Note from David

The entire globe has faced an unprecedented challenge in the past two years, thanks to the near-universal disruption of the Covid pandemic. And computing is no exception, not least because the discipline has spread into almost every area of study and commerce: public health, news, business, finance, manufacturing and more.

Of course, the Online Master of Science in Computer Science (OMSCS) program was uniquely placed to thrive in these circumstances because our classes were already asynchronous and online. We have actually seen our enrollment grow to more than 11,500 students.

We have also continued to expand the programs’ offerings. We’ve taught six new one-credit seminars on topics ranging from entrepreneurship to women in computing. We added a number of new courses including: distributed computing; data analytics and security; deterministic optimization; modelling, simulation and military gaming; and advanced malware analysis. OMSCS has also invested considerably in scaling up our support services as our student body grows.

We have also continued to grow as an organization, adding associate directors for academic integrity and for diversity, equity, inclusion and student life. Our students and alumni continue to publish research both on computing problems and on learning at scale.

Speaking of learning at scale, Dean Charles Isbell and I have authored a new book, The Distributed Classroom, which distills the lessons we have learned creating and growing OMSCS. I am proud of the book, of course, but even prouder of all the students who have taught me so much while learning themselves.

With the support of our community, OMSCS is making a difference, both in computing and in the world at large. We are building educational structures for the future and building a strong, diverse computing community at the same time. I can’t wait to see what comes next.

David Joyner
Executive Director of Online Education and OMSCS and Senior Research Associate
“New Book on Future of Online Education Draws on Faculty OMSCS Experience”

Dr. Charles Isbell, the Dean of the College of Computing and the John P. Imlay, Jr. Chair, and Dr. David Joyner, Executive Director of Online Education & OMSCS and Senior Research Associate, have written a groundbreaking new book that rethinks learning and student experience. Both Isbell and Joyner are instructors in OMSCS and are leading the way into a new horizon of online education.

Their new book The Distributed Classroom, which published on September 14, 2021, proposes a model that transcends the traditional bounds of education. A brilliant rethinking of the physical classroom where education could seamlessly move between in-person, remote synchronous, and remote asynchronous teaching and learning with equal quality and experience. Moreover, Isbell and Joyner’s proposed model of distributed learning creates a pathway for equity in education where high-quality education is no longer a privilege of few but a true possibility for all as it removes boundaries of exclusion in cost and geography.

“How a massive open online course (MOOC) is changing higher education | Interview with Dr. Zvi Galil” Academic Influence

This interview with Dr. Zvi Galil, the founding director of OMSCS, is conducted by Dr. Jed Macosko, the academic director of AcademicInfluence.com. This interview reviews the beginnings of OMSCS and what makes it unique and highly successful.

Dr. Macosko sets up the interview by asking Dr. Zvi Galil what inspired him to create OMSCS. To which, Galil explains that OMSCS was born from his concern with higher education’s exclusivity and lack of access. Galil reasoned that education could be both inclusive and affordable as well as successful and credible. With the arrival of MOOC, there was an opportunity that Galil could seize. Galil brilliantly bypassed the shortcomings of MOOCs by creating a fully accredited program while retaining the intrinsic merits of MOOCs. Thus, as Galil explains to Macosko in this interview, there are four characteristics of OMSCS that makes it extraordinarily successful and unique. These four characteristics are that OMSCS is MOOCs based, highly affordable, vastly accessible, and excels in student engagement through online platforms such as Piazza and social media.

The interview ends with Macosko’s hope that other university can create similar programs to OMSCS.

This article written by the Wall Street Journal contends that when COVID-19 catapulted the traditional modes on in-person learning to online learning almost overnight, there were fears that the quality of education would significantly be reduced and there would be lack of engagement. However, Dr. Zvi Galil argues in this article that this presupposition is incorrect. Online learning, as demonstrated by OMSCS, can be as credible, rigorous, high quality, and engaging as in-person learning. Galil reasons that even in a large lecture hall there can be dissociation and distance between students and a professor. Physical presence does not necessarily warrant engagement and connection. The main point of this article is to present the argument that online learning, such as OMSCS, can provide high quality education where students can also engage and socialize through online platforms.

“Georgia Tech’s Online MS In Computer Science Continues To Thrive. Why That’s Important For The Future of MOOCs” *Forbes News*

This Forbes News article begins by claiming OMSCS as the “the most successful online graduate degree program in the United States” and also “the largest computing master’s program in the nation - and probably the world.” (Nietzel, 2021). The article continues by reviewing the disadvantages of MOOCs and lack of engagement experienced in Zoom courses during the transition to online learning prompted by the COVID-19 pandemic. However, as Dr. Zvi Galil illustrates in this article, OMSCS has surmounted all these disadvantages and has become a model for online learning through its quality of education, student engagement, and affordability.

“High Quality, Low Cost: Impact of a MOOC-Based Degree Program” *Wiley*

This interview with Dr. Zvi Galil by Todd Zipper, the President of Wiley Education Services, focuses on the affordability of OMSCS and its implication for the future of higher education. This interview illuminates how OMSCS offers a high quality accredited educational experience for only a mere fraction of the cost of an in-person degree. Furthermore, this interview showcases how MOOC-based programs, such as OMSCS, can revolutionize affordability and accessibility in higher education.
Updated Stats

11,537 Enrollments in Fall 2021
20.0 % Women
11.4 % Underrepresented Minorities
3,074 New Enrollments in Fall 2021

6,491 Total Alumni, including 838 in Fall 2021

15,000 Total Course Enrollments in Fall 2021 alone
105 Countries Represented
62.4 % US Citizens & Residents
37.6 % International Students
### About our Students:

#### New Student and Alumni Survey

<table>
<thead>
<tr>
<th>New Students</th>
<th>Among the respondents to the Fall 2021 entrance survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>Average age</td>
</tr>
<tr>
<td>74</td>
<td>% Seek Career Advancement</td>
</tr>
<tr>
<td>25</td>
<td>% Women Enrollment</td>
</tr>
<tr>
<td>48</td>
<td>% Seek Higher Salary</td>
</tr>
<tr>
<td>87</td>
<td>% Working Full-time</td>
</tr>
<tr>
<td>26</td>
<td>% Prior Graduate Degree, 5% Prior Doctorate</td>
</tr>
<tr>
<td>89</td>
<td>% Seek Program’s Content</td>
</tr>
<tr>
<td>78</td>
<td>% Seek Master’s Degree</td>
</tr>
<tr>
<td>74</td>
<td>% Seek Career Transition; 33% seeking community of peers</td>
</tr>
<tr>
<td>29</td>
<td>% Plan to pursue a TA position while in the program</td>
</tr>
<tr>
<td>18</td>
<td>% Plan to pursue a doctorate after; 7% plan to teach computer science</td>
</tr>
<tr>
<td>15</td>
<td>% Plan to transition into tech sector from outside of it</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alumni</th>
<th>Among the respondents to the Spring 2021 alumni survey, since completing OMSCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>% Started another graduate program</td>
</tr>
<tr>
<td>7</td>
<td>% Transitioned into the tech sector from outside of it</td>
</tr>
<tr>
<td>6</td>
<td>% Have continued on to a PhD program</td>
</tr>
<tr>
<td>8</td>
<td>% Started teaching CS at the K-12 or college level</td>
</tr>
<tr>
<td>96</td>
<td>% Say OMSCS was worth the investment</td>
</tr>
<tr>
<td>96</td>
<td>% Would recommend OMSCS to others</td>
</tr>
<tr>
<td>55</td>
<td>% Started a new job</td>
</tr>
<tr>
<td>81</td>
<td>% Say OMSCS has helped their career</td>
</tr>
<tr>
<td>48</td>
<td>% Say OMSCS helped them secure a higher salary</td>
</tr>
</tbody>
</table>
New Associate Directors

In Fall 2021, OMSCS brought on two new Associate Directors:

**Dr. Ana Rusch** joined OMSCS as its Associate Director of Diversity, Equity, Inclusion, and Student Life (AD-DEISL). In this role, Ana focuses on supporting student life outside of individual classes, such as clubs, seminars, communities and networking, career development, etc., as well as recruiting and supporting underrepresented groups and groups with unique needs. Prior to joining OMSCS as AD-DEISL, Ana worked for several years in Student Affairs, Diversity and Inclusion, and Online Education at FIU, with extensive experience with fully online programs and distributed, international student bodies. She completed her Ph.D. at Florida International University in Global and Sociocultural Studies; her dissertation, titled “An Alternative Narrative of Integration In Germany through an Ethnographic Exploration of Cuban Immigration”, involved conducting a series of ethnographic studies on Cuban immigrant integration in Germany.

**Keith Adkins** joined OMSCS as its Associate Director of Academic Integrity (AD-AI). In this role, Keith works with all OMSCS classes to help expand and streamline their academic integrity efforts, including making it significantly easier to check for plagiarism and other forms of academic misconduct, to scalably document and resolve such suspicions once identified, and to handle academic integrity cases in a consistent and fair manner across the program. Keith is an OMSCS alumnus who worked as both a teaching assistant and an instructional associate for several classes both during and after his time as a student in the program. Prior to joining the program as our AD-AI, Keith has worked as a web developer and electrical engineer for several companies; among other achievements, Keith holds two patents from his time working as an electrical engineer on power repeaters.
Fall 2021
Project Showcase

Fall 2021 saw the first OMSCS Project Showcase. Modeled after the Interactivity exhibition for on-campus graduate students, the Project Showcase invites students to present the projects they worked on during the semester, especially in open-ended classes like CS6457: Video Game Design and CS6460: Educational Technology as well as Master's projects, Master's theses, and VIP projects.

Over 50 projects were presented in the showcase. As part of the event, students voted for a Students' Choice Award. The winners of the Fall 2021 Project Showcase Students' Choice Awards are “Zombie Island,” a CS6457: Video Game Design project by Glenn Cameron, Brandon Rodgers, Andrew Pecka, Patrick Shean, and Tim West, and “Using Deep Learning to Detect COVID-19 From Lung CT Scans,” a CS7643: Deep Learning project by Eddy Mina, Isaac Dekine, Qiang Hu, and Ziwei Wu. A Staff Choice Award was also presented to “Prediction of diabetes macular edema (DME) patients’ response to Anti-VEGF Treatment,” a CS6440: Introduction to Health Informatics project by Siliang Lu.
2021 saw the introduction of seminars to OMSCS students. Seminars—numbered CS8001 in the course registration system—are one-credit hour, pass/fail courses that do not count toward degree requirements. Their purpose is to help expand the types of learning experiences available to OMSCS students beyond those that come in high-stakes, letter-grade classes.

The initial three seminars offered in Fall 2021 were:

- **CS8001: Learning @ Scale Reading Group.** Led by David Joyner, this reading group took students through four prominent books in the learning at scale literature: Failure to Disrupt: Why Technology Alone Can’t Transform Education by Justin Reich; The Distributed Classroom by David Joyner and Charles Isbell; Writers in the Secret Garden: Fanfiction, Youth, and New Forms of Mentoring by Cecilia Aragon and Katie Davis; and Peer Pedagogies on Digital Platforms: Learning with Minecraft Let’s Play Videos by Michael Dezuanni.

- **CS8001: GVU Brown Bag.** In this seminar, students attended the weekly Brown Bag seminar series put on by Georgia Tech’s Graphics, Visualization, and Usability (GVU) Center. Participants discussed the sessions in parallel using the discussion forum.

- **CS8001: Research Seminar.** In this seminar, on-campus PhD students were invited to present their research to online students. Many students attended the seminars live, while others watched the recording and sent along follow-up questions via the forum.

Seminars continued into Spring 2022 with new seminars on Entrepreneurship (led by Keith McGregor and Ana Rusch), Women in Tech (led by Ana Rusch), and Artificial Intelligence (led by David Joyner).
In September 2021, Dr. David Joyner and Dean Charles Isbell’s book, *The Distributed Classroom*, was published by the MIT Press. Part of the *Learning in Large-Scale Environments* series edited by Justin Reich and Nichole Pinkard, the book explores how lessons learned in the context of OMSCS can be generalized out to education more broadly. Below is the official description of the book:

**A vision of the future of education in which the classroom experience is distributed across space and time without compromising learning.**

What if there were a model for learning in which the classroom experience was distributed across space and time—and students could still have the benefits of the traditional classroom, even if they can’t be present physically or learn synchronously? In this book, two experts in online learning envision a future in which education from kindergarten through graduate school need not be tethered to a single physical classroom. The distributed classroom would neither sacrifice students’ social learning experience nor require massive development resources. It goes beyond hybrid learning, so ubiquitous during the COVID-19 pandemic, and MOOCs, so trendy a few years ago, to reimagine the classroom itself.

David Joyner and Charles Isbell, both of Georgia Tech, explain how recent developments, including distance learning and learning management systems, have paved the way for the distributed classroom. They propose that we dispense with the dichotomy between online and traditional education, and the assumption that online learning is necessarily inferior. They describe the distributed classroom’s various delivery modes for in-person students, remote synchronous students, and remote asynchronous students; the goal would be a symmetry of experiences, with both students and teachers able to move from one mode to another. With *The Distributed Classroom*, Joyner and Isbell offer an optimistic, learner-centric view of the future of education, in which every person on earth is turned into a potential learner as barriers of cost, geography, and synchronicity disappear.

*The Distributed Classroom* is available via local bookstores as well as via Amazon, Barnes & Noble, and other online retailers.
2021 saw the publication of numerous academic papers both about the OMSCS program and by OMSCS students. Below are a selection of the publications:

- "Beyond Instruction: Scaling Support for a Large Online Master’s Program", a book chapter by Joyner in International Perspectives on Supporting and Engaging Online Learners by OMSCS director David Joyner describing the non-instructional support used to scale the OMSCS program.

- "The Role of Symmetry in Geometric Intelligence", a journal article in the Baltic Journal of Modern Computing by OMSCS alumna Snejana Shegheva and OMSCS faculty member Ashok Goel, based on Snejana’s Master’s thesis work exploring how geometric patterns simulate the imagination.

- "Towards Automatic Grading of D3.js Visualizations", a paper at IEEE VIS’21 by OMSCS alumni and instructional associates Matthew Hull and Susanta Routray, OMSCS faculty member Polo Chau, and on-campus students Connor Guerin and Justin Chen, which won VIS Best Poster.


- "JackMarker with GitDown: A Framework to Counter Plagiarism at Scale", a paper at the 2021 Learning @ Scale conference by OMSCS alumnus and instructional associate Rocko Graziano and OMSCS faculty member Thad Starner, as well as
"Entering or advancing in the IT labor market: The role of an online graduate degree in computer science", a journal article in The Internet and Higher Education by Isabel Ruthotto, Quintin Kreth, and Julia Melkers examining the motivations of students in the OMSCS program.

"Lurking and participation in the virtual classroom: The effects of gender, race, and age among graduate students in computer science", a journal article in Computers & Education by Isabel Ruthotto, Quintin Kreth, Jillian Stevens, Clare Trively, and Julia Melkers examining forum activity in OMSCS classes.


on-campus students Akshay Dahiya and India Irish, on preventing plagiarism in code assignments through individualized watermarks.

"Content-Neutral Immersive Environments for Cultivating Scalable Camaraderie", a paper at the 2021 Learning @ Scale conference by OMSCS director David Joyner and OMSCS alumna Denise Kutnick, as well as on-campus students Akhil Mavilakandy and Ishaani Mittal and faculty member Blair MacIntyre, looking at the user of an immersive virtual environment to support online classes.

"Toward Reshaping the Syllabus for Education at Scale" and "Components of Assessments and Grading at Scale", two papers at the 2021 Learning @ Scale conference by OMSCS alumna and teaching assistant Bobbie Eicher and OMSCS director David Joyner, both looking at patterns in assessment and syllabus construction across OMSCS classes.

"Online Forum Participation in an Online Master of Computer Science Program", a paper in the International Journal on E-Learning by OMSCS alumna Sandra Davis based on her CS6460: Educational Technology project.
New Courses

2021 saw the debut of nine new courses: OMSCS courses CS7210, CS7280, CS7632, and CS8803-012, and sections of OMS-Analytics and OMS-Cybersecurity courses like MGT6311, INTA6450, ISYE6669, CSE6742, and CS6747. Below are brief descriptions of some of the new additions to the catalog. January 2022 saw four additional new courses; read about them in next year’s annual report, or check them out at omscs.gatech.edu/current-courses/.

CS7210 – Distributed Computing (Ada Gavrilovska)
Develop an in-depth understanding of the core concepts of distributed computing, including abstract concepts and practical techniques for building system support for distributed applications; construct distributed system components by doing project work; and understand the current state of the art in several areas of distributed systems.

INTA6450 – Data Analytics & Security (Jeff Borowitz)
Explore the foundations of big data and data analytics, as well as the nature of underlying technical challenges and statistical assumptions used to understand relationship in a variety of applied fields, with a focus on fraud detection and communication monitoring. Engage with the social implications of increased knowledge, surveillance, and behavioral prediction made possible by big data, and the ethical tradeoffs faced.

ISYE6669 – Deterministic Optimization (Andy Sun)
Learn about deterministic optimization methodologies, including approaches from linear, discrete, and nonlinear optimization algorithms and computations.

CSE6742 – Modeling, Simulation, and Military Gaming (Mariel Borowitz)
Create and apply computer simulations to model strategic international events concerning warfare. Collaborate on projects with other students to define and evaluate specific questions in international events, formulate hypotheses concerning the resolution of these questions, develop modeling and simulation software to aid in an analysis, and apply the tools to test hypotheses and formulate conclusions from this investigation. The learning objectives will be accomplished in the context of a specific wargame scenario.

CS6747 – Advanced Malware Analysis (Brendan Salaformaggio)
Learn advanced approaches for detecting the presence of vulnerabilities in binary software, analyze malicious software, and explore recent research and unsolved problems in software protection and forensics. Engage in critical discussion around key research topics in software security and forensics, including: binary program analysis principles; binary software security; software forensics; and cyber attack response.