Key Concepts for Digital Photography

By Barbara Chamberlin

Subject: Digital cameras and images

Audience: Technology coordinators, technology integration specialists, technology facilitators, administrators, teachers, teacher educators

Grade Level: 5–Adult (Ages 10 & up)

Standards: *NETS•T* I; *NETS•S* 1, 3 (http://www.iste.org/standards/)

Digital photography is an appealing technology to use in the classroom because it is rooted in skills many teachers already have—taking and viewing photos. Some aspects of digital photography are different from traditional photography. Understanding these differences makes all aspects of acquiring, analyzing, creating, and communicating with photos easier. Most importantly, understanding the key concepts of digital photography makes it easier to use digital cameras and photos, enabling teachers to concentrate on content learning, rather than technical support.

Selecting a Digital Camera

Several Web sites such as the Digital Photography Review site (http://www.dpreview.com) and the Digital Camera Resource site (http://www.dcresource.com) provide excellent reviews of digital cameras. Also consider visiting a store with a sizeable electronics section and experiment with as many digital cameras as possible. By using several, you'll get a good feel for which are easy to use, have menu settings you understand, and seem durable enough for classroom use. Explore some of the features found in traditional, film-based cameras such as auto or manual focus and the ability to add additional lenses or an external flash.

Digital photography has introduced new features to cameras. Displays on the camera allow the photographer to review photos immediately after taking them, a major advantage of digital photography. Unfortunately, these displays take a lot of battery power—another important consideration. Some digital cameras use traditional alkaline batteries that can be expensive to replace and may have a short life span in the field.

Many digital cameras offer optical zoom, allowing clearer close-up shots. Some digital cameras also offer the lesser-quality digital zoom option.

When using digital zoom, the object can appear larger in the picture, but the picture will not be as clear and sharp as if it were taken with an optical zoom.

Chances are good that your budget will dictate which kind of camera you can purchase. Identify the features that are important for your use (such as ability to add external lenses or optical zoom). Then, consider buying the highest megapixel camera in your price range with the features that you need.

Understanding Pixels, File Size, and Resolution

Digital photos, whether taken on a digital camera or scanned from a traditional print, are made of *pixels,* small squares of solid color. When you use software to look very closely, you can actually see the pixels.

One way of measuring photo size is to count the number of pixels in a photo. For example, look at the photo of the butterfly on the flower (Figure 1). When that photo was taken with the digital camera, it was 2,272 pixels across and 1,704 pixels tall. By multiplying width by height, we know the total number of pixels in that image is 3,871,488. A *megapixel* is one million pixels. The butterfly image has 3.87 million pixels, or 3.9 megapixels.

One measure of camera quality is the number of pixels it can take in an image. A camera that takes photos with 5 megapixels will yield higher quality photos than one that takes photos with 2 megapixels.

The more pixels in your image, the smoother the image will be (Figure 2). Of course, the more pixels in your image, the more data your computer has to store for that photo. A 3.9 megapixel photo will take about twice the storage space as a 2 megapixel photo. When using digital photos, you will need to decide which is more important, the quality of the photo, or the amount of space on your camera or computer hard drive required to store the photo. Larger photo sizes also mean slower transfers to and from computers and can make a computer in the image editing and printing phases perform slowly.

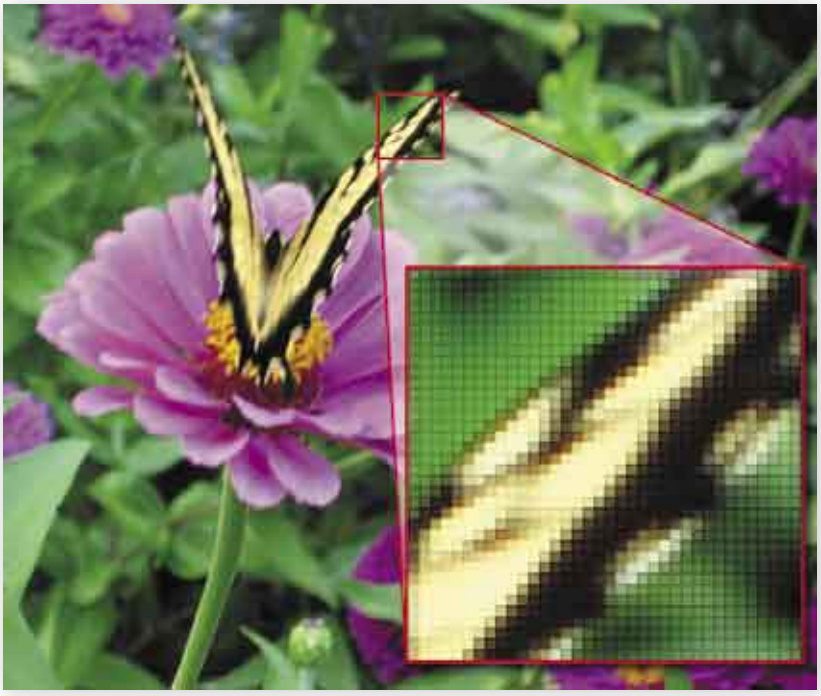

Figure 1. Digital photos are made of pixels. By zooming into a digital photo, you can actually see and count the number of solid, square pixels in an image.

Figure 2. The more pixels, the smoother the photo. The left part of the photo is the smoothest; it has the most pixels in it. As the pixel count decreases left to right, the quality also decreases.

Many cameras allow you to change the resolution at which you take photos. You can take photos with fewer pixels and fit more photos on your camera, or you can change the settings to take fewer photos with more pixels.

Photos that will be viewed on screen need only 72 pixels per inch (ppi) to look smooth. However if

Table 1. Photo Size and Pixel Count

Final Size	Web, E-mail, or Presentation (72 ppi)	Home printing (150 ppi)	Professional printing (300 ppi)
4 x 6 inches	288 x 432 = 124,416 pixels	600 x 900 = 540,000 pixels	1200 x 1800 = 2,160,000 pixels (2 megapixels)
5 x 7 inches	360 x 504 = 181,440 pixels	750 x 1050 = 787,500 pixels	1500 x 2100 = 3,150,000 pixels (3 megapixels)
8 x 10 inches	576 x 720 = 414,720 pixels	1200 x 1500 = 1,800,000 pixels (2 megapixels)	2400 x 3000 = 7,200,000 pixels (7 megapixels)

you print a photo at only 72 ppi, it will look blocky and rough. To look smooth in print, a photo should have 150 ppi for printing on a color inkjet printer or 300 ppi for professional printing.

Before determining how many pixels you will need in a photo, decide how you will share your photos. If you are sharing your photo on a computer monitor (through e-mail, Web, or presentation software), you will need fewer pixels in your images than if you share them printed. See Table 1 for optimum pixel counts for various uses and sizes.

A camera that shoots at 1 megapixel or less will still yield photos that look great on screen … even as large as 8 × 10 inches. A 2 megapixel photo will still print beautifully at 4 × 6 inches, even on a commercial printing press. However, additional pixels provide an edge when cropping photos. The most common mistake of everyday photographers is taking a photo from too far back. See Figure 3 for an example of how cropping decreases the pixels available. This is especially important when documenting small items. If you have more pixels in a photo, you can crop out more pixels and still have enough left to work with.

Another measure of quality in digital images is compression. Compression is a mathematical algorithm that digital cameras use to reduce the size it takes to store a photo, without changing the photo's actual dimension. The trade-off for this storage savings is quality—a lot of compression on your image may make it look "noisy," sometimes showing a strange pattern on the photo. If you have enough space to store images, shoot your photos at the highest quality and lowest compression you can (referred to as "image quality" or "compression" in camera menu settings).

Storing and Organizing Photos

Most digital cameras store photos on some kind of removable media. Several types of media are available for cameras—from floppy disks in older cameras to compact flash cards or rewritable CDs or DVDs in newer cameras. It really isn't important what kind of media your camera uses, but you should understand how they work.

Most removable media comes in various sizes. For example, your camera may have come with an 8 MB, 16 MB, or 32 MB card already in it. Remember, the larger your pictures, the fewer pictures your card can hold. You may want to invest in a larger card or a couple of smaller cards so that each photographer has one. Changing cards is easy; many teachers find it easiest for each student to store photos on a personal card rather than keeping track of which photos belong to which student.

When you move or download images from the camera to the computer, you can usually do it one of two ways: using a cable to plug the camera into a computer, or removing the media in the camera and using a card reader attached to the computer.

Most digital cameras ship with imaging software included in the purchase. Some of these programs have organizational features that allow you to group photos by photographer or topic. At the least, you'll want to create an organizational structure on

Figure 3. The original photo is 2272 x 1704 pixels, or 3,871,488, but once the excess pixels are cropped out, the image is 924 x 693 pixels, or only 640,332.

your hard drive to keep photos organized. Store all photos in a central folder, with additional photos within that one organized by topic or student (as seen in Figure 4).

Additionally, your camera will number photos for you when naming them. As soon as you view photos on your computer, consider renaming them so that you can identify them later. If your computer has the capability to write to CD-ROM or Zip drives, consider storing photos for each student on individual disks.

Your best organizational option is an album program. With album programs, you can view thumbnails of photos, organize them by date, assign keywords, and rename them as needed. You can also create custom layouts for your photos, such as photo album pages, greeting cards, or multi-photo layouts for printing with most album programs. Apple's iPhoto is available free of charge on new Macintosh computers and through its iLife software. A variety of free and low-cost photo organizers are available for Windows machines as well. Most image-editing applications either include album functions or are available in a suite that includes an organizer, the editor, and often other imaging utilities.

Album programs typically allow you to do simple photo editing, such as cropping, removing red eye, simple color adjustment, and exporting for use in e-mail, Web, or presentation programs. More advanced editing programs enable greater editing such as adding text and arrows to a photograph, creating text boxes, detailed retouching, and applying effects.

Sharing Photos

Low-cost ink-jet printers offer surprisingly good results for photo printing, especially when using photo-quality paper and printing at high resolution. Ink-jet printers fill the needs of most classroom sharing. Digital photo printers, typically specialized ink-jets, are also available that print directly from some digital cameras. The immediacy is great when students need to share their photos right after taking them. Ink-jets do have some drawbacks. Depending on the printer, replacement ink cartridges can be expensive. Ink-jet printouts are typically easily damaged by water (because the inks are water-based) and do not last as long as professional printing methods.

More durable, longer-lasting prints can easily be purchased. Many photo kiosks at photo labs and discount stores accept memory cards directly from the camera or CD-ROMs made on your computer. Quality and color balance can vary from kiosk to kiosk, as can cost.

Another option is online printing. You'll want a high-speed connection, because a 32 MB card full of images transfers very slowly over a dial-up connection. Many Web sites and most album programs provide simple access to online printing services; you select photos in the album to print, enter your credit card number, and it sends the photos to the print house for you. Prices vary from one print site to another, as well as special features, such as printing a photo to a T-shirt or coffee mug. Although there is a delay of several days while the print house mails the photos to you, the quality is usually very good and prints are almost indistinguishable from traditional film prints.

Figure 4. Hard drive organization. Consider placing all your digital photos in one folder on your hard drive, with additional folders for organization.

Figure 5. Album software. Most album software allows you to view thumbnails of, rename, assign keywords to, and group photos.

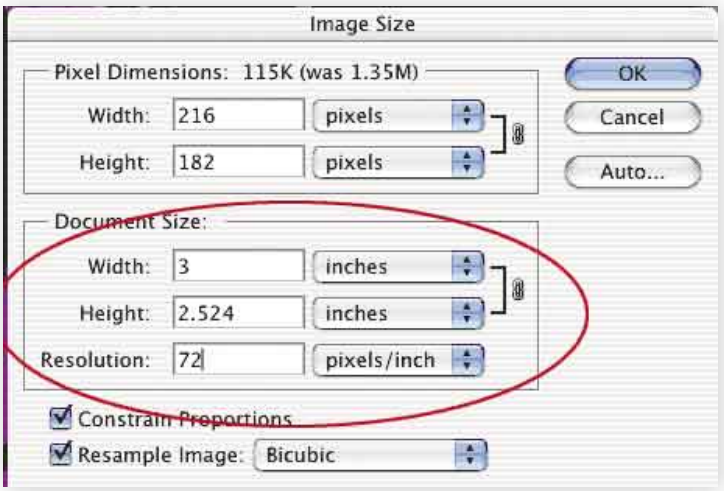

Figure 6. Resize images as needed. Use the Resize Image command in editing programs to size your photo appropriately. Select your dimensions first, and then select the appropriate ppi as your resolution for viewing or printing. Make sure that the Resample Image box is checked, or when you change dimensions, the ppi will automatically change also and the overall number of pixels will not be affected.

Sizing Photos

When preparing your photos for print, be sure to size them appropriately. Use an image-editing program, such as the one that came with your camera, to resize your image to the correct size. Use caution whenever you resample (change the number of pixels used) an image. Each time you resample, you degrade the quality somewhat, and although an image-editing program will allow you to increase resolution, the process actually loses information and, thus, quality. Once you lower the number of pixels in an image, you'll never be able to retrieve the lost details. It is best to make a copy of your original image before experimenting with resizing.

The most common mistake in using digital photos is placing images that are too large into e-mail, Web sites, or presentation programs. The images may appear too big on screen or cause the size of a Web site or presentation to be dramatically large; they can even cause a Web page or presentation to crash. Particularly when placing photos in a presentation program, be sure to use a photo-editing program to size them appropriately. Remember that any image displayed on screen will be 72 ppi.

Conclusion

Digital photography lends its power to the classroom through the images used—not through the digital quality of the image, the technical expertise of the teacher in the room, or the settings used on the camera. It is easy to feel overwhelmed by new technologies and terminologies; however, it is more important to feel comfortable with the techniques used to enhance teaching and learning through photography than to understand all the settings on a camera menu.

The most important benefit of digital cameras is the immediacy of use. Because photos can be shared almost as soon as they are taken, learners can spend more time seeing what is in the picture and less time working a camera. Photography changes learning in the classroom—not because learners simply use a camera, but because they are better able to see that which they are shooting.

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