Resilience in Geospatial Learning and Collaboration

Best Practices for
Enhancing Peer Support
and Self-Determined Learning

Introduction

What is digital pedagogical resilience?

Digital pedagogical resilience asks us to prepare for classroom disruption in ways that we have not necessarily done so before. Further, it ensures that the online class format is not a "lesser" version of in person teaching, but that online teaching equally offers "democratic non-authoritarian"[1] learning. While many teachers bemoaned online Zoom teaching during the pandemic, the reality is that we will need to adapt to a future of online learning and teaching — whether it's the increasing variants of Covid, or California's prolonged wildfire season.

Instead of simply taking an offline classroom format, such as a seminar or lecture, planning for resilience can offer opportunities for more equitable learning. Digital pedagogy can go beyond the Zoom lecture format, or the information banking model of education, and instead incorporate a variety of other material such as podcasts, visual archives, videos and websites beyond traditional reading to respond to different student learning styles, that can be enacted both in-person and remotely. Additionally, online teaching is a chance to incorporate a flipped classroom model, where students can spend in-class time collaborating and interacting, and prepare for class by watching lecture material beforehand.

1 https://www.insidehighered.com/advice/2020/04/22/professor-explores-why-zoom-classes-deplete-her-energy-opinion

Digital pedagogy and geospatial learning

Geospatial learning presents unique challenges for remote classrooms. Most geospatial courses are taught in bespoke computer labs, with specialised software installed. We can assume that all students will have access to the same operating systems, with the same software, programming languages and packages installed - all at the same version. Our lab worksheets rely on this consistency - and our students trust in our expertise and their learning experiences rely on their code working when we say it will (spelling errors aside, of course!).
Remote teaching throws these simple, but increasingly precarious, expectations into disarray: a classroom of thirty students may have thirty different software/hardware combinations, and it only takes one student with a slow computer, or unusual operating system to derail an entire class. It is near impossible to write worksheets and design syllabi that account for every possibility, a problem made exponentially larger by the specificities of geospatial technology, digital fatigue and our computer-heavy courses.

But it *can* be done. Some universities - such as Penn State - offer sophisticated online-only GIS courses for remote students across the US and abroad. They use specific proprietary tools such as ArcGIS Pro which work generally across

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platforms - but not every campus has access to these tools, not every teacher wants to use them, and sometimes, as we have seen with the COVID-19 pandemic and the wildfire seasons, students do not have enough access to computers which can run geospatial programs without crashing. Furthermore, not everyone wants to teach online: many prefer the stability of a lab space if that option is available, and only will teach remotely if they must.

Based on research with undergraduate and graduate students, our survey of best practices on pre-existing remote or online-only courses, and our own experiences talking, engaging and thinking about digital pedagogy this semester, we have established a few helpful principles for building resilience into geospatial courses *before* they go remote. In unstable times, this means hoping for the best, while preparing for the worst, and knowing that, if needed, you will be able to teach course material effectively in person or online.

Three Principles

1. **Clouds, browsers and phones: make use of the most accessible technologies**
2. **Screening out screens: think beyond visual learning**
3. **Debug and destress: foster independent problem solving and build confidence**

Beyond Zoom

There are an increasing number of options outside of Zoom that try to emulate “real world interaction”, using avatars as well as proximity sound and video. Gather.town is a 2 dimensional “video game” like space, where each person can walk around a “map”, with video and voice chat being proximity based. Interactive “objects” can be placed throughout the map, such as chalkboards and screens.
Mozilla Hubs similarly offers proximity based sound and video, although it is much more immersive. Instead of walking around a map, you can be in a room, as well as arranging different rooms and objects. With a VR headset, there are additional features.
Group conference call / asynchronous voice memos should not be discounted! They are simple and powerful. For group conference calls, mechanisms like Uberconference or Zoom without video are a powerful way of having everyone present and on a phone call. Asynchronous voice memos can also be used — where students can respond to material and work by posting voice memos instead of written essays.

Flipped classroom model

A number of theoreticians such as bell hooks and Paulo Freire, as well as educational tech experts have emphasized the importance of the flipped classroom model to overcoming the "information banking" style of education. In a flipped classroom model, students spend time outside the classroom reading, watching/listening to content, and time in the classroom pair programming, coding together or working on projects. Especially with hybrid asynchronous/synchronous classrooms, this can be a great use of synchronous time, with students being able to connect and socialize around collaboration and problem solving.
There are a number of different discussion formats that can be used for structure discussions in flipped classrooms. These include:

Round robin discussion

Working off a series of prompts in a google document

Critical debate

Concept/word maps using Jamboard or Miro

Interactive polling using Zoom polls or mentimeter.com

Pair problem solving

Reaction prompts

Group exploration — a perfect vehicle for groups to do things like taking walks outside, observing together and walking together, especially for a cartography or geography class!

In "A Third University Is Possible", la paperson argues and unravels the imbrications between settler colonialism, anti-Blackness and the modern university. la paperson posits the figure of the cyborg, as a force for "hot wiring" university machines for decolonization. Instead of eschewing online teaching or taking the privileged position of Ludditism, online teaching can be a chance to hotwire the university. Our Three Principles stem from this place of rethinking and building new practices in online teaching and beyond.

> "Figure out how technologies operate. Use a wrench. Technologies can be disrupted and reorganized—at least for a machine cycle. Rather than thinking of ourselves as just subjects of those technologies, think about how we are the drones, the explosives, the toxified, the operative parts of those technologies—and ideally, how we might operate on ourselves and other technologies and turn these gears into decolonizing operations."
>
> la paperson, A Third University Is Possible

What's in this booklet?

The first part, Tools and Trends, goes over tools and trends in teaching digital cartography and geospatial analysis. We discuss the hardware and software constraints, as well as the different levels of technical background students are coming in with.

The second and third sections go over teaching online, best practices, as well as activity ideas and interaction models for online classrooms.

Part 1: Tools and Trends

Clouds, browsers and phones:
make use of the most accessible technologies

Before the semester starts

Since teaching online requires that students have access to a strong internet connection, and in some cases, a laptop capable of running computation heavy software, consider sending out a questionnaire or survey to students before the semester starts. With students who are located outside of the US, some internet platforms might be unavailable (for example, Youtube is blocked in China). Within the US, not all students might have reliable internet connections, especially those located in rural areas. STEP (Student Technology Equity Program) at Berkeley loans out laptops and WiFi hotspots to students.

It's worth considering a "minimal technology"[2] approach to teaching online. Instead of asking students to use multiple different platforms, another way is to be creative with your lesson plan, using simple tools like Google Docs. Additionally, while you might

2 Yairamaren Maldonado, "A Low-Tech State of Mind: Applying the Principles of Minimal Computing to Remote Instruction" https://medium.com/@yairamaren/a-low-tech-state-of-mind-applying-the-principles-of-minimal-computing-to-remote-instruction-9ae9c229b4d

Social cohesion

One missing element in remote classes is social cohesion in student groups. While conversations could usually take place after and before class in a room together, now students might become adrift. A good way to keep social cohesion is to build in attendance into the labor based grading contracts. In large groups, Slack or arranging students into "pods" can be a way to have students message and problem solve with each other. A set of protocols/community guidelines can be helpful.

For smaller classes, providing a space to create community agreements and emphasize the learning space as a community rather than top-down classroom can also be helpful in creating social cohesion. Either way, it's important to emphasize the classroom as a point of contact and solid anchor during trying times, not another place of stress!

Interaction online / Repetition

Interactions online can be difficult, not just because there's lack of eye contact, but there can often be lags in communication. Some pointers for interacting on Zoom:

In a large group classroom setting, let students decided if they want to use the "raise hand" function or type "stack" into chat.

"Progressive stack" is a mode that some organizations do, where those who haven't spoken up get bumped to the top of the stack.

Stack or "Raise hand" (under the "reactions" toolbar) ensures that everyone has a chance to speak

Ask everyone to keep themselves muted unless they are in stack.

When calling on students, it can be helpful to state the order of the next two people on stack, so that the person after has time to prepare.

In group activities, suggest the "popcorn" method, where the person speaking "popcorns" or choose the person up next to answer a question or prompt. You can even have the person whose turn it is announce who is going next, and then give their own update, allowing the person next in turn a forewarning.

Make time for pauses, so that people who haven't spoken can ask questions or speak, especially since there's a lack of body language over Zoom.

Decide early on in the semester if everyone is open to using the Zoom chat function, as Zoom chat can be sensory overload or distracting for some students, while others might prefer it.

Be open to repeating yourself, especially around logistics! When we Zoom or work from home, we are often sitting in the same space all day. This means details and our memory can blur together.

feel like it's important to use open source conversation platforms like Jitsi or Discord, consider the varying levels of support across different operating systems (mobile and desktop) available for the software, as well as access. While Google docs and Slack are not open source, they offer consistent service and robust offline syncing options.

Admin tools

When teaching moves online, keeping materials in a centralized place is enormously helpful — a place where students know they can access all the course information.

Storage

Google Drive: Set up a class drive, which contains the syllabus, in class activities and a place for online back chatter/collecting Zoom links after class.
Dropbox/Box: Similar functions to Google Drive.

Bcourses: On Bcourses, there is Google Drive integration. What that means is you can embed Google docs very easily, and any changes to the document will automatically update on Bcourses. This is likely easier than updating bcourses and keeping track of changes.

Communication:

Email and Bcourses: These two are straightforward,

Slack: Slack has become the go-to for asynchronous communication. For pedagogical purposes, you can think of Slack as one big group chat. Slack is available across many different operating systems and features robust support. Especially in times of remote instruction, Slack is a way for students to connect directly with each other, helping form study and social groups online. For more information on Slack features, see: https://paper.dropbox.com/doc/errata-why-slack--BJuJVq9d8J0bD-E4nrfrRxEW8AQ-S8XPd1CWoil7t-JUqXzCqJ

A note on Zoom vs Google Meet: Most online activities at Berkeley are on Zoom, since it offers an array of security controls. Users need to have a Zoom account before joining a UC Berkeley Zoom meeting. Google Meet, however, has less access control — anyone can join a Google Meet. Depending on your security needs, one might be more preferable than the other.

Embodiment

There's a large body of research on the importance of embodiment in learning — from the Alexander Technique to the ways knowledge is stored somatically. Staying embodied despite disembodied communication platforms like Zoom remains important.

Here are some suggestions for holding space to stay embodied and present on Zoom:

> Every so often, take time for the class to check in with their bodies, whether it's the soles of your feet or where the ground is in the room.
>
> Take movement and stretch breaks.
>
> Take time transitioning between meetings and class.

Surveillance

Many online edtech platforms are also surveillance regimes. Whether it's an exam module on bcourses that tracks students' mouse movements, or online proctoring that detects student pupil movements, online platforms can invade student privacy in the name of preventing "cheating". Other forms of surveillance are less obvious — whether the use of proprietary platforms that collect data about its end users for profit (such as the use of Google Maps), or even the way Zoom can expose students' homes and private spaces, as well as it being an unencrypted platform.
While surveillance is a larger, structural issue, curtailing surveillance in the classroom can foster a greater sense of community and trust. Using labor based grading contracts, for example, can offset the need for surveillance and assumptions about "cheating". Emphasizing simple tools and interactive activities can also help curb surveillance.

Scheduling:

"What's our class Zoom link again?" can be a common question. It's worth sending out a recurring Google calendar invite with the class meeting link to all the students.

"How do I sign up for office hours?" Set up a way for students to sign up for office hours. This can be done by creating appointment slots on Google Calendar (https://support.google.com/calendar/answer/190998?co=GENIE.Platform%3DDesktop&hl=en) or using calendly.com (a freemium service). By creating a sign up link, you can include the meeting link.

For scheduling group meetings (ie a study session, class Q&A), when2meet.com and doodle.com allow for multiple people to specify their availability.

Computation and coding tools:

The "typical" in-person learning model for coding is usually pair programming done in labs, where students work through a programming exercise together. This can still be accomplished online! Coding tools are increasingly living on the cloud, which means code changes, any associated assets, can be accessed by logging into your account from any computer. As students increasingly utilize smartphones and less powerful laptops such as Chromebooks, these cloud coding tools are invaluable.

Self assessment or peer assessment, with "goals" established for self assessment at the beginning of the semester.

Contract based grading, which lists a contracted number of assignments to a specified quality

Specifications grading:

For example, completing X number of assignments means an A, completing Y number of assignments earns a B.

Labor based grading contract, which has a set of social agreements organized into a contract.

Creates a set of clearly defined expectations on how much labor is required to reach a certain grade. For example — regular attendance, prompt, daily discussion posts in order to receive an A, versus regular attendance and weekly discussion posts in order to receive a B.

For more information on labor-based contract grading, see Labor-Based Grading Contracts: Building Equity and Inclusion in the Compassionate Writing Classroom, by Asao B. Inoue https://wac.colostate.edu/books/perspectives/labor/

Pt 2 : Debug and destress: foster independent problem solving and build confidence

Assessment

According to The American Cultures Center, Creative Discovery Fellows Program and The Center for Teaching and Learning at UC Berkeley, extensive research shows that grades are an unreliable measure of learning, and "foster extrinsic motivation, and impeded intrinsic motivation". Grades also "enhance student anxiety and fear of failure", as well as "lead to failure-avoidance behaviors, like cheating". In teaching remotely, under a time of duress, lessening student anxiety to foster a learning environment, as well as encouraging intrinsic motivation instead of failure-avoidance behaviors is key to keeping students engaged. Additionally, traditional grading is ableist, and "merit-based grading affirms white supremacy, privileging some students while punishing others".

Other forms of grading exist that can be a form of feedback and radical empathy. These include:

Desktop based

Atom (in a pinch) - Atom is a desktop based text editor. It is similar to Sublime Text or Wordpad (on Windows). In using Atom, emphasize to students that they should be aware about saving their work often, as well as noting where they save their work in the filesystem. Atom has the benefit of being open source and cross-platform.

R Studio - A desktop based IDE (integrated development environment) for R, the language used for data analysis. Since it's desktop based, it uses your laptop for computation.

Cloud based

Codepen and JSFiddle - Both allow for quick and easy website creation with HTML, Javascript and CSS. They are relatively collaborative and helpful for troubleshooting. Students can create a codepen or JSFiddle and send others the link for help on debugging their code.

Jupyter Labs - UC Berkeley has its own "Jupyter hub", which allows students to create notebooks in Python and R. Computation and processing are done "in the cloud", so students can leave a process running.

Google CoLab - The Google version of Jupyter. Useful because it can load data saved on a Google Drive server.

Online Collaboration

Online collaboration tools are a very saturated space, and there continues to be new tools released every day. For the purposes of this booklet, we'll only list out a few of the online tools used in each domain, with an emphasis on tools that allow for collaborative group editing.

Social Activities

Icebreakers in small breakout rooms
Drawing spirals together before the start of class
https://adamwestbrook.substack.com/p/62-spirals
Movement and stretching together.

A few notes on Zoom fatigue:

Zoom fatigue is real, and it can be slightly alleviated through:

Taking breaks

Occasionally turning video off

Turning self view off
If possible, use headphones or keyboards that allow for mobility.

Resizing the Zoom window so that it is not full screen.

These suggestions are from: https://news.stanford.edu/2021/02/23/four-causes-zoom-fatigue-solutions/

Synchronous activities:

If you're doing synchronous activities, give students outside of Pacific timezones the opportunity to pre-record material, especially if they're doing a presentation.

During meetings, give time for students to do activities together, whether it's writing together, drawing or annotating together.

Since synchronous activities might be the rare occasion for students to meet each other on a regular basis, use breakout rooms as a way for students to get to know each other.

For breakout rooms, you can pre-assign breakout rooms at random or allow students to join the breakout rooms they would like to.

Go over good Zoom etiquette before the class starts. Establish that good Zoom etiquette includes turning video on, and keeping yourself on mute. If students do not want to keep their video on due to privacy reasons, that is fine. If students do keep their video on, tell them about the blurred background functionality.

Synchronous time is a way to make things interactive. Some activities:

- Annotating a reading or document together in google docs
- Typing up keyword list from readings or lecture
- Working through a series of questions
- Playing a game together / pair programming
- Group presentations

ONLINE COLLABORATION
(a short list)

Graphic Design
Illustration
Web Design

Canva (presentations, zines, other graphics)
Figma
Miro (collaborative mind maps and more)
Webflow (online websites without code, collaborative)

Documents
Discussion tools

Google docs
Written docs with tables and sections students can fill in
A slides doc that allows students to annotate, draw and sketch
Jamboard https://jamboard.google.com/
Collaborative discussion mapping
Mentimeter https://www.mentimeter.com/
Collaborative / interactive presentations with word clouds, live polls

Collaborative coding

Glitch.com - collaborate easily with multiple users on a single code repository, whether it's a website, app or simple script. Glitch requires an account, but is a nice starting point if you don't want to delve into the intricacies of git version control.

Github - the go-to for collaborating with others on code. There is a desktop UI, or you can use the command line. Github student offers additional benefits, including access to a lot of other free software.

Recording Tools:

Recording tools are helpful for pre-recording lecture materials (either video or podcast/audio based), or for students working on projects outside of the essay format. We will discuss this in later sections, but thinking creatively about incorporating different types of media into a class can accommodate different learning styles.

Video:

Zoom recordings:
Quicktime recordings:
Imovie
OBS Software (Open Broadcaster Software, note has a learning curve!)
TikTok

Audio:

Voice memos
Garage Band
Anchor.fm

Some ideas for asynchronous activities:

Give students material to listen to throughout the week: pre-recorded lecture videos, audio lectures (podcast style), or other material such as audio books, videos and podcasts.

Use innovative formats. For example, if students are listening to an audio lecture you've made, perhaps they can listen to the lecture while doing a related activity. Professor Tao Leigh Goffe of Cornell University, for example, has "cook alongs", where her students understand imperialism and diaspora through cooking recipes together and listening to a lecture. Other formats could include picnic intensives for synchronous and asynchronous meetings.

Mail kits to students beforehand with hardware and materials they can use. For example, Jane Mi (http://www.janecmi.com/) of Scripps taught a class where students undertook weaving projects in order to understand computation, using traditional Hawaiian materials.

Asynchronous activities where students can "tag" each other in, such as an online version of emma rae norton's "hand coding round robin" https://doodybrains.github.io/hand-coding-round-robin/

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Checking in after asynchronous activities

If you're concerned about attendance and knowledge retention, create a "check-in" activity due every week to make sure students have viewed and engaged with the asynchronous material. This can be as simple as posting questions or comments about the material on a forum.

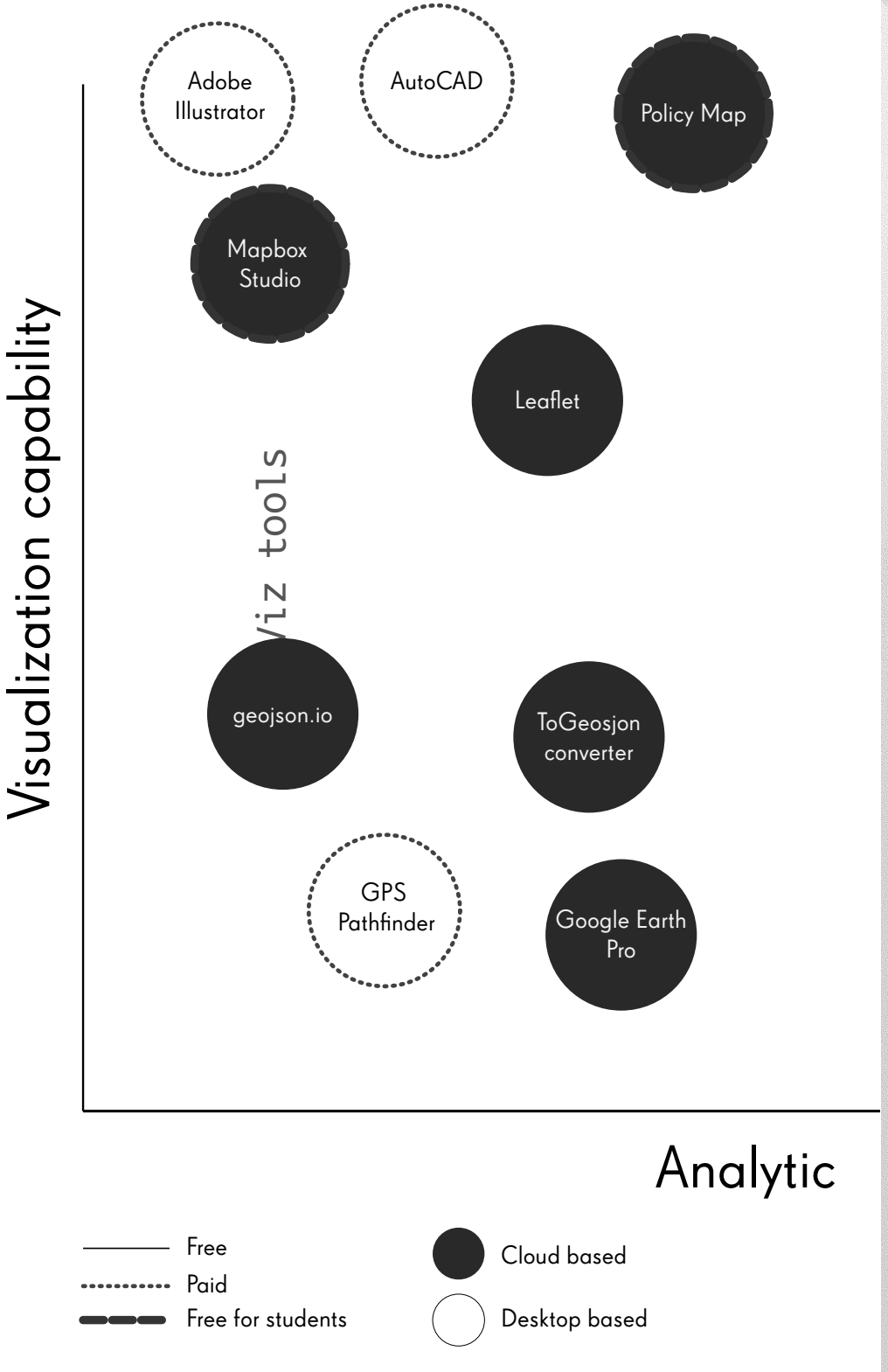
Best practices Part 1

Screening out screens: thinking beyond visual learning

Even in-person classrooms and assignments can prioritize certain modes of learning above others, contributing to a culture of normativity and ableism. In online contexts, learning can become hyper-visual, with an overemphasis on screens and video. For those that might experience overstimulation with simultaneous Zoom presentations, video and Zoom chat, it's important to think beyond visual learning.

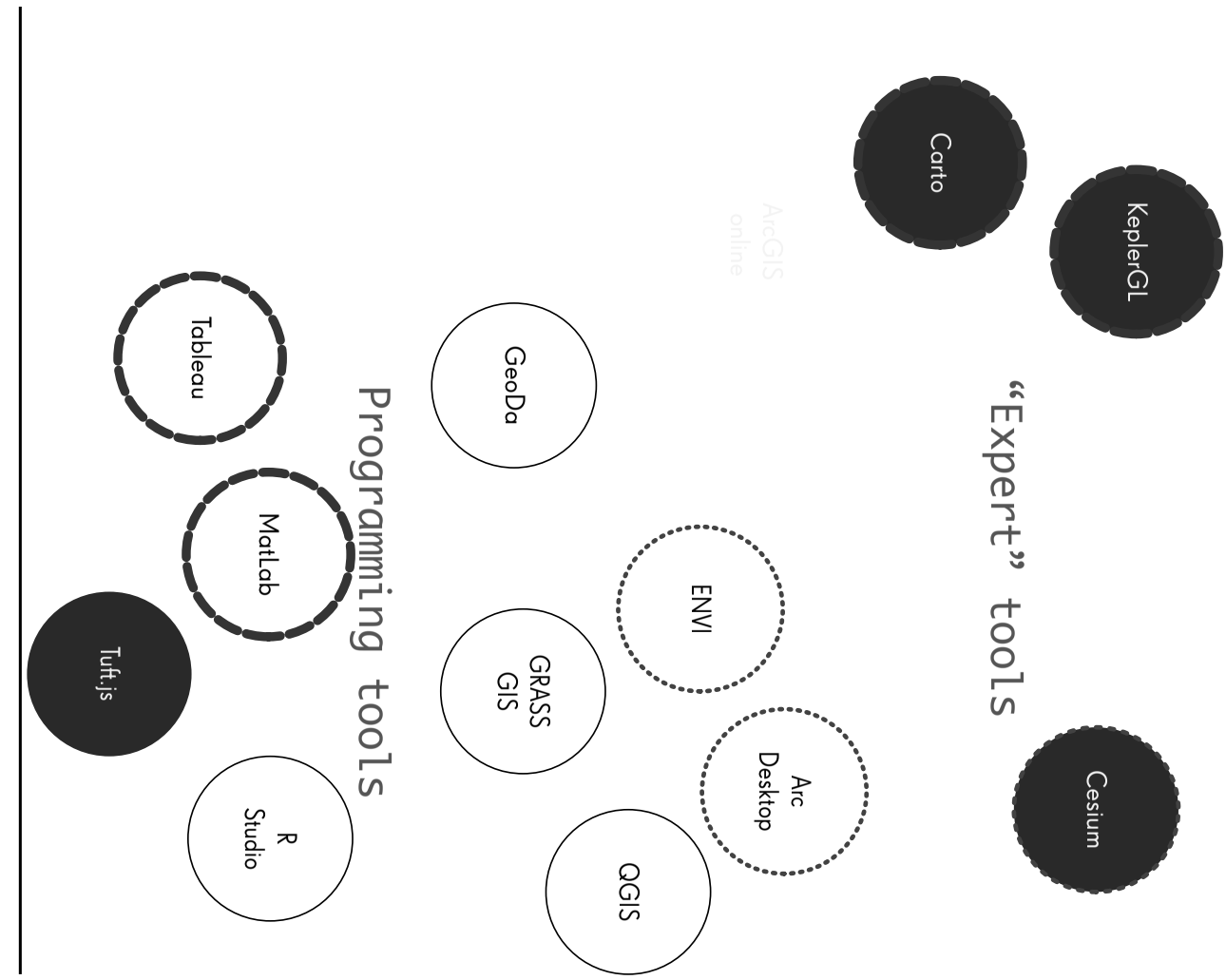
Synchronous vs Asynchronous vs Hybrid

Due to Covid and visa restrictions, online teaching throughout 2020 brought together students from multiple timezones. Although fall classes for 2021 are slated to be in person, ongoing disruptions from travel are anticipated. For equity, accommodating a variety of time zones is key. This can be done through a hybrid of asynchronous lectures and synchronous meetings. Additionally, asynchronous instruction can cut down on Zoom fatigue.


Adobe Illustrator
AutoCAD
Policy Map
Mapbox Studio
Leaflet
Viz tools
geojson.io
ToGeosjon converter
GPS Pathfinder
Google Earth Pro
Visualization capability
Analytic
Free
Paid
Free for students
Cloud based
Desktop based

Free Smartphone Apps for Collecting Data

	Android	iOS
Maps.Me	X	X
Strava (*caution on data-sharing)	X	X
Physics Toolbox Sensor Suite (https://www.vieyrasoftware.net/)	X	X
Sensors Toolbox	X	X
Metal Detector	X	X
LightMeter Free	X	
Photo Light & Exposure Meter		X
Real Thermometer	X	X
Sound Meter	X	
Decibel X:dB Sound Level Meter		X



Digital Cartography tools

Smartphones + Sensors

While access to adequate computing can't be taken for granted, it's a far safer assumption that most students have access to a working smartphone, *and know how to use it!* According to Pew Research (2021)[3], 100% of US Adults aged 18-29 own a cell phone, with 96% owning a smartphone. This correlates to our own research, in which all respondents were familiar with mobile phones, with over half self-assessing as being experts in their use.

For geospatial teaching, this opens up a whole new remote learning tool kit. Though often not very accurate, smartphones have a surprising number of sensors which are easily accessed by free, cross-platform apps, and can be used for "in the wild" spatial data collection practice.

3 https://www.pewresearch.org/internet/fact-sheet/mobile/#who-owns-cellphones-and-smartphones