

Remotely the Same? Going Virtual with a Cybercamp in a Pandemic

Matthew W. Bovee and Huw O.L. Read

Norwich University, Northfield, Vermont, USA

mbovee@norwich.edu

hread@norwich.edu

Abstract: Summer camps and other week-long activities are popular ways to introduce cybersecurity to middle- or high-school aged children. Such experiences have traditionally been conducted in-person, with many having residency components and evening activities. The COVID-19 pandemic brought these traditional experiences to an abrupt halt. To support and promote continued education in the face of the global pandemic many such in-person camps – as well as higher-education courses – precipitously migrated to online remote learning. The shift presented challenges beyond simply preparing and posting content online. This case study examines the challenges, solutions, and lessons learned from morphing a successful hands-on residential NSA GenCyber digital forensics summer camp to a fully online remote learning "camp".

Keywords: Digital Forensics, Remote Learning, Cyber Security Education and Training, Gamification Strategies

1. Introduction

Summer camps and other week-long activities are popular ways of introducing cybersecurity to children in their last six to seven years of required education in the United States of America (USA). One prominent example is the GenCyber program, founded and sponsored in 2014 by the USA's National Security Agency (NSA) in collaboration with the National Science Foundation (NSF, n.d.). GenCyber grants support provision of cybersecurity summer camps to students, teachers, or both. GenCyber seeks to: promote correct, safe student behaviour online; increase student diversity and interest in cybersecurity and related national workforce careers; and, improve cybersecurity teaching content and methods in secondary curricula (NSF, 2022). In its first five years, GenCyber reached over 15,000 students directly. In its last pre-COVID year (2019) over 3,000 students and nearly 780 teachers attended GenCyber camps (NSF, 2022). Such experiences are traditionally conducted in-person, often with residency components and evening activities.

From 2016 through 2019, the authors created and conducted five week-long GenCyber residential student camps. Three focused on introductory cybersecurity; two on digital forensics. Students in each had multiple face-to-face (F2F), hands-on, and team-based activities, including: lessons; labs, outdoors exercises, and competitions in which they applied cybersecurity and digital-forensics principles; off-campus site visits; and guest speakers. The camps all received very positive anecdotal and survey-based ratings from participants and NSA auditors tasked with observing and improving GenCyber camps. In 2019 the authors were awarded two additional GenCyber grants for summer 2020 camps.

However, in Spring 2020 the COVID-19 pandemic brought traditional USA F2F camp experiences to an abrupt halt (Table 1). By late March 2021 many USA states were considering lifting some or all restrictions on travel and large gatherings. During this time the NSA notified GenCyber camp grant awardees they could fulfil their 2020 grant obligations in 2021 with either F2F or online camps and required official notice of the modality by April 1st. The authors' State still had an emergency order in effect and no final decision, assurance, or guidance whether or when COVID-19 restrictions would be lifted. The authors therefore opted for an online-only camp format. This case study examines challenges, solutions, and lessons learned converting our NSA GenCyber digital forensics summer camp to a fully online remote learning "camp".

1.1 Contributions

This rapid shift presented numerous challenges beyond simply preparing and posting content for online delivery. As contributions, this paper:

1. Examines key considerations for converting an established residential Cyber camp to virtual format;
2. Identifies virtual digital forensics activities that simulate residential camp experiences; and,
3. Highlights lessons learned that served to improve future F2F teaching.

Table 1: USA COVID-19 Educational Events. Within two months, USA schools went from being fully open to mandatory closures state- and nation-wide (Education Week, 2020; Lieberman, 2020).

Date (dd/mm/yyyy)	Action	School Impact
29/01/2020	Few confirmed mainland USA COVID-19 cases	Calls for guidance; voluntary temporary closures
25/02/2020	USA Centers for Disease Control and Prevention (CDC) hints about virtual schooling	"Ask about teleschool"
27/02/2020	Temporary individual school closings	Disinfections attempted
Early 03/2020	Major USA school district closings	District-wide actions
11/03/2020	CDC declares global COVID-19 pandemic	Formal federal confirmation
13/03/2020	300 universities have closed	Shift to remote-only classes
17/03/2020	Kansas closes all schools	First USA state-wide closure
25/03/2020	All USA public schools closed	GenCyber (GC) camps postponed indefinitely
01/04/2021	USA states begin considering lifting restrictions	GC Camp modality decision required

The rest of this paper is presented as follows. Descriptions of a 'normal' digital forensics camp versus an online-only version are provided. Next, differences, challenges and developed solutions are discussed. Finally, lessons learned and their impact on future teaching are summarised.

2. Residential Digital Forensics Camp

After Sunday arrival and "check-in", residential camp consisted of five consecutive days of lessons, hands-on exercises, and activities oriented towards GenCyber program goals (Appendix A). These included: learning and applying appropriate online behaviour, cybersecurity and digital forensics terminology and concepts; contemporary cybersecurity issues; assembling a working device for continued studies; observing cybersecurity in practice in the field; and a professional-level digital-forensics tool certification exam. Participants ate meals with the camp instructors, staff, and guest speakers. Attendees departed on Saturday.

3. Virtual Equivalent of the Residential Forensics Camp

The virtual version also began Sunday (Appendix B), hosted at the authors' university, which standardized on Microsoft Teams for videoconferencing. Instead of arrivals and "check-in", Sunday was the final opportunity for participants to download, install and test the Teams delivery platform remotely. The next five days involved online lessons, hands-on exercises guided by remote demonstration and discussion, and online individual- and team-based activities oriented towards the same GenCyber program goals.

4. Differences and Challenges

Differences in each camp type and their respective challenges are categorized as logistical or instructional. Table 2 summarises the logistical issues: policy & practice, general event planning, camp schedules, recruitment, staffing, instructional support, lesson materials, environment of the modality, and review sessions. Table 6 presents three example activities that highlight key instructional issues: digital forensic acquisition; forensic analysis; and installation of Kali NetHunter.

Although categorized for ease of consideration, some logistical issues impacted instruction and vice versa, and some caused "knock-on" issues. For example, dropped network connections and software crashes were anticipated to cause attendees to fall behind. To address this staff were scheduled to provide on-call support via phone and online text, and lesson sessions were recorded for review by attendees. That required guidelines for staff-attendee interactions and a data retention plan for recordings. Since camp attendees were not adults, these practices had to be documented and approved by their parents during application.

4.1 Logistical Issues

For the schedules in Appendices A and B much planning, scheduling and coordination was required (Table 2). These issues are highlighted next, with differences in the virtual camp emphasised.

Table 2: Logistical Issues Overview. Examples of logistical challenges pivoting from residential to virtual camp.

Category	Residential	Virtual	Challenges
Policy & Practice	Legal responsibilities	Legal responsibilities	Each activity and service and related policies reviewed for virtual camp applicability
General Event Planning	Accommodations, services, staff, site visits, materials	Services, staff, materials	Room & board, transportation, or site visits not required for virtual camp
Camp Schedules	Lessons, meals, breaks, field trips, study sessions	Regular lesson times, breaks and meals	Virtual attendees spanned several time zones, required a later start and finish; offered less collaboration during meals and breaks
Recruitment	Limited computer experience	More advanced computer experience	Virtual attendees had to be self-sufficient with computers and virtual resources
Systems Required	Provided by camp	Provided by attendee	Virtual attendees required access to basic hardware, software, network, & peripherals
Staff	Lead evening activities, supported academic activities	Lead team-session "breakout rooms"; staffed on-call "hotline"	Dropped connections due to distal issues; assisting by remote via bad connections; need for after-hours "catch-up" help sessions
Instructors & Speakers	Hosted on-campus	Participated via remote	All participants and attendees required hardware, Microsoft Teams software, network, and minimal training
Lesson Materials	On-site	Remote "site"	All required materials for virtual lessons had to be packaged and shipped in advance
Modality Environment	Physical lab space	Virtual "breakout" rooms	"Virtual space" makes it more difficult to spot distracted or struggling attendees
	Meals, breaks, F2F help	Regular schedule, breaks	Virtual-only risks screen fatigue for all; "out of your seat" activities needed to vary routine
Review	After-hours sessions	Homework, "hotline", and streamed video	On-call help & streamed video to support homework replaced in-person help sessions

4.1.1 Policy and Practice

Regardless of the camp modality, the instructors, staff, and hosting University had a legal obligation to act in the best interests of the participants, who were not adults. All necessary guidelines, documentation, and measures had to be in place in advance. Examining organizational policy and practice was therefore critical.

For the virtual camp all F2F camp policies and procedures were considered (Table 3). Some were easily clarified to show they applied to virtual sessions (Table 3, asterisks). Additional issues were unique to a virtual camp and required separate guidelines, documentation, or preparation (Table 3, italics). For example, attendees needed guidelines for acceptable use of virtual university resources, support staff interactions, online behaviour during camp, and the recording of camp sessions.

4.1.2 General Event Planning

Many camp elements such as staffing, facilities, transportation, equipment, materials, and lessons must be planned and prepared well in advance (Table 4). Some relate directly to the need for policy review (e.g. parking, linens, and rooms). Some require considering the sequence of their resolution. For example, to determine required equipment and materials requires identifying and planning the related lessons and exercises. The *only* general issues that could be excluded for the virtual camps were room and board, transportation, and site-visit field trips.

4.1.3 Changes to Camp Scheduling

Both camp types were designed to maximize learning opportunities. The residential camp alternated between lecture-style lessons and individual- or team-exercises applying lesson information (Appendix A). For example, the mobile forensics lesson was followed by practice acquiring mobile handset data using Cellebrite's UFED4PC software, and then by a team-based mock-case analysis competition modelled on the classic sleuthing game "Cluedo!". Meals and breaks punctuated daily schedules. After-hours cybersecurity-themed activities provided a change from the classroom.

Table 3: Policy & Practice Issues. Items with an asterisk were extended to the virtual context. Italicized items were virtual camp issues requiring additional guidelines and documentation.

Category	Description
General	<ul style="list-style-type: none"> • Attire: University guidelines on acceptable attire and classroom decorum* • Calling Home: Participants confirmed arrival and departure details; Periodic contact with their legal guardians was recommended • Cars & Parking: Some participants were of legal age to drive to camp • Linens: Items provided with room, and what to bring • Mail: Sending/receiving regular mail during camp • Medication: Appropriate storage and timely access for prescription medications • Rooms: Key card use/deposit; secure storage of valuables; respect for privacy • Supervision: Appropriate adult supervision throughout the camp experience*
Conduct	<ul style="list-style-type: none"> • <i>Acceptable Use: Guidelines regarding access and use of virtual University resources</i> • <i>Difficulties with Labs & Exercises: on-demand virtual support was provided by camp counsellors</i> • <i>Disrupted/Lost Connections: Supported via campus IT Services</i> • <i>Microsoft Teams Problems: Supported via campus IT Services</i> • <i>Session Communications, Interactions, and Recordings: expectations regarding online interaction, its supervision, and recordings for quality control purposes</i>
Emergencies	<ul style="list-style-type: none"> • Procedures, contact numbers, and notification systems for medical and other emergencies*

Table 4: Event-Planning Logistical Issues. Advance preparation required for hosting a summer camp for juveniles. Italicized items applied solely to the residential camp.

Category	Description
<i>Room & Board</i>	<i>Advance scheduling and booking space on campus</i>
Staff	Identifying, hiring, training camp counsellors
Instructors	Identifying, soliciting, and scheduling instructors and invited subject-matter experts
<i>Field Trips</i>	<i>Identifying appropriate facilities and points of contact, securing visit approval, scheduling visit</i>
<i>Transportation</i>	<i>Hire staff with commercial licenses (or train staff); schedule vehicle use/rental</i>
Lessons	Identify, acquire, and prepare all lesson and exercise plans and materials

Virtual camp attendees joined from time zones up to four hours behind that of lessons. To minimize potential disruption, yet keep a reasonable length to the class day, the virtual schedule started later and was less variable than the F2F camp (Appendix B). So-called “Zoom fatigue” (Elbogen, et al., 2020) or “exhaustion” (Fauville, et al., 2021) was another key concern. Meals and breaks still punctuated the schedule, and attendees were asked to spend them away from the computer to provide a break from “screen time”. Because many attendees fitted the virtual camp into a busy home schedule, and the wide range in attendee time zones, virtual group evening activities were not attempted. To prepare attendees for the certification exam associated with the camp, homework was assigned instead of hosting group study sessions. Other than academic sessions, the virtual camp offered fewer opportunities for attendees to make casual connections useful for team building and collaboration.

Table 5: Camp Application Packet Requirements. Italicized items were for virtual camps only.

Requirement	Assessment Purpose
Transcript	Appropriate cybersecurity or computer science background
Interest Statement	Identifying those who might best benefit from increased cybersecurity interest, academic pursuit
Support Letters	Motivation, interest, and prior extracurricular experiences regarding cybersecurity
<i>Broadband Access</i>	<i>Videoconferencing and collaboration requirement</i>
Microsoft Teams	<i>Hosting university video conferencing standard</i>
	<i>PC with adequate hardware and software specifications</i>
	<i>Webcam and microphone</i>
	<i>Administrative access (parental permission) to install the software</i>

4.1.4 Recruiting Attendees; Systems Requirement

Recruiting attendees must start even before addressing many logistical issues. Applicants submitted packets (Table 5, above) that aided review and selection of attendees who would potentially benefit most from the camp, plus help meet the GenCyber goals. A glaring difference was that residential applicants had no hardware requirements - everything was provided in situ. Virtual camp required basic systems (Windows PC, webcam, microphone) for the best experience of participants. Unfortunately, that excluded some applicants.

4.1.5 Staffing

Experienced adult student staff were hired for each camp type. At residential camps they supported lessons and activities, supervised evening activities, and provided overnight and emergency supervision. The virtual camp needed no evening supervision, but team-based activities required what Microsoft describes as Teams "breakout rooms". Rather than gathering around a table, each student team interacted in a videoconference session separate from the main course. Camp staff supported each breakout session.

To support virtual attendees who missed session content due to connection issues, staff were available throughout each day by phone and online, and for four evening hours. All sessions were also videorecorded and accessible via Teams until four weeks after camp. Notice of sessions being recorded, and permission to temporarily use them, also helped motivate appropriate norms for online interaction in the context of a non-adult class.

4.1.6 Instructors and Speakers

Both camps scheduled invited guest speakers. For the virtual camp everyone interacted via Teams, requiring advance preparation and testing by instructors and speakers as well as attendees.

4.1.7 Lessons & Materials

To determine content, schedule it, and identify necessary materials, lessons appropriate for attendees and camp goals were planned for both camp types. Residential lessons and materials needed to be ready by the start of camp. Virtual lessons needed to be ready sooner, so related materials could be acquired, vetted, packaged, and shipped to reach attendees *before* the start of the camp.

4.1.8 Modality Environment

Four issues unique to the virtual camp environment were "videoconferencing fatigue" (Elbogen et al, 2022), shutting off cameras, suboptimal learning environments, and the ability to identify when an attendee is struggling with the material or distracted.

At residential camp, attendee time spent focused on computer monitors was not an issue. Varied sessions, breaks, and topic introductions ensured at most several hour-long sessions and daily totals of a few hours. Virtual camp sessions were deliberately kept at or below one hour to reduce screen fatigue, and activities varied between lessons and exercises. Regardless, almost *everything* was necessarily done via computer. To address this, we introduced impromptu changes that required getting away from the screen. For example, when describing mobile phones, the instructor announced an unscheduled competition. Attendees were given five minutes to get up, find the oldest example of technology in their house they could think of, and bring it (or a photo of it) back to show everyone online. The three oldest examples were declared winners and discussed in the context of rapid technological change and digital forensics. This also related the topic to attendee households and got them out of their chairs and away from the screens for a few excited minutes.

Residential camps provided a focused study and learning environment, whereas some virtual camp attendees connected from communal home areas and other environments rife with distractions. Virtual attendees would periodically turn off their webcam, often for a valid reason such as others in the background, concerns about their appearance, or a bathroom break. During virtual sessions we were especially mindful of identifying students looked puzzled, distracted, or detached. However, with the camera off one cannot. Even with the camera on, postural and gestural cues suggesting someone needs help are absent or difficult to detect. Many attendees whose cameras were off still interacted; some did not. Requiring Teams reaction and emoji responses (such as a virtual "thumbs up") helped focus attendees and identify those who had lost connection or become distracted. We also demonstrated how much faster, easier, and – frankly – more satisfying it was to keep the

camera on and see a *physical* “thumbs up” to gauge comprehension than to find, select, and use an emoji. Those struggling were able to visit a side-room with camp staff for catching-up with the activity.

4.1.9 Review & Revision

Residential camps had scheduled evening sessions for review and revision, supported by camp staff. Some students also collaborated independently via Google Docs. To give virtual camp attendees a break from screen time, we did not hold evening online reviews. Instead, students were assigned homework to prepare for the professional certification (something most were very interested in achieving). Interestingly, some virtual camp students *also* collaboratively studied in the evenings via Google Docs, sharing notes and study tips.

We next highlight instructional issues by discussing three exercises: forensic acquisition; forensic analysis via a “whodunnit” based on Cluedo; and installation and testing of Kali NetHunter. These are outlined briefly in Table 6.

4.2 Instructional Issues

4.2.1 Forensic Acquisition

Performing basic forensic data acquisition is a key exercise in our digital forensics camp. Residential attendees used physical kit in the lab, learning how to connect hard drives and cell phones to forensic workstations via write blockers, create images, and about image formats and log files. Pre-acquired extractions developed by the authors were used in later exercises and competitions.

For each virtual camp attendee, we created a virtual machine (VM) configured with licensed and freeware digital forensics tools and an attached read-only virtual drive. Using these, we demonstrated digital forensic imaging online plus provided clear, streamlined, and illustrated process instructions (a “walk-through”) on the Teams site. Although the walk-through guides were well received and attendees created images successfully, they missed learning nuances of handling and connecting physical kit. The authors’ pre-acquired extractions were loaded to attendee VMs for later exercises and competitions.

4.2.2 Forensic Analysis

A popular camp exercise involved a gamified (Švábenský V, et al., 2021) forensic cell phone analysis to solve a mock “whodunnit” like the game *Cluedo*. Residential camp teams were each given a phone extraction from a different “character” in a mock incident, plus the software tools to analyse it for evidence. Use of the software was explained and demonstrated, and they were provided questions that prompted finding useful case details. No one extraction was sufficient to fully solve the case. However, teams could ask other teams a limited number of analysis-related questions (which required honest answers). Thus, the exercise had elements of “capture the flag” (CTF), team competition and inter-team collaboration.

For virtual camp attendees, special VMs with the same software tools plus access to a single mock case phone extraction were provided. The analysis software was explained and demonstrated online. To promote inter-student collaboration in the virtual environment, each VM was shared by two attendees who then had to figure out how to work together, collaborate to analyse the data, record their findings, and query other teams.

Table 6: Instructional Issues Overview. Example instructional changes pivoting a residential to a virtual one.

Category	Residential	Virtual	Challenges
Forensic Acquisition	Physical kit: write blockers, hard drives, cell phones, workstations	Providing kit to each attendee impractical, expensive	Demonstrating imaging with read-only virtual drives attached to virtual machine
Forensic analysis	Group activities, digital whodunnits.	No F2F group interaction	Encouraging communication between virtual attendees by sharing one VM.
Kali NetHunter	Detailed booklet, self-paced. Staff support and check-in.	Installation of tools and Kali led step by step online. Breakout rooms for those who fell behind.	Ensuring materials arrived before camp; extra time after camp to work one-on-one for those who lost activity.

4.2.3 Kali NetHunter

Another popular camp activity was self-paced installation of Kali NetHunter penetration testing software to a Google Nexus phone. Residential camp attendees were provided a detailed booklet and all materials. Instructors and staff monitored and supported their progress. Virtual camp attendees were shipped the same materials in advance and given a guided online session by an experienced instructor. However, even by day four of the camp some attendees' materials had not arrived. Others temporarily lost connection during the demo. Some were confused by the demo or the instructions, not readily identified as such, and fell behind. Experienced staff opened real-time breakout rooms to support those who fell behind. Ultimately, additional one-on-one sessions were needed to ensure virtual attendees succeeded and benefited from the exercise.

5. Lessons Learned

Lessons learned are not always purely logistical or instructional. However, as with the examination of issues and solutions above, for convenience we have summarised our lessons learned in the same manner plus highlight several used in current F2F teaching.

5.1 Logistical Lessons

1. *Do Not Underestimate the Task.* As the preceding tables illustrate, preparing and delivering a virtual camp involves as many issues and as much work as a F2F camp, or more.
2. *Start Preparations Earlier.* Allow as much time to prepare for a virtual camp as a F2F one. If you will be sending lesson materials to participants to use during the camp, plan on extra time (and money) to ensure they arrive in time to be used and pay for parcel tracking.
3. *Be Alert for Emergent Issues.* Technological, policy, and instructional issues - and the choices made to deal with them - can result in a cascade of other issues. Even small things normally taken for granted, such as stable network connections, can be overlooked.
4. *Plan for Lost Connections.* This is an inevitable and incredibly disruptive risk of online instruction. Expect it.
5. *Leverage VM "Snapshotting".* Teach how to create VM snapshots to capture/rollback to previous states. This provides students more creative control and reduces reliance on instructors and staff to "fix" VMs.

For academics (who are not project managers), lessons one through three can be challenging to actualize, especially when creating any camp for the first time. Lesson five is now routinely used in our F2F instruction.

5.2 Instructional Lessons

1. *Beware of Videoconferencing Exhaustion.* "Zoom fatigue" appears to real, although its antecedents and causes are still being researched and debated (Fauville, et al., 2021). Limit attendee screen time, motivate engagement and learning, and require getting up and moving.
2. *Beware of Instructor/Staff Burnout.* They lead and support virtual sessions, plus must stay focused and alert to attendees. They also incur more screen time reviewing, planning, and prepping for the next day. Schedule screen-time breaks for them, too.
3. *Plan for Lost Connections.* Provide instructional support for those who fall behind. Helplines, streaming videos, one-on-one tech support, and even repeat sessions, may be needed.
4. *Watch for/Motivate Interaction.* The usual cues of confusion or disaffection are harder to detect. Prompt for visual, verbal, or technological responses to gauge attention.
5. *When Webcams are Off, Inquire.* Not everyone with a webcam is necessarily able or ready to turn it on. However, it may mean a dropped connection or loss of interest.
6. *Present Modules; Provide Walk-Throughs.* Some of our best-received virtual sessions, whether standalone or sequenced, were crafted to take 40 minutes of a 50-minute block (80%) plus provided clear and simple walk-throughs to help attendees keep up or catch up when dealing with several multimodal resources simultaneously.
7. *Creative Ideas/Solutions Also Help.* Game-like or realistic, CTF-type scenarios generate strong student interest. Although aspects of F2F group/team interaction are lost, some exercises translate well to virtual contexts.
8. *Motivate Discovery of How to Collaborate Remotely.* Creating situations where participants must interact and share resources to succeed can prompt them to find ways to work together.

Many of these lessons also make sense F2F (e.g. varying activities, scheduling breaks, gauging attention, motivating collaboration). However, we utilize modularisation and walk-throughs, game-like/CTF scenarios, and after-hours technical-support staffing in current F2F teacher-training camps to great success.

6. Conclusion

Pivoting a residential camp to an equivalent virtual version is daunting, with a scope and complexity like creating and coordinating a physical camp. Some preparations may require *more* time than the F2F equivalent. Small, easily overlooked issues can have important knock-on consequences, and solutions can cause a cascade of other issues. Attempting to actualise lessons learned can leave academics feeling like project managers. Logistical issues and solutions can impact instruction, and vice versa. So-called video conferencing fatigue is a major concern in a week-long camp, for attendees, *and* instructors and staff. However, creative instructional approaches can help deal with detecting lack of attention, generate collaboration and aspects of group- or teamwork, and translate F2F teaching of traditional digital forensics concepts and skills to a virtual environment.

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Appendix A: Residential Digital Forensics Camp - Daily Schedule

Time	Day 1 Activities	Time	Day 2 Activities	Time	Day 3 Activities
0700	Breakfast	0700	Breakfast	0700	Breakfast
0830	What is “digital forensics”?	0830	Morning Kahoot!; Q’n’A on “Searching..”	0830	Daily Kahoot!
1015	Break	0915	Break	0900	Intro to casework and c
1030	What is “digital forensics”? (continued)	0930	Searching...(hands-on activities)	1015	Break
1200	Lunch	1200	Lunch	1030	Casework and case an
1300	Intro to Forensic Took Kit (FTK) Imager	1300	Windows Registry & Access Data Registry Viewer	1200	Lunch
1400	Handling Evidence	1415	Break	1300	Intro to Mobile Forensi
1500	Break	1430	AD Registry Viewer (continued)	1430	Break
1515	Handling Evidence (continued)	1600	The problem with passwords, and PRTK	1515	Mobile Data Extraction
1700	Dinner	1700	Dinner	1615	Break
1800	After-hours activities	1800	Open lab	1630	(We haven’t got a) Clu
Time	Day 4 Activities	Time	Day 5 Activities		
0700	Breakfast – Review the day’s activities	0700	Breakfast – Review the day’s activities		
0830	Competition Time – (We Haven’t a) Clue!	0830	FTK Q’n’A / Catch-Up		
1030	Break	0915	Break		
1030	Mobile Forensics with Kali NetHunter	1045	FTK ACE Certification		

1200	Lunch	1200	Lunch		
1300	Bookstore Trip	1300	FTK ACE (continued)		
1430	FTK ACE Certification – Review & Practice	1545	Forensic analysis of game systems		
1515	Break	1615			
1530	FTK ACE Review & Practice (continued)	1615	Break		
1630	FTK ACE Certification – Q'n'A	1630	Team Results & Awards		
1700	Dinner	1700	Dinner		
1800	Open Lab	1800	Pack'n'Prep for Departure		

To accommodate different topics and exercise requirements, time blocks are of unequal length. After hours activities included games and movies with a cybersecurity theme or issue. Supervised evening open labs provided opportunity for review and preparation for the professional-level certification exam.

Appendix B: Virtual Digital Forensics Camp - Daily Schedule

Time	Day 1 Activities	Time	Day 2 Activities	Time	Day 3 Activities
1000	Welcome & Orientation	1000	Fun with "Hex"	1000	Mobile Forensics
1050	Break	1050	Break	1050	Break
1100	Welcome & Orientation (continued)	1100	Fun with "Hex" Ex(ercise)	1100	(We don't have a) Clue!
1200	Lunch Break	1200	Lunch Break	1200	Lunch Break
1300	What is Digital Forensics?	1300	Windows Registry	1300	Clue! (continued)
1350	Break	1350	Break	1350	Break
1400	Introduction to FTK Imager & Hashing	1400	Windows Registry (continued)	1400	Clue! (continued)
1450	Break	1450	Break	1450	Break
1500	Introduction to FTK	1500	Passwords and Password Recovery Tool Kit	1500	Scholarships & Admissions
1550	Break	1550	Break	1550	Break
1600	Introduction to FTK (continued)	1600	Regular Expressions (RegEx) & KFF	1600	Cyber Jobs Panel
1650	Break	1650	Break	1650	Break
1700	Daily Wrap-Up	1700	Daily Wrap-Up	1700	Daily Wrap-Up
1730	Scheduled End of Day	1730	Scheduled End of Day	1730	Scheduled End of Day
	After-hours activities (Oh no...Homework!)		After-hours activities (Oh no! <i>More</i> homework)		Oh no! (Just kidding - it's a night off!)
Time	Day 4 Activities	Time	Day 5 Activities		
1000	Kali NetHunter	1000	ACE Certification		
1050	Break	1050	Break		
1100	Kali NetHunter (continued)	1100	ACE Certification (continued)		
1200	Lunch Break	1200	Lunch Break		
1300	Kali NetHunter (continued)	1300	ACE Certification (continued)		
1350	Break	1350	Break		
1400	Recap/Review/FTK ACE Q'n'A	1400	IoTease		
1450	Break	1450	Break		
1500	Recap/Review/FTK ACE Q'n'A	1500	IoTease (continued)		
1550	Break	1550	Break		
1600	RecapReview/FTK ACE Q'n'A	1600	IoTease (continued)		
1650	Break	1650	Break		

1700	Daily Wrap-Up	1700	Final Wrap-Up		
1730	Scheduled End of Day	1730	Scheduled End of Day		
	After-hours activities (Oh no! <i>More</i> homework)		After-hours activities - Have a great summer!		

To accommodate participants in multiple time zones, days started later than a residential camp. To better coordinate via virtual supervision, activities and breaks followed a fixed schedule. To replace the supervised open-hours labs, after-hours activities involved assigned homework.