

THE STEMEDGE

A quarterly magazine from NCSSS giving teachers and administrators the competitive advantage in professional development.

PAGE 6

CONSORTIUM CONNECTS: Equity & Inclusion - We Have the POWER

"By pooling NCSSS's talents, experiences, and resources, we can have a tremendous impact on all of our students and they, in turn, on the world of STEM."

QUARTER 1 | 2021

PAGE 9

Take-Home Experiments to Enhance Science Homework

"A science class without experiments is just a science appreciation class."

PAGE 9

Teaching Engineering During a Pandemic

"You can complain until you're blue in the face, or you can teach them how to use a fork."

PAGE 28

Back to Basics

"In light of the current global pandemic, the world feels upside down, but this time, let's not blame technology."

PAGE 28

Creating a Valuable Partnership for Your School: Cloudbridge Nature Reserve and The Gatton Academy Model



NCSSS MAGAZINE

CONTENT

VOLUME 5 | ISSUE 1

03 **From the Executive Director**
by Todd Mann

05 **President's Corner**
by Dr. Germain McConnell

06 **CONSORTIUM CONNECTS: Equity & Inclusion - We Have the POWER**
by Dr. Comfort Akwaji-Anderson
& Dr. Corey Williams

"By pooling NCSSS's talents, experiences, and resources, we can have a tremendous impact on all of our students and they, in turn, on the world of STEM."

09 **Take-Home Experiments to Enhance Science Homework**
by Michael Horton

"A science class without experiments is just a science appreciation class."

13 **Teaching Engineering During a Pandemic**
by Rebecca Gaillot

"You can complain until you're blue in the face, or you can teach them how to use a fork."

18 **What works really well or doesn't work at all for teaching virtually**
Collective ideas from NCSSS members.

22 **Back to Basics**
by Jessica Golden-Harrington

"In light of the current global pandemic, the world feels upside down, but this time, let's not blame technology."

26 **Home Work: Illinois Tech Students Discover, Create, and Solve—Virtually**
Students Study Biomedical Engineering from Home with Hands-On Remote Lab KitsAI Degree
(Sponsored Content)

28 **Creating a Valuable Partnership for Your School: Cloudbridge Nature Reserve and The Gatton Academy Model**

FROM THE EXECUTIVE DIRECTOR

I am very excited to be bringing you another edition of our STEM Edge publication. STEM Edge is yet one more vehicle for our members to communicate with each other on a host of topics. Many of you are likely familiar with our Consortium Connects, a monthly roundtable which features schools or partners zeroing in on a subject of interest and affording our members the opportunity to reach out to peers across the country on these topics. We hope our members take advantage of both.

"For quite a while now, we have been hearing about substantial increases in student anxiety, depression, suicide ideation, and suicide. We have begun to do something about this ."

Just recently on our calendar was NCSSS's Student Mental Wellness Summit. For quite a while now, we have been hearing about substantial increases in student anxiety, depression, suicide ideation, and suicide. We have begun to do something about this. At this Summit, we presented the latest research performed at our member schools, so that there is now hard data to go on. We featured students talking about how they wished their schools would approach mental wellness, and we heard from their administrators.

Coming up for NCSSS is the Student Research Conference. This event is always a powerhouse for our students. It will be virtual again this year, and now hosted by the Arkansas School for Math, Science, and the Arts. If you haven't done so, now is a good time to register your students.



And of course, the Professional Conference is the one we all wait for. Taking place in Kansas City the first week of November, you will be surprised to see all that KC has to offer when it comes to STEM. We hope you will be there to join us.

Lastly, we know it has been an added struggle for all of you this past year. From all of us at NCSSS – Board and staff – let me say how grateful we are for you, and for everything you do. Thank you for your support, as always.

Todd

A handwritten signature of Todd Mann in black ink.

NCSSS Executive Director | todd.mann@ncsss.org

Greetings Fellow Educators!

I want to start by thanking you for your hard work and commitment to providing the best possible learning experiences for our students during this pandemic, which has forced all of us outside our comfort zones. Though this pandemic has caused great stress and discomfort, I hope we take time to identify the valuable lessons learned that could positively impact our practice moving forward. Below are a few take-aways from the pandemic I want to share.

First, in-person learning in a structured school environment is still extremely important. Many of our students are struggling and experiencing significant declines in what they are learning because their home environments are filled with various distractions. These students fear falling behind in school more than getting sick, and parents are also pleading for their students to return to the classrooms. When students can return to the classrooms in full capacity, I hope educators are prepared to capitalize on this newfound appreciation for learning. Educators will also need to address student learning losses that have occurred during the pandemic.

Second, students from lower socioeconomic households are being left farther behind. If schools are providing online instruction, many students have not been able to participate because of limited internet access. If schools are sending home packets, many of the parents have not been able to aid with learning the material. Though unfortunate, educators can use this as an opportunity to establish policies and implement programs that may not have been possible before now.

Third, this pandemic has exacerbated issues related to mental health of both students and educators. The combination of students being more isolated, concerns of getting sick, and fear of falling behind academically are causing great mental stress to our students. As educators, we are not only concerned about the health and safety of our own families, but we are deeply concerned about the physical, mental, and academic well-being of our students.

I am happy to serve NCSST as President because I feel that educators can receive help with all the



issues just highlighted. We are meeting the needs of our members through various professional development and networking opportunities. In particular, I hope you will join us for April's Consortium Connects as we continue our series on Equity and Inclusion. Additionally, the Student Mental Wellness Summit we just held, is and will hopefully continue to be helpful as we address mental health issues associated with the pandemic.

Now that we have engaged in this forced experiment for just over one year, our focus must be on what we will learn from it. As educators, we are lifelong learners and experts at utilizing "teachable moments." Let us use this teachable moment to inspire the next generation of problem solvers, helping them attain the knowledge and key skills needed to impact their world during the next big worldwide challenge. Our obligations have never been as important as they are now.

Warmest Regards,
Germain McConnell, Ph.D.

A handwritten signature of Germain McConnell in black ink.



JOIN US FOR THE 2021 PROFESSIONAL CONFERENCE

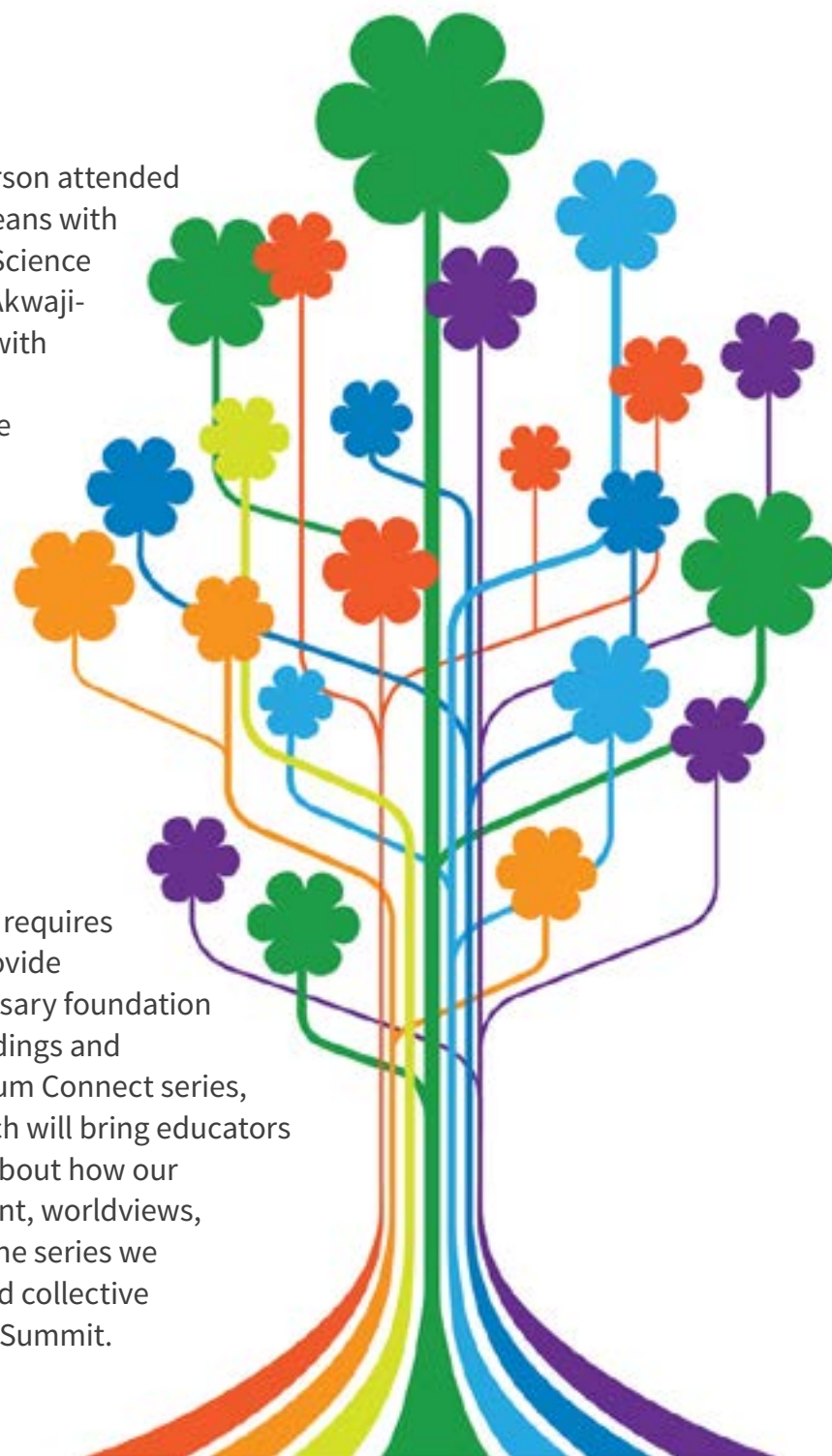
NOVEMBER 3-6, 2021
KANSAS CITY

Equity & Inclusion - We Have the POWER

By Dr. Comfort Akwaji-Anderson & Dr. Corey Williams

In January 2020, Dr. Comfort Akwaji-Anderson attended the NCSSS Leadership Summit in New Orleans with a team from the Illinois Mathematics and Science Academy (IMSA). While in attendance, Dr. Akwaji-Anderson had the opportunity to discuss with NCSSS's leadership the idea of addressing equity in STEM, and the decision was made by the NCSSS Board to make equity the focus of the 2022 Leadership Summit. All NCSSS institutions have the power to improve the STEM learning experience of every student; however, collectively, we are exponentially stronger. By pooling NCSSS's talents, experiences, and resources, we can have a tremendous impact on all of our students and they, in turn, on the world of STEM.

Our belief and practice is that equity work requires more preparation and intentionality to provide individuals and institutions with the necessary foundation on which to advance their own understandings and practices. That is what led to the Consortium Connect series, *Equity & Inclusion: We Have the Power*, which will bring educators together to have meaningful discussions about how our students' cultures impact their achievement, worldviews, and experiences in our schools. Through the series we intend to build individual, institutional, and collective capacity leading to the NCSSS Leadership Summit.



We co-facilitated the first Consortium Connects in the Equity & Inclusion series on January 26, 2021. We began by defining culture as values, beliefs, norms, and life ways of a group that are learned, shared, and transmitted intergenerationally and influence and individual's thoughts and actions. We then introduced foundational concepts around diversity, equity, and inclusion such as material and immaterial culture, privilege, and unconscious bias.

The session was grounded in the research of Dr. Gloria Ladson Billings who says, "Culture is regularly used as a code word for difference and perhaps deviance in the world of teacher education." With this in mind, participants engaged in breakout rooms to discuss how culture impacts our work, how our own unconscious biases and privilege impacts students, and what inclusive best practices we have tried or encountered.

Some of the thoughtful takeaways shared from the breakouts included:

- **Educators' acceptance of outdated definitions of gifted and talented can harm diverse groups of students, including rural students.**
- **Unconscious biases can create mistrust when some students feel they have to prove constantly their worth in particular situations.**
- **Educators carry our biases into how we judge students or measure success.**

The second in the series will be hosted April 20, 2021 on understanding cultural competence and responsiveness in school, with the goal of providing attendees an understanding of the tenets of culturally relevant/responsive pedagogy (CRP) and leadership (CRL) in theory and practice. The third will take place in September 2021 on building opportunities to learn via equitable beliefs, practices, and policies, with the goal to introduce strategies to implement CRP and CRL. This leads to the January 2022 Leadership Summit, where we will

discuss operationalizing cultural competency: forming a cultural competency team; setting expectations and goals; implementation; and tracking progress. After the Leadership Summit, we hope that NCSSS schools will be better equipped as individuals and a collective to foster equity in education.

If you missed the first Consortium Connects on Equity & Inclusion, you can catch up by reviewing [this handout](#). You can register for the April 20 Consortium Connects [here](#). ■

Connect with STEM Peers from around the world

APRIL 20

Equity and Inclusion: Understanding
Cultural Competence and Responsiveness

MAY 18

Virtual Learning Across the Globe: Creating
a Cross-Cultural Design Thinking Program

SEPTEMBER 20

Equity and Inclusion: Third in the Series

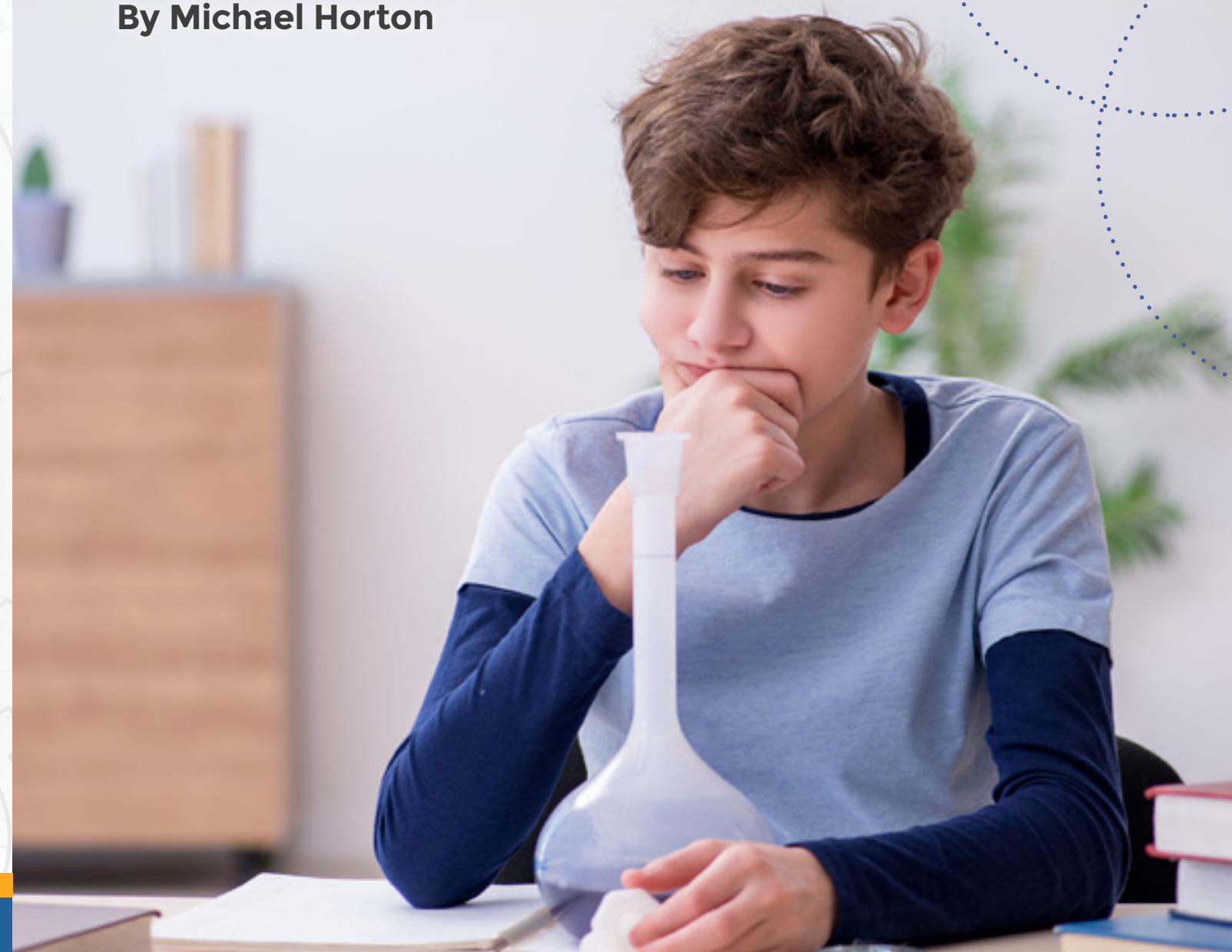
DECEMBER

Admissions & Placement

Register at ncsss.org

TAKE-HOME EXPERIMENTS TO ENHANCE SCIENCE HOMEWORK

By Michael Horton



In my third year of teaching, I moved to a school-wide Title 1 school that was over 85% Free/Reduced Price Lunch in an economically depressed city. I enjoyed working with this group of students because they reflected my own childhood, but motivation to succeed in school was challenging to empower. Test scores hovered in the single digits around 3-5% proficient on what I would consider a fair measure of their academic proficiency. For my first two years, my scores remained stagnant, growing slightly. Then, within 4 years, I was able to increase proficiency in Chemistry over 1000% while the math scores of that same group of students remained unchanged.

While my young son was learning to play baseball, I realized that there are 3 parts to learning a new task, the coaching, the practice, and the big game. In my chemistry class, it was the teaching, the independent work, and the test. The students at this school had notoriously low homework completions rates, often through no fault of their own. As I think back to some of their home situations that I learned about as I taught, I'm still brought to tears. Imagine trying to coach a baseball team full of kids who have never played baseball before and you teach them how to play but never let them practice and then expect them to do well during games. That's exactly what I was doing in my classroom. So, I had to figure out a way to increase the access to homework and the motivation to complete it.

I am a true believer that experimentation is the way that we truly learn science. A science class without experiments is just a science appreciation class. So, in order to free up some

class time for guided practice, I decided to start sending some simple experiments home in Ziploc bags. I sent home marbles, rubber balls, salt packets, Styrofoam pellets, etc. with simple instructions for inquiry experiments. These experiments were done before, not after, we had learned a concept so as to build background knowledge instead of just bemoaning the lack thereof and teaching onward like I had always done before.

Students compiled their experimental results in a lab notebook that they would turn in approximately every 10 experiments or about 3 weeks.

I would learn later that the lab notebook was a powerful part of the program and would help support literacy as well. Within a few rounds of this cycle, I measured the result and it was incredible. More than 85% of students had completed at least 9 out of 10 of the experiments. When giving more traditional homework, I would predict less than half of students would complete 9 out of 10 assignments.

I began by sending experiments home in Ziploc bags one at a time.

Eventually, this took up too much time and space and there were too many items that crossed over to multiple experiments. Eventually, I converted it to where students checked out a bar-coded box from the library containing all of the materials that they would need for the year. This had the additional benefit that a student could not check out of the school until they had returned their box just like a textbook.

In all, we did more than 50 take-home experiments in both chemistry and physics and the results spoke for themselves. (Physics data was not included because most physics students were seniors and California did not test seniors at the time.) In class, we did another 30 or 40



experiments plus a half a dozen long-term projects. Not only did this modification demonstrate the power of take-home labs, it also crushed the misconception that experiments do not prepare students as well for standardized exams as lectures do. Between the inquiry, background knowledge, motivation, literacy support, and the fact that students were actually excited about doing their homework, the program was highly effective.


In the end, the model changed slightly. Putting 250 boxes together over the summer took me more than a week by myself. Instead, students would check out an empty box from the library and then we had an assembly line set up in the classroom where they would fill

it with equipment in a very short amount of time. At the end of the year, they would bring it in, I would verify that all of the materials were still there, and then they would put the individual items back into storage containers for next year. This would allow me to do an inventory and restock over the summer.

There is no reason why this model could not be modified for middle school, Earth Science, Biology, or just about any other science course. The cost of the boxes was minimal and would be even easier with today's access to Amazon's bulk ordering. For example, "super balls" are one item in the physics box and on Amazon, they cost 8 cents each. They also use things like sugar, salt, and mustard packets that we received as donations from a local fast food restaurant.

The books are still available from National Science Teachers Association, but one of the best uses of these experiments is for a teacher to take their own simple, tried-and-true experiments of their own and send them home. What experiments could your teachers modify to be completed at home? Have that discussion with them and give them all of your support. If you have questions, you can connect with me on Twitter or Instagram @mhortonleads. ■

MICHAEL HORTON is the assistant principal of the Western Center Academy in Hemet, CA. Previously, he was AVID Administrator and Science Coordinator for two county offices. Prior to that, he was a high school science teacher. He has authored 3 books: "Take-Home Physics," "Take-Home Chemistry," and "Excellence: Every Classroom, Every Lesson, Every Day."



TEACHING ENGINEERING DURING A PANDEMIC

By Rebecca Gaillot

Across the country, our students are missing a large amount of instruction in 2020 and 2021. The teaching techniques that we value so much such as hands on experiences, individualized instruction, and scaffolding, are greatly diminished in online instruction. Many would say this loss of learning is unprecedented and while it is in some ways, it is reminiscent to the disruption in school we experienced in New Orleans post Hurricane Katrina. Lessons learned from surviving that challenge have resurfaced as valuable this past year. Teachers must now strengthen all of the qualities we ask of our best students: flexibility, perseverance, and grit.

Early in my teaching career I had an impactful moment that has guided me ever since. One teacher was aggravated with how messily the students were eating their lunch and blaming parents for not doing a better job raising their children. A veteran teacher stopped the conversation with some blunt advice, “You can complain until you’re blue in the face, or you can teach them how to use a fork.” Facing the new world of online teaching, I relied on this experience to inspire me to find innovative solutions to adapting my teaching.

One of the biggest obstacles I encountered related to online teaching was how to accomplish the project based learning Introduction to Engineering class. This is a dual enrollment course between Benjamin Franklin High School, the public school where I teach, and Louisiana State University. The students earn college credit for the course, gaining exposure to various sub disciplines of Engineering and practicing the Engineering design process through hands on projects. They code LEDs on Arduinos and build prosthetic hands, create conveyor belts for candies and test the strength of various bridges. Without a large amount of materials, many of which cannot be purchased in stores, students could not be successful with these projects. It was imperative that I find a way to get these supplies to them, and thus was born the Engineering bin.

A good portion of our students are on free and reduced lunch, and all students, regardless of income level, deserve equal access to success in the course. Inspired by the book, Teaching With Poverty in Mind, I knew I had to provide all materials to students at the start of the

course. Over a few weeks in summer I gathered all the required materials and large plastic bins (see appendix for item ideas) so that I could maintain the rigor of the projects. The adult caretakers of the students received an email about these contents, warnings, and what needed to be returned before pickup day.

The first semester in fall of 2020, the bins were filled with each item separated in bags by project. I realized later that doing this limited their thinking as they just built with what was in each bag and not the extra items in the bin that could be used for any project. The next semester I did not label bags for each discipline, rather I made plastic bags with similar items inside just to help keep the bins organized. Looking to the future, one downside to the current list for the bins is that some items are pricey, and many are not environmentally friendly. I reuse items as much as possible between semesters (those that can be disinfected) and use recycled materials often, such as paper towel tubes and grocery bags to organize materials. As these bins and projects continue to develop over the years, my goal is to move to more environmentally friendly items.

One unrelated gem in the course is guest speakers in the Engineering fields. Not only do students learn the real world day to day experience of Engineers, but they also gain confidence in seeing people like themselves describe how they achieved their goals. It is vital that these speakers represent a diverse group of people, racially, in gender expression, and in sexual orientation. Luckily this was easy to switch to a Zoom speaker and still maintain the interactive question and answer sessions that we would have in the brick and mortar classroom.

Perhaps schools will all be in person in the near future, and these bins won’t be needed. The lesson here is not just about the actual bin, neither was the sage teacher’s advice truly about a fork. We are facing a new set of challenges that we are only just beginning to uncover in education during or hopefully soon, post pandemic. It is yet to be seen what skills might be lacking next year, or 10 years from now when your Algebra students are the children who missed those fun multiplication games in elementary school. As the years go on, there will be plenty of moments where we need to teach students how to use the metaphorical fork, even when you think “they should know this already”. Avoid that phrase like the Corona virus, because it won’t help you or your students. Students want to do well and want to know we are on their side, so let’s meet them where they are and give them the tools they need to be successful. If there’s one thing fumbling through zoom has taught us this year, it is that learning is an experience we can do together.



Here are some of the important components of the bins:

- A course label on top, numbered, so that when supplies are returned, they can be matched to a student who had that bin.
- An inventory list inside including bolded items that must be returned.
- A warning taped over the lid about the small items in the bin, to keep out of reach of pets or small children.
- A list of food related items (such as vegetable oil for environmental engineering project) in case of allergies.

“You can complain until you’re blue in the face, or you can teach them how to use a fork.”
Facing the new world of online teaching, I relied on this experience to inspire me to find innovative solutions to adapting my teaching.

Engineering Bin Inventory Sheet

Items in **bold** are expected to be returned at the end of the semester, even if some has been used. Any unused materials should be returned as well, including empty containers.

- Notetaking packet, rubrics, Engineering notebook
- **Scissors**
- **Tape (masking tape plus clear packaging tape or duct tape)**
- **Glue**
- **Ruler**
- **Permanent Marker**
- Index cards
- **Arduino Kit (for Electrical and Computer Science)**
- **Knex pieces**
- Cardboard, Rubber bands, Yarn
- 2 large sponges (Save for petroleum project)
- Plastic Spoons
- Pipe Cleaners
- Popsicle Sticks
- Plastic Cups
- Straws (coffee stirrers plus drinking straws, save 3 of these for biomedical)
- Styrofoam blocks
- Foil
- Cotton Balls
- Paperclips
- Tubes (pvc and cardboard)
- **Plastic Wrap (should be able to return some)**
- **Plastic Gear set**
- **Ping Pong Ball**
- **Weights**
- **Floss**
- **Environmental Bag (Veggie Oil, dish soap)**

READ THIS PAGE BEFORE TAKING A BIN

This is your engineering bin, full of all the supplies you will need for class. Please make sure you have this plus some cardboard.

IF YOU HAVE ALLERGIES: Please talk to me and your guardians before taking this bin. There are food items inside plus some parts of these bins were used before so they may have been in homes with pets or other allergens. Items in the bin were not touched for two weeks so you may use them now, but wash hands after using items to be safe.

There are scissors, very **SMALL PARTS and FOOD** items in here which could be dangerous for small children or pets. Please **keep out of reach** for them and be careful when using items.

There are electrical items in a blue plastic kit, please do not use these until you learn how to do so appropriately in class.

Most of this needs to be returned, so be careful to keep it all in one area. You will be graded on how neatly this is returned!

There's a goodie bag for you- I normally have treats in my class so these are for when you're ready to treat yourself. I can't wait to start class with you! Ms. Gaillot

Rebecca Gaillot, AP Statistics and Engineering teacher, Benjamin Franklin High School, New Orleans, Louisiana

WHAT WORKS REALLY WELL OR DOESN'T WORK AT ALL FOR TEACHING VIRTUALLY



1/ The private chat function in Zoom is awesome. I wish I had some version of this during regular face to face years. It has made it so easy to touch base with shy or struggling students during class.

Sarah Harrelson
Liberal Arts and Science Academy

2/ Using a Surface Pro for working chemistry problems with students in hybrid classes; the Surface projects to large flat screens in physical classroom and is simultaneously shared via Zoom with virtual students.

Kaye Truitt
Mississippi School for Mathematics and Science

3/ I have found giving students more choices in demonstrating mastery of objectives is easier virtually than f2f. It has been my experience, in working with gifted learners, that when they are f2f working on small group or individual projects, some students enjoy “bouncing” every idea off me. While I understand the “why” of that, it makes it more challenging for me to insure that my less vocal students are getting the attention they may need. Breakout rooms in Zoom practically make this issue obsolete.

Given our residential status, Zoom is great for interfacing with parents. Zoom and breakout

rooms have made it easier to conference with parents and students individually or in small groups. I regret not using this technology earlier and intend to keep using it post pandemic.

Microsoft Teams works well in small groups that are geographically close. For example, meeting with departmental faculty on campus via teams is seamless. Teams has not been reliable if attendees are off campus and in numbers greater than 3 or 4.

Because most Mississippi students are rural with few internet provider choices, Canvas has been very successful as a LMS for students who may lose or not have connectivity during any given class.

Dawn Barham
The Mississippi School for Mathematics and Science

4/ The virtual classroom requires more creativity in order to get the students engaged. One project that has worked well for me has been to challenge them to use the supplies available to them to create bio-inspired designs for engineering. It is often difficult to get materials to the students in a predictable timely manner, so focusing on what they already have and can use is a must.

Danielle Grimes
The Mississippi School for Mathematics and Science

5/ I have LOVED using screencastify and my Surface to record lessons. This way students that are remote or in person can access the lesson and learn at their own pace. The students have shared they enjoy the videos because they are interactive (yes, I ask and answer my own questions) and they can watch it at their own pace. This flips the classroom and allows me to annotate the notes and record at the same time. Then in class, we can discuss the notes and homework problems which encourages engagement and participation.

Jenna Gordon
Hathaway Brown School

6/ I have always kept a stack of index cards with students names on them for cold-calling during class. During virtual learning, I've continued to rely on them to make sure I'm including all students in discussion, and I aim to link each question with a student's name. I like to show students the card on my camera, so they can see that I'm engaging students at random. I'm also a fan of changing the question from “can anyone tell me...” to “can everyone tell me...” through a direct message,” so that I can create more room for participation and accountability from all students.

Amanda Morehouse
Benjamin Franklin High School

7/ One thing I learned early on is how much the students wanted to play a more active role in my English classes. While we've worked on group discussions and editing and revision exercises, the activity that has energized the class in so many ways has been with my “class meteorologist” ice breakers. Students sign up in pairs to kick off class in school appropriate fun, creative ways. Some examples of these student-generated activities are: creating name anagrams, “guess who's Spotify playlist”, virtual class scavenger hunts, what do we miss most about our school pre-pandemic, and “two truths and lie--the Disney version.” During the same lesson, the class meteorologists lead the class through short stretches to help us re-

member that we are “human beings behind the screens”. Classes end with our “meteorologists” forecasting what is on the horizon for the next class. By turning over the controls to the students in this way, our classes have truly become communities-- even though we haven't met face-to-face.

Suzette Henry
Thomas Jefferson High School for Science and Technology

8/ What I have found that does not work well is helping students in large groups and using software that is web/browser based. Several students experienced software lag while working and on ZOOM simultaneously.

What I have found that works well and utilizing the breakout rooms to help students in smaller groups. Also, having an assignment, or discussion due at the end of class to ensure that the students stayed on topic and understood the lesson. Something as simple as a screenshot of their program they were working on will work.

Kendra Winnick
The Mississippi School for Mathematics and Science



9/ Things I love about virtual education: the private chat feature on Zoom (this is miraculous for reaching reserved students), being able to connect with kids when they are on field trips, out sick, or otherwise unable to physically report to a building but still wanting instructional support, expanding the reach of my classroom in general - kids now have greater access to my content and instructional activities and can choose to engage more on their terms.

Things that I'm struggling with: the time involved in creating engaging interactive content that really sings in a virtual environment is crushing me. I work 10-12 hours a day; I work on weekends; and still I feel as though I am doing an insufficient job. There's always some other cool tool that one of my colleagues is using that I haven't learned yet. I don't feel like I've built any kind of real workflow routine. Such a large percentage of my working hours is focused on just creating good content that I feel like I'm deficient at the SEL tasks that I have spent so much time over the last 5 years integrating into my practice. On a smaller scale, I really miss the ambient chatter of a classroom. All of my interactions with students now is very direct and focused on the task at hand. I don't get to just eavesdrop on the gossip or dip into non-academic conversations just because they happen to be occurring in my earshot. It's changed my relationship with the kids in a negative way - putting more distance between

us and making it less likely they feel comfortable coming to me for help - either with my class or with larger issues.

Sarah Harrelson
Liberal Arts and Science Academy

10/ To increase student engagement and participation and to get quick feedback on comprehension nearpod is a great learning tool. If you have pre-existing presentations there is no need to start from scratch either, just upload and the program converts it for you!

Kristin Connor
North Carolina School of Science and Mathematics

11/ The Swivl robot (swivl.com) has been a lifesaver in resolving audio issues in my hybrid classroom (with 1/2 of students in person and 1/2 of students joining via Zoom).

Meredith Murphy
North Carolina School of Science and Mathematics

12/ Doesn't work: I (and my students) desperately miss being able to fill a room full of whiteboards with equations, graphs, data displays, etc., and be able to look around the room and compare them.

Michael Buescher
Hathaway Brown School

13/ Having a 360 camera has helped me--or rather the class--because it has allowed the zoomers to see the rest of the class. I will also note that our new docking stations have helped tremendously, b/c before we got them, it took me about ten minutes to hook everything up for class. One thing that I am disappointed about is the lack of students taking advantage of office hours; this semester, I have not had but ONE student check in to office hours, and that was for a conference with his parent. I don't know if they just don't need any help, or if they are intimidated, or what, but I find this both odd and frustrating, b/c I feel like office hours allow us to really get to know our students. I will also note that, personally, I would either do all zoom, or all face to face; the hybrid model is exhausting and unsatisfying b/c it never feels like we're a "class," even though I make a point of including all in discussion and requiring all to contribute. It just feels "off" and again, I never feel satisfied after class.

Pamela Francis
Louisiana School for Math, Science, and the Arts

14/ The students enjoy guest speakers or guest participants who do "screen-share" demonstrations. For larger groups, break-out sessions are also fun, as they break up the monotony of just sitting and listening to the instructor.

Anne Lucas
Louisiana School for Math, Science and the Arts

15/ The good: The internet communication and speed are very good. Classroom cameras,

online office hours, safety measures, technology, in general, went very well.

The bad: Some classes as robotics are difficult to teach. With a small group of students split by half, one online one in the classroom, both working on different things.

Edwin Perez
The Louisiana School for Science Math and the Arts

16/ Our CMS has a built in Discussion Board option in Assignments. (Just like Moodle, BlackBoard, et al.) I've never scored participation points as part of a grade before and my experience with these discussions had been lack luster. But I tried this a few times and was pleasantly surprised. I'm confident that some students are just doing the requirements for the points. But monitoring the discussions weekly has become one of my highlights. I get to see the students engage with each other (difficult virtually) and use their vocabulary to describe and explore. Slowly, they expand their vocabulary to that of the discipline. For me, vague is better. "Minimum, two posts this week," has become my staple. I continue to monitor and occasionally delete posts, but this has worked for me. 100% Participation Grade!

Randy Key
The Louisiana School for Science Math and the Arts

17/ I've found calling on all of my students by name to be the most effective way to get students at home to participate. They've come to expect it and are more engaged.

Allison Landry
Louisiana School for Math, Science, and the Arts

18/ Virtual fishbowl protocol works. It helps with student participation and engagement. What does not work is the lack of academic accountability for students.

Dona Bien-Aime
Raisbeck Aviation High School



BACK TO BASICS

By Jessica Golden-Harrington

Technology was part of my teenage schedule, but it never defined or set my schedule. I had a computer, a TI-82 graphing calculator, and a glorious corded phone. I could tell time, keep a planner, read a map, hand write legibly, all things lost or “improved” upon with the development and integration of 21st century technology. As an adult who uses technology all day as a necessity of my job and the management of a household, I sometimes forget what it is like before I had 2 laptops and a smartphone. I take Technology Time-outs... drifting back to a simpler time by leaving my cell phone at home when I go to the post office or the grocery store. After the immediate anxiety subsides, I feel free of the burden of constant connectedness. Did I grow up in a simpler time or do one set of anxieties and difficulties replace another? Does 24 hour a day connectedness erase the boundaries between work and home life, hobbies and self-care, while simultaneously making multitasking a new priority and sense of false life balance?

For years, I have been reading articles, memes and posts by my fellow Gen Xers discussing their stories about what it was like to be a child in the 80’s and a teen/young adult in the 90’s, always pondering what it would be like to get back to basics...because we thought we were living basic lives. What would it be like if our children did not have access to the technology that runs our daily lives and schedules? There

has been so much venting, commiserating, complaining about how difficult it is to parent in a different time and age than our parents and grandparents. The judgment and critical lens that we have turned on ourselves is hard to see through. Truthfully, with each generation there are new sets of challenges with families, parenting, socializing, working. As technology brings us “forward” in so many ways, it has limited our experiences in others. By tethering us to intense and over crowded schedules with too many *to dos*, *must dos*, and *should dos*, our children don’t have the same opportunities to unplug. They are watching us adults model the very things that we are criticizing: too much time on cell phones, social media, streaming sites, webholes, etc. always crossing work priorities, calendars, appointments with wasted time online. How could our children possibly see the boundary that we continue to blur?

In light of the current global pandemic, the world feels upside down, but this time, let’s not blame technology. Technology is helping our workforce, families, and schools operate. Technology is helping all of us feel some sense of normalcy in uncertain times. It’s been 100 years since the threat of a plague like disease was an American reality and this time, as our world really does “shut down,” many have the ability to maintain their employment. Our children are able to attend school remotely,

receive instruction, and socially connect with friends; we are able to converse with friends and families through video chats and online meetings. We can order almost anything we need or desire online. Maybe the new fangled 21st century technology is not the issue. Perhaps we have strayed too far from the basics. No, not basic technologies, basic and essential priorities: Family, friends, work/school, leisure...maybe a handwritten note or directions to someone’s house scribbled on the back of a napkin/envelope is just as useful as a text, calendar invite, family post. Maybe striking a balance to stay connected via internet and cell technologies and reset our lives and schedules at the same time is exactly what we adults need. Looking at my google calendar wipe itself is exciting and has given a bit of clarity.

Technology provides us with structure and ease of task, but without boundaries and balance, it has become the scapegoat and addiction, for some, that we use to justify blame for our busy lives, our 24 connectedness, our family/

parenting challenges, and the greater issues that we face as a society. I am not making light of the millions of people who will contract this disease, lose loved ones, lose employment, but maybe our dance with the pandemic will lend a new lens, and provide a cultural reset of sorts.

What non-scientific outcomes can come from a global pandemic aside from the immediate changes that we are all experiencing? Well, you have a choice. We all do. We can reduce the number of activities and social commitments to allow for our lives and families to achieve a reasonable balance again. We can reconnect with life long friends and family who add value. We can review and revisit our values as a family, a community. We can relearn how to live a family-centered life by really knowing our spouses and children, not just understanding how they fit into a schedule or plan or post. We can decide to stop blaming technology for the loss of anything and destruction of everything and start practicing healthy boundaries with technology. We have a choice to get back to these basics.

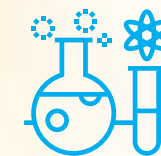


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Home Work: Illinois Tech Students Discover, Create, and Solve—Virtually

Students Study Biomedical Engineering from Home with Hands-On Remote Lab Kits

(Sponsored Content)

With the coronavirus pandemic limiting activity on campus as of mid-March 2020, [Armour College of Engineering](#) biomedical engineering undergraduate students were determined to bring to life—virtually—the topics covered in the course BME 443 Biomedical Instrumentation and Electronics, led by [Phil Troyk](#), professor of biomedical engineering and executive director of the [Pritzker Institute of Biomedical Science and Engineering](#).

Sophia Nelson (BME 3rd Year) began to consider how students in the spring 2020 course could participate in hands-on learning experiences and continue to apply the principles of circuit analysis that was talked about in the virtual classroom. This idea sparked further discussions with Troyk about the possibility of developing a remote lab kit for students to build a circuit—and get it working—while sheltering in place at home. Chandrika Halder (BME 3rd Year) and Claudio LoBraico (BME 4th Year) opted to participate in this remote lab opportunity along with Nelson.

Within a few days, the Pritzker Institute met this challenge by creating electrocardiogram laboratory kits remotely. An electrocardiogram, or ECG, is a test that measures the electrical

activity of the heartbeat and can be used to diagnose and assess heart conditions. Finding out how long a wave takes to travel from one part of the heart to the next can show if the electrical activity is normal or slow, fast, or irregular.

Unlike other educational kits that are considered “plug and play,” Troyk explains that the Pritzker Institute’s lab kit required students to fabricate an electrocardiogram-measuring electronic circuit from individual components, debugging the circuit to obtain full operation.

To initiate the process, Troyk prepared a lab kit equipped with resistors and capacitors, electrodes to measure ECG results from the wrist, a solderless breadboard—a construction base for prototyping electronics—and portable oscilloscopes used to draw a graph of an electrical signal and create a waveform display.

“We didn’t just convert a laboratory, [Pritzker Institute] actually mailed the necessary hands-on materials to students at home,” says Troyk. “I put together a kit in which they could build their own heart monitor waveform just like we were discussing in the lecture.”

Troyk tackled the challenge of moving the course online by setting up Zoom meetings so that he could actively engage with students and provide feedback along the way. In addition, he provided detailed instructions and recorded videos to ensure each student had access to the necessary resources.

As a result, all three students successfully assembled the electrocardiogram circuit and produced heartbeat ECG waveforms, which they were able to measure and analyze from home.

Participating students then delivered a video presentation to the class in which they reported on the overall process and findings.

Nelson describes the electrocardiograph lab kit project as the highlight of the academic year. *“Dr. Troyk provided us with the framework we needed such as his circuit implementation and testing notes...and most importantly our open minds,”* she adds. *“We also had the chance to design our own experiments, and it was very rewarding to see how an ECG can be alternatively designed to be an EEG, or a device that can measure if two hearts can beat as one.”*

LoBraico shares that the ECG remote lab was his favorite academic experience as a college student. He chose to study biomedical engineering because of his interest in wearable technology and medical devices, and says that he could not pass up this opportunity.

“It had been a topic we spent several class periods on, discussing not only how the circuit is constructed and what components are used, but also the reasoning for why ECG amplifier circuits

are built the way they are,” adds LoBraico. *“Being able to apply this knowledge hands-on was invaluable. Plus, being able to reliably measure my own ECG with a device that I built at home was very rewarding.”*

With some remote video troubleshooting assistance, students not only measured their own ECG waveforms but were also able to perform other experiments they designed themselves.

“One of the biggest takeaways was learning how to troubleshoot electronics without losing patience, which as a BME student with neural specialization is an invaluable skill,” says Halder. *“Personally, the satisfaction of being able to measure my own ECG with a tiny oscilloscope in my dorm room was beyond exciting, and I am thankful to Dr. Troyk for the chance as well as Sophia who came up with the idea.”*

While students received nominal course credit, Troyk was impressed with the initiative they displayed throughout the process and the enthusiasm for more hands-on learning opportunities.

He shares that this collaborative experience goes beyond showcasing how Illinois Tech students and faculty came together to cope with a challenge; it highlights how they were able to create something better.

“When the last student sent the email after figuring it out, I said, ‘I’m so happy you got it.’ But then I looked at the ECG results and said, ‘Wow, your heart rate was 100. You must have been really excited, too,’ and she said that she was,” adds Troyk. ■

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“Over the course of a week at Cloudbridge, students collect data, use the lab at the Cloudbridge classroom, and draw conclusions.”

CREATING A VALUABLE PARTNERSHIP FOR YOUR SCHOOL:

Cloudbridge Nature Reserve and
The Gatton Academy Model



A decade ago, the first 16 Gatton Academy of Mathematics and Science in Kentucky students conducted research at Cloudbridge Nature Reserve in Costa Rica. The Cloudbridge connection was instant magic.

The Gatton Academy's partnership with Cloudbridge was predicated on building a sustainable international field research program for our secondary STEM students.

Since that inaugural journey in January 2011, the partnership between the school and Cloudbridge has thrived. The roots put down initially have grown deep. The Gatton Academy returns annually, now leading two programs each year because of student interest.



To-date, 224 Gatton students have conducted original, mentored research at Cloudbridge. The partnership was honored by the NCSST's Innovative Partnership Award in November 2020. Now, Cloudbridge is ready to partner with additional NCSST member schools to build similar customized programs.

Cloudbridge Nature Reserve is in a mid-altitude cloudforest. Started as a reforestation project in 2002, tens of thousands of trees were initially planted, and pioneer species like the cecropias are fast-growing. Today's visitors walk an elaborate network of trails connecting the ranging forest, including undisturbed old growth and the secondary forests at different stages of regrowth. Along the River Trail, students encounter pristine water flowing from the adjacent UNESCO World Heritage designated Chirripo National Park, home to Costa Rica's tallest mountain. The river is punctuated by waterfall after cascading waterfall.

As rare as high school student access to research remains outside of our Consortium, international research opportunities are even more unusual. Through The Gatton Academy's partnership with Costa Rica's Cloudbridge Nature Reserve, a successful model for international student STEM research has been created.

The following research projects are routinely conducted, most for years sequentially, collecting longitudinal data useful for Cloudbridge:

- Tree Diversity, Carbon Sequestration, and Climate Change
- Hydrology, Morphology, and Biodiversity of Stream Drainage
- Plant Diversity of the Cloudforest
- Useful Native Plants of the Cloudforest
- Species Diversity in Heliconia Bract Micro-Ecosystems
- Elevational Gradient of Leaf Litter Insects
- Large Mammal Photo Capture
- Gunnera-Nostoc Symbiosis
- Butterfly Diversity
- Bromeliad Study
- Bird Survey of Cloudbridge
- Dung Beetle Diversity and Litter Inverts

Gatton students visit Cloudbridge in group sizes of 16. Well before departure, they are assigned into research teams of four students maximum, assigned a scientist field leader from Cloudbridge or our hosting teacher, and given their topic.



Cloudbridge is an international destination for visiting researchers. The research projects at Cloudbridge are led by Costa Rica, American, Canadian, Spanish, Dutch, German, and English scientists, lending global perspectives for our students. The mentors carefully guide students into leadership roles—first teaching their topic's depth, and then mentoring them to form their own research questions, hypotheses, and methodologies.



Students get an in-field crash course on-site by their group leader who is expert on their topic and given several options for how to approach new inquiry. Under mentorship of the group leader, student teams ultimately take leadership, choosing the research question, setting a hypothesis, and designing a simple methodology to run their field experiment. Over the course of a week at Cloudbridge, students collect data, use the lab at the Cloudbridge classroom, and draw conclusions. The visit ends with teams presenting and documenting their results. Many teams present these same presentations at conferences and science fairs once returning to the USA.





Gatton Academy students love to walk to the nearby village of San Gerardo de Rivas. They eat in the village's restaurants, play soccer with local teens on the town's field, and load up on snacks from the town store. Each Thursday and Friday features the bustling farmer's market in the nearby city of San Isidro de General, where our students are immersed in Costa Rican culture.



If your school is interested in developing a program at Cloudbridge Nature Reserve, you can learn more at www.cloudbridge.org or by emailing derick.strode@wku.edu. ■

Meanwhile, Cloudbridge has grown during this decade partnership. Dormitory lodging for students has been built, teachers stay on-Reserve too in cabins, and Cloudbridge serves hot meals. Cloudbridge is open year-round to welcome other school groups and researchers. Cloudbridge offers a range of tours and special programs for students to round out their learning. Gatton Academy students always love the night hikes—especially finding glass-heart frogs—and the Forest Art class.





The National Consortium of Secondary STEM Schools (NCSSS) was established in 1988 to provide a forum for specialized secondary schools focused on science, technology, engineering, and mathematics (STEM) disciplines to exchange information and program ideas.

NCSSS Mission

Our mission is to advance STEM education by providing professional development and networking opportunities for educators and learning experiences for students; to serve as a national resource for STEM schools and programs in partnership with educational, corporate, and international organizations; and to inform policymakers on STEM education.

NCSSS Vision

Our vision is to serve as the resource for secondary STEM schools by supporting collaboration and knowledge sharing and providing professional development for teachers and administrators to positively impact student achievement in authentic STEM educational environments.