Learning Never Stops, Even at a Distance

Reimagining IT Education for Distance Learning

Education in a Digital Age

Education beyond the year 2020 is being reimagined. Digital capabilities were already transforming education[1], but the COVID-19 pandemic has upended education and dramatically accelerated this digital transformation at unexpected speed and scale. Yet, seeing instructors across the globe resiliently rising up to face these challenges instills hope and courage for the future. Perhaps as we look out to the horizon, we might even see benefits from this digital disruption and new opportunities to prepare learners in our technological age. What could education look like if we intentionally design our curriculum for the digital future?

As we reimagine and redesign education, students remain the top priority and learning science must be the grounding framework, whether teaching is in-person, online, or a hybrid of both. This is vital to ensure that educational efficacy is not compromised. In this paper, we lay out key learning science principles that are foundational for learning effectiveness and provide guidance for applying these principles in the context of distance learning.

As distance learning is particularly disruptive for domains which traditionally rely heavily on hands-on labs as a central pedagogical component, we look at one such domain and take Information Technology (IT) education as an example. A fundamental element of IT education is networking – how to connect users, devices, applications, and data through the Internet and across modern computer networks. We will use networking examples throughout this paper.

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Effective Distance Learning – Built on Learning Science Principles

As millions of students and instructors have already recognized, effective distance learning isn't as simple as moving lectures online. The field of learning science, backed by research and practice, can provide foundational insights to serve as a north star towards learning effectiveness, even as educational approaches and modalities change. By applying these principles, instructors can help students achieve the expected learning outcomes in this new distance learning context.

Learning happens in relationship.

Now, more than ever, in the face of pandemic-imposed physical distancing and isolation, students need to feel that their instructor knows them as a learner and that they are part of a community learning together. Learners of all ages benefit from encouragement and from engaging friends, family, and community members in the learning process. There are many ways we learn through interactions in a physical classroom – whole class (inspiration, demonstration), instructor to student groups ("over the shoulder" scaffolding), instructor to individual student (support), and student to student (peer help, new perspectives)[2,3]. With modern networked collaboration, elements of these interactions are still possible. Blending synchronous and asynchronous learning can help you optimize your students' learning. Where possible, utilize synchronous time for real connection and active learning – activities, discussions, questions. Consider moving lectures to video for students to access on their own time.

Learning requires student control of the learning process.

Distance learning requires more self-regulation by the student. All learners need time to explore at their own pace and room to make mistakes, but it is especially crucial when students are at a distance from instructors, who cannot help them as readily as being in person. Students will need more empowerment with appropriate guidance for taking on this new level of agency. Build in places for them to reflect on their learning progress, to determine what kinds of support they need for their learning, and how to pursue that.

Learning is active.

We make sense of things we do and use. Active learning requires that students grapple with the material, with just enough support to feel they can work through it and just enough challenge to be motivating and satisfying[4]. For example, give students opportunities to go beyond just configuring networks to troubleshooting and then designing them. The ability to model networks or security threats is a strong measure of content mastery. Help students learn to ask questions of themselves and their peers.

Learning Happens in Relationship

"Networking Academy taught me to take risks. It helped me branch out and not be scared to ask questions.

I also got to work with a lot of different people - from diverse backgrounds, perspectives, and knowledge sets. It's amazing to see how many people you have common ground with."

Justin Smith

Former Networking Academy student

Sr. Network Engineer, Evergy

Learning requires practice with feedback.

Building on the notion that learning is active, activity alone is not sufficient, especially for efficient learning. Efficient, effective learning requires guidance. A useful way to talk about guidance, or scaffolding, is the notion of the Zone of Proximal Development (ZPD) – the space within which a learner can work successfully if given assistance: not too easy, but not too hard either. When a problem is posed within the learner's ZPD, just beyond their current competence to solve without assistance, the loop must be closed with ongoing feedback. That feedback can come from oneself, a peer, the instructor, or even software. However, providing these mechanisms for feedback in distance learning looks different from in-person teaching.

Learning is cognitive, affective, and kinesthetic.

People learn with their whole selves, not just their brains. Our understanding (thinking, planning, designing) is impacted by how we feel, how well connected we are (our emotional, social self), and what we can touch and experiment with (in-person handling of physical equipment). Distance learning requires that we consider and discuss with colleagues what shifts are possible in our cognitive, affective, and kinesthetic learning outcomes. Providing collaborative learning through breakout group activities, team projects, games, or competitions can still happen using technological solutions. Without access to physical equipment, distance learning must include other forms of practice with feedback that approximate in-person learning. Examples include simulation lab activities, labs based on remote access to real and virtual networks, interactive curriculum, or projects students can do physically at home.

Learning should include solving problems.

To support cognitive and skill development as well as ongoing engagement in distance learning, orient learners towards solving realistic, situational problems with teaching methods such as problem-based and project-based learning. Problems that are of interest to learners increase their engagement, and posing problems that are meaningful to them also drives deeper learning and retention.

Applying These Principles to Distance Learning for IT Education

For lab-oriented courses, such as those in the IT domain, we cannot expect to provide equivalent experiences that are the same as an in-person class with a physical lab. Instead, we look toward a goal of achieving equivalence of learning outcomes through careful instructional design that leverages the unique affordances that distance learning can offer.

Simulation-Based Labs with Cisco Packet Tracer

With over **1 million** Packet Tracer users each year, simulation software has become a key learning tool in the Networking Academy curriculum, enabling instructors to teach complex concepts without complex hardware.

Cisco Networking Academy

As an example, we look at Cisco Networking Academy, the global IT and cybersecurity education program. Cisco Networking Academy is taking this challenge head on. As Cisco's largest and longest-running Corporate Social Responsibility program, Networking Academy has been partnering with learning institutions and educators around the world to empower all people with career opportunities since 1997. The curriculum offered through the program is rooted in learning science principles, with significant emphasis on learning tools and experiences that prepare students to gain practical, job-ready skills rather than mere conceptual knowledge. The curriculum incorporates many features – interactive activities, simulation-based labs, assessments, and more – but the foundation of the career preparation courses has been in-person labs with physical networking equipment. Shifting to a distance learning paradigm is no small feat.

Luckily, one thing we have known since the program's inception is that Networking Academy instructors are in it for the impact. Across the globe, instructors know their students are looking to develop the problem-solving skills needed to enter exciting and life-changing careers in IT. With that goal in mind, we are working hard to support our instructors with a distance learning solution now, while also mapping out and experimenting with what will be possible in the future of IT education.

Distance Learning in the Near Term

In the near-term, Networking Academy is making significant improvements for distance learning with an emphasis on simulation-based labs, enhanced assessments, and collaboration tools – all grounded in learning science principles.

Simulation-Based Labs

Without access to physical equipment, in-person learning must be approximated with other forms of active learning, practice, and problem solving. Simulation-based software, like Cisco Packet Tracer, provides a learning environment for students to explore and experiment, even remotely. For example, Cisco Packet Tracer gives students opportunities to go beyond configuring networks to troubleshooting and designing them. Simulation environments can provide a rich learning experience with visualizations, as well. Packet Tracer features a "Physical Mode" to help students practice interacting with network racks, build better models of networks, and gain active learning from simulation. Soon-to-be-released enhancements will make "Physical Mode" even more realistic, with new visualizations such as "rack and stack" interactions. Simulation technology like this can significantly change the types of learning interactions that are possible. Plus, simulation activities and assessments can be designed specifically for distance learning to give students more opportunities for practice, with instant feedback to guide the learning progress.

Turn assessments into educational opportunities

Meaningfully engage students early and often to reflect on what they are learning.

Networking Academy provides a comprehensive suite of learning activities and assessments, designed in collaboration with learning science experts, to support students and turn mistakes into learning opportunities.

Enhanced Assessments

To give students more control of the learning process, with time to explore at their own pace and make mistakes, we are redesigning assessments for distance learning. These enhancements will build in more support for students to reflect on their learning progress, check their understanding, and take more ownership of their learning along the way with enhanced formative assessments. We are also establishing secure assessments for more reliable, valid, and fair summative assessment.

Collaboration Tools

Since learning happens through relationship, it's vital to provide learners opportunities to engage others in the learning process. With modern networked collaboration tools, versions of these interactions are still possible. Video conferencing provides features to host online meetings with video, audio, and screen sharing, and team collaboration tools provide features for connecting through messaging, file sharing, whiteboarding, and calling. That's why we are integrating Cisco Webex Meetings and Webex Teams collaboration tools, with flexibility for online instruction and student collaboration. With Cisco Webex Meetings video conferencing, instructors can provide synchronous, collaborative learning through breakout group activities, team projects, games, competitions, and more. With Cisco Webex Teams, a team collaboration platform, instructors can also offer extended or project-based collaborative work asynchronously, allowing even more support for students' cognitive, affective, and kinesthetic learning.

Innovating for the Future

Networking Academy will continue to innovate because our learning never stops either. We are reimagining IT education and looking ahead to some exciting developments. Consider this a preview into what our team of instructional designers, learning scientists, and subject-matter experts are exploring as future enhancements to the Networking Academy curriculum.

Adaptive Learning

Take practice with feedback even further. What if you could provide "over the shoulder" support to each and every student exactly when they need it, all at the same time? Adaptive learning uses evidence of a learner's prior skill level to provide them with a personalized sequence of activities. These personalized recommendations would adjust the sequence of activities and pacing, with the goal to optimize their learning path of mastering learning objectives. We are applying adaptive learning to enrich the student experience with simulation-based labs using Cisco Packet Tracer[5,6]. With adaptive learning enhancements, Packet Tracer will be able to provide students with real-time feedback based on their prior actions. If students can have smart "over the shoulder" scaffolding within Packet Tracer, how might that empower instructors to up-level their interactions with students to deepen their understanding and skills?

Keeping classrooms connected

Distance learning does not have to be isolated learning.

Digital platforms like Cisco Webex provide flexible, secure ways to engage students before, during, and after class.

Keep students connected to one another with small group breakout rooms, team collaboration messaging, and more.

And this is just the start. Adaptive learning technology has compelling potential for gamification to make learning more fun. In fact, Networking Academy already has a cybersecurity game that challenges students with a series of missions to test their cyber skills. Instructors can spark team competition to make learning social and fun and motivate students with an immersive storyline while reinforcing technical, teamwork, and communication skills.

With adaptive learning as a foundation, it opens doors to design engaging learning games, such as a server-assisted, synchronous, multiplayer-at-a-distance rapid fire networking challenge.

Insights for Instructors

And finally, in distance learning, instructors lose the richness of natural feedback from interpersonal cues and insights that would come through in-person interactions with students. But they should not have to fly blind. What if instructors could get some of those insights back? This is why we want to equip instructors with data-driven insights. We're working on new dashboarding to provide instructors with better data access to help you see more clearly where students require support or need to be challenged and what interventions would be most helpful. These dashboards are being designed to help you focus the time you spend through relationship with your students and provide timely and effective feedback to your learners.

Meeting Students Where They Are Today to Prepare for Jobs of Tomorrow

Jobs in the 2020s and beyond require IT students to build core networking competencies and possess the ability to problem solve in dynamic situations, all while collaborating with people they may not ever meet in person. Distance learning can still provide students with the opportunities they need to build these skills, and ultimately may even have advantages to better prepare them for these situations. Plus, with the value added by today's digital badging credentials, students can demonstrate verified skills from well-respected programs like Cisco Networking Academy to strengthen their professional profiles.

Digital transformation is impacting every business, across every industry. This disruption in education is difficult and uncertain: teaching and learning are changing faster than ever before. But this also opens up opportunities. Collaborating in a digital, online world is the future of work, and we are only at the beginning. Today's students are tomorrow's workforce, and they will go on to have and create jobs that may not even exist yet. We intend to help them be ready.

We are excited about creating an inclusive future for all, and we invite you to join us. Cisco builds networking. Networking Academy instructors build the future into it. Let's reimagine it – together.

Learn More

To learn more about Cisco Networking Academy, visit **NetAcad.com.**

To access the latest resources for remote teaching, check out the Learning Never Stops page at **netacad.com/ learning-never- stops.**

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