



SITS 2023

Summer Institute in Teaching Science 2023

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The Transformational Loop

by Michael Gray, Founder and Director: Summer Institute in Teaching Science



The Summer Institute in Teaching Science (SITS) is all about transformation. It starts by catalyzing personal transformation in the very first weeks of the

first summer in Track 1, but that sets in motion a chain reaction that never stops. It circles back again and again to call the teacher to commit to a new cycle of metamorphosis. I call this the transformational loop.

Those who personally experience the transformation that deep learning brings invariably pass this good news to others. Real lifelong learning isn't about accumulating information; it's about developing insight. Lifelong learning is motivated by building understanding that is durable and fruitful. We all have too much experience with the weariness that follows most so-called learning. It is demotivating to "learn" and then "lose" the learning. Learning that regularly builds surprising, intriguing, and powerful connections over a lifetime is satisfying. It leads to increasing wisdom and a clarity of perspective that is the antithesis of a decaying database of facts.

This personal passion for learning drives a passion for our students to have the same transformative experience. This is what drives the transformation of pedagogy. Transformative pedagogy creates learning environments where students wrestle with powerful core ideas of a discipline and gain deep personal ownership of those ideas. Student transformation is evident when students solve complex authentic problems. These students know that they know. Looking back over just one semester they can see their growth and they want more.

When faculty see student transformation, they want more as well—more for their students. Because culture changes, my academic discipline changes, educational expectations change—not to mention the reality that generations of students change—there is a continuing need to address change with requisite change in pedagogy. Improved pedagogy can only come from teachable faculty who are passionate learners above all.

You don't have to take my word for it. Check out four podcasts from this summer. These recount the formation of the SITS philosophy of teaching and learning, the structure of the

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Photo credit: Caleb Olivero (BJU photo archives)

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Track 2 participant Jeff King reflects on how the first two years of SITS has transformed his teaching on [page 2](#).

Transforming Faculty and Students

Hear what students have to say about SITS-trained faculty and their courses on [page 3](#).

Two New Faculty Join SITS in 2023

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RIU Updates

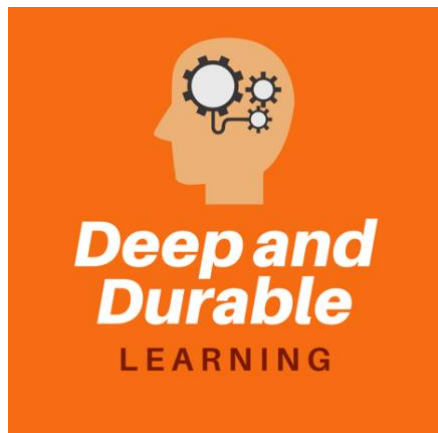
Four different Science & Engineering Endowment-funded Research Immersion for Undergraduates programs took place this summer. See what they were up to on [page 5](#).

The Value of SITS 2023

What is the importance of SITS from the participants' perspectives? See what they said on [page 6](#).

learning environment in SITS, and interviews with Track 1 and Track 2 participants. In this newsletter you can read about the transformation of **Dr. Jeff King** (formerly of the Naval Academy) who teaches aerospace engineering. Another feature of this newsletter is a compendium of quotes garnered anonymously from science and engineering course evaluations. I think the transformation of these students is palpable.

I'm currently recording fall episodes for the Deep and Durable Learning podcast. These are interviews with BJU and BJA faculty who have implemented the SITS principles of teaching and learning in a variety of disciplines outside of science. The first will be released Sept. 9. All these inspiring stories recount personal transformation leading to transformed pedagogy and transformed students. ♦♦♦



Check out these new episodes of **Deep and Durable Learning**:

[S6 E1](#): "3 Musketeers Synthesize 3-legged Stool"
(A conversation between three SITS co-founders, *Mike Gray, Bill Lovegrove, and Brian Vogt*)

[S6 E2](#): "Three Legs Morph into Three Tracks"
(An interview with the SITS Associate Director, *Derrick Glasco*)

[S6 E3](#): "Content Delivery or Personal Transformation?"
(An interview with 2023 Track 1 participant, *Timothy Tittiris*)

[S6 E4](#): "Transformed by the Third Rail"
(Release date: July 29, 2023)
(An interview with 2023 Track 2 participants, *Tim Anglea, James Collins, and Jeff King*)

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A Reflection on SITS 2023

by Jeff King (Track 2), Department Head: Engineering



Having just completed my second summer of SITS I thought I would reflect on how it has changed or benefited my teaching. I started my teaching career

at another institution and like most other academics, was thrust into teaching with little to no formal training on how or why. It is assumed that if one earned a Ph.D., one can teach. We all know this is a faulty assumption and yet it remains prevalent in academia, even to this day. Because my training was primarily in the technical field of Aerospace Engineering, I had very little formal education on learning. I gleaned some knowledge from my own experiences and observation of others, but that was more of the how it works rather than the why it works. I observed different mentors and colleagues to see how they taught and what styles and techniques they used. I began to recognize what seemed to work and what didn't work for me, while not fully understanding why it was or was not working.

Last year, Track 1 of SITS exposed me to the why behind learning and caused me to think differently about how I taught. It gave me a firmer foundation for my teaching philosophy beyond observation and the pragmatic "it just works" approach. In many cases, it solidified certain concepts that had

been tenuously held from observations. In other cases, it caused me to change my style to better align with how students learn. Spending the summer thinking deeply about why you do what you do was such a blessing and not something that I had been afforded at my previous institution.

This summer, SITS Track 2 gave me a plethora of practical and concrete tools for my teaching toolbox. Like any toolbox, the more tools you have available and are experienced in using, usually means that you can find and use the tool that best fits a particular need. The toolbox analogy continues because even our favorite tool may not be the best tool for the job. Each course, each topic, and even each cohort of students

is different, and we need to be able to adjust and adapt our teaching to maximize the learning in our classrooms. In SITS, as we looked at different tools, we were constantly evaluating them in terms of how they helped usher students into a natural learning environment to maximize their understanding of the topic. I am thankful for the many different examples across multiple academic genres that we discussed and read about. Once again, my summer in SITS caused significant change in my teaching style and format. One example is that I realized what I called good questions and interaction, was occurring at a surface level, and tended to move the class along according to my plan. These questions were not necessarily causing my students to think deeply about the concept at hand. As I develop and adapt my courses for the next year, I am even more excited about how to help my students learn deeply as they pursue the ability to think like an engineer. ♦♦♦



Jeff King getting ready to present a "Teach Your Colleagues" session, an assignment for Track 2.

Transforming Professors and Students

Hear What **Students** Have to Say About SITS-Trained Faculty and Their Courses

Traditionally, our newsletter contains plenty of comments from **faculty** about the value of SITS. But what about our **students**? For sure, most of them *have no idea* that SITS even exists – but when you examine their **comments on course evaluations**, it's clear that they are reaping its benefits through transformed faculty and courses!

Below is just a sampling of these comments from the past couple of years. The students are already anonymous to us, but we'll leave the professors' names out, too, as to not embarrass them (in a good way)! ♦♦♦

"Dr. ██████ really knows his stuff and can **explain things on a level maybe no other professor here can**. He is in touch with current research and can contribute beyond the book and the curriculum. **It is a privilege to learn from him.**" –Biology Student

"Sometimes I take a step back and look at what I've learned this year, and I think, "wow, how did I understand that crazy concept? How could I do that?" and I credit it to Dr. ██████'s exceptional skills in explaining concepts in a way where it's just easier to understand! Additionally, he shows such care for us students..." –Chemistry Student

"...the tests were so fun and challenging and really made me think about the material. **They were brilliantly written.**" –Biology Student

"Dr. ██████ explained difficult concepts well. **He didn't just give the answer to us right away. He tried to help us understand it.**" –Engineering Student



Bill Lovegrove, Engineering
Photo credit: Derek Eckenroth (BJU photo archives)

"Dr. ██████ utilizes a wide range of **resources**...in a professional way that **shows his experience in teaching**. He is also humorous and never fails to entertain the class." –Biology Student

"Dr. ██████ does an excellent job explaining the procedures at the beginning of class but also **getting us to think about why** the procedures are performed in that manner. This helped me to think about how to design experiments in a scientific manner." –Chemistry Student

"...extremely diverse learning techniques and assessments, **more creative than those in other classes I have taken**..." –Biology Student

"Dr. ██████ clearly taught important ideas, **challenging our conceptual understanding** without pressuring us for pure memorization." –Engineering Student



Derrick Glasco, Biology, with some of his students.

"Definitely **helped me think more critically** about the implications of facts and ask 'Why' more often. **Honestly, sometimes I wished class time was longer.**" –Biology Student

"Dr. ██████ does a great job keeping the class interesting with examples and illustrations. He truly cares about his students and makes himself available whenever they need him...**He is very practical in the way he teaches**, allowing group work throughout the class and encouraging collaboration reflective of that in the real world." –Chemistry Student

"**Many different learning methods were used** (lecture, online quizzes, adaptive learning modules, and lab work) that really helped me have a deeper understanding of the material." –Biology Student



David Boyd, Biology.
Photo credit: Derek Eckenroth (BJU photo archives)

Dr. ██████ "**understands how to explain** when we are struggling with a topic." –Engineering Student

"**Engaging and makes you think**. I was looking forward to the class since freshman year and now I'm miffed because I don't have a class with Dr. ██████ next semester." –Biology Student

In an email to multiple science faculty:
"I...wanted to thank you gentlemen for teaching me about the nature of science and not just knowledge about science. **Your instruction reshaped the way that I think about science** and truly helped me while student teaching chemistry at [a high school]. **I especially appreciate the Biblical worldview that was woven into your classes**...Thanks again!" –Former Student

Dr. ██████ "**understands what is needed to be learned and centers the course around the major topics and learning objectives.**" –Biology Student

"Despite the breadth of material covered in the course, Dr. ██████ clearly had a grasp on the key components students needed to master and **used a variety of methods to enable students to learn effectively.**" –Biology Student

"The course overall was **very well put together**. The quiz and test material **demand that I understand** concepts being presented conceptually as well as being able to apply equations...I feel that this gave me a deeper understanding and **motivation to understand the why behind what I was actually doing**, which in turn helped me to apply equations with more confidence rather than just guessing based on what variables were present." –Engineering Student ♦♦♦

Two New Faculty Join SITS in 2023

We are always thrilled to welcome new (or new to us) science faculty in our joint effort to grow in our craft of teaching. Our newest participants have very different backgrounds but are both BJU graduates and recently finished their first year of teaching at BJU. This summer, they completed Track 1, our intensive first-year experience focused on clarifying their own thinking as teachers.

Here's a little bit about them: → → → →

FUN FACTS

- With the arrival of **David Kan**, there are now **four** Davids teaching in the Division of Natural Science! For some reason, though, we still call each of them by their first name.
- With the arrival of **Timothy Tittiris**, we also now have **two** Timothy's! After some negotiation, one has agreed to just be called "**Tim**" (**Anglea**).
- We used to have **three** Amys but are now back down to one (the original)!
- We also have a **Susan & Susie**, a **Rick & Derrick & Patrick**, and **two** professors named **William**, neither of which go by William!



Timothy Yiannakis Tittiris returned to BJU after living in Cyprus for a few years. He earned his B.S. in Biochemistry & Molecular Biology from BJU and then went to SUNY Buffalo to earn a Ph.D. in Medicinal Chemistry. After graduating, he worked as a high school science teacher in West Seneca, NY before moving to Cyprus with his wife and three children. In Cyprus, he worked as a science teacher and was involved with youth work before the opportunity to return to BJU arose.

Timothy's goal in returning to BJU is to reinvest what was poured into him when he was a student. He has developed a passion for training young people to observe God's amazing handiwork in Chemistry, and then to go out equipped with the required scientific knowledge, as well as the proper biblical worldview, to be an effective testimony in what has seemingly become a godless field to work in. He has found the foundational principles discussed in SITS to be instrumental in designing classes to achieve the proper equipping of the next generation of Christian chemists.



David Kan is our newest Biology faculty member and brings us a unique and invaluable skill set – he's both a physician *and* a theologian! After studying Science at Pennsylvania State University, he earned his M.D. from Thomas Jefferson University, specializing in ophthalmology. Later, he came to BJU and earned an M.A. in Bible and a Ph.D. in Theological Studies (Old Testament).

David teaches a variety of introductory biology courses (including labs), particularly those geared towards health sciences and nursing majors. He is passionate about teaching and especially helping to biblically shape the worldviews of college students at this critical juncture in their lives.

David and his wife have six children, two of which are currently in the Premed and Nursing programs here at BJU!

And if that wasn't enough, we also hear he's quite the photographer! ♦♦♦

RIU Updates

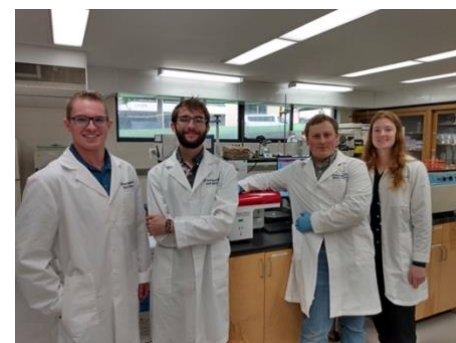
Several **Research Immersion for Undergraduates** (RIU) programs take place at BJU each summer which are supported by the Science & Engineering Endowment Fund. Here are some quick updates from each of the RIU directors:



Biology RIU – Cancer Research Lab (Steve Figard)

This summer we had two firsts for the program: a summer "volunteer" and a bioinformatics project not related to cancer. We also started a new project related to the cytoskeletal rearrangement that occurs in cancer cells.

Continuing our work on almonds and cancer, after much trial and tribulation, it was determined that our new flow cytometer needed some "adjustments" that only the manufacturer could give. Consequently, we received a loaner and sent our instrument back to BD for a tune up of sorts. As of this writing, we are just now starting experiments with the loaner flow cytometer. Stay tuned!



A particular cytoskeletal protein, vimentin, appears to increase in concentration in many forms of cancer. Our research question was simple: can the quantity of this protein predict the stage of lung cancer? Initial

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attempts to evaluate the vimentin levels by Western blot did not yield definite results, and an ELISA assay is being evaluated to see if more definitive data can be collected.

With our newer concentration area of biotechnology, an opportunity was given for a student to work with Dr. Nathaniel Jeanson, a geneticist from Answers in Genesis, on Y-chromosomal data previously collected through genetic testing to trace human history back to Noah and his three sons. Working primarily on groups found in the Middle East, this research is trying to determine who the modern people groups of the Middle East descended from and how they got to where they are now.

Chemistry RIU (Robert E. Lee)

This summer, Isabella (Bella) McDonald, a rising junior Chemistry major, and Lukas Shelton, a rising senior Biochemistry and Molecular Modeling major completed Summer 2023 Chemistry RIU as CHM 413 EXP. Their target was the potential active pharmaceutical ingredient, N-(4-(2,4-dimethylphenyl)thiazol-2-yl)isonicotinamide.



Their final paper has been submitted to the American Chemical Society for the regional meeting in October. That paper is available for all who are interested by contacting rlee@bjv.edu. Their research was both rewarding and extremely challenging as they built on their chemical knowledge to perform the required synthesis. The first two reactions, bromination and Hantzsch triazole condensations worked well. However, the amidation reaction gave them plenty of riddles to solve. Parallel with the lab work,

they also participated in specific reflections as part of the experiential learning (EXP). It was rewarding to see them connect this research with both previous training and future career plans.



Physics RIU (Nick Gothard)

The Physics RIU hosted one student to study microstructural development of advanced materials. The focus this summer was on ceramic Li-ion electrolytes for application to solid state batteries. Materials were prepared using a combination of high temperature thermal sintering and direct microwave application. Both a research-grade mixed-mode microwave and a custom single-mode microwave resonant cavity on loan from the US Air Force Research Laboratory were employed. Microstructures and elemental dispersion were characterized by scanning electron microscopy as well as energy dispersive X-ray spectroscopy. The student gained experience with materials preparation, synthesis techniques, and characterization by electron microscopy. The project resulted in an improved understanding of microstructural development, and characterization of ionic transport is ongoing.

Robotics RIU (James Collins)

This year, one faculty member and five students competed in the Intelligent Ground Vehicle Competition (IGVC) that is held annually in June at Oakland University in Michigan. They competed in the "Auto-Nav" part of the competition which requires a robotic vehicle to navigate a 500-ft obstacle course autonomously. Twenty-three teams participated and our team placed eleventh. The students spent three weeks leading up to the competition working on the robot as part of the summer Robotics RIU program. Two of the students were freshmen and it was encouraging to see their enthusiasm as they learnt from the senior members of the team.



The team implemented a software upgrade to ROS 2 from the previous ROS and this was an excellent learning experience for the students. Although the robot did not perform as the team had hoped over the competition weekend, they all came away from the experience excited to work on the robot and make improvements for next year's event.



The Value of SITS 2023

THANK YOU to Our Donors Who Continue to Make SITS Possible!

"I have benefitted from SITS much more than I can imagine. It has shaped the way I think about teaching—from preparation to course and class management to assessment and everything else, too."

"I find [the interdisciplinary 'C4'] sessions valuable and maybe even some of the most memorable sessions of SITS over the years. I'm thankful to the Lord for being able to serve alongside other scientists and I'm grateful to them that they are willing to have open discussions in a more formal way each week."

"The worldview sessions reiterated the necessity of inculcating logical, persuasive, Biblical truth into all that we teach, whenever we can. Reviewing Mike Gray's Season 1 podcasts echoed previous emphases on the importance of stressing concepts and principles rather than mere facts, and that the best teachers answer 'why' questions which are stickier."

"This summer's SITS has helped me focus on improving unity and narrative flow of my target course."

"The emphasis of Track 2 on making the classroom environment more interactive was also challenging and helpful. It gave me the confidence to try out some new things and to be brave enough to ask more questions and wait for the responses."



"I love SITS. I believe that the idea of working together to improve your courses helps build teamwork and understanding of different fields. It is what makes our division the best one to work for."

"Once again, spending dedicated time thinking deeply about my teaching has and will continue to influence my course development. SITS has forced me out of my comfort zone and helped me see gaps in my own pedagogy. I enjoy the regular interactions with colleagues as well."

"I appreciated the time to work on course revisions with new textbooks in two classes. It is so busy during the semester there isn't the time to do the job well. This allowed me to get input from others as well that I probably would not have had the opportunity to do. I was also able to convert an internship course to an EXP course with the input of several professors which was very helpful."



"I really value the time to be able to think about what and how we teach. It is such a privilege to be able to spend time improving our art. Of course, snack time and the social aspect of getting to know our colleagues is [also] valuable to me."

"The discussion on Bible integration was very helpful and applicable; it allowed me to do some self-reflection for my own courses and how I can incorporate more levels of Bible integration."



COMING SOON



SITS 2024

THE 20TH ANNIVERSARY

WE'LL SEE YOU THEN!