3D in the Optometric Classroom: Forward-Thinking or Fluff?

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What's the big deal about three-dimensional (3D) technology? Cynics contend it is just a fad that drives sales of 3D Blu-ray content, increases the price of televisions, smartphones and going to the movies, and decreases the quality of the content we watch. However, 3D is gaining support from some in the field of education, who point to emerging evidence that, although the technology is still in its nascency, it may have significant educational value when properly used.

I have some experience teaching with 3D assistance. Pacific University was the first to open a 3D Vision Clinic just more than a year ago.[1] In that time, we've discovered that digital 3D projection technology holds great attraction to students and normally sighted patients alike. Surprisingly, I've also discovered that the average patient experiencing one of the so-called "Three Ds of 3D" (dizziness, discomfort, or lack of depth) is most concerned with a fourth "D" (diplopia).

At Pacific, we will soon have a 3D drop-in teaching laboratory to allow students to complete assignments with simulations of basic science experiments and virtual patients. We are not the first, and will not be the last, to do so. If the 3D content can keep pace with the demand, I imagine labs like this will be a model for all of our didactic facilities in the near future. Just like many consumers are purchasing televisions with 3D capability when they upgrade their home entertainment systems, so it will be in the classroom. I believe it would benefit us and our students if our classrooms are 3D-capable in the future. Here's why.

3D and Attention

Competition for our students' attention has never been fiercer. Anyone who has been teaching in front of a sea of laptops for the past decade or more knows this. It would be fair to say that students love this change, while teachers are generally less fond of it. Yet the advantages of the wired classroom to the instructor are often forgotten. For example, many can attest that it makes us better teachers to have fact-checkers among our students. Also, the competition of the Internet is incentive to make sure we keep lectures lively and interactive — as best we can with 2D presentations, that is.

If you'd like to lift the eyes of your students from their laptops, you're not alone. Many are concerned that split attention during lecture is handicapping us in the lecture hall. There is evidence that this is true. A study from Ohio State has shown that multitasking makes us feel good, but we're not nearly as good at it as we think we are.[2] Split attention affects performance.

Some optometric educators require students to close their laptops and drop back to paper notes during their classes. After all, we all want the doctors of tomorrow to listen to us so they know all they can in order to best treat patients. Our students might say that closing their laptops during class is not conducive to this goal. One simple reason is that they often can type notes faster than they can write them. Others engage better when they can interact, albeit not verbally.

Yet for all of the concerns about laptop use in the classroom, it's not the offline world that concerns us. It's the Internet. It's not just the students' attention in the classroom for which we are competing, but the myriad of digital entertainment available when they study at home. So if we can't beat the competition, can we join it? A major challenge to education at all levels in the wired world is to ride the wave of educational technology rather than becoming overwhelmed by it.

Enter 3D at the podium. With the aid of a digital light processing (DLP) or similar 3D projector and electronic 3D glasses that flicker, attention comes up off the students' laptops and back to the front of the room. The active 3D glasses they must wear flicker in synch with the frame refresh rate of the projector and faster than our critical flicker fusion (CFF) frequency, providing very high-definition resolution compared with circular polarization, the typical 3D technology used in movie theaters.

If we accept that a 3D presentation can

command attention, does it follow that students can learn more with it? One of the assertions made at the November 2011 Monterey Symposium by the American Optometric Association (AOA) and 3D@Home Consortium was that "Individuals can learn faster and retain more information in an immersive stereoscopic 3D presentation than in a traditional 2D presentation."[3] Let's examine these two somewhat sweeping claims.

3D and Efficiency

Despite its shortcomings, the efficiencies of the traditional lecture format in higher education have to be recognized. Efficiency is why optometric education is largely still following the classic "sage on the stage" model, which has permeated Western classrooms for generations. This model is relatively independent of class size, and has been used in larger universities for class sizes of 1,000 or more students at a time. On the other hand, this extreme economy of scale often leaves something to be desired for both students and their teachers.

In the schools and colleges of optometry, much of the typical student's didactic first three years are spent in auditoriums. Yet the difficulty in retaining and mastering material based on passive listening alone is well-established. The word auditorium means "a place for hearing," and is familiar to our students. But most have not been trained in the techniques of active listening, including following and reflecting skills and avoiding distractions. These skills become very useful in listening to patients in clinic later in their educations.[4]

The elegance of using 3D in the classroom is that it retains the efficiency of the traditional lecture format while encouraging a level of engagement not otherwise possible. This level of engagement includes optometric educators, who can create their own content using special software such as the XPAND 3D Plugin for PowerPoint. Some might argue that adding 3D by itself will not improve the content of the presentation any more than PowerPoint animations or transitions would. However, it has been shown that 3D can add depth to a class such that students become engaged. According to a white paper by Professor Anne Bamford, director of the International Research Agency, describing a large European study, "During class observations, 33% of the pupils reached out or used body mirroring with the 3D, particularly when objects appeared to come towards them and where there was heightened depth."[5]

3D and Retention

Even with audiovisuals, teaching in the 2D classroom is by definition a passive way to convey information. There is the advantage of efficiency, but the risk is that it may come at the expense of retention. An analogy many of us can relate to is that a classroom lecture is no more effective for retention than verbal patient education in clinic. Without written instructions on how to use their medicine, clean their contact lenses or perform home vision therapy, for example, much of what we tell patients is lost. Similarly, for our students, we all know that retention without active listening is typically less than is necessary for competency.

So why do we still use the "chalk and talk" method of teaching, if both retention and attention are less-than-ideal? Perhaps it is because heretofore, we have not had a viable alternative. But now, there is evidence that 3D software and presentations will increase retention. As stated concerning public school students in The 3D in Education White Paper: "86% of pupils improved from the pre-test to the post-test in the 3D classes, compared to only 52% who improved in the 2D classes. Within the individuals who improved, the rate of improvement was also much greater in the classes with the 3D. Individuals improved test scores by an average of 17% in the 3D classes, compared to only an 8% improvement in the 2D classes between pre-test and post-test."[5]

These statistics make a convincing case for enhancing some of our lectures with quality 3D content. The numbers may be different for students in optometry school, who have the advantage of practicing what they have learned in teaching labs or clinics. But what to do when students would like to practice their lab or clinical skills even when teachers and patients are not available? Lab and clinic simulations are other potential applications of 3D, especially since the decline of print media and other analog, noninteractive information.

Optometric Content and the 3D Classroom

While graduate-level content is still lacking, optometric education is rife with subjects that would lend themselves perfectly to 3D education. These subjects include:

- histology
- microbiology
- ocular anatomy and physiology
- optics: geometric, physical and physiological
- optometric methods/procedures
- systemic and ocular disease.

Is Analog 3D Just as Good?

Some of us (this author included) learned subjects like human anatomy and physiology by using plastic models of bones, muscles, nerves and organ systems. Some schools that offer anatomy and physiology through distance education have discovered that students still need hands-on time in the lab to be competent in the upper classes. The principle here is that 3D, albeit plastic analog models, is necessary for complete understanding of human anatomy. While neither 3D technology nor the plastic models come cheap, the former has the advantage of being highly portable and usable by larger numbers of students at a given time.

Feedback from the Field

According to "3D in the Classroom, See Well, Learn Well, Public Health Report," published by the AOA and 3D@Home Consortium, the response of public school students and teachers to 3D learning and teaching has been generally positive.[6] Comments from students quoted in the report include, "The information sticks with me a lot more" and "Using 3D has helped me look at what we are learning in a different way. It almost makes it look real — it's fascinating …" Comments from teachers include, "An accessible, yet powerful, way to convey difficult or abstract concepts" and "An engaging and attractive introduction to new material."

Judging by what we know so far, the magic of 3D in the classroom seems to be that with a little extra content, the efficiencies of the lecture format can be combined with the interactive nature of 3D. When this is done right, it may very likely make for a better learning experience for students, as well as happier optometric educators.

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