

Using a webcam as a document camera in remote instruction – what we have learned

Whether you use a modular 3D-printed camera support or soup cans to adapt your webcam, we have learned some tips for getting the most readable result on the other end of a zoom meeting.

Website: about.illinoisstate.edu/gawiman

Blog presents videos on using a webcam, using video software, on 3D printing and on 3D printed remote instruction accessories like the WebDocCam stand.

What's missing on the website, at this writing? An assembly video. I am planning to post that video over Winter break.

Also: the videos, hosted on Office365 Video, are only accessible to campus members. Once the transition to Microsoft Stream is completed, I think it will be possible to make them public.

Webcams aren't designed for document camera use, but can perform this function. Issues include a tendency for focus to wander as it searches for faces. This can be addressed to some extent by writing large and bold.

Choosing a webcam

I tried every webcam I could get my hands on, and they all worked including the older, low-res one stowed away in a drawer. But an HD camera like the Logitech C920 is a good fit.

Remember that the smaller the lens (and webcam lenses are very small) the more difference a fingerprint or smudge makes. Use a microfiber cloth to clean the lens before a session.

Can you use the camera that is built into your laptop? Yes – by using a mirror and placing documents on the keyboard of your laptop. But the external camera is far more convenient.

Commercial document camera options

Commercial document cameras are available – a quick Amazon search will turn up literally dozens of options under \$200. These are good options (be sure to read the reviews!) but the idea behind using an existing webcam is low cost. For example, our 3D printed stand costs about \$10 to make in quantities three-and-up, and can be scaled as necessary.

In addition, some of the reviews highlight physical stability or durability problems. The 3D printed stand is robust and durable... and lightweight for mobility.

Choosing a marker

- **Felt-tip pen** works well, but becomes fainter over service life
- **Ball-point pen** not quite dark enough
- **Gel Pen** is an excellent choice, producing a dark line throughout service life. Not ideal for left-handed writing.
- **Standard pencil** ranges from mediocre to usable, but produces a consistent line

- **Blackwing Palomino pencil** produces a dark, readable, smooth, consistent line throughout service life, and features a functional, reloadable eraser. These are available on Amazon.
- **Sharpie marker** works well, but bleeds through paper, and tends to fade during service life

Lighting

Most webcams can function with room light, but benefit from direct illumination. Setting a table lamp next to the document camera will help. Avoid positioning a lamp above the document camera, to avoid reflective glare.

Writing and paper management for document camera

- It may be helpful to use wide-rule paper, and set your character height to the height of the line. Doubling the character height quadruples the visual area of the character.
- Practice consistent writing by doing whole pages of the letter “e” or other characters. While exercises like this are normally for artists, they benefit anyone who needs to communicate in written form. One page per day will make a dramatic improvement in your handwriting in two weeks. Occasionally revisit the exercise for even more benefit.
- Use loose pages and place one sheet at a time on the camera surface, setting them aside face down as each one is complete. Then after class, create a digitized set as described below.

Digitizing your written presentation, after the class

One advantage of using a document camera over an erasable white board is that, after the class session, handwritten sheets can be placed on the camera and a sequential set of .jpg images made for posting on Reggienet. This can be done with nearly any camera application; on Windows machines, use Microsoft Camera. Microsoft Windows has the capability to rename a set of image files (or any other files) with sequential names.

How to get a 3D printed document camera stand

For the time being, you can request one from College of Business, and we have capacity to make one for you. Larger requests can be considered depending on circumstances.

You can also make your own, using downloaded STL files from my website. I will be posting an assembly video over break.

Special Requests

The WebDocCam has already benefited from feedback and special requests. In addition, if you have a custom design request, it might be something others could benefit from.

Transcript, more-or-less:

1. EVERYBODY OUT! BUT KEEP TEACHING
2. Handout slide
3. Back in March the word came down, that because of covid, we had to leave the campus, but keep teaching online. To put it mildly, this was a bit of a transition for our faculty. Our campus

responded with massive increases in remote instruction resources of all kinds. But our faculty really missed having a whiteboard.

4. Now to be honest, a whiteboard is a lot more useful in a conference room than a large classroom. Unless you make a conscious effort, there is a natural tendency to write just large enough for yourself to read. Students in the back row would have to be using binoculars to read the board.
5. A better option for real-time written content, in the classroom and out, is a document camera. That way, everyone in the room can get a close-up view of the instructor's writing. So we received requests for document cameras to use in offices or at home. There are a couple problems fulfilling those requests: high-end document cameras cost hundreds of dollars, and they also don't belong to us. I think Learning Spaces would have something to say if we started handing them out to instructors to take home. So I started looking for alternatives.
6. Nearly every instructor already has a webcam though. Is there any reason you couldn't leverage that device as a document camera? Let's find out. Even a simple webcam has all the resolution it needs. I did experiments. It wasn't as simple as flipping the camera downward however; the document goes upside-down.
 - a. Another problem is that most webcams are not built for text; they are looking for faces. Even simple ones, either internally or by software, have some facial recognition. I found that most webcams can do just fine if you write with a bold marker, and fairly large. Coincidentally, these are the same things that make reading easier for your students.
 - b. Once in a while it will focus on your hand while you write, but then re-focus on the text when you move your hand out of the field. This is because of the change in distance. I'll cover practical tips based on those experiments in a few minutes.
7. There are a LOT of people working on this very idea. YouTube is full of creative instructors who have rigged up a solution to share. Some of them are amazingly inventive. For instance, if you don't mind laying a document on your laptop keyboard, you can attach a makeup mirror from the Dollar store with a couple rubber bands, and get right to work.
8. This instructor will not only survive the apocalypse, but she'll keep teaching while she does it.
9. And of course there are commercially available supports and mirrors that achieve the purpose.
10. .
11. But to varying degrees they have the problem of switching between document and face modes.
12. I wanted a more robust solution that was simple to use and would give repeatable results.
13. And it would be nice if it were modular, so it could be configured in different ways.
14. And while we're at it, could it be simple enough so that volunteers could assemble it?
15. And make it cost less than ten bucks - good, let's do that.
16. .
17. Using existing objects seemed like a good way to simplify design and construction. For instance, why couldn't an ordinary clipboard be the base? And clip the stand in for instant assembly. That worked really well.
18. Unfortunately, the first prototype was complicated to make and use. I needed cheap, strong, precise widely-available components... like PVC pipe and fittings. Then I would only have to design a couple special-purpose parts and it would be ready to go! That sounded easy.
19. It wasn't. The camera mount, its main component, turned out to be a real puzzle.

20. For instance, making it swivel around a vertical axis, with a camera mounting thumbscrew that worked easily and well, that could be easily assembled, was a problem.
21. Figuring out what parts to print, and how to print a complete set in one file, was also a challenge.
22. many prototypes and redesigns later, I had a parts list. The total cost would be well under ten dollars.
23. It's pretty easy to make in small batches
24. Finally! production underway
25. The resulting stand could switch modes easily between document camera and webcam. Swivel-flip to be a document camera, flip-swivel to be a webcam.
26. There's a different arm for use with a cell phone. You simply install the Zoom app on your phone, clip it into the holder, and start your meeting. Like the webcam model, it switches between document camera and meeting modes.
27. Users told us that it would be really helpful to have adjustable height. Creating the height adjuster was the key to modularity: now it could have different bases, and different arms, and become all kinds of things.
28. For instance, the standard base could now support a funnel for refilling hand sanitizer bottles
29. If you want a more versatile base that can go on any surface, take the arm off the clipboard base and put it on the brick base.
30. The brick base works so well, I use mine that way all the time now. It's more stable, more versatile, and even cheaper than the clipboard.

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“Gladly We Learn And Teach”