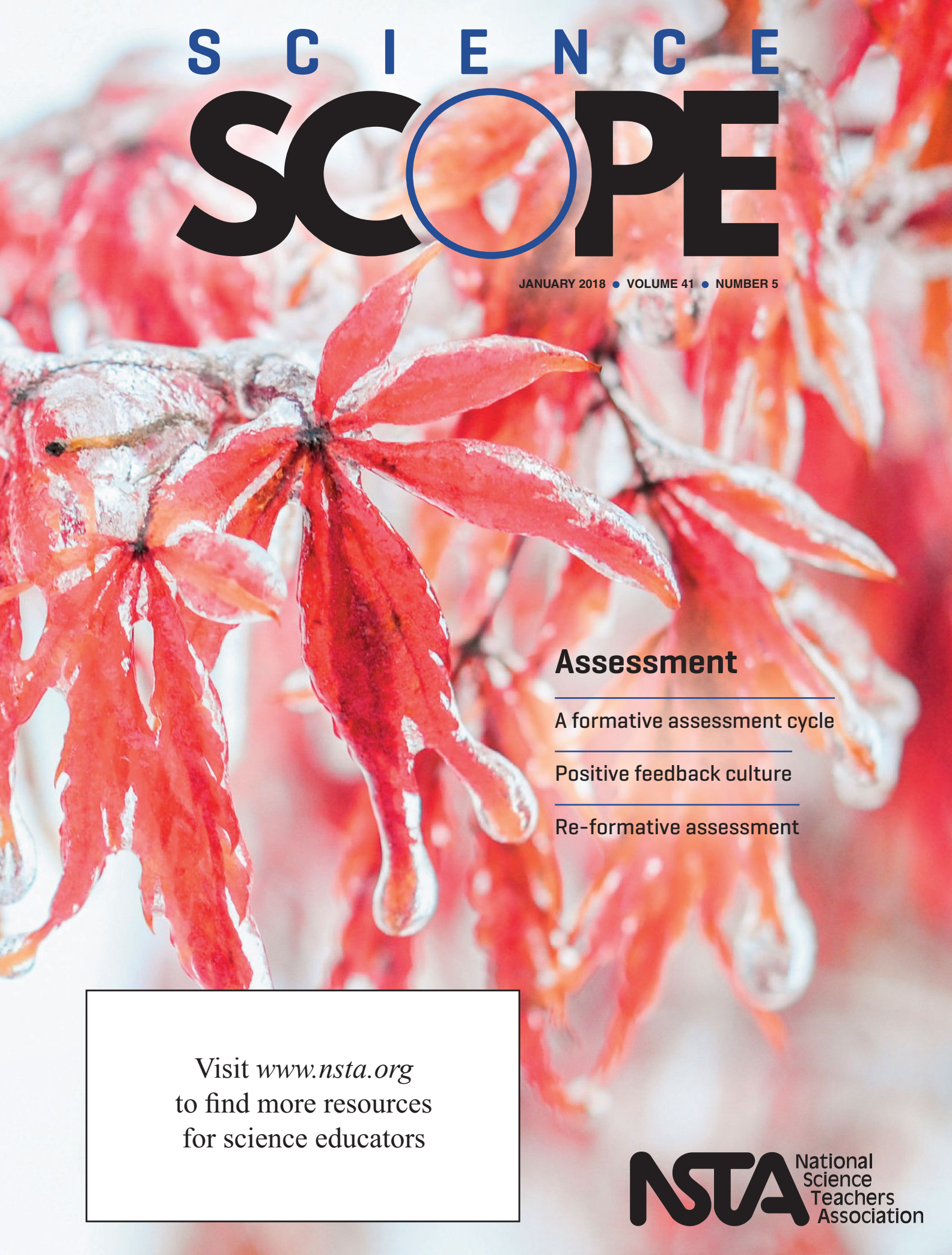

SCIENCE SCOPE

JANUARY 2018 • VOLUME 41 • NUMBER 5

Assessment

A formative assessment cycle

Positive feedback culture

Re-formative assessment

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SCIENCE SCOPE

NSTA's peer-reviewed journal for middle level and junior high school science teachers

ON THE COVER

Imagine being trapped by a freak snowstorm while camping in the mountains—just as your water has run out. How would you keep hydrated? Engaging students in this type of creative problem-solving keeps them engaged *and* provides you with the opportunity to assess student learning. Find out how by turning to page 50 in this issue of *Science Scope*.

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This issue's focus:

ASSESSMENT

● DENOTES THEMATIC CONTENT

FEATURED READING

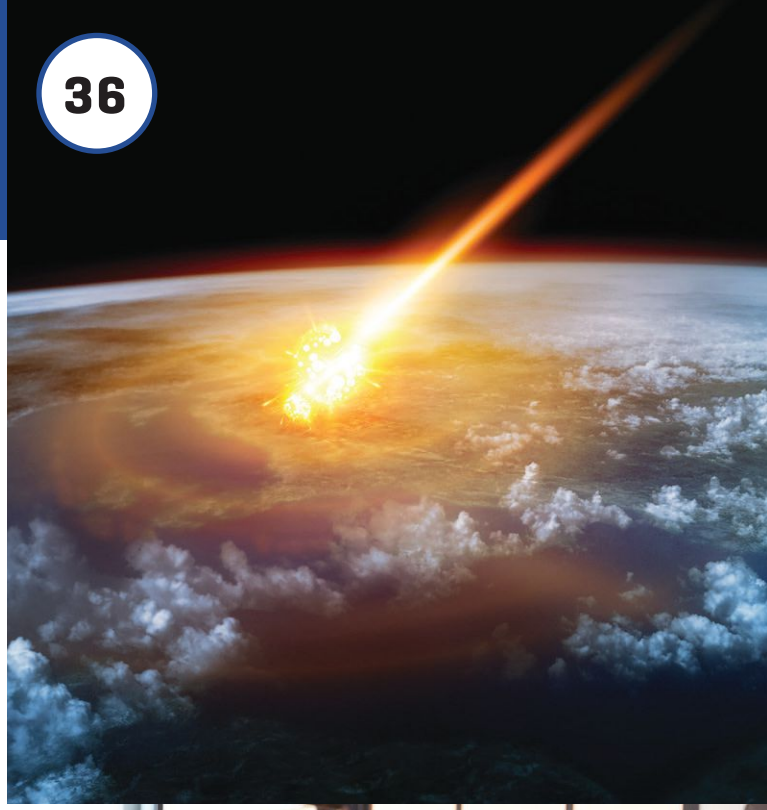
INTEGRATING TECHNOLOGY

HARDWARE, SOFTWARE, AND WEBSITES FOR USE IN THE CLASSROOM

TEACHER'S TOOLKIT

HOW-TO STRATEGIES AND CLASSROOM MANAGEMENT TIPS

ALSO IN THIS ISSUE



Bringing science to life

Using social learning to make real-world connections in science

BY LOUISE MAINE, ANNE FRIEDERICH, JOSHUA HAMES, BARB BREDLOW, KEVIN BOWER, AND JOELLEN POLLACK

Early adolescence is often a time during which students decide whether something is "cool." If middle school students see science as difficult, and therefore less appealing, this could limit the paths they choose later in life (Beard 2013). To engage and motivate our science students, my colleagues and I decided to develop a website that would leverage students' interest in social media and technology. A grant proposal sparked our interest (see Acknowledgment), and we launched the MySciLife website in 2011 (Figure 1).

On this website, students choose an identity related to the content they are studying, such as a specific rock, cell part, or atomic element, then personify that identity through a series of social media exchanges with their peers (Figure 2). Their posts can be shared to the main stream of the site, where others from outside of their class and school can comment and interact. Most students complete their tasks in the classroom, and some work at home, as MySciLife can be accessed using any web browser. We hoped that by having students use these personified identities, the natural flow of social media interaction would create the sort of constructivist engagement that can make science "click" for middle schoolers. We found the approach to be successful for students in grades 5 through 8 with whom we have worked.

The MySciLife modules

- Atoms
- Cells
- Chemical Reactions
- Earth
- Ecology
- Force, Motion, and Energy
- Genetics
- Human Body Systems
- Moon Phases and Seasons
- Universe
- Weather

About MySciLife

MySciLife is not connected to

CONTENT AREA

Middle school science

GRADE LEVEL

5–8

BIG IDEA/UNIT

A variety of topics related to life science, Earth science, and physical science are available.

ESSENTIAL PRE-EXISTING KNOWLEDGE

Varies, depending on chosen module

TIME REQUIRED

5 hours of professional development training to learn the MySciLife platform

COST

$0

SAFETY

Complies with KidSafe COPPA certification

any specific curriculum and is flexible enough to be used with any middle school grade level. Teachers can choose any number of modules to use with their classes. Each content module (see sidebar) provides a variety of prompts and activities that range in complexity. Teachers choose the prompts that match the content used in their classes, and students post responses about how their identity would react to various scenarios. For example, in the cells module, students have the option to respond to the questions: "What did you see/hear/read/view on another post that caused your understanding about cells and cell parts to change?" and "Did you have to revise any of your work? What did you revise? How did this help you understand cells?" These prompts help learners examine their thinking and reflect on the activities by getting them to identify goals, generate new ideas, improve and elaborate existing ideas, and strive for idea cohesion. Their posts become a record of their learning, many incorporating video or digital art.

On the MySciLife platform, students receive feedback from their classmates and teacher, as all posts are seen in the class sidebar. Teachers remind students that they are communicating what they know to others in a "public" area. This motivates students to do well (Schwartz et al. 1999). Students comment on each other's posts to continue the conversation and learn about the various student identities. Student posts can also be shared in the "main stream," where they can be viewed by other students and teachers from across the country, to connect the identities and concepts they are learning. Students are encouraged to visit the main stream and comment on posts in topics they may not be studying. These comments to other students outside their class or school clarify discussions and explanations. This helps students

FIGURE 1: Teacher dashboard

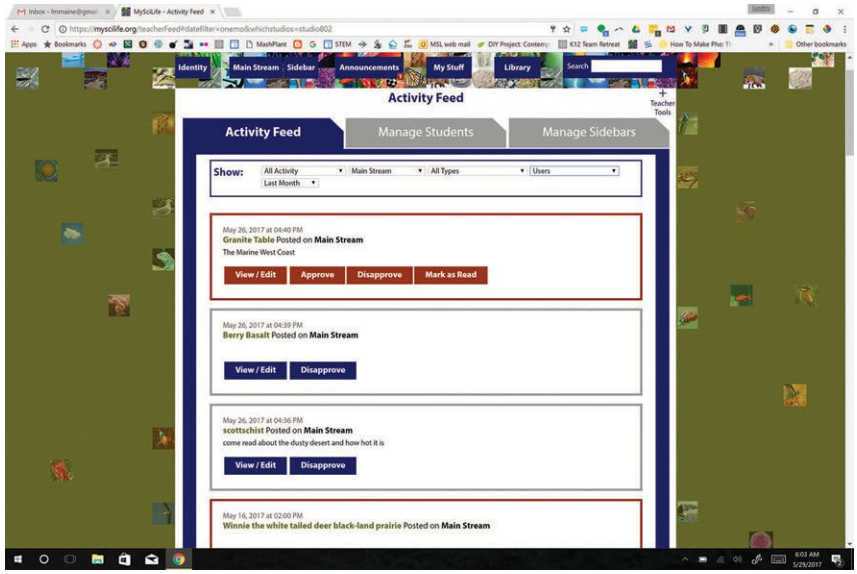
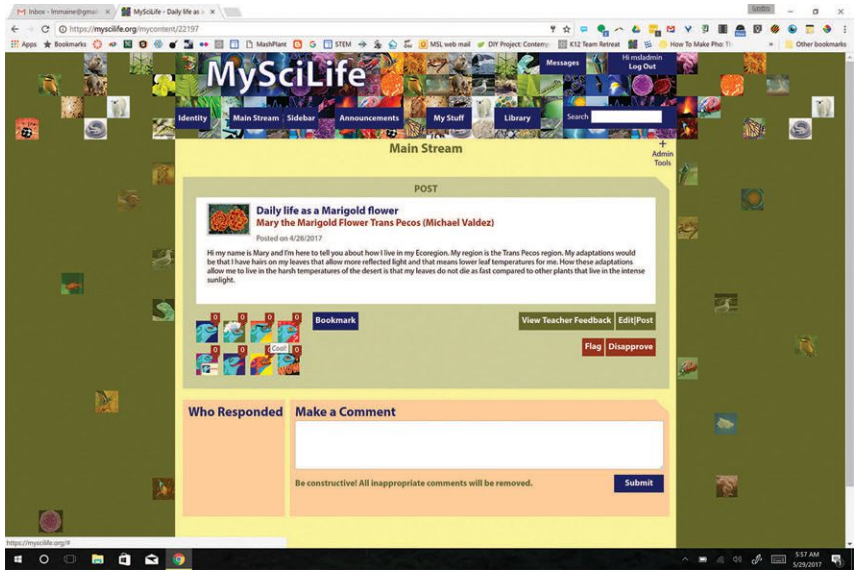


FIGURE 2: Student dashboard



identify and understand the "big ideas" that unify different areas of content such as cause and effect relationships.

Students often need in-class support and flexibility when completing MySciLife tasks. Many teachers demonstrate how to create posts and comments using the resources found in the teacher community library on the site. Barb Bredlow has a show-and-tell session, during which students share a post of interest they found in the main stream and discuss as a class the science and writing of the post. Checklists, such as the one shown in Figure 3, structure the activities that students will complete through the module and are available in the MySciLife Teacher Community library. Teachers can alter checklists or create their own to provide differentiation for students who need altered assignments. Students receive written feedback on draft posts, as well as verbal communication from the teacher to help them revise work to meet expectations before posting (see Figure 4 for post commenting guide). Teachers approve student posts and students look forward to seeing their posts and comments become live so they can continue conversations with other identities. Teachers have the flexibility of using MySciLife as often as they wish. Teachers can also create materials and share these through the Teacher Community sidebar, a sidebar where all MySciLife teachers can interact and share.

To help with their commenting, students can first practice using more familiar topics. For example, students can practice first person posting as a piece of scientific lab equipment wishing for a different job or telling the story of their family vacation as told by their big toe. Teachers discuss these practice responses with the class, comparing comments for effectiveness and examining what aspects are needed for a good comment grounded in science. Improving comments takes practice. Novice students often struggle with writing strong comments, so providing ample and frequent practice time for writing better comments results in more effective commenting. Students often use online document editors like Google Docs to collect, research, and create their posts and comments before submitting their drafts in MySciLife.

FIGURE 3: MySciLife checklist

Requirement	Completed
Genotype/phenotype practice	☐
Genetics avatar (assignment #1)	☐
Creature genotype/phenotype (assignment #2)	☐
Creature (profile) picture (assignment #3)	☐
Creature profile created	☐
Creature profile picture uploaded	☐
Creature bio post on MSL (assignment #4)	☐
Creature feedback #1	☐
Creature feedback #2	☐

Safety

MySciLife incorporates security that complies with KidSafe COPPA certification (see Resources), and parents give permission for students to use the site and to share their posts and comments. (Teachers can download the permission form from the MySciLife library.) Only the names of identities are visible; a student's teacher is the only person who knows the name behind each identity. Teachers moderate comments before the posts go "live" so students can make any needed corrections in content or structure. Other teachers using MySciLife can flag questionable posts. The student's teacher receives the notification and can take action.

Several early adopters of MySciLife are now mentor teachers. As mentor teachers, they post helpful hints in the teacher community and share tools during professional learning community meetings. These teachers now approach content and teaching differently, because they have found that MySciLife strategies also work well offline to support instruction and engage students.

FIGURE 4: Commenting guide

	1	2	3	4
Ask a question	What season is it where you are?	During which season is the Northern Hemisphere tilted toward the Sun?	How does Earth's tilt affect the seasons?	How would Earth's seasons change if there were no tilt?
Make a comment	I really like your identity!	I like your diagram. It is very detailed.	Your diagram is very helpful. I always thought that the Sun gave the plant energy.	Your diagram is very helpful because I always thought that the Sun gave the plant energy, but now I know that it helps the plant make glucose and oxygen.
Make a prediction	I predict that the vinegar will cause the egg to change.	I predict that the vinegar will cause the egg to shrink.	I predict that the vinegar will cause the egg to shrink because vinegar is some sort of acid and the shell seems delicate.	I predict that the vinegar will cause the egg to shrink because vinegar is some sort of acid. I think it will ruin the shell and that will make the egg lose mass.
Clarify something	Tell me more about your identity.	You mentioned that you were a nonmetal. What does that mean?	Beatrice the Blue Heron, I looked at your diagram showing your predators and prey. So, would the bear be one of your predators? How can I tell from your diagram which organisms are predators or prey?	Triva the Travertine Rock, you mentioned that you are considered a limestone. I agree with you because you said you are made of calcium carbonate ($CaCO_3$).
Make a connection	You and I have some things in common.	You and I have some things in common. For example, plant cells and animal cells have cell membranes and a nucleus.	I'm Katie Krypton and I am in the same group as you. So, does that mean that I have eight valence electrons too?	Ava Atom, that's cool that you make everything! Did you know that the faster something is moving, the hotter it is? That is because the movement of atoms generates friction and heats something up. It's the same reason that when you rub skin together, it makes you warmer. The atoms in me are moving ridiculously fast so I am really, really hot.

Structure through interaction

Joshua Hames notes that helping students navigate the science curriculum is one of the most important strengths of MySciLife. Learning the vocabulary and content in a personal context is one of the website's strengths. After completing the basic assignments about atoms, his MySciLife students choose an element that becomes their identity. Students then explore the elements further using MySciLife, writing posts as if they were their element. Students research their specific element, interact with the other elements on MySciLife to learn more about each, and explain what they have learned about their own identity. It is interesting to see students asking others how much they weigh (in atomic mass, of course!) and who discovered them.

To further their understanding of atoms, students are challenged (see Figure 5 for rubric and example prompts) to write and publish posts that answer prompts and, through social commenting, dig deeper into content. For example, prompts may ask students to find and interact with another element in their periodic table "neighborhood," make a case for which superhero would use their element's identity, or react to a scenario such

FIGURE 5: Atom module: Alert and response rubric

Adapt this rubric to suit your students' needs. Share this rubric with students so they know what is expected of them. Adjust the scoring to achieve the desired point total.

Alert	Timely response to alert	Scientifically correct response	Appropriate replies to other posts	Your score
You have lost an electron somewhere and cannot find it. How does this change how you interact with other element identities?				/3
You have been asked to go on a diet and lose some "mass." How will you do this and what will be changed by removing some of the basic parts of your element?				/3
Create your own alert: At any time, create your own alert or situation that would require other elements to respond. These can be "What if?" situations. Be creative!				/3
King Octavius has announced the Law of Octet, which requires all elements to have full energy levels. All atoms are forbidden to have extra electrons. How will you follow the new law?				/3
The temperature has increased substantially. Are you in the same state of matter? If not, what happened to you as you changed into your new state?				/3
Someone has stolen a proton from you. What is the result of this?				/3
An element friend of yours has misplaced a neutron and wants another. You are feeling generous and want to give your friend one of your neutrons. Why could this be a bad idea? Could it be a good idea?				/3
Total				/21

as the loss of an electron and how that changes how they interact with other elements.

Changing the "environment"

Prompts reinforce connections across scientific areas of study when they integrate "big ideas." JoEllen Pollack shares an example of one such prompt from the ecology module: "What would happen if a small organism in your environment became 10 times bigger? How would this affect your organism?" Students could write about larger insects eating more plants, which would affect a small herbivore's (one student's identity) ability to find food in that ecosystem. Another student taking on an insectivorous bird identity would be able to post that larger insects would make finding food easier. Those two students would be able to comment on each other's posts, connecting ideas related to predator and prey interactions.

Anne Friederich shares how she used MySciLife in a genetics unit. In this module, students can create an avatar identity digitally or by hand (with an image taken of their artwork) to represent their phenotype, based on the genotype of a fictitious creature. Students are given their multiple-trait genotype for their identity. Students then write a post to introduce their creature. Students also create a wanted ad to attract a mate for a specific phenotype outcome. The teacher shows students a sample assignment to give them an idea of where to start, as well as a rubric, a checklist of tasks to complete (Figure 3), and a list of required sign-offs to keep them accountable each class period.

FIGURE 6: Ecology prompts

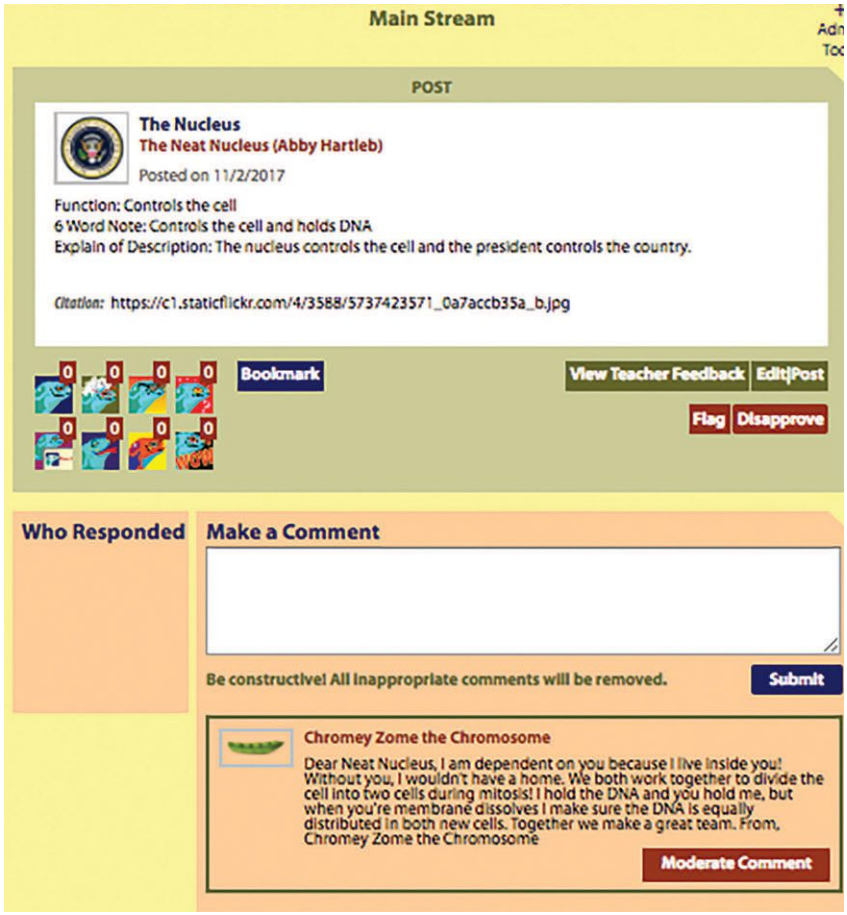
- "To-Do." In terms of ecology, if your organism were to create a "to-do" list or agenda for one full day, what would be on it? Post your list on the MySciLife page.
- More Or Less. Explain why your biome is either rich or deficient in biodiversity. Post your findings on the MySciLife page then leave a post for at least two other students' comparing your biome's biodiversity to their biome's biodiversity.
- Survival Of The Best Adapted. How do climate and precipitation affect the type of organisms that live in your biome? What kind of adaptations do organisms in your biome have that make them suited to live there? Create a table showing at least three organisms from your biome and the adaptations that help them to successfully live there.
- Biological magnification. Use one of the food chains created in a previous assignment to show how a pesticide becomes more concentrated as it moves through the chain. Be sure to explain how the pesticide enters the food chain and why the pesticide continues to accumulate throughout the chain. Post your competed prompt to the MySciLife page.
- Q And A. Interview an organism at another trophic level in any biome. Make up 5-6 interview questions. Post the questions and the other organism's replies on the MySciLife page.
- Come on Down! If your organism could be on any TV game show or series, which would it be an why? Post your response on the MySciLife page.
- "In My Opinion…" Choose a controversial ecological topic to debate online. Start a thread titled with your chosen topic.

For this assignment, the female creatures had first pick at finding their perfect mate. Students could search the ads and find an available mate that matched the qualities their creatures were looking for, and they could comment on other posts. Students chose a mate that would create an offspring with a specific trait. Students used the wanted ad posted on MySciLife to demonstrate their understanding of key vocabulary related to genetics, and their interactions with other students' ads further demonstrated their understanding of the content. Many students completed the extended activities, such as creating a board game.

Extending the concepts

Barb Bredlow explains how active participation in MySciLife prompted her students to extend their understanding of geology. Her seventh-grade class had finished the MySciLife Earth module, learning about rocks and minerals and Earth forces and processes, and wanted to learn more about volcanoes and use MySciLife specifically. They proposed developing a module on volcanoes for themselves, which will later be shared with the wider MySciLife community.

The class worked together, patterned their volcano module after



Example of a post and reply.

the MySciLife modules they had previously completed, and submitted their proposal for review to their teacher. Students chose a specific volcano as their identity and compared themselves to the other volcanoes' characteristics and types. Students made connections to the Earth module they had just finished using their knowledge of plate tectonics and Earth's layers to help explain their volcano's "activity." They cited specific plates for their volcano's location and referenced plate actions that might influence their volcanic activity.

Assessment

Kevin Bower explains that providing students with opportunities to reflect on their learning processes is an essential element of evaluation. The metacognitive activities available through MySciLife support the individual learner, giving students a chance to perceive their own knowledge growth. As students apply information to their identity, misconceptions and misunderstandings are uncovered. Teachers are an integral part of this ongoing process, assessing and coaching student understanding. As students become more experienced in researching and writing posts, they learn about themselves (as a learner) and become more efficient at these tasks.

As teachers, we seek activities that immerse and engage students in content. Using a networked community from which students are able to learn allows them to find and investigate more complex patterns of interaction (UCD 2017) and understand that knowing is a process (Jones and Brader-Araje 2002). This social learning not only engages students, but it also helps them "learn how to learn." The end result, for all involved, is not just that science becomes cool again—it becomes the cornerstone for our students' approach to all learning.

The Source for Learning (see Resources) provides MySciLife

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at no cost to individual teachers and their students. Teachers interested in using MySciLife should complete an interest form that can be found on the website (see Resources). From here, teachers sign up for an Initial Jumpstart Training, followed by three hour-long, self-paced modules. Once they have successfully completed the training, teachers can access all parts of the MySciLife platform with their students. ●

ACKNOWLEDGMENT

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RESOURCES

About the KidSafe COPPA certification—*www.kidsafeseal.com/aboutourseals.html*

MacArthur grants—*www.macfound.org/info-grantseekers*

MySciLife—*https://myscilife.org/welcome*

MySciLife teacher interest form—*http://about.myscilife.org/teacher-apply.php*

The Source for Learning—*www.sourceforlearning.org/home*

ONLINE SUPPLEMENTAL MATERIALS

Commenting guide, commenting rubric, and genotype and phenotype worksheet—*www.nsta.org/scope1801*