
RISE

Research Institute for Studies in Education



IOWA STATE UNIVERSITY

IOWA PBS: IOWA SCIENCE PHENOMENA

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PROJECT EVALUATION REPORT 2022

EXECUTIVE SUMMARY

This is the final report of the Iowa Science Phenomena pilot test. The Research Institute for Studies in Education (RISE) partnered with Iowa PBS to evaluate the Iowa Science Phenomena web-based science content use in science classes in two Iowa school districts. The first section of the report consists of an overview of the project and goals of the pilot test. The introduction also includes a breakdown of the rural and urban district guides for selecting the districts in the pilot test. The second section includes a description of the mixed-methods used in the pilot testing, including observation and survey data collection. The methods section also includes the description of the participants, the data, and the analysis used.

The final section summarizes the results from the pilot test, broken down by each method used. The teacher surveys and observations are separated by district and classroom, whereas the student feedback questionnaires are aggregated to ensure student anonymity. The Appendices include samples of the instruments and protocol as well as parental consent forms.

Teacher survey responses indicate that there was a lack of awareness of the Iowa Science Phenomena website and content among science teachers. There was a low response rate of teachers who were familiar with the content, or had used the content previously. The responses highlight the need for further promotion of the content, as the responses from teachers show that there is interest and need for Iowa-based science content. Additionally, teachers wanted more Iowa place-based content that fit within the current science curriculum standards.

Observations were difficult to conduct, given time and budget constraints as well as complications due to the COVID-19 pandemic. However, data collected revealed that students enjoyed learning about science topics that were relevant to their experiences and lives. In particular, both elementary classes used lessons around the topic of erosion; however, both topics remained relevant to the students' lives – such as the formation of the Loess Hills in Sioux City and the erosion of ponds and farmlands of the rural communities.

Finally, the student feedback questionnaires revealed students' interest in learning about science relevant to their lives. Students expressed interest in wanting to learn more about agriculture and climate change, and the impacts of those topics in Iowa in particular. Students mostly agreed that they liked science and learning about science in Iowa. Some students commented that things they thought were boring (like semi-trucks or buffalo) were more interesting to them now that they had more context.

Brief Description of RISE

RISE was formed in 1974 to conduct comprehensive, integrated research and evaluation studies that enhance PK-20 education locally, nationally, and globally. RISE promotes the integration of evaluation, research, and policy through partnerships with schools, colleges and universities, federal and state education agencies, and private agencies and foundations.

RISE is a team of interdisciplinary scholars with extensive experience in a variety of research and evaluation focus areas that include evaluation of community college projects and projects related to climate and diversity, curriculum development, STEM, student learning and development, teacher

education, and health and well-being. RISE staff have extensive experience developing, conducting, and managing large-scale survey projects. Previous projects include both cross-sectional and longitudinal studies funded by state and federal government sources (e.g., Title III, NSF S-STEM, U.S. DOE, U.S. DOL TAACCCT, NSF ATE, U.S. Dept. of State Community College Initiative Program). Through collaborative efforts with clients, RISE supports institutional research activities, conducts evaluations of academic programs, and contributes data for institutional improvement, policy development, accreditation, and program review.

Evaluators are well versed in data analytics and have the necessary expertise in both qualitative and quantitative methodology to conduct process/implementation and outcomes evaluations required for the pilot testing of the Iowa Science Phenomena project.

RISE evaluators are members of the American Evaluation Association (AEA). RISE uses the national Program Evaluation Standards as a critical foundation of our work as program and project evaluators, following the five standards of utility, feasibility, propriety, accuracy, and accountability (Yarbrough et al., 2010). RISE also recognizes that this evaluation requires an awareness of our cultural competence (American Evaluation Association [AEA], 2011; Fitzpatrick et al., 2011; Mertens & Wilson, 2012). Because the program involves students, faculty, and staff from a variety of cultures, RISE will develop a culturally responsive evaluation (Mertens & Wilson, 2012) in which we will seek to understand the influence of the cultural and historical context of the program.

INTRODUCTION

Iowa Science Phenomena

Iowa PBS is engaging Iowa teachers and partners in a new online service to curate and share a growing collection of science phenomena media for use in Iowa's classrooms. The Iowa Science Phenomena is meant to build awareness of instructional strategies anchored in local, place-based science events relevant to student interest and experiences. (Iowa Science Phenomena Project Overview, as stated in the Documentation for Informal Quote Selection).

Pilot Test

The goal of the pilot test was to measure the accessibility and reception of the Iowa Science Phenomena content by teachers and students. Particular interest was spent on noting the teachers' feedback on the use of the content and the students' interest in learning about Iowa science.

Iowa Rural and Urban Districts

The pilot test was administered in separate districts representative of Iowa's rural and urban districts. The criteria for determining rural and urban districts was based on the definitions provided by the National Center for Educational Statistics:

Referred to as the "urban-centric" classification system to distinguish it from the previous "metro-centric" classification system, the new classification system has four major locale categories – city, suburban, town, and rural – each of which is subdivided into three subcategories (<https://nces.ed.gov/surveys/ruraled/definitions.asp>)

The research team combined the city and suburban major locale categories into a group labeled "urban" and combined the town and rural major local categories into a group labeled "rural" to

reach our final classification of two groups. Next, the team was able to generate a report from the NCES using 2019 school statistics to identify all districts with these classifications.

To select the rural and urban school district which most closely represented the state average demographics for the urban and rural districts, the Iowa Department of Education enrollment demographic and free and reduced lunch (FRL) data from the 2018-2019 school year was used as a comparison.

The Iowa Urban and Rural data set along with the Demographic Criteria data were cross-tabulated to generate two lists of school districts which most closely matched the average key demographic criteria for the state. The order of key demographics followed were FRL and race. The research team took the top 5 closest related districts representative to the state average and reached out to each district to field interest in participating in the pilot test, if the first five were not responsive to interest, the team continued down the list of the districts that most closely reflected the state averages.

METHODS

A mixed-methods approach was used to administer the pilot test in the two districts. Surveys were conducted to gain feedback using Likert-scale and open-ended questions, and classroom observation data were collected during lessons. Student feedback was gathered from the middle and high school grade levels in order to gain as much feedback as possible. At the elementary level, discussion and question prompts were included in the observation when class time allowed for the observer's engagement (See Appendix E for question prompts).

Per IRB requirements for studies involving youth under 18, students were given permission slips for parental consent to participate in the feedback questionnaires. Any student who did not return the signed permission slip was not included in the analysis of the student questionnaires. Students were given the option to complete the questionnaire; consent was verbally requested when the questionnaires were handed out (see Appendix D). Consent was not required for the classroom observations, as the process was done for evaluation only, and no identifiable data was collected on individual students.

Classroom observations

Evaluators sat in on several lessons at different grade levels in each district. Data were collected through the use of field notes, discussion prompts from students, and one-on-one questions with teachers. Data were stored in personal files and organized in a word document upon completion of the observation. The analysis consisted of summarizing and highlighting key areas of feedback about the Iowa Science Phenomena content.

Observers noted the time spent on the lesson, the engagement of the students, and discussion prompts from the teachers. The observer also took time to ask the students questions regarding how they liked the lesson, particularly about the content being relevant to their lives.

See Appendix A for the observation protocol.

Teacher survey

Teacher surveys were sent out to each science teacher in both districts using Qualtrics Survey Software. Two reminders were sent to administrators to pass on to the teachers and the teachers themselves. The surveys asked teachers if they were familiar with the Iowa Science Phenomena website and if they had used the content in their lessons. If teachers had used the content, they were asked several more Likert-scale questions on their experiences with the website and their preparedness and willingness to share the content.

Teachers were also asked to share how they used the content in their lessons and their familiarity with using place-based science content in general. Several open-ended questions allowed for teachers to provide feedback on their experiences.

See Appendix C for the survey.

Student feedback questionnaires

Questionnaires were handed out on paper to students who had attended the lesson using Iowa Science Phenomena content. The questionnaires were given to middle and high school classes only to obtain as much feedback as possible from student perceptions. Students were asked using Likert-scale questions to rate their level of agreeableness to how they like science and learning about science in Iowa. Additional open-ended questions included their favorite part of the lesson, more topics they would like to learn about, and their understanding of the word 'phenomena.'

See Appendix B for the questionnaire.

Participants

Sioux City School District

The Sioux City School District represented the urban district in Iowa. At the elementary level, there are 145 teachers who are responsible for including science content in the curriculum, and 75 secondary education teachers. Twenty-one science teachers participated in a survey sent to all science teachers in the district.

All respondents from Sioux City were classroom teachers. Of the 13 teachers who responded to years teaching, all were in the elementary school except one who taught 6th grade. All elementary teachers have science lessons in their grade levels taught.

Osage Community School District

Osage Community School District includes one elementary, one middle, and one high school. There are 23 teachers who teach science in the district: 18 elementary, four secondary, and one special education teacher. Seven teachers responded to the teacher survey sent to the entire district.

Five respondents from Osage were classroom teachers, and one responded 'other' and did not clarify. Of the teachers who responded, two were elementary school, one middle school, and three high school teachers. One high school teacher responded they taught physical science.

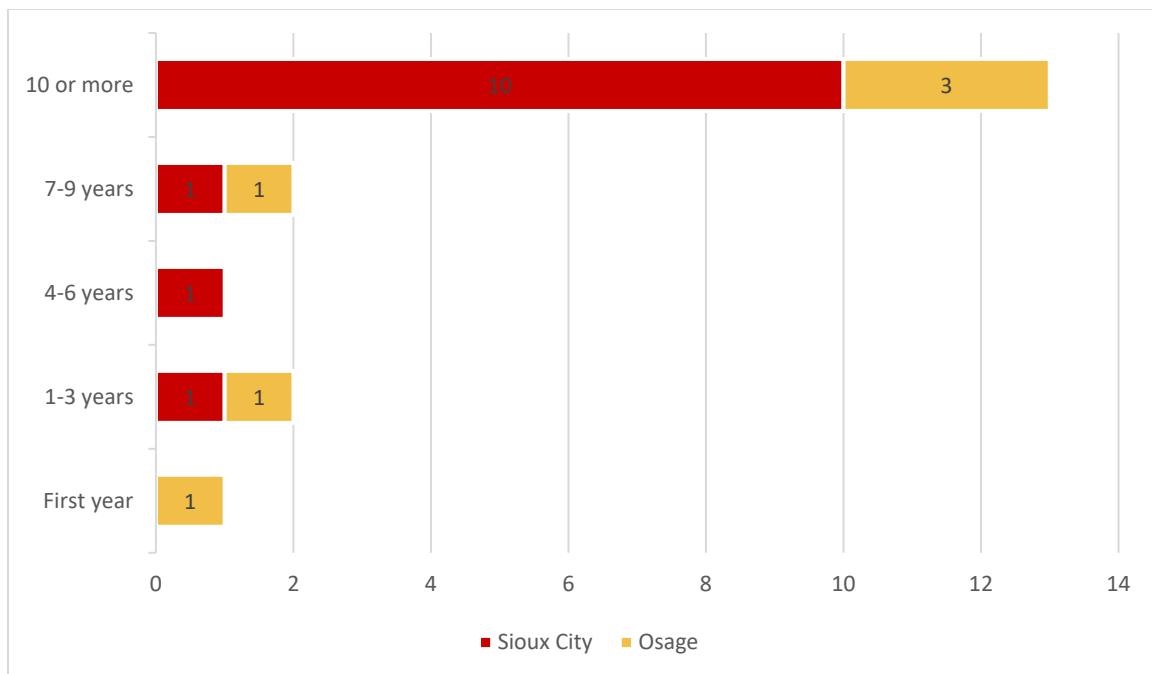


Figure 1. Years teaching

Data and Analysis

Teacher survey responses were collected via Qualtrics Survey. Anonymous links were sent district-wide to all science teachers. Three reminders were sent from either district administrators or Iowa PBS staff representatives. Data were downloaded into Excel and analyzed for frequency results. Open-ended responses were summarized, and anonymous responses were shared in this report due to the low response rate.

Classroom observations were conducted over one day at each district by two evaluators from RISE. One elementary classroom from the urban district (Sioux City), as well as three middle school and two high school classes were observed. At the rural district (Osage), two elementary lessons were observed. Two high school classes were given student feedback questionnaires to complete. Due to conflicts in time and individual emergencies, no middle or high school observations were done at the rural district.

Student feedback questionnaires were distributed, on paper, to all high school and middle school students during the observations. Parental/guardian permission was obtained in order for students to participate in the questionnaire. Data collected from students were entered into excel by RISE associates and stored on a secured RISE server managed by ISU. Data were de-identified before analysis. Responses were aggregated and summarized for this report. Selected responses were chosen to highlight important results.

RESULTS

Teacher Survey Responses

Teachers were asked to respond with their level of experience using the Iowa Science Phenomena website and their experience with phenomena-based teaching practices. The majority of

respondents had no or little experience with any of the items. One or two responded that they had some moderate experience with the Iowa Science Phenomena website and/or phenomena-based teaching and learning practices.

Please rate your current experience with each of the following items.

Table 1. Please rate your current experience with each of the following items.

		n	No Experience	Little Experience	Moderate Experience	Extensive Experience
<i>The Iowa Science Phenomena website</i>	Sioux City District	21	17 81.0%	3 14.3%	1 4.8%	0 0.0%
	Osage Community	7	3 42.9%	3 42.9%	0 0.0%	1 14.3%
<i>Content available on the Iowa Science Phenomena website</i>	Sioux City District	21	17 81.0%	2 9.5%	2 9.5%	0 0.0%
	Osage Community	7	3 42.9%	3 42.9%	0 0.0%	1 14.3%
<i>Classroom teachers' contribution to Iowa Science Phenomena</i>	Sioux City District	21	18 85.7%	3 14.3%	0 0.0%	0 0.0%
	Osage Community	7	4 57.1%	1 14.3%	2 28.6%	0 0.0%
<i>Overall knowledge of using Iowa as background for science lesson</i>	Sioux City District	21	15 71.4%	5 23.8%	1 4.8%	0 0.0%
	Osage Community	7	3 42.9%	2 28.6%	1 14.3%	1 14.3%
<i>Phenomena-based teaching practices</i>	Sioux City District	21	16 76.2%	3 14.3%	2 9.5%	0 0.0%
	Osage Community	7	1 14.3%	2 28.6%	3 42.9%	1 14.3%
<i>Phenomena-based learning practices</i>	Sioux City District	21	16 76.2%	3 14.3%	2 9.5%	0 0.0%
	Osage Community	7	1 14.3%	4 57.1%	1 14.3%	1 14.3%

All teacher participants were asked if they had ever used the website before. Twenty responded, and approximately half stated they had not used the website but were interested in the content. Three stated they had used it, and five stated they were not interested.

Have you used the Iowa Science Phenomena website content before?

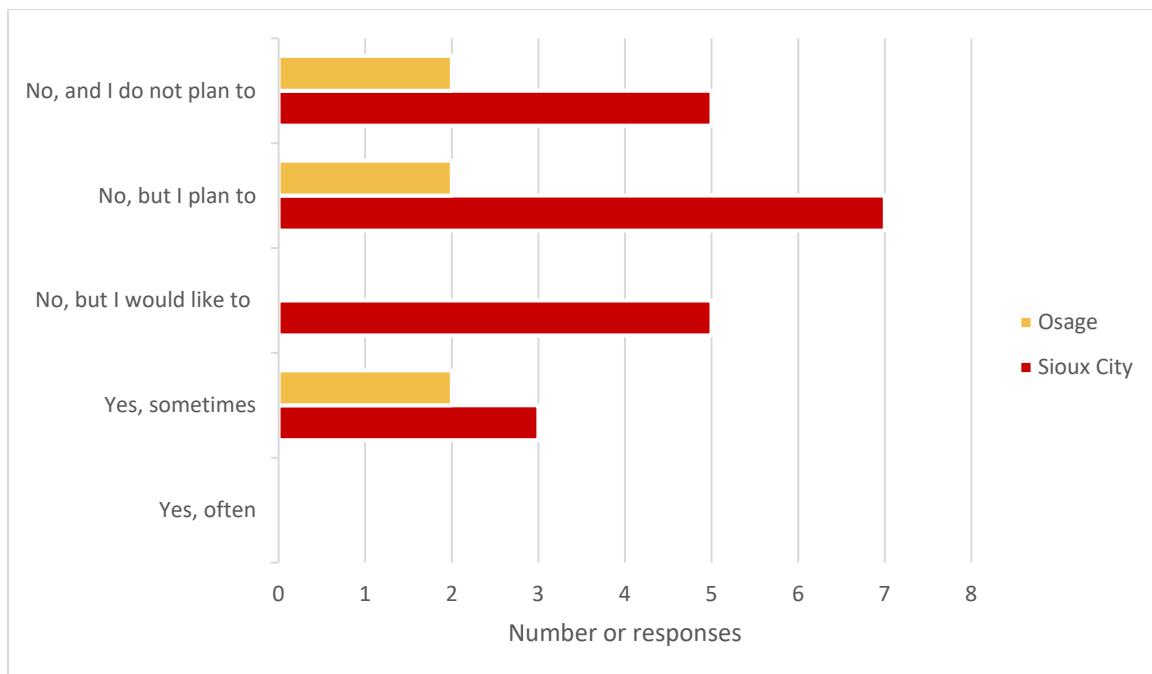


Figure 2. Use of Website

Of those who responded 'Yes, often' or 'Yes, sometimes,' one teacher from each district responded they use the website monthly, and another one from each district responded they use it once or twice a year. Teachers who used the website were asked what the best resources they found from the website; however, both responses indicated that the website did not quite meet their science lesson needs. Responses from teachers who have used the website include:

Not a lot of resources that are beneficial to our standards. I have browsed the website, but have had to look at other grade level to find something that meets what we are learning about. (Sioux City)

I have searched around the site, narrowing it to my grade level, to see the short videos that have to do with animals (& animal calls) or insects, since we study life cycles & habitats. (Sioux City)

Thus far, I have used the wooly mammoth and the nitrogen/forest phenomena. I've only been using the platform for a month/month and a half. They worked well because they gave me a way to tie local phenomena to others that I use to make our units more impactful. (Osage)

When asked what they would like to see more of, teachers stated they wanted more lessons that fit in their standards and grade levels and more information on specific topics. Responses include what teachers would like to see more of on the website:

More resources that fit into not only state standards, but grade level as well. More resources that are STEM and Environmental oriented. (Sioux City)

I like to see video clips about magnetism, electro magnets, circuits/batteries, habitats, life cycles, weather & weather data. (Sioux City)

At this point it's too early to tell but it would just be nice to have at least one option per NGSS standard. (Osage)

Suggestions for improvements include:

For lesson plans, possibly include the activities instead of saying "find this..." (Sioux City)

It's set up pretty well. Just a possible suggestion: an additional online (free) virtual lab to accompany the phenomena would be great for young teachers with less resources. (Osage)

Teachers were asked to describe their experiences using Iowa Science Phenomena, using local science content examples of how they connected students to the community. However, only one teacher responded, and they included an example of how they would like to use the Iowa Science Phenomena content during their lessons, and another stating they wanted to see more NGSS standards:

We are only allowed 25 minutes total per day for either science or social studies, but not for both. The time is very short (our schedule is planned out for us by admin, & we are given blocks of time for the subjects). So, we look for ways to get the most bang for our buck-in other words, if there is a great video that shows how magnets work or that ties in with animal life cycles-if it is short but effective, that is what we're looking for. (Sioux City)

My experiences have been positive other than not having phenomena for some standards. So far they have tied to NGSS standards well. (Osage)

Overall, teachers who have used the Iowa Science Phenomena website reported mostly neutral perceptions. The quality of content and the ability to integrate the content had somewhat negative perceptions. Further responses from teachers indicated they wanted more content to meet their needs, and teachers responded and had not had any interaction with the website. Only one responded that they had a somewhat negative perception based on their ability to integrate the material into their science curriculum.

Please answer the following regarding your perception of the Iowa Science Phenomena website:

Table 2. Perception of the Iowa Science Phenomena website

		n	Very negative	Somewhat negative	Neutral	Somewhat positive	Very positive
Quality of content	Sioux City	13	0 0.0%	0 0.0%	8 61.6%	1 7.7%	4 30.8%
	Osage	6	0 0.0%	2 33.3%	2 33.3%	2 33.3%	0 0.0%
Ease of use	Sioux City	13	0 0.0%	0 0.0%	8 61.6%	1 7.7%	4 30.8%
	Osage	6	0 0.0%	0 0.0%	3 50.0%	2 33.3%	1 16.7%
Ability to integrate into science curriculum	Sioux City	13	0 0.0%	1 7.7%	8 61.6%	2 15.4%	2 15.4%
	Osage	6	0 0.0%	2 33.3%	2 33.3%	1 16.7%	1 16.7%

Teachers further explained the responses they chose above:

I have never been aware of this but want to be! (Sioux City)

I can narrow my search to my grade level or standards, see what is available, & click to watch or use. (Sioux City)

I know there is earthquake activity in the Midwest, and I know that Iowa has been able to feel some very minor shaking in the past. Is there some way that could be incorporated in? Do we have seismometers in Iowa since we are a low risk area? This would add to the different areas of science that could be covered using Iowa as a reference point. (Sioux City)

There is nothing posted for Kindergarten that I could find. (Sioux City)

I haven't used this before but it looks like quality material. (Sioux City)

I was going to help pilot this in our district but I could only find a couple that met one of my standards and it wasn't the standard I was working on at the time. Also the few that I watched did not seem of very high quality or something that would really catch the attention of my students and want to make them delve into the subject further. (Osage)

When I looked at the science standards I am working on with my students, they were not on the website, so I was unable to use it. (Osage)

It seems to do what you would expect it to do. Just needs more content. (Osage)

Teachers were asked how likely they were to share their resources, and most stated they were at least somewhat likely to share the resources with students, families, and colleagues. From Sioux City, one indicated they were not likely to share the resources with anyone, and several indicated they were not likely to share the resources with families or community groups. Overall, teachers from Osage were not likely to share resources from the Iowa Science Phenomena website. However, one respondent was extremely likely and prepared to share information from the website.

How likely are you to share resources from Iowa Science Phenomena?

Table 3. Likelihood of sharing resources.

		n	Not likely	Somewhat likely	Very likely	Extremely likely
<i>With your students, individually</i>	Sioux City	10	1 10.0%	4 40.0%	3 30.0%	2 20.0%
	Osage	6	5 83.3%	0 0.0%	0 0.0%	1 16.7%
<i>With your whole class</i>	Sioux City	10	1 10.0%	2 20.0%	5 50.0%	2 20.0%
	Osage	6	2 33.3%	3 50.0%	0 0.0%	1 16.7%
<i>With your colleagues</i>	Sioux City	10	1 10.0%	4 40.0%	3 30.0%	2 20.0%
	Osage	6	4 66.7%	1 16.7%	0 0.0%	1 16.7%
<i>With parents, families, or community groups</i>	Sioux City	10	4 40.0%	3 30.0%	2 20.0%	1 10%

	Osage	6	4 66.7%	1 16.7%	0 0.0%	1 16.7%
With administrators or faculty and support staff	Sioux City	10	2 20.0%	5 50.0%	2 20.0%	1 10.0%
	Osage	6	4 66.7%	1 16.7%	0 0.0%	1 16.7%

Additionally, teachers did not feel prepared to provide information about the website with any groups. Less than half of the respondents (three to four out of ten) felt at least a little prepared to provide information.

How well prepared do you feel to provide information about Iowa Science Phenomena with the following groups?

Table 4. Preparedness of sharing resources.

		n	Not likely	Somewhat likely	Very likely	Extremely likely
With your students, individually	Sioux City	10	6 60.0%	3 30.0%	1 10.0%	0 0.0%
	Osage	6	3 50.0%	2 33.3%	0 0.0%	1 16.7%
With your whole class	Sioux City	10	6 60.0%	2 20.0%	2 20.0%	0 0.0%
	Osage	6	3 50.0%	2 33.3%	0 0.0%	1 16.7%
With your colleagues	Sioux City	9	5 55.6%	2 22.2%	2 22.2%	0 0.0%
	Osage	6	4 66.7%	1 16.7%	0 0.0%	1 16.7%
With parents, families, or community groups	Sioux City	10	7 70.0%	2 20.0%	1 10.0%	0 0.0%
	Osage	6	5 83.3%	0 0.0%	0 0.0%	1 16.7%
With administrators or faculty and support staff	Sioux City	10	6 60.0%	3 30.0%	1 10.0%	0 0.0%
	Osage	6	5 83.3%	0 0.0%	0 0.0%	1 16.7%

Teachers were asked to share ways they have seen the use of Iowa or local phenomena as a basis for science lessons. One teacher indicated they have seen how students can connect with what is familiar to them and another stated they like to use real-life examples. Responses include:

Students can make connections with what it's familiar to them. (Sioux City)

Loess Hills formation. (Sioux City)

If I can, I like to use real life examples/things from Iowa to make our science more real for students. (Sioux City)

I have not used it yet this year because it has not had anything that fit our content (earthquakes and volcanoes). The science department is planning to use it this year. We

found some resources that would have been timely for our first unit (rock cycle), but we did not know about the resource until after completing this unit, so it will be used at the beginning of the next school year for that unit. We will be using it for our life science unit later this year. (Sioux City)

Introductory or supplementary to the topics I am teaching. (Osage)

Teachers reported they incorporate local science in their lessons, even if they had not used the Iowa Science Phenomena website. Teachers were asked how they incorporate local science into their lessons. Responses include:

I made some references in the past and I'd like to connect the contents with it in this current year. (Sioux City)

I've incorporated local science by looking for animal habitats/homes in trees while on a field trip to a nature center/preserve. We looked for evidence of animals living in an area & we searched for tracks. (Sioux City)

Connect life cycles to gardening at school for qtr. 3 qtr. 1- weather- weather channel, news, etc. (Sioux City)

We will be doing this later in the year. (Sioux City)

Using other resources within our community to support science teaching. (Sioux City)

Local Ag in the Classroom instructor comes in, our county naturalist does lessons for us, we collect local weather data and talk about local weather hazards, we examine fossils from the Rockford Fossil Park, etc. (Osage)

Use local science businesses and scientists to help in the classroom. Either by doing labs, field trips, or by having them just talk to the class about their career. (Osage)

Finally, teachers were asked how their experience with Iowa Science Phenomena changed their outlook on using Iowa to create their science lessons. One teacher responded they think using local science concepts will help make it more personal for students. Responses include:

I think students could use their prior knowledge to understand and learn better the new contents. (Sioux City)

I don't know if it changed my outlook, since I have always noticed students being more interested when they feel something is real & made more like a personal experience for them. (Sioux City)

I think that using our state to teach science concepts will help give students a more personal connection and ownership of their learning. (Sioux City)

It has made me realize we have other resources or ideas I can use from Iowa, but I feel our district does a great job of including local resources/idea with also using global activities. (Osage)

Not really. I tend to think of science globally and use the examples and phenomena that I think my students can best relate to. (Osage)

Classroom Observations

The Sioux City school district planned classroom observations at all grade band levels – elementary, middle, and high school. Two high school, two middle school, and one elementary school classrooms were observed using the Iowa Science Phenomena website content in their lessons.

Osage Community School district had one day of observations consisting of two elementary lessons (same lesson, same teacher, different classes) and one high school classroom. The high school classroom teacher did not use an Iowa Science Phenomena lesson but had students complete the feedback questionnaire in regards to a previous lesson.

Observations consisted of time spent in lecture, student engagement, activity, and teacher feedback.

Feedback from teachers consisted primarily of their excitement to share content related to Iowa with their students. One teacher expressed her appreciation of the accessibility of the videos since getting to take students on field trips has been difficult due to both budgets and COVID-19.

Elementary classroom observations:

Weather, natural disasters, and erosion (Sioux City).

Formation of the Loess Hills

The classroom teacher began the lesson with a brief overview of a previous lesson of natural disasters around the world, and prompted small group discussions of natural disasters in Iowa. After two minutes, the teacher asked students to share out what their groups discussed.

Student responses of disasters in Iowa consisted of:

- Tornadoes
- Floods
- Snow storms

Following the group discussions, the teacher led the class in a larger discussion about how natural disasters and other weather events cause erosion to take place. The teacher led the discussion to the formation of the Loess Hills, a natural land formation in which Sioux City and much of the western border of Iowa is made. Students discussed having visited parts of the Loess Hills and how centuries of wind caused the sand to build up creating the formation. The class then watched a video on the formation of the Loess Hills using the Iowa Science Phenomena website content.

Student's shared feedback they learning about the formation of the Loess Hills was interesting to them since it was something they were familiar with and could visit. Some student comments included:

I liked learning about the Loess Hills formation, it was interesting seeing the video of my town.

I didn't know that the Loess Hills were made of sand. That's cool.

Farmland and erosion (Osage)

Soil Deposits in Ponds

The classroom teacher started the class with a review of a previous assignment on erosion. After reviewing the homework, the teacher gave instructions and started a PearDeck activity where students followed the teacher's slides on their personal computers. The teacher started the activity with an Iowa Science Phenomena video where someone was measuring the depth of the pond in winter. The teacher first had the students guess what was going on in the video and then discussed the history of Iowa's topsoil. During the rest of class, students discussed in groups questions from the Iowa Science Phenomena website:

1. What would lead to this pond filling in with soil from a neighboring field?
2. What effects might this form of eroding soil have on the ecosystems within the pond?
3. What effect might this erosion of soil have on livestock, birds and other mammals who drink from this pond?
4. How might this have been prevented?

The students seemed to enjoy the video and related discussions questions as they seemed excited to share what they knew about living on a farm, ice fishing, or experiences with watching a pond be filled in. One recommendation for future content from the teacher would be to have a virtual version of a field trip to see erosion happening as it is challenging to arrange an in-person field trip.

Middle school classroom observation:

Human Impact on the Environment (Sioux City)

Challenges and Misconceptions of Recycling

The classroom teacher started the class off by reviewing what they learned last class and then introduced the idea of conservation and recycling. Then the teacher walked around passing out sticky notes for students to write down what they knew about recycling. After students wrote down what they knew, the teacher played the Iowa Science Phenomena video on recycling (two minutes). After the video, students wrote down what they learned from the video and still wondered about recycling. The students brought their sticky notes to the front of the board and put them in three columns (Knowledge, Wonder, and Learning). The teacher then went through all the answers and summarized what the students wrote. Students were very surprised and intrigued that juice boxes could be made into drywall but not the juice box straws. Following this activity, students completed an Exploring Recycled Materials Activity on Canvas for the rest of the class. Students paired up in groups of three to four and looked online to see what other things could be recycled. Before the end of class, each group reported an item that could be recycled to the class.

Habitats in Iowa (Sioux City)

Decreasing Ruffed Grouse Habitat

The teacher started the class by polling the students on their involvement with nature and discussing their own experiences with nature. This led to a mini-lecture on what a phenomenon is and the importance of curiosity for ten minutes. Then the teacher had the students watch an Iowa Science Phenomena video about the Ruffed Grouse Bird (four minutes). Afterward, the teacher led a discussion on the purpose of the video and reviewed keywords from their lessons on ecosystems. Then for the rest of the class, students responded to a writing prompt, integrating what they learned from the video and their knowledge ecosystems.

High school classroom observations:
Aerodynamics and trucking.

[Aerodynamics: Truck Gas Mileage](#)

The classroom teacher began the physics lesson on aerodynamics and concepts, including drag and airflow and how it relates to truck driving. Students worked in partners discussing prompts and answering questions regarding aerodynamics on Canvas. After students shared out the answers to the online prompts, the class watched a video on how making trucks more aerodynamic is better for the environment. After the video, the class discussed the different concepts from the video.

Responses consisted of:

- Reduced drag improves gas mileage
- The curves on the front of the truck helps with air flow

After the whole class discussion, students were put into groups to work on putting together PowerPoint presentations based on their research on aerodynamics and trucking. Student feedback questionnaires were distributed, and some feedback from students included:

It's interesting applying the lesson to something in real life that I see every day. Now driving on the interstate and seeing trucks will be a little more interesting.

I wonder how applying aerodynamics might apply to wind turbines.

Student Feedback Questionnaire

All middle and high school students in the classroom observations were asked to fill out a feedback questionnaire regarding their thoughts on the Iowa Science Phenomena lesson. This section summarizes the aggregated feedback from students. A total of 149 students returned feedback questionnaires following the observed lessons.

Table 5. Student Feedback

	n	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Lesson was interesting	145	6 4.1%	5 3.5%	39 26.9%	71 49.0%	24 16.6%
I liked learning about science in Iowa	145	3 2.1%	11 7.6%	42 29.0%	64 44.1%	25 17.2%
I want to learn more about science in Iowa	144	4 2.8%	12 8.3%	46 31.9%	62 43.1%	20 13.9%

Students involved with Iowa Science Phenomena were asked to answer a couple of questions about their participation, what they learned, and what they enjoyed during their experience. Between the different classes, students were engaging with a variety of topics, including physics, biology, recycling, chemical changes, physical changes, aerodynamics, animals, and habitats.

Favorite/Most Interesting Part of the Lesson

The physics lesson left students interested in how snowshoes work, the formulas associated with the topic, and brainstorming ideas for shoes to walk on water. The biology lessons left students valuing trees, restoration, native plants, and natural aspects of Iowa. Recycling left students aware of what should and

shouldn't be recycled, the benefits of recycling, what happens after you recycle, and what some possible materials that recyclables become. Learning about wooly mammoths and savior seeds left students aware of their presence in Iowa a long time ago. Memorable discussions surrounded when they were alive, how big they were, and the bones found in Iowa. Photosynthesis, birds, trees, grass, and ecosystems are what students found interesting during the habitat and animal lessons. The students engaging with the aerodynamics of semi-trucks found the various applications, physics behind airflow, the role that different devices play, and how different things can help reduce drag most interesting. Lastly, the chemical and physical change lesson left students intrigued by massive temperature change, atoms, and changing properties.

What Iowa Science Topics would you be interested in learning about?

After completing each of their lessons, students shared additional topics that sounded interesting. Agriculture is one topic that students expressed interest in, from farming and the science behind it to crops and the economics of farming. In terms of the natural world and those who inhabit it, students were also curious about the ecosystem, trees, wildlife/animals, plants, the evolution of species, and civilizations, and bodies of water. Quite a few students expressed interest in recycling, pollution, and global warming. Other general topics of interest include natural disasters, bio-medical, physics, weather, chemistry, the universe, friction, energy, gravity, the brain, rocks, and the history of science.

In your own words, how would you describe "phenomena"?

Students had a variety of definitions and thoughts about the meaning of the word "phenomena." Some students saw it as "something that is going on around you," "something you observe," "stuff that occurs in nature around us," or even "fact or situation that is observed to exist or happen." A small handful of individuals describe it using different events like wind/climate change, trees, and the northern lights. Other words or phrases like "extraordinary," "a rare event," "strange," or "a unique occurrence that can't be fully explained by science" were used. Many students found it to be *something that happens*. Student comments included:

Something that is strange and can't be explained.

Something very interesting that you can observe.

Something great that is happening.

Something weird or odd that occurs naturally.

Something that you are interested in and want to know how it works.

I would describe the word phenomena as something that is extraordinary

Something that's important and will impact history

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APPENDIX A

CLASSROOM OBSERVATION PROTOCOL

Lesson Topic: _____

Time spent lecture:

--	--	--

Student engagement:

What are they doing?	
How are they responding?	

Activity:	Time Spent:
Faculty actions:	Student actions:

Activity:	Time Spent:
Faculty actions:	Student actions:

Activity:	Time Spent:
Faculty actions:	Student actions:

APPENDIX B

STUDENT FEEDBACK QUESTIONNAIRE

Who is your science teacher?

What was the topic of the science lesson?

Please tell us how much you agree or disagree with the statements about your science lesson today.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The lesson was interesting					
I like learning about science in Iowa					
I want to learn more about science in Iowa					

List one thing that was your favorite or most interesting part of the lesson:

What Iowa science topics would you be interested in learning more about?

In your own words, how would you describe phenomena?

APPENDIX C

IOWA SCIENCE PHENOMENA - TEACHER SURVEY

Q2 Thank you for taking the time to answer some questions about Iowa Science Phenomena. The information you provide will remain completely anonymous and never be connected to your identity. Your feedback will assist in evaluating the progress of the content of the Iowa Science Phenomena website, as well as providing direction toward improving future programming efforts. You are free to skip questions you do not want to answer or stop responding at any time. Any information you provide is greatly appreciated.

For reference, visit the website here: [Iowa Science Phenomena](#)

Q3 Please rate your current experience with each of the following items:

	No Experience (1)	Little Experience (2)	Moderate Experience (3)	Extensive Experience (4)
The Iowa Science Phenomena Website	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Content available on the Iowa Science Phenomena website	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Classroom teachers' contribution to Iowa Science Phenomena	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall knowledge of using Iowa as background for science lessons	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Phenomena-based teaching practices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Phenomena-based learning practices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4 Have you used the Iowa Science Phenomena website content before?

- Yes, often (1)
- Yes, sometimes (2)
- No, but I would like to (4)
- No, but I plan to (3)
- No, and I do not plan to (5)

Skip To: Q10 If Have you used the Iowa Science Phenomena website content before? = No, but I would like to

Skip To: Q10 If Have you used the Iowa Science Phenomena website content before? = No, but I plan to

Skip To: Q10 If Have you used the Iowa Science Phenomena website content before? = No, and I do not plan to

Q5 How often do you use the Iowa Science Phenomena website?

- Weekly (1)
- Monthly (2)
- Once or twice / semester or course (3)
- Once or twice / year (4)

Q6 What have been the best resources you've used from the Iowa Science Phenomena website?
Please explain why they were the best.

Q7 What phenomena or topics would you like to see more of on the Iowa Science Phenomena website?

Q8 What improvements might you suggest for the Iowa Science Phenomena website?

Q9 Please describe your experience using the Iowa Science Phenomena website. Give any examples of how you have connected students to the community using local science content (lesson details, instruction or assessment practice, alignment with science teaching standards, etc.).

Q10 Please answer the following regarding your perception of the Iowa Science Phenomena website

	Very negative (1)	Somewhat negative (2)	Neutral (3)	Somewhat positive (4)	Very positive (5)
Quality of content (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ease of use (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to integrate into science curriculum (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11 Based on your responses above, please explain why you chose that.

Q12 Have you participated in the Iowa Science Phenomena development program?

- Yes (1)
- No, but I would like to (2)
- No, and I have no interest (3)

Q13 How likely are you to share the resources from the Iowa Science Phenomena?

	Not likely (0)	Somewhat likely (1)	Very likely (2)	Extremely likely (3)
With your students, individually	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With your whole class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With your colleagues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With parents, families, or community groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With administrators or faculty and staff support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q14 At this point, how well prepared do you feel to provide information about Iowa Science Phenomena with the following groups?

	Not Prepared (1)	A Little Prepared (2)	Moderately Prepared (3)	Very Prepared (4)
With your students, individual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With your whole class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With your colleagues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With parents, families, or community groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With administrators or faculty and support staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q15 How long have you been a teacher in your current school?

- This is my first year (1)
 - 1-3 years (2)
 - 4-6 years (3)
 - 7-9 years (4)
 - 10 or more years (5)
-
-

Q16 What grade band (elementary, middle, high) and subject(s) do you teach?

Q17 What is your primary teaching or staff assignment? Check all that apply.

- Classroom Teacher (0)
- Support Staff (Intervention, Administrative, Specials, Counselor, Special Education, etc.) (1)
- Other (2) _____

Q18 Please type your responses to the following questions.

Q19 In what ways have you seen the use of Iowa or local phenomena as a basis for science lessons?

Q20 As a teacher, how did you incorporate local science in your lessons?

Q21 How has this experience changed your outlook on using Iowa as a basis for creating science lessons?

Q22 Please type any further questions, comments, or suggestions you have regarding Iowa PBS or Iowa Science Phenomena.

Q23 If you have a question you would like answered, or if you would like more Iowa PBS or Iowa Science Phenomena please email Tiffany Morgan (tiffany.morgan@iowapbs.org) or Cori Hyde (cjhyde@iastate.edu).

Q24 When you have completed answering the questions, please select the arrow below to submit. Thank you for taking the time to provide Iowa PBS with your valuable input!

APPENDIX D

PARENTAL CONSENT FORM FOR: IOWA PBS – IOWA SCIENCE PHENOMENA

This form describes a research project. It has information to help you decide whether or not to allow your child to participate. Research studies include only people who choose to take part—your child's participation is completely voluntary. Please discuss any questions you have about the study or about this form with the project staff before deciding whether to grant consent for your child to participate.

Who is conducting this study?

This study is being conducted by Cori Hyde on behalf of RISE at ISU.

Why am I invited to participate in this study?

Your child is being asked to take part in this study because he or she is a student in Mr./Mrs. X's class.

What is the purpose of this study?

The purpose of this study is determine how teachers are utilizing the Iowa Science Phenomena web based science content in their science lessons. Additionally, the study is to observe student engagement with the science content.

What will my child be asked to do?

Students will be asked questions during the lesson in groups by the research and/or project team. All answers are completely voluntary. Students will not be asked to complete anything outside of the normal academic or classroom setting.

What are the possible risks or discomforts and benefits of my child's participation?

There are minimal foreseeable risks or discomforts related to your child's participation in this research. Your child may experience minimal discomfort when responding to interview questions for the researchers because they may be shy or embarrassed to respond to questions.

How will the information my child provides be used?

The information your child provides will be used for the following purposes: to inform the project team on ways to refine continue to use the Iowa Science Phenomena web content to improve students' engagement and learning. In addition, information may be used in manuscripts, conference presentations, and for education and training of current or future researchers/teachers. In all data will be anonymized, and will pseudonyms instead of real names.

What measures will be taken to ensure the confidentiality of the data or to protect my child's privacy?

Records identifying you or your child will be kept confidential to the extent allowed by applicable laws and regulations. Records will not be made publicly available. However, federal government regulatory agencies, auditing departments of Iowa State University, and the ISU Institutional Review Board (a committee that reviews and approves research studies with human subjects) may

inspect and/or copy study records for quality assurance and analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken: a code (e.g., 001M) will be used to identify your child's work and the identity of your child will be kept confidential in a locked file cabinet and the audio recorded interviews will be stored on a password protected computer.

Future data use

De-identified information collected about you during this study may be shared with other researchers or used for future research studies. We will not obtain additional informed consent from you before sharing the de-identified data.

Will I or my child incur any costs from participating or will I or my child be compensated?

You or your child will not have any costs from participating in this study. Your child will not be compensated for participating in this study.

What are my child's rights as a human research participant?

Your child's participation in this study is completely voluntary. You can choose not to give consent or you can withdraw consent at any time without any penalties or negative consequences. Your child may also choose not to participate or withdraw from the study at any time without any penalties or negative consequences. Your child can skip any questions that he or she does not wish to answer. If you do not want your child videotaped or photographed, your child will not be videoed or photographed, but will still participate in the science lesson. If your child does not participate in the study, it will have no impact on their experiences at school.

If you have any questions *about the rights of research subjects or research-related injury*, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, 1138 Pearson Hall, Iowa State University, Ames, Iowa 50011.

Whom can I call if I or my child has questions about the study?

You and your child are encouraged to ask questions at any time during this study.

- For further information *about the study*, contact Cori Hyde, via phone (515-294-5847) or email (cjhyde@iastate.edu)

Consent and Authorization Provisions

Your signature indicates that you voluntarily agree to allow your child to participate in this study, that the study has been explained to you, that you have been given the time to read the document, and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your child's participation in the study.

I agree my child can participate in the research.

I DON'T agree for my child to participate in the research study.

Child's Name (printed) _____

Printed Name of Parent/Guardian or Legally Authorized Representative

Signature of Parent/Guardian or Legally Authorized Representative Date

APPENDIX E

STUDENT DISCUSSION QUESTION PROMPT

1. What did you think of the lesson?
2. What was the best part?
3. How would you define phenomena?
4. Did you know that Iowa had so much science?
5. What other topics would you like to learn about?