Full STEAM Ahead

Science, Technology, Engineering, Art, and Math from nclab More Than Coding

Issue 2, January, 2017

The 21st Century Classroom and Nevada Ready 21

By Daphne O. DeLeon, Nevada Ready 21 Program Director

Nevada Ready 21 (NR21) schools are welcoming 2017 with a toolkit that includes: engaged students, teachers, principals and parents; innovative Nevada Standards-aligned educational software and robust-responsive student and teacher devices. Fully deploying 20,000 devices by September 31, 2016 at 23 school sites, I am privileged to report that the program is already seeing classroom impacts - the cornerstones upon which the 21st century classroom is being built by our students and teachers.

Sample Student Impacts: An English Language Learner (ELL) student was able to access his teacher's lesson plan on the same day by using the Google Translate plug-in on his device. Seamlessly being able to toggle back and forth between teacher-created lessons in his home language and English also empowers him to learn English as his own pace.

A student has used his device and his experience in the classroom (technology being a 24/7 accessible tool) to help his abuela (grandmother) strengthen her hand after a car accident by finding an online how-to video and creating a stress ball with flour and balloons at home.

Sample Teacher Impacts: Teachers have increased the equity in their classrooms by using the Google Translate plug-in on their devices to provide real time access to their lessons to their ELL students.

Teachers have increased the student engagement in their classrooms by being able to provide near-instantaneous feedback to their students through the use of Google Classroom.

Funded by the 2015 Nevada Legislature, the NR21 program's strives to: ...ignite economic development by delivering a 21st century workforce, and by ensuring student equity through personalized access to a connected, 21st century education. (*Nevada Ready 21 Plan*)

For more information: www.doe.nv.gov/Legislative/Nevada_Ready_21/

STEAM and SHINE: Your Project for January

Although this is not a typical Turtle activity, today we will plot the graphs of functions! It's easy, with free NCLab Turtle Tina tools!

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'Year of Growth' at NCLab

'Tis the season to look back at the past year's accomplishments, and it's a fun endeavor given all we accomplished. New staff, new software, new servers... and more!

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Build Your Own Molecule!

Do you remember assembling molecules using balls and sticks from a plastic molecular modeling kit? NCLab's 3D Molecules module works differently... and better!

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Nevadan Wins National Educational Award

***Erquiaga honored for work on* Nevada Ready 21**

Dale Erquiaga, former chief strategy officer for the Office of the Governor in Nevada, was named **State Policy Maker of the Year** by SETDA, an association of US educational technology leaders. Erquiaga was "instrumental" in convincing the Nevada legislature to allocate $20M for Nevada Ready 21 (NR21), SETDA said in a press release.

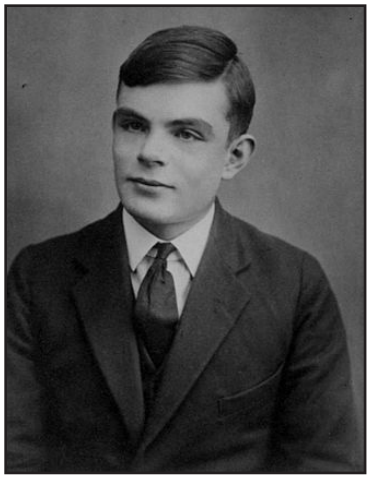
NR21 aims to provide middle and high school students and teachers with 24-hour access to personal, portable computing devices with wireless Internet access. So far, it has distributed 20,000 ruggled CTL Chromebooks in Nevada. The devices include web filtering software, along with educational software from half a dozen providers, including Reno, Nevada's own NCLab.

According to SETDA, Erquiaga provided guidance and constant support to ensure the NR21 plan was approved by the Nevada Commission on Educational Technology. He then promoted the plan to Nevada Governor Sandoval, leading to its inclusion in the Governor's proposed budget for FY16-FY17. During Nevada's 120-day legislative session, Erquiaga met with legislators personally to ensure NR21's final passage.

"As a dad, and as a former superintendent and as someone who has advised the Governor, I know how important educational technology is for kids and for the future of our country," said Erquiaga. "As America grapples with issues like racial equity and children in poverty, educational technology closes that divide and really gets kids across the finish line."

Alan Turing: Computer Visionary

Today, it's hard to imagine a time before computers existed. It's even harder to imagine how, long before the first one was ever built, a 24-year-old mathematician could describe their theoretical capabilities and limitations.



Passport photo of Alan Turing at age 16, the year he read and understood Albert Einstein's work, according to biographer Andrew Hodges.

(photo in the public domain)

That's essentially what British educator and cryptographer Alan Turing accomplished, though. His 1936 paper "On Computable Numbers" gave us the "Turing machine," a simple model widely acknowledged to represent the invention of the central concept used by modern computers.

Today, Turing machines remain integral to the field of theoretical computation. Any programming language that can imitate a Turing machine is said to be "Turing complete," which means that like a "universal" Turing machine with limitless time and memory, it can execute any and every possible algorithm.

In his seminal paper, Turing used his Turing machine to prove two limitations of mechanical computation. One is the inability to predict whether an arbitrary set of instructions will ever finish running, or instead enter an infinite loop. Another is the simple inability to predict whether a given symbol will ever be printed by an arbitrary algorithm. Given these limits, Turing's paper posited that some math problems will remain unsolvable by algorithms.

Turing went on to lead the successful effort by the British to crack the "Enigma Code" used by the German military in World War II. A paper he wrote in 1946 led directly to the first stored-program computer. And, in 1950, near the end of his short but brilliant life, he devised the "Turing test" for distinguishing artificial from human intelligence. Every time you solve a "captcha" problem before submitting a web form, you are taking a kind of Turing test.

Turing's life and work are immortalized in the 2008 documentary *Dangerous Knowledge*, the 2014 BBC children's program, *Absolute Genius* with Dick and Dom, and in the 2014 American historical drama/thriller, *The Imitation Game*. Those aspiring to understand how computers actually work could do worse than starting their exploration with a look at the life and work of Turing, who today is often remembered as the "Father of Computer Science."

STEAM and SHINE: Your Project for January

Plotting Functions with Turtle Tina

Although this is not a typical Turtle activity, today we will plot the graphs of functions! Moreover, we will add some colors and 3D to it, and also spice it up with a bit of computer programming.

Turtle Tina in NCLab is an excellent tool for that. You don't even have to create a user account or log in – just visit the Free Portal and launch the Turtle App.

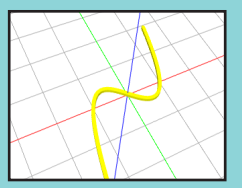
Here is a simple program that will make Tina plot the graph of any function f(x) in the interval (a, b):

Here is what the program does: On lines 2-3 it defines the function to be plotted, and on lines 6-7 the plotting limits. On line 10, it creates a new NCLabTurtle named "tina" at the position (a, f(a)) – that's exactly where the graph begins. On line 14 it defines a subdivision. What's that for? The graph will be a sequence of short linear pieces. Recall that Tina can only walk straight and turn. That needs to be enough to plot the graphs. On line 15 it defines the step – this is the size of the x-axis increment. Lines 17 – 19 are a Python loop where Tina will make n steps of length "step" on the x-axis, and always plot the short line that she just drew. On line 20 she will display the graph. That's it!

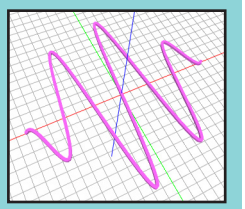
```
1 # Function to be plotted:
2 def f(x):
3   return x*(x+1)*(x-1)
4
5 # Limits: make sure that a < b:
6 a = -1.5
7 b = 1.5
8
9 # Main program:
10 tina = NCLabTurtle(a, f(a))
11 tina.width(0.1)
12 tina.height(0.1)
13 tina.color(YELLOW)
14 n = 50 #of subdivisions
15 step = (b - a) / n
16 xi = a
17 for i in range(n):
18   xi += step
19   tina.goto(xi, f(xi))
20 tina.show()
```

The cool thing is – you can change anything in the program, including the function to be plotted, the limits, the subdivision, the thickness and height of the 3D line, and the color of the graph. And you can print the graph on a 3D printer if you want. **Here are some examples:**

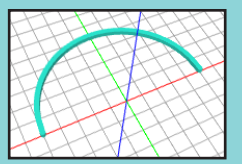
f(x) = x(x+1)(x-1)



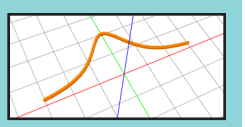
(10 – 0.1x^2)sin(x) in the interval (-10, 10)



f(x) = sqrt(25 – x^2) in the interval (-5, 5)



f(x) = 2 / (1 + x*2)



The Heartbeat of the Community

By Sheila Crawford-Bunch, NCLab Director of Education

How do we learn? Schools provide a sequential ladder of learning for our children, starting with letters and sounds, and ending with research and thoughtful essays. Libraries are different. People browse books, read a few pages. Some books go back on the shelf. Others get checked out, and and possibly get checked out again. These books lead to other books. We fall in love with a new author, hobby, or a chunk of history, and return for more. This is learning as play, yet with serious intent. This is how we learn in libraries, whether we are toddlers listening to stories, elders learning something new, or kids hanging out after school.

(c) The Goodsprings Library, LVCCLD.org

You can find libraries in the tiniest towns. Have you heard of Goodsprings, Nevada? It is the smallest community in Clark County, with only 170 residents. Yet it still has a modest, 900 square foot library with 5,000 books. Libraries provide intellectual nourishment wherever we find ourselves - a place for ideas, and a place to gather.

Enter the 21st century. People talk to their phones and get answers about nearly everything. We can download books, how-to videos, and so much more. In spite of this, libraries are not fading away. They remain the heart of learning in the community for young and old alike. Except now, many of our libraries have a bank of computers with Internet access, and perhaps a 3D printer or two.

NCLab is part of the new library environment in Nevada. In the spirit of storytime and summer reading programs, many Nevada libraries hold computer camps, where young people can try their hand at coding and 3D modeling. Trying out a program is like browsing a book. We hope that users will continue exploring this world, using their skills to build 3D models, solve real world programs, maybe even help the library with digital resources.

We look forward to showcasing these programs in our newsletter, so please share your stories. Drop us a line at office@nclab.com.

May libraries always be with us!

2016 'Year of Growth' at NCLab

'Tis the season to look back at the past year's accomplishments, and it's a fun endeavor given all we've done.

In 2016, NCLab became an integral part of the **Nevada Ready 21** program of the Nevada Department of Education. This is a one-to-one computing program that initially put 20,000 Chromebooks in the hands of middle school students in 23 schools across Nevada. The laptops came pre-installed with NCLab coding and 3D modeling curriculum. As part of the program, we trained dozens of teachers both in Northern and Southern Nevada. The NCLab coding and 3D modeling curriculum was endorsed by **Nevada Governor Brian Sandoval** (see Issue 1 of this newsletter for details).

In 2016, NCLab was adopted by the **Nevada system of public libraries**. Libraries are using NCLab's self-paced and self-graded courses for programs and camps. The NCLab program at the Carson City Library won a prestigious nation-wide **YALSA award.** In 2016, NCLab was adopted by **Signature Academies** (CTE high schools) in Reno, and by an **Brian Crosby's innovative STEM program** for Northern Nevada, which combines building and operating drones with coding and 3D modeling.

New Team Members

In 2016, former geologist and K-12 teacher **Sheila Crawford-Bunch** joined NCLab as a new Director of Education. Sheila is developing lesson plans and other materials to accompany NCLab's self-paced and self-graded courses, and the Creative Suite. She is also supporting teachers and librarians.

This year we also welcomed **Bernard Jech** as the new Director of Software Development. Bernard is an experienced software engineer and database expert who lead teams of programmers at several large U.S. companies.

Last but not least, we welcomed **Alicia Seefeld** as a new NCLab office coordinator. Alicia is doing a great job keeping us organized and providing behind-the-scenes support to the whole team.

New Software and Servers

In 2016, we added a second 3D modeling library: **OpenSCAD.** Thanks to our work, this popular, open source language is now usable on mobile devices, including tablets and Chromebooks.

Last year, we made deep changes to our **software infrastructure** that brought much faster performance, better monitoring and feedback systems, and much better internal reporting. We also added tons of new features to our self-paced, self-graded coding and 3D modeling courses; for more details, see this blog post Goo.gl/TvHFaU.

Happy New Year!

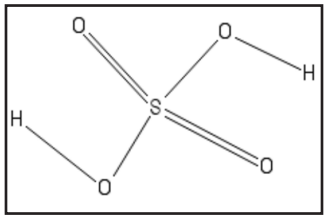
NCLab is not an affiliate program of the University of Nevada, Reno.

CREATIVE SUITE APP OF THE MONTH

Build Your Own Molecule!

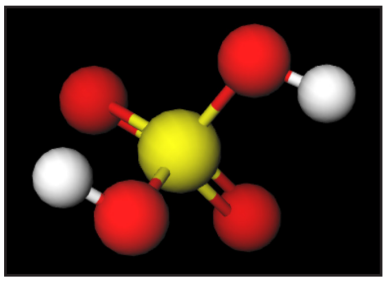
Do you remember assembling molecules using balls and sticks from a plastic molecular modeling kit? To get it right, you had to know exactly what the molecule looked like.

NCLab's 3D Molecules module works differently. You just sketch the molecule, making sure you have the right atoms and bonds. You do not need to know atom positions or the lengths and angles of the bonds.



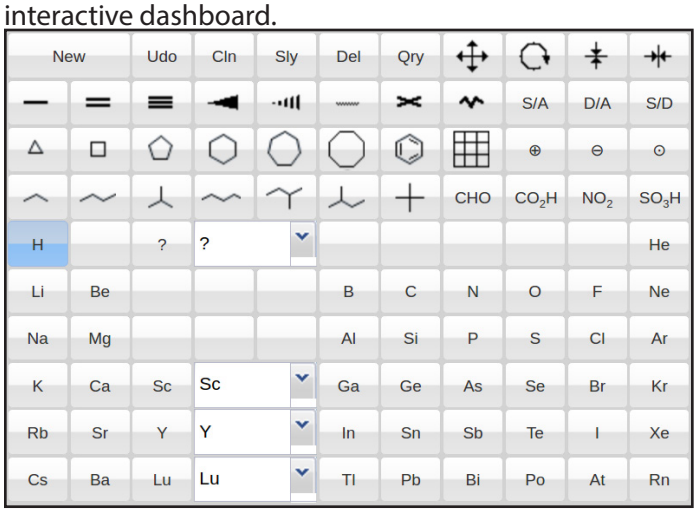
Can you recognize the molecule to the right?

Once you click Submit, your drawing will be sent to the cloud. Scientific computing will minimize the energy, imitating what nature does. In seconds, your molecule comes back to your browser as a fully shaped 3D image.



You guessed it — it's H2SO4, sulfuric acid.

Using the 3D Molecules module in the NCLab Creative Suite, you can build any molecule you know. There's a large library of predefined templates for organic chemistry, and you can even experiment with molecules that you design by yourself. All this is very easy using a simple interactive dashboard.



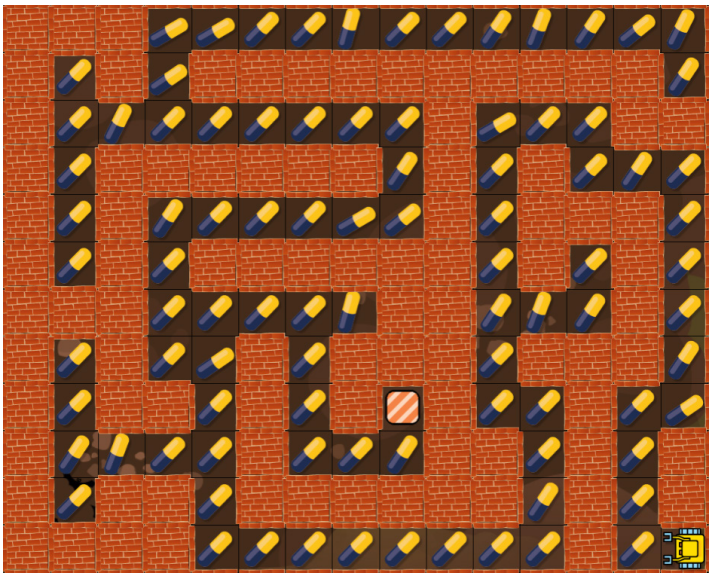
In the future, NCLab plans to connect this interactive module to a real scientific database at the National Institute of Health (NIH). This will allow teachers and students to download and study viruses, proteins and other advanced organic molecules.

To learn more, check out the video tutorial on the NCLab website's "Free Portal."

KAREL GAME OF THE MONTH

Don't Do Drugs by Dylan Sanders

Dylan Sanders created this awesome game in an NCLab Summer Workshop class.



Karel is trapped in a drug dealer's underground hideout. You need to write a program for Karel to collect all the pills and escape.

To help you solve it, Dylan prepared the following code template:

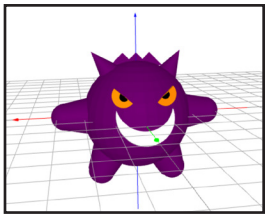
```
while not home
  if pill
    ...
  ...
  while wall
    ...
  ...
```

Dylan's game and many others are available in the Karel Gallery, NCLab.com/karel-gallery

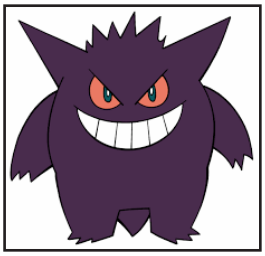
3D MODEL OF THE MONTH

Gengar by J. Annisi-Palmieri

In case you don't know what Gengar is, it is a Ghost/Poison type Pokémon!



The model is combines various 3D objects together in very interesting ways, and it delivers a realistic picture of the Gengar.



This 3D model, including its source code, is available in the 3D Gallery NCLab.com/3d-gallery.

Have your students created awesome games or 3D models? Let us know at office@nclab.com!