



SITS 2021

Summer Institute in Teaching Science 2021

IN THIS ISSUE

“No Small Gratitude”: A Reflection from Our Newest SITS “Graduates”

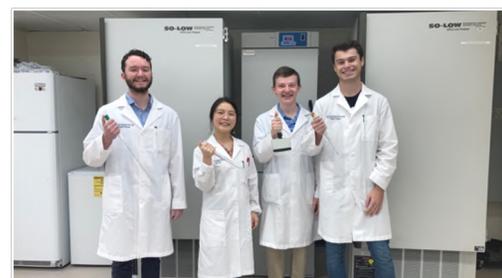
by David Gardenghi and David McKinney

Summer 2021 draws to a close, but something monumental has happened. Sure, it's quiet, the kind of event that passes unnoticed by most, but carries with it great import for the future. Four faculty members, **Dr. Jeremiah Deang, David Gardenghi, Wencong Lai, and David McKinney** have completed our formal program in the Summer Institute in Teaching Science (SITS), made possible by the generous donations of like-minded souls. Although we are hardly the first people to complete the SITS program, both of us, David G. and David M., were also trained under teachers of the SITS program. Let us clarify what we mean.

We came as students to Bob Jones University in '03 and '04, David G. and David M., respectively. The faculty were just beginning the SITS program formally, though they had been developing its ideas prior to that. As undergraduates, we heard about the program, and we saw many of the principles established in the program exercised in the classroom. From concepts maps and Socratic

questions to complex multipart problems and work groups, each approach was designed to engage our thinking as opposed to imparting content. We went on to graduate school with a capacity for thinking that outpaced our peers, as indicated by our performance being ranked with top students both locally and nationally, and we credit our success largely to the facility of thinking afforded us by a SITS model of pedagogy. We have seen SITS from a learner's perspective, and now we have seen SITS from a teacher's perspective.

Having returned to our alma mater, degree in hand, to teach in the very classrooms in which we once learned was more than a little intimidating. We honestly had doubts that we could accomplish the near magical transformation that had been wrought in us in others through our own teaching. SITS is structured with three equal but necessary elements for the purpose of training students to operate with expert thinking in their respective disciplines. As Jeremiah said, “All



Multiple Summer Research Programs Available for Students

Thanks to the Science & Engineering Endowment Fund, three different programs were able to host students for summer research projects. Read about them on [page 3](#).

Engineering Students Compete in the Intelligent Ground Vehicle Competition

Engineering students were once again successful in this year's competition. Read about it on [page 3](#).

SITS Worldview Sessions: Interdisciplinary and Focused

This year's SITS worldview sessions included speakers from five different departments on campus. Read about them on [page 4](#).

The Sustaining Value of SITS

Find out what SITS participants said about their experience this summer on [page 5](#).

three interconnected tracks of SITS have influenced my teaching and have given me more confidence as I prepare for the semester as well as in the classroom”, and all of us who participated can say the same. The first track of SITS focuses on clear thinking about the discipline in the mind of the teacher that is necessary for its clear communication to the student, which is the second track. The program concludes with the final track that addresses assessment of that communicated thinking in the students. This comes full circle back to the expert thinking, but with the focus now on the student.

The first track of SITS, focusing on the clear-thinking teacher, was instrumental in challenging us that there is an organized and intentional way to teach thinking. Our own thinking was mostly intuitive and needed a systematic arrangement with the guidance of seasoned mentors. It also helped immensely to see our former mentors struggling alongside us in the same goal of becoming the most God glorifying teacher possible. The number of pieces that needed to come together to grapple with one’s own thinking warranted spending two summers on the topic. The sum of this effort is best captured in Wencong’s words that the first track helped to “better understand the logic of a course.” With the inkling of understanding clear thinking, we were ready for the second track, communicating that thinking to students.

Effective communication of thinking is essential for illustrating and guiding students in thinking like an expert. As teachers and experts in our disciplines, we often forget what it is like to be a novice. The various communication tools that we employ must not only improve communications but work with the student’s thinking. The intentionality of this process is incredible. For example, the things that we had perceived as automatic in our teachers, we now know were carefully honed skills . . . skills that we too would have to practice and develop. Jeremiah echoed this sentiment about skills saying that “New tools and techniques were learned to help students think critically and to help students to flourish.” Communication is central, but not sufficient in itself to carry us to the goal of being excellent teachers.



Mike Gray (back row) presenting certificates of completion to SITS 2021 graduates. Left to right: Jeremiah Deang, Wencong Lai, David Gardenghi, and David McKinney.

Assessment, the assurance of successful communication, is the third track of SITS.



Assessment is perhaps the most challenging and important track of SITS, presuming the previous foundation of clear thinking and clear communication. Without being able to assess a student’s thinking, the rest of the 3-legged stool falls over. Learning to think critically about assessment has been crucial to reaching the goal of thinking like an expert and is probably the area where we personally have the furthest to go. It was encouraging to think about it in terms of trying to

challenge the students holistically, and not just as a check on whether or not they remember what was said or written. As Wencong put it, our focus in track three is holistic, aimed at “measurement of student learning outcomes.” Not just their ‘grades.’

Having completed the last track of SITS this summer, we look back on the previous years with joy for what God has taught us about teaching, about our beloved colleagues, and about ourselves. We believe that we are well equipped, but only just beginning this journey of becoming what may only be best described as excellent teaching professors. We owe no small gratitude to the many who have given in support of the SITS program and let us be among those who have benefitted from the program to say ‘thank you for your kindness, thank you for the difference you have made, not just in our training, but in the hundreds and thousands of students whom we will have the privilege to teach as the Lord tarries’.

Multiple Summer Research Opportunities Available for Students

by Bill Lovegrove and Steve Figard

This summer, we conducted three Research Immersion for Undergraduates (RIU) programs with funding from the Science and Engineering Endowment.

We had two students this year in our first ever Physics RIU, directed by **Dr. Nick Gothard**. The program lasted for four weeks, and students performed original research in the area of experimental and computational condensed matter physics. One project utilized our new GPU-accelerated computational server to study a novel defect in diamond for application as a quantum sensor. Software modeling tools were used to construct the defect model, calculations using a quantum mechanical framework were performed on the server, and the

results were analyzed with respect to energies of formation as well as optical transitions. The other project used microwaves to study the interaction of electromagnetic energy with materials. Materials were mixed from elemental powders in an inert gas environment, after which they were subjected to either E field or B field radiation. A theoretical framework for the observed effects was constructed. Full characterization is still pending and is planned for the fall as part of a physics research course.



The Chemistry RIU students presented the results of their summer research to faculty and guests on Friday, July 2nd.

Three students participated in the Chemistry RIU directed by **Dr. Robert Lee**. In partnership with Cayman Chemical, Inc., the students spent eight weeks working on microwave-assisted synthesis of 3,6-dimethoxyxanthone to be used by other researchers worldwide. Xanthenes are tricyclic aromatic compounds that have multiple pharmacological uses due to their anti-tumor, antioxidant, anti-inflammatory,

anti-bacterial, and potentially chemoprevention properties. Our research demonstrates that a laboratory microwave can assist in the synthesis.

The Biology RIU program in the Cancer Research Lab is led by **Dr. Steve Figard** and runs for eight weeks through June and July. Four students are chosen to participate in this immersion into research experience. They are tasked with specific problems but are required to develop their own solutions by way of experimental design and execution, including any troubleshooting of problems that arise along the way. This summer's work continues the previous line of research into the apparent cytotoxic effect of almonds on at least some gastrointestinal cancer cell lines (i.e., specific cancer cell lines grown in tissue culture). There are several biochemical pathways of cell death that could be triggered, so one question to which an answer is being sought is, which pathway is responsible for the cell death we see? Preliminary results suggest apoptosis (as opposed to necrosis or some of the less common mechanisms) and we are seeking to confirm that result with more solid data. In addition, we are also looking at trying to identify the cytotoxic agent/component of the almonds that would be responsible for this result. To date, it appears to be a small molecular weight entity that is most likely not a protein.

Engineering Students Compete in the Intelligent Ground Vehicle Competition

by Bill Lovegrove

For a couple of decades, the BJU Engineering Department has been attending the Intelligent Ground Vehicle Competition

(IGVC) held in Michigan each June. The competition is usually held at Oakland University. One of the sponsors of the competition is the US Army.

The competition takes place on two levels. The lower competition involves small vehicles (Figure 1) and is called the Autonomous Navigation Competition. The upper competition involves street-legal passenger vehicles (Figure 2) and is called the Self-Drive Competition.

The competition always occurs during SITS, and SITS has provided a variety of levels of support for the robot team and the trip. Most importantly, as part of our summer RIU (Research Immersion for Undergraduates) program, the endowment has sometimes funded research programs for engineering students to work on these robots and prepare for the competition.

As a result of our success over the years, we developed a relationship with the Army's Ground Vehicle Systems Center to do research on autonomous vehicles. They provided the funds to purchase our current Self-Drive vehicle which we call Bruin-3. They provided the funds that paid for this year's engineering RIU.

In a COVID-reduced field of nine teams, this year's Auto-Nav team came in second place overall on the strength of a well-designed vehicle and an excellent design report.

We view competitions like this as a valuable way to get an external measure of the quality of our students' education compared to big-name schools. First place this year was Embry-Riddle Aeronautical University. Notable other schools participating included Cedarville and Georgia Tech.

(See photos on next page.)



BJU engineering students participated in the Intelligent Ground Vehicle Competition at Oakland University in June 2021.

SITS Worldview Sessions: Interdisciplinary and Focused

by Derrick Glasco

Worldview sessions are an integral part of SITS each summer. Over the years, these have taken on various forms with many different speakers, but always with a common goal – equipping SITS participants with Biblical thinking as it relates to the sciences, teaching, and current theological issues. They are inherently interdisciplinary and are open to faculty across campus.

This year, we used *The Shortest Leap: The Rational Underpinnings of Faith in Jesus* by A.L. van den Herik as a starting point for discussion. *The Shortest Leap* is a new, wide-ranging apologetics book with many hits and misses, which certainly inspires dialogue!

This year's sessions were as follows:

- **Dr. Bill Lovegrove**, Department of Engineering: "Cosmology"
- **Dr. David Boyd**, Department of Biology: "Origin of Life"
- **Dr. Renton Rathburn**, Director of the Center for Biblical Worldview: "Ancient Near Eastern Use of Myth and the Battle for the Real Adam"
- **Dr. Brent Cook**, BJU Seminary: "The Resurrection"
- **Dr. Dan Olinger**, Division of Biblical Studies and Theology: "Testable, Falsifiable Evidence for a Supernatural Claim"



The Sustaining Value of SITS

Here's what this year's participants had to say about the impact of SITS on their teaching and professional development:

"SITS is invaluable to me as a professor in a rapidly changing field. I simply don't know how I could deliver quality teaching with up-to-date concepts and labs year after year without the focused time that SITS affords. At the end of each summer, I feel improved, confident, and ready to jump into the grueling academic year. I know my students are benefitting."

"It's such a blessing to be able to work on improving/updating a course when there is time to think things through! I am so grateful for the availability of funds from generous donors/graduates to enable this—something that other faculty on campus do not have!"

"I really enjoyed learning about how others approach assessment and the value of varied assessment within a course. Track 3 has also shown me the value of an aligned course (principles, learning outcomes, and assessment) and has forced me (in a good way) to consider a variety of assessments so students can think more like an engineer."

Additionally, the value of assessing my own assessment and trying to validate whether my assessment is good is something I



haven't thought to consider, but going through Track 3 has given me some tools I could apply."

"[Track 3] has made me realize that our final goal can only be accomplished through good assessments. I am now more aware of how testing can be ineffective at meeting our course objectives. I will work hard to make my assessment actually meet my goals."

"Track 3 has:

- Helped me see the ways in which questions fail, and what to do about it.
- Provided me with examples of multiple approaches to assessment, some of which I was not familiar with.
- Given me opportunities to practice question writing and question assessment.



"I also appreciate the time to talk to colleagues about everything from class content, presenting different types of information, general life, and spiritual encouragement."

"Thank you for the opportunity! I appreciate all the time and effort this is to put together as well as the investment in money from the



- Pushed me to consider what I assess, why I assess, and how I assess."

"I love having the time to work on my courses especially this year when I have a new prep in the fall semester and a new class in the spring semester. It also allows me time to look at the lecture/lab courses to make sure the concepts being presented in lecture are being reinforced in lab. I was able to add a case study to the lab...that I think will really make the students put together some concepts discussed in class and apply them to a real-life situation."

donors. I really think my students benefit from the time I have to work on my courses. The goal of giving my students an excellent learning experience is enhanced by the time I get to invest in my courses and the skills I learn through SITS."
