3.1%)
Michigan	1 (3.1%)
New Jersey	1 (3.1%)
Georgia	1 (3.1%)
Oregon	1 (3.1%)
Tennessee	1 (3.1%)
Texas	1 (3.1%)
Virginia	1 (3.1%)
Washington	1 (3.1%)

Note: Parents could choose more than one race or ethnicity, so the totals may be greater than 100%.

Family Science and Nature Experience

During recruitment, most families reported having only some to little science activity experience: 23 of the 32 families (72%) said that they only did "some" science activities together; six reported that they did not do any science activities together at all (19%), and only three families said that they did "lots" of science activities together (9%). All 32 parents (100%) reported that they had access to at least some form of nature in their neighborhood, anything from small gardens, trees, and plants to parks or trails. Five parents reported that their children could not play outdoors due to fears that their children might get hurt (16%). Three parents (one each) indicated that the following were obstacles for their children: nature was uncomfortable for them, gangs or crime made outdoors dangerous, and health reasons. Other reasons cited by parents included: the current pandemic emergency and weather.

Table 2:
Family Science and Nature Experience (N = 32)

Characteristics	Count and Percent
<i>Experience with science together</i>	
We do lots of science activities together	3 (9.4%)
We do some science activities together	23 (71.9%)
We don't do any science activities together	6 (18.7%)
<i>Obstacles to exploring nature</i>	
Nature is uncomfortable for my child because of things like heat or bugs.	1 (3.1%)
Gangs or crime make the nature areas unsafe for my child.	1 (3.1%)
My child might get hurt in a place with nature (from animals, or he/she might fall, or get lost).	5 (15.6%)
My child's health keeps my child from doing activities in nature.	1 (3.1%)
Other obstacles	8 (25.0%)



Program Implementation

How Families Used PLUM LANDING

We asked parents to report how they accessed the PLUM LANDING resources and incorporated them into their daily routines (hereafter, when we use the term "PLUM LANDING," we include all the components of the PLUM LANDING Explore Outdoors Toolkit—the introductory videos, parent tips, animated stories, outdoor activities, app, badging feature, and game that families were directed to use at the beginning of the study). We also asked parents to report what devices they used to access PLUM LANDING throughout the study. Twenty-five (78%) reported using a computer or laptop, 22 (69%) reported using a smartphone, and eight (25%) reported using a tablet. Parents could report more than one device.

All but one of the families (97%) reported that when they watched the videos, they did so indoors. Conversely, all but one of the families (97%) reported that when they did the hands-on activities, they did so outdoors, as intended. One parent reported that their child was not interested in going outdoors to do the activities, so they did the activities that could be done indoors in their home.

For families who did the activities outdoors, about half of parents reported that they printed the activities to use outdoors. For example, some parents told us:

- *I would play the videos for her, and then I'd print up the activities, and then we'd go outside. And I would read through it if there was any prep or whatever, usually, while she was watching the videos, and then we'd go outside and follow along the printed out activities and do what it directed.*
- *I printed them off. I feel like you could do it on a phone, though.*
- *I printed it out on paper after reading everything online and was prepared for the next day when we went for a walk to somehow incorporate it into us being outside.*

The other half reported that they didn't print anything and took their phone or tablet outside to follow along with the activities. For example, some parents told us:

- *We watched the video first, and then we would talk about what the activity is, and then attempt it. Go outside, talk about it, go outside, and then do it. I just used my phone. We watched the videos indoors.*
- *I had my phone with me [indoors], and then when we went to the backyard, we just had either this laptop or a tablet [on our picnic table].*
- *We watched the videos inside on my laptop, and we used the phone for the outside activities.*

A couple of parents reported that they printed some activities and not others:

- *For certain ones, I did print them out. The bean one we did at the park by our house where we had to take the toilet paper roll and see how far it went. That one I printed just cause I didn't want to mess it up. But there's some we did in my backyard. Like there was the beehive dance one and that we just brought my laptop outside. It just depends on the activity.*
- *Well, I would give it to him. I pulled up the list of activities, and I go, "Okay, look through these and see which ones," because he can read. So I'm like, "See which ones you want to do." I like going in order because that's just how my brain works. And then we try to do a couple of activities, and if I was on my computer, then I printed out the bee activity we printed out because it was just easier that way. And so we start with number one and print out the activity. I think that the first one was the only one that we actually printed. The rest we just use the phone for, and I guess we had the items, we do it.*

Families used PLUM LANDING in various ways. A couple of parents described how they used PLUM LANDING in detail. We've included these descriptions below as they are illustrative of the ways other families used PLUM:

- *Each morning, I would open up the email that had the link to the missions or explorations. And I would first go through and just make sure I had all of the material that we needed. After we ate breakfast and got ready for the day, we would watch the videos together. And then if there was one for the parents only, she would usually just sit*

on the couch and watch it with me too. And then we'd head outside. If we were looking for something that needed to be wooded, or if I were looking for a certain kind of insect or flowers, we'd head over that direction. So we'd try to do one exploration. And then there were a few days where she would play on the game during her sister's nap.

- *First, my son literally read through each of the segments inside. Then probably within a week after that, I went through and read the parent's part, and I read the activities. Then I would go back and ask him. I made him go through the activities as well, and I would prioritize which ones he wanted to do first. Because it was mostly him and me on the computer, when it was time to incorporate his dad and his sister, I would have him explain what it is we were doing. I would kind of fill in the holes and make sure the instructions made sense, but I would try to get him to introduce what activities we were doing and why. I didn't print anything. I would literally read it to make sure I understood it first, that he comprehended, and we would come outside. We used our phones to capture pictures and stuff like that.*
- *What we did was we watched the videos kind of as a pre example of what we're going to talk about. And then we went outside to do the activity and then we came in. And I would ask him, "Okay, so what do you think about this?" or, "What do you think about wildlife?" or, "What do you think about things happening in the city?" So I would give him follow up questions about what we saw. I did it on my iPad. So I just carried my iPad with us when we were doing it.*
- *What we would do is we would watch the videos. After you watch the video, you have some more things, some captions underneath the videos. The first one can be like, "Keep Exploring," or "Parenting Tips," or something like that. Then you had the one at the bottom. It was kind of structured like an activity. We would read that. We would read it together, and I'd get a notepad, and I'd get a piece of paper, and we would write down a title. I would write down a couple of key topics of what we were supposed to be doing: nothing complicated, maybe three or four bullet points of activity guidelines. Then we'd just throw on some Kicks, and we'd kick it. We'd head down to the park or walk a city block in our neighborhood, or get in the backyard and just start digging.*
- *We went through it, and I asked him, "Hey, these are some of the activities. Which ones do you think you would like?" He was like, "Oh, I like that one. I want to collect leaves." Or he gravitated towards the rocks. So he loved hunting for rocks, and then he added his own touch, and he's like, "I want to paint them." So we're like, "Okay. Cool." So it gave him a little more creativity. So yeah, we went, he told me which ones he liked. I took a*

screenshot on my phone, and then we went from there. So the episodes we saw, some of them we saw together, some of them we saw on his phone, but they were all indoors, the episodes. Then, we did an overview right before we left some of the ideas or on what to do.

- *Well, to be honest, he wasn't a hundred percent on board with doing the activities. So we just watched the videos [inside], and then I was able to get them to try out some of the games associated with it. But there were some instances where I could carry over some stuff that we'd seen on one of the videos while we were outside. He didn't want to go outside. He liked the idea of watching the video, and then he, like, all right, let's go outside and try these activities. He was like, absolutely not. He didn't want to make the transition.*

Program Fidelity

The table below summarizes the degree to which families implemented the PLUM LANDING program as instructed (i.e., program fidelity). Families demonstrated high levels of program fidelity or adherence to the study instructions. Families tried at least four of the five outdoor activities together, with each of the activities being tried by 74% to 96% of family dyads. Interestingly, a couple of families occasionally let their children do the outdoor activities alone despite being specifically instructed and encouraged to do them together. These were usually cases of children wanting to do them alone or an unplanned interruption from a sibling that took the parents' attention elsewhere. But, these instances were rare. Also, a couple of parents reported doing the activities alone because they wanted to test them out but never ended up doing them with the children for various reasons (usually due to a lack of time).

Concerning co-viewing of the media, not surprisingly, all the parents and children watched the short video intended to introduce the PLUM LANDING characters together, while parents were more likely to watch the additional introductory material geared toward parents alone or with their children. Most families reported watching the content-related videos together. Each of the videos was viewed by 80% to 96% of family dyads.

Slightly more than half of the sample reported that they tried out the additional, optional media, including the app, badging feature, and the game. Between 77% and 88% of families used these media together, rather than just the child alone or the parent alone.

Table 3:
Family Fidelity to the PLUM LANDING Program Instructions

Components	N	Parent Alone Count (%)	Parent & Child Together Count (%)	Child Alone Count (%)
<i>Introductory Material</i>				
Watched the 2-minute video about how to explore nature with your children	32	11 (34.4%)	20 (62.5%)	1 (3.1%)
Watched the short video to meet PLUM, a little purple alien from the planet Blorb!	32	0 (0.0%)	32 (100.0%)	0 (0.0%)
Checked out the videos and printable tips for parents	32	14 (43.8%)	18 (56.3%)	0 (0.0%)
<i>Exploration 1. Animals and Plants Depend on Each Other</i>				
Watched the video: Brick Eating Ivy Mystery	31	1 (3.2%)	26 (83.9%)	4 (12.9%)
Did the activity: Waggle Dance activity	31	2 (6.5%)	23 (74.2%)	6 (19.4%)
<i>Exploration 2. Finding Wildlife in the City</i>				
Watched the video: Why We Live in the City	31	0 (0.0%)	28 (90.3%)	3 (9.7%)
Watched the video: Wild, Wild Life	31	0 (0.0%)	28 (90.3%)	3 (9.7%)
Did the activity: Fly It, Spy It	26	0 (0.0%)	25 (96.2%)	1 (3.8%)
<i>Exploration 3: Animals' Need for Water</i>				
Watched the video: Squirrel for a Day	28	0 (0.0%)	24 (85.7%)	4 (14.3%)

Components	N	Parent Alone Count (%)	Parent & Child Together Count (%)	Child Alone Count (%)
Watched the video: When Animals are Thirsty	30	1 (3.3%)	24 (80.0%)	5 (16.7%)
Did the Mission: Water! activity	29	1 (3.4%)	27 (93.1%)	1 (3.4%)
<i>Exploration 4: Seed Dispersal</i>				
Watched the video: Plant Your Socks!	28	0 (0.0%)	24 (85.7%)	4 (14.3%)
Did the activity: Seed Blaster	26	0 (0.0%)	25 (96.2%)	1 (3.8%)
<i>Exploration 5: Plants in the City</i>				
Watched the video: Cities vs. Plants	31	0 (0.0%)	26 (83.9%)	5 (16.1%)
Did the activity: More Trees, Please!	28	0 (0.0%)	26 (92.9%)	2 (7.1%)
<i>Other Activities</i>				
Played the game: Wild City Search	24	0 (0.0%)	20 (83.3%)	4 (16.7%)
Played with the app: Outdoor Family Fun with PLUM	25	2 (8.0%)	22 (88.0%)	1 (4.0%)
Earned badges with the Outdoor Adventures feature	22	0 (0.0%)	17 (77.3%)	5 (22.7%)



Findings

Children's Habits of Mind

We asked parents to rate the extent to which they had observed habits of mind related to science and nature learning (i.e., questions you need to ask when investigating an ecosystem) in their children before and after using PLUM LANDING outlined in the chart below. At pre-test, parents rated whether they observed their children use environmental science habits of mind on a scale of 1 (strongly disagree) to 5 (strongly agree). On average, parents reported moderate levels of agreement between 3.34 and 3.97 (out of 5.00) with respect to whether their children exhibited environmental science habits of mind. Parents were most likely to report that their children exhibited an interest in going outside than other habits of mind. Parents were least likely to report that their children were showing curiosity about nature or asking questions about nature.

At post-test, we asked parents whether their children were exhibiting these habits less than, as much as, or more than before using PLUM LANDING. After using PLUM LANDING, most parents reported increases in their children's environmental science habits of mind. Many reported their children showed an increased curiosity about nature (66%) and an increased desire to share new information and ideas about nature (78%). Approximately half of the parents reported that their children were now asking more questions about nature (47%), noticing things about nature (53%), and expressing more of a desire to go outside (56%).

Table 4:
Children’s Habits of Mind
Before and After PLUM LANDING
(N = 32)

Habit	Pre-Test Average (sd)	Children doing this a little more at post-test Count (%)	Children doing this a lot more at post-test Count (%)
Asking questions about nature (e.g., “What animals and plants live here?” or “How did this plant start growing here?”)	3.41 (0.71)	11 (34.4%)	4 (12.5%)
Noticing things about nature (e.g., that bees are usually found near flowers, or that puddles in the sun dry up faster than puddles in the shade)	3.53 (0.57)	10 (31.3%)	7 (21.9%)
Showing curiosity about nature (e.g., asking why certain animals and plants look the way they do, or following an ant to see where it goes)	3.34 (0.70)	17 (53.1%)	4 (12.5%)
A desire to share new information and ideas about nature (e.g., telling me something he or she learned in school, or describing an interesting thing they saw in nature)	3.72 (0.52)	19 (59.4%)	6 (18.8%)
Asking to go outside a lot	3.97 (1.00)	12 (37.5)	6 (18.8%)

Children’s Motivation and Attitudes

One way that we assessed children’s motivations and attitudes related to science and nature was to ask them to indicate the degree to which they enjoyed general science and nature activities—with a “thumbs-up” if they enjoyed each activity, a “thumbs-down” if they did not enjoy it, or a “thumbs in the middle” if they were neutral about an activity.

We found no appreciable change in reported enjoyment levels across a number of activities from pre-test to post-test. At pre-test, the average proportion of positive (thumbs-up) responses across all activities was 71%. The activities with the most positive responses were playing outdoor games (89%) and playing sports (89%). The activity that got the least favorable response from participants was collecting rocks and leaves (46%). Most activities were reportedly enjoyed by more than half of the children who participated.

It should be noted that a total of 28 out of 32 children answered this question as some of them were too shy or too distracted during our pre-test interview. At post-test, the average proportion of positive responses was still 71%. The highest activities were still playing outdoor games (88%) and playing sports (75%). The activity rated lowest was still collecting rocks and leaves, though more children reported enjoying this activity at post-test than at pre-test (53% versus 46%).

Table 5:
Children’s Attitudes towards Various Activities
Before and After PLUM LANDING

Activity	Thumbs-Up Pre-Test Count (%) N = 28	Thumbs-Up Post-Test Count (%) N = 32
Play outdoor games like hide and seek or tag	25 (89.3%)	28 (87.5%)
Look for small animals and birds	23 (82.1%)	26 (81.2%)

Activity	Thumbs-Up Pre-Test Count (%) N = 28	Thumbs-Up Post-Test Count (%) N = 32
Learn about animals, plants, weather, or water	23 (82.1%)	26 (81.2%)
Play a game indoors*	20 (71.4%)	25 (78.1%)
Play sports	25 (89.3%)	24 (75.0%)
Take a walk outdoors	20 (80.8%)	24 (75.0%)
Look at trees, plants, flowers	20 (71.4%)	24 (75.0%)
Take pictures of nature	15 (53.6%)	19 (59.4%)
Read a book*	17 (60.7%)	18 (56.2%)
Look for bugs	14 (50.0%)	18 (56.2%)
Collect rocks or leaves	13 (46.4%)	17 (53.1%)

*We included indoor or location-neutral activities so that children who weren't interested in outdoor activities would have something positive to respond to.

To further assess children's attitudes about nature, we asked children to use one word to complete the following sentence, "When I am outdoors in nature, I feel ____." Before using PLUM LANDING, 26 out of 28 (93%) of the words children used to complete the sentence were positive words such as "happy" or "good." After using PLUM LANDING, 30 out of 32 (94%) of the words children used were positive. This change is only a slight improvement, but already most children were positive at pre-test, so there was little room for growth.

To assess children's attitudes towards science at both the pre-test and post-test, we asked children to tell us whether they liked science. Even though there was an increase in the proportion of children who replied in the affirmative at post-test, the differences were not

statistically significant.¹ At pre-test, 21 out of 28 (75%) of children reported that they liked learning about science. At post-test, 26 out of 32 (81%) reported that they liked learning about science.

To further explore whether PLUM LANDING helped children develop more positive attitudes towards nature, we looked for evidence that the program helped children feel more connected to the outdoors and gave them ideas of new things and places they could explore in nature. So, at post-test, we asked children, "Did PLUM LANDING help you think of new things you can do outside?" and "Did PLUM LANDING help you think of new places you could explore in your neighborhood?" and "Did PLUM LANDING make you feel more or less like learning about science?"

When asked if PLUM influenced their ideas of what they could do outside in nature, 22 children out of 30 (73%) said that it did, and five of these children (23%) stated that they wanted to do some of the PLUM activities again. Three of these children said they were starting to look at nature differently now that they watched the videos and done the activities. Only five children stated that PLUM did not give them new ideas, and three were unsure if PLUM helped them think of new things to do outside.

When asked if PLUM LANDING helped them think of new places to explore, 22 out of 29 children (76%) said yes. Their answers ranged from very small locations, like under rocks or in trees, to larger areas like the park, the forest, and even space (likely inspired by the main character, PLUM, being an alien). Only three children said no, while four were unsure if PLUM helped them find new places to explore.

When asked if PLUM LANDING helped them feel more or less like learning about science, 23 out of 26 children (88%) who answered this question said that it helped them feel more excited about science. As one child described, "PLUM LANDING is like a friend and teacher for me. I like the cartoon characters shown in the videos. I feel like I am with them doing those activities."

¹ We converted responses to ordinal values ("yes" = 2, "depends" = 1, and "no" = 0) and compared children's pre-test and post-test responses using a paired samples t-test. The difference was not statistically significant ($t_{(df=27)} = -0.441, p = .663$).

Only two children said PLUM made them feel less like learning about science. Only one was neutral, saying they already liked science a lot, and one was unsure of how PLUM affected their excitement about science.

Children’s Content Knowledge

We asked children six questions designed to assess their knowledge of a set of environmental science constructs addressed in the PLUM LANDING program. These included questions about animals, plants, seeds, and plant/animal interdependence (for example, “What do animals need to survive and be healthy?” and “How do plants spread their seeds far and wide?”) The children's answers to these questions were scored. Children earned either zero, one, or two points for a possible total content score between zero and 12. The table below outlines how the answers were scored.

**Table 6:
Scoring Children’s Responses to Science Questions**

Score	Reasoning and Description
0	Answer is incorrect, child is unsure of answer, and/or child did not respond to question
1	Child on the right track to correct answer, and/or child only answered part of the question
2	Answer is correct

Four children were too shy or distracted at pre-test to adequately complete the science content questions. Their data were incomplete, so these data are not included in this analysis. At pre-test, children's total content scores ranged from zero to 11, with a mean of 5.43. At post-test, children's total content scores ranged from one to 12, with a mean of 7.82. This was a statistically significant difference between the children's knowledge scores before and after using PLUM LANDING. For example, at post-test, children were more able to identify at least three wild animals that lived near them (e.g., squirrels, wild dogs, birds) versus at pre-test when many could only identify one or two, or they included imaginary animals (e.g., unicorns). One question where children demonstrated growth was about how plants spread their seeds. At pre-test, most children responded, "I don't know." By post-test, they included responses such as "Bees help to spread them." or "Birds help to drop them."

Table 7:
Children's Content Knowledge Scores Before and After PLUM LANDING
(N = 28)

Pre-Test Average (sd)	Post-Test Average (sd)	Statistically Significant Difference?
5.43 (2.52)	7.82 (2.54)	$t_{(df = 27)} = -5.892, p = .000$

To further assess content knowledge gains after using PLUM LANDING, we asked parents, "Did you or your child learn anything from the activity that you or your child didn't know before?" All 32 parents reported that their children learned by watching PLUM LANDING videos and doing the activities. Many parents mentioned that their children learned science content. Though children had some familiarity with the environmental science topics addressed in the program, parents reported that their children still were interested and could expand their knowledge when doing the activities. Several reported that their children learned about new ways that animals, plants, and people could support one another.

Nine parents said that PLUM helped them and their children look at nature differently and made them more observant of the world around them. One parent explained, "My husband's family has a dairy farm. [The children] go down there every day because they never thought of it as nature. We never talked about how the plants help the animals until this activity... It was a good activity for us. We're around nature and animals all the time, but we don't talk about it."

In addition to reporting on their children's learning, thirteen parents said that they also learned something from the videos and activities themselves. One parent said, "I didn't know about the way bees communicate. So that was new." Another parent added, "I'm doing a lot more Googling and researching than I ever did before."

Parent Motivation

We asked parents to rate their agreement with the following statements about their motivation to explore science and nature with their children before and after using PLUM LANDING. Parents rated their motivation on a scale of 1 (strongly disagree) to 5 (strongly agree). The pre-test averages were so high that there was no statistically significant change observed over time. This could be an artifact of the methods used to collect these data. Pre-test motivation data was collected during the face-to-face interview, although the researcher was remote. Post-test data was collected in the final parent survey online (without any face-to-face interaction). The pull to provide a socially desirable response may have driven parents' answers to the pre-test questions since they looked directly at the researcher when responding. This explanation seems even more likely when one considers that the recruitment screener (delivered via web survey) data showed that most families did not do many science activities together before the study, so one might have expected their motivation levels to be lower at pre-test.

Table 8:
Parent Self-Reported Motivation
Before and After PLUM LANDING
(N = 32)

Statement	Pre-Test Average (sd)	Post-Test Average (sd)
Motivation to explore NATURE with my children.	4.56 (.56)	4.28 (.68)
Motivation to explore SCIENCE with my children.	4.41 (.71)	4.28 (.68)
Desire to spend more time outdoors with my children.	4.91 (.30)	4.44 (.72)

Parent Comfort

We asked parents to rate their agreement with the following statements about their comfort levels exploring science and nature with their children before and after using PLUM LANDING. Parents rated their comfort on a scale of 1 (strongly disagree) to 5 (strongly agree). The only statistically significant difference between the pre-test and post-test was for the first item, “comfort helping my children learn about nature.”² We don't have any evidence to argue that PLUM made families less comfortable learning about nature, so we need to consider that, again, social desirability effects may have artificially inflated the high pre-test scores.

Table 9:
Parent Self-Reported Comfort Levels
Before and After PLUM LANDING
(N = 32)

Statement	Pre-Test Average (sd)	Post-Test Average (sd)
Comfort helping my children learn about NATURE.	4.75 (.51)	4.19 (.54)
Comfort helping my children learn about SCIENCE.	4.59 (.56)	4.41 (.56)
Comfort teaching my children about the world by exploring nature with them.	4.28 (.77)	4.44 (.62)

² $t_{(df=31)} = 4.756, p = .000.$

Family Behaviors

At pre-test and post-test, parents reported how much time their families generally spent together outdoors exploring nature. Data collection took place at the start of the COVID-19 pandemic, so the responses may not reflect "typical" family behaviors before the stay-at-home orders, but this is the best information that could be gathered. At pre-test, most parents either reported their families spent less than four hours exploring nature together per week (41%) or more than six hours weekly (53%). By post-test, 88% reported spending more than four hours together exploring nature every week. We asked parents whether this was less, the same, or more time than before the PLUM study, and 14 parents (44%) reported that they were spending more time together as a family exploring nature than before the study began. The remainder reported that they were spending the same amount of time as before. The number of hours reported by parents was statistically higher after using PLUM LANDING.³

Table 10:
Families' Weekly Nature Exploration in Hours Before and After PLUM LANDING
(N = 32)

Total Time per Week	Pre-Test Count (%)	Post-Test Count (%)
Less than 2 hours per week	3 (9.4%)	1 (3.1%)
2-4 hours per week	10 (31.3%)	3 (9.4%)
4-6 hours per week	0 (0.0%)	8 (25.0%)
More than 6 hours per week	17 (53.1%)	20 (62.5%)
Unknown	2 (6.3%)	0 (0.0%)

³ We converted responses to ordinal values ("less than 2 hrs" = 1, "2-4 hrs" = 2, "4-6 hrs" = 3, and "more than 6 hrs" = 4) and compared pre-test and post-test responses using a paired samples t-test. The difference was statistically significant ($t_{(df=29)} = -2.443, p = .021$).

At post-test, we asked children, "Did PLUM LANDING make you feel more or less like spending time outdoors exploring nature?" Twenty-one out of 32 children (66%) reported that PLUM made them want to spend more time outside. Many stated that they began to notice new things about nature and enjoyed learning new things while going outside. Two children were neutral, as they felt they already went outside a lot. One child said, "I play outside plenty, but if people don't play outside a lot [PLUM LANDING] would be good to encourage them to." Five children did not think that PLUM made them want to go outside more. Three were unsure of how PLUM made them feel about going outside.

We also asked parents, "Do you think your experience with PLUM LANDING will change the kinds of outdoor activities your family will do in the future?" Twenty out of 24 parents (83%) reported that they believed their experience would change their families' activities. One parent explained, "I think the template of watching videos indoors and then learning about it more outdoors, I think it's a good combination... We might do more of that." The parents who said yes described how they liked that PLUM had influenced their children's curiosity and excitement about learning with minimal tools and special materials necessary. One parent said, "After looking at the parent videos and then seeing honestly how simple the activities were, before reading all that stuff I thought it was going to take a lot more planning to do. But I realized as far as the material goes, it's stuff that we already had in the house." Another parent added to this by saying, "I realized that it's not that hard to include science. So I thought this would be so much fun. We've never collected rocks before. So I thought, 'Well, maybe I can take them to like a different park and see what rocks they can find there.' Yeah. So yeah, it just seemed like science. A lot of things are free... It's just knowing what to do."

Most parents (30 out of 32, or 94%) had a very positive response to PLUM and planned to use what they experienced while trying PLUM to change how they talk about science and nature with their children. Two parents said that PLUM would not change the activities they do with their children. Two parents were unsure if PLUM would change the kinds of activities they would do with their children.

In addition, we asked parents, "One of the goals of PLUM LANDING is to encourage children to be physically active while investigating the outdoors. Did you feel that PLUM LANDING helped your child be physically active? Please explain." Twenty-three out of 28 parents (82%) said that PLUM helped their children be more active outdoors. One parent described how they used

PLUM to encourage their child to be excited about going outside, saying, "It's hard to get her to go outside and run around when she can't play with other children because of everything going on. So this was the incentive. Hey, we need to go tell PLUM." One parent suggested turning the PLUM LANDING activities into a club, explaining, "These kinds of platforms are really helpful to gain knowledge and...proving the mental ability to think differently and question sessions, we can arrange with multiple children. If a club arranges it... then it, it can be helpful if children participate [with] their parents and ask questions [to] each other."

Although the responses to this question were mostly positive, two parents clarified their answers by PLUM only helped to get the children outside and moving rather than providing intense exercise. Three parents did not think PLUM helped their children be more physically active.

Evaluation of PLUM LANDING

Parent Evaluations

When asked to describe their overall experience with PLUM LANDING, all but one parent (31 out of 32 or 97%) reported that they enjoyed PLUM LANDING. One parent was neutral about their experience. We asked parents whether they would recommend PLUM LANDING to other families. All parents (100%) reported that they would recommend it.

We asked parents whether they planned to continue using PLUM LANDING. Nearly all (97%) reported that they "might" or "definitely" would continue using PLUM.

We asked parents to rate how easy or difficult it was to integrate PLUM LANDING into their everyday lives on a scale of 1 (Extremely difficult) to 5 (Extremely easy). The average rating parents gave PLUM LANDING was 4.25 (sd = 0.76); thus, on average, parents found it very easy to integrate PLUM into their everyday lives. Some parents reported:

- *The app and the activities are great and easy to follow. Good activities for children around my son's age to get engaged in even with little supervision.*
- *The activities required minimum supplies. We were able to make it family fun, and it never seemed like "work." The children enjoyed the interaction, and I let my son kick off*

each activity. This was the best way to gauge his true understanding of why we were outside doing new things.

- *Our schedule is pretty open right now because of COVID. I would try to read about and plan the activity the night before, so if the weather was good and the baby was napping, I put on the videos for [my child]. We went out and did the corresponding activities... sometimes just the two of us and sometimes with other siblings. We also have a big yard, so it was very convenient to go out and explore.*
- *The activities were easy to follow. My son liked most of them and tried most. He asked questions about nature and, at times, wanted to know more.*
- *We had no issues at all.*
- *The directions were pretty easy to understand, and my son picks up on things quite quickly.*
- *It was very easy to add to our outdoor time.*
- *The videos and activities gave us talking points on our daily walks. The children notice things in nature that they didn't notice before, which initiated great conversations.*
- *It was easy to incorporate the concept introduced by PLUM LANDING when we go on walks.*
- *The activities themselves were easy to incorporate.*
- *The video was short, to the point, and interesting. [My child] watched the videos and was interested in the information. It also did not take a lot of time to watch the video and then explore the activities outdoors.*
- *The apps and games were easy.*
- *It was easy because distance learning from school is over, and we have free time for these activities.*

Two parents reported that, while PLUM was easy to integrate, the pandemic made it more challenging for them, given how much screen time their children were getting with virtual school or the stress of social distancing:

- *He did like the videos, but right now, COVID life outside is bike riding and trying to be creative while staying close to home. Can't really "explore." He said no to the additional games, and I'm trying to disconnect whenever possible from technology, so no app. I apologize for that, but virtual school created a monster for begging to use electronics. Over it! lol*
- *The explorations were a little tricky. My seven-year-old was very excited to do the study, but I think distance learning took its toll. Every time we watched the video, and I scrolled*

down to the conversation starters. She would escape or groan or fight doing the activity. I think it was more of an attitude over the content situation.

- *Once we actually got outside and started doing the activities it was more interesting and more fun. It opened our minds to other ideas, too.*
- *It gave us new activities to do with our daily outside time.*

When asked, "How was PLUM LANDING different, if at all, than other things you do with your children?" parents had many different responses. Overall, all of the 22 parents who responded to this question described how PLUM positively impacted their children's excitement about learning. Eight parents said they liked how PLUM gave structure and guided instructions to exploring nature and having fun outside. One parent described how "I thought that it kind of gave the activity a purpose because a lot of the times we're doing things that it seems like they're not really learning... It kind of guides me, or it's like a segue between fun and learning."

Five parents said PLUM LANDING offered them a different approach or added more to what they were already doing with their children. A parent explained, "We do a lot of different science experiments. We watch a lot of educational series on Netflix. But it was nice that it forced you to do both." Another parent said, "We go out and ride bikes all the time, but we don't actually walk and explore nature or look for nature." For these parents, PLUM helped them find new ways to teach their children about nature. One parent emphasized that they liked how PLUM got the entire family involved in the lessons it teaches, encouraging parents and siblings to do activities together.

Five parents said that PLUM was a learning program that worked well with how their children learned and how their families preferred to have their children learn, saying that they felt that PLUM LANDING (and PBS) felt age-appropriate, easy to use, and safe for their children to explore on their own. One parent added to this by explaining how they appreciated the characters' diversity, saying that PLUM LANDING "seems to be a diverse platform for each and everyone."

Four parents said that they had never used videos or activities like PLUM LANDING before with their children. One parent noted, "We never cared about where the squirrels live or where the holes were, so that was something new because that never came across us. We never discussed it, so that was a first... we're exploring more now than ever."

Children's Evaluations

When asked what they liked and didn't like about PLUM LANDING, 23 of the children reported having positive experiences with PLUM. Ten children said they enjoyed everything about PLUM LANDING. One child said, "I liked that it let me go outside and run because in Tennessee I [barely get] to go outside," while another child simply concluded, "PLUM is a great website. I loved it."

Seven children talked about enjoying the activities and games they did. Many said they enjoyed exploring aspects of nature, building projects with their parents, and many said that they enjoyed the bee activity ("Waggle Dance") the best. Three children said they did not like the activities, though, saying that they couldn't think of any they liked or liked the videos better than the activities.

Six of the 23 children who responded (26%) said they really enjoyed the videos, saying they liked the characters and the concepts taught in each episode. However, one child said that the videos were too short, and another child added to this by saying, "You know what episode I didn't really care for? ...the beginning episode about PLUM LANDING...wasn't really exciting." Another child said that they thought the videos were "for kids younger than six years old."



Summary

CEG conducted an independent evaluation of the PLUM Toolkit with 32 families across the US in the spring and summer of 2020. The evaluation was designed to assess the extent to which the PLUM project enhanced children's environmental habits of mind (i.e., questions you need to ask when investigating an ecosystem); motivation to explore the environment; attitudes about nature, including appreciating nature in their local environments and feeling more connected to nature; and environmental science knowledge. In addition, CEG explored the extent to which PLUM supported parents to become more motivated to explore environmental science with their children; become more comfortable exploring environmental science with their children, including knowing how to find nature in local neighborhoods; and spend more time exploring nature with their children. The study findings for each of these areas of focus are summarized below.

Overall, the evaluation provided evidence that PLUM LANDING helped encourage environmental connectedness in families. Specifically, we found that families spent more time outdoors exploring nature and more time being physically active as a result of using PLUM LANDING. In addition, children's environmental science content knowledge increased, and parents reported an increase in children's nature-related habits of mind (i.e., questions you need to ask when investigating an ecosystem) after using PLUM LANDING. Children's interest and attitudes towards outdoor activities were moderate to high at pre-test and did not change over time. Overall, families were very positive about their PLUM LANDING experience and reported they would continue to use the program and recommend it to other families. This study provided evidence that digital media, accompanied by hands-on activities, has the potential to support families in learning about and becoming more connected to nature while together at home.

Parents reported an increase in children's habits of mind after using PLUM LANDING.

- After using PLUM LANDING, parents reported their children's increased curiosity about nature (66%) and an increased desire to share new information and ideas about nature (78%).
- Approximately half of the parents reported that their children were now asking more questions about nature (47%), noticing things about nature (53%), and expressing more of a desire to go outside (56%).

Children's interest and attitudes towards outdoor activities were moderate to high at pre-test and did not appear to change over time.

- At post-test, the average proportion of positive responses to outdoor activities was 68%, which is lower than the proportion at pre-test (71%). But, since none of these changes over time were statistically significant, we concluded that they simply did not change over time.
- Before using PLUM LANDING, 26 out of 28 (93%) of the words children used to complete the sentence were positive words such as "happy" or "good." After using PLUM LANDING, 30 out of 32 (94%) of the words children used were positive. This change was only a slight improvement, but most of the children were positive at pre-test, so there was little room for growth.
- At pre-test, 21 out of 28 (75%) of children reported that they liked learning about science. At post-test, 26 out of 32 (81%) reported that they liked learning about science. Even though there was an increase in the proportion of children who replied in the affirmative at post-test, the differences were not statistically significant.
- 88% of children reported that PLUM LANDING helped them feel more like learning about science. One child described, "PLUM LANDING is like a friend and teacher for me. I like the cartoon characters shown in the videos. I feel like I am with them doing those activities."
- When asked if PLUM gave them more ideas of what they could do outside in nature, 22 out of 26 children (85%) said it did.
- 76% of children reported that PLUM LANDING helped them think of new places to explore. Their examples ranged from very small locations, like under rocks or in trees, to larger areas like the park, the forest, and even space (likely inspired by the main character, PLUM, being an alien).

Children learned environmental science content from PLUM LANDING.

- Children's average pre-test content knowledge scores were 5.43 at pre-test and 7.82 at post-test, resulting in a statistically significant difference between the children's knowledge scores before and after using PLUM LANDING.
- All parents (100%) reported that their children learned at least a little bit by watching PLUM videos and doing the activities.
- One-quarter of parents volunteered that PLUM helped them and their children look at nature differently and made them more observant of the world around them. For example, one parent explained, "My husband's family has a dairy farm. [The children] go down there every day because they never thought of it as nature. We never talked about how the plants help the animals until this activity... It was a good activity for us. We're around nature and animals all the time, but we don't talk about it."
- Though some of their children already knew a bit about some of the topics, parents reported that their children still were interested and could expand their knowledge when doing the activities.

Parents were highly motivated and comfortable exploring nature and science with their children at pre-test and at post-test.

- Parent pre-test motivation and comfort ratings were so high that no statistically significant change was observed over time. This could be an artifact of the desire to provide a socially acceptable response to our interviewers during the pre-test face-to-face interviews, as parents indicated at the screening phase that they were not very familiar with or comfortable with such exploration.

PLUM LANDING encouraged families to spend more time outdoors exploring nature together.

- At pre-test, most parents either reported their families spent less than four hours exploring nature together per week (41%) or more than six hours weekly (53%). By post-test, 88% reported spending more than four hours together exploring nature every week. We asked parents whether this was less, the same, or more time than before the PLUM study, and 14 parents (44%) reported that they were spending more time

together as a family exploring nature than before the study began. The number of hours reported by parents was statistically higher after using PLUM LANDING.⁴

- At post-test, 21 out of 28 children reported that PLUM LANDING made them want to spend more time outside. Some of these children volunteered that they began to notice new things about nature and enjoyed learning new things while going outside. Of the children who did not report an increase, two were neutral, as they felt they already went outside a lot. One child said, "I play outside plenty, but if people don't play outside a lot [PLUM LANDING] would be good to encourage them to."
- Twenty out of 24 parents reported that they believed their experience with PLUM LANDING would change their family's kinds of outdoor activities in the future.
- Twenty-three out of 28 parents reported that they believed PLUM LANDING would encourage children to be physically active while investigating the outdoors.

Families were very positive about their PLUM LANDING experience, will continue to use it, and would recommend it to other families.

- All but one parent reported that they enjoyed PLUM LANDING.
- All parents (100%) reported that they would recommend PLUM to other families.
- Nearly all (97%) reported that they "might" or "definitely" would continue using PLUM.
- Parents reported finding it very easy to integrate PLUM LANDING into their everyday lives. The average rating parents gave PLUM LANDING was 4.25 (out of 5.00).
- Eight parents said they liked how PLUM gave structure and guided instructions to exploring nature and having fun outside. One parent described how "I thought that it kind of gave the activity a purpose because a lot of the times we're doing things that it seems like they're not really learning... It kind of guides me, or it's like a segue between fun and learning."
- Five parents said PLUM LANDING offered them a different approach or added more to what they were already doing with their children. For these parents, PLUM helped them find new ways to teach their children about nature. One parent emphasized that they liked how PLUM got the entire family involved in the lessons it teaches, encouraging parents and siblings to do activities together.
- Five parents said that PLUM was a learning program that worked well with how their children learned and how their families preferred to have their children learn, saying

⁴ We converted responses to ordinal values ("less than 2 hrs" = 1, "2-4 hrs" = 2, "4-6 hrs" = 3, and "more than 6 hrs" = 4) and compared pre-test and post-test responses using a paired samples t-test. The difference was statistically significant ($t_{(df=29)} = -2.443, p = .021$).

that they felt that PLUM LANDING (and PBS) felt age-appropriate, easy to use, and safe for their children to explore on their own. One parent added to this by explaining how they appreciated the characters' diversity, saying that PLUM LANDING "seems to be a diverse platform for each and everyone."

- When asked what they liked and didn't like about PLUM LANDING, 23 children reported having positive experiences with PLUM.
- Ten children said they enjoyed everything about PLUM LANDING. Seven children talked about enjoying the activities and games they did, including exploring aspects of nature, building projects with their parents, and the bee activity ("Waggle Dance"), which they liked the best. Six children specifically said they really enjoyed the videos, including the characters and the concepts taught in each episode.
- Three children said they did not like the activities, though, saying that they couldn't think of any they liked or liked the videos better than the activities.
- When asked, "How was PLUM LANDING different, if at all, than other things you do with your children?" parents had many different responses. All the parents who responded to this question described how PLUM positively impacted their children's excitement about learning. Four parents said that they had never used videos or activities like PLUM LANDING before with their children.



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