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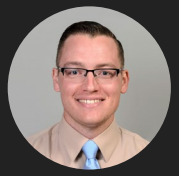
White paper

A Modern-Day Medical School Ultrasound Curriculum



By Dr. Ryan Anderson. Director of Ultrasound at William Carey University College of Osteopathic Medicine

With Brittnie Dunn Harbuck, Second-Year D.O. Candidate

William Carey University

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The Clinical Potential of POCUS

Point-of-care ultrasound (POCUS) has played a critical role in my treatment of patients throughout my medical career. I will never forget a case from my third year of residency at Lehigh Valley Health Network when a patient presented to the emergency department with unexplained dyspnea and diaphoresis. Having been provided adequate ultrasound training, I immediately performed a point-of-care limited echocardiogram, which revealed cardiac tamponade. Ultimately, the information gained from that scan enabled us to make immediate medical decisions and send the patient to the operating room for definitive management.

That experience and many others contributed to my current belief that ultrasound should play a central part in the initial assessment of almost any patient. This belief is increasingly supported by a growing body of literature, as study after study concludes that earlier integration of ultrasound into the assessment process leads to better patient care and outcomes, driven by faster and more informed clinical decisions.[1,2,3,4,5] Using ultrasound early has the potential to save lives.[5,6] It's as simple as that.

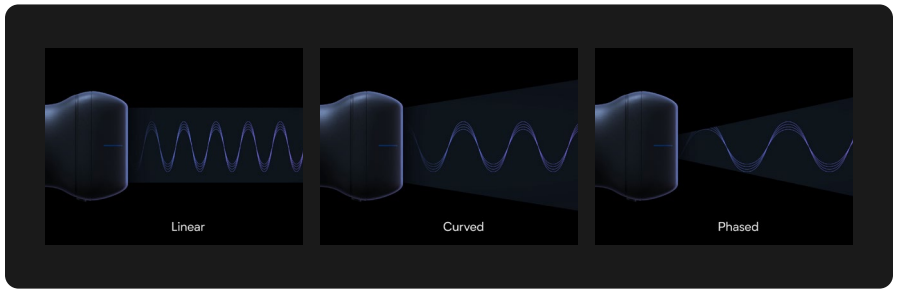
Unfortunately, most physicians are still not being trained to incorporate ultrasound into the initial exam, as medical schools have not allocated the requisite time and resources required to effectively train students to be proficient scanners and interpreters of exams. As an example: in a typical setup, a medical student will likely graduate with only a couple hours' worth of hands-on ultrasound experience, equating to very little clinical competence in ultrasound utilization—as it takes hours of practice and hundreds of scans to become fluent at acquiring and interpreting ultrasound images. In short, the current medical school model isn't working.

Starting A Point-Of-Care Ultrasound Program At William Carey

First steps

Traditionally, William Carey University College of Osteopathic Medicine, where I teach, had been no different. Due to limited time and resources, each student was limited to only 6-8 minutes of 'hands-on' ultrasound time in a small clinical exam room with a traditional, bulky ultrasound device.

As the newly appointed Director of Ultrasound, I knew I had a chance to influence the training and exposure that medical students could have to point-of-care ultrasound. I was passionate about the problem and the tremendous upside that solving it could bring. Our solution was to partner with Butterfly Network to build an innovative new ultrasound program.



Our Butterfly deployment

In June of 2022, we deployed 80 Butterfly iQ+ probes to ensure our medical students would be able to develop true competency. The probes simply plug into a compatible smartphone or tablet, giving each student an intuitive, touch-based user interface through which to adjust gain and depth, select presets, and perform all the other actions required to collect a good image. The probe's first-of-a-kind Ultrasound-on-Chip™ technology enables it to emulate all three traditional ultrasound transducers—phased array, linear, and curvilinear—anywhere on the body merely by changing the settings on the app.

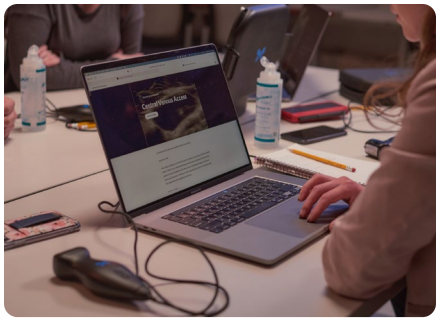
A former sonographer in one of my student cohorts once commented that the ability to have all three arrays on a single probe truly changes the game from a versatility standpoint. "Instead of having to change probes and fix all your settings, you can just find a preset at the touch of a button," said Brittnie Dunn Harbuck, a second-year student doctor at William Carey. "It's very convenient and easy to go from deep structures to superficial structures."

She also found the Butterfly's chip-based probe to be much more durable than the traditional systems. Traditional systems use piezoelectric crystals, which are prone to breaking and expensive to replace. Butterfly's probe, by contrast, is tested to reliably withstand a four-foot drop with an aluminum body casing.

The 2:1 model

Of crucial importance was Butterfly's price point: the affordability of the probes enabled William Carey to purchase enough probes to allow for a 2:1 student-to-probe ratio in the ultrasound workshops, significantly increasing the amount of hands-on ultrasound time each student receives, which is what ultimately translates to ultrasound proficiency. I firmly believe that either a one-to-one (one probe for every student) or two-to-one (two students share each probe) model is critical for the nurturing of true scanning competence.


The Butterfly iQ+ probe and mobile interface.


A student completing work in Butterfly's educational software.

> Our students have hands-on learning opportunities and can visualize on their ultrasound devices what they're seeing in their anatomy lab.

Implementing A “See One, Do One, Teach One” Curriculum

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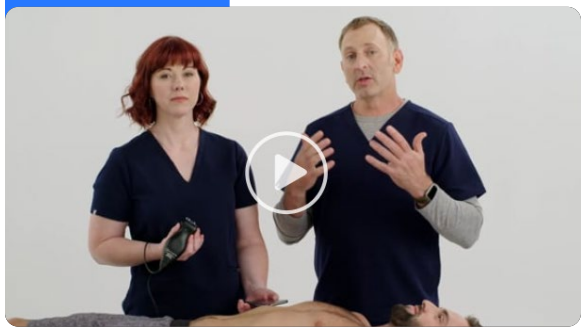
Just as important as Butterfly’s technology was its powerful education software and training modules enabled us to develop and implement a simple, but effective, “see one, do one, teach one” approach to ultrasound training.

See one



One of the hundreds of videos available on Butterfly.

To enable our students to “see one,” we use Butterfly Academy™, which features educational modules designed to guide students from their first scan to ultrasound competence. It includes focused courses made specifically for learners and allows faculty and administrators to assign any of these courses to specific students, as well as track their progress. Students can also access 150 tutorial videos built into the Butterfly app that demonstrate the most common scans, teaching both image acquisition and interpretation, which takes a lot of pressure to teach these ultrasound skills off of the medical school faculty. This allows students to brush up on previously developed skills or simply get a preview of the next learning goal and “know what to expect when we walk in the workshop,” as Brittnie said.

Do one

My workshop setup.

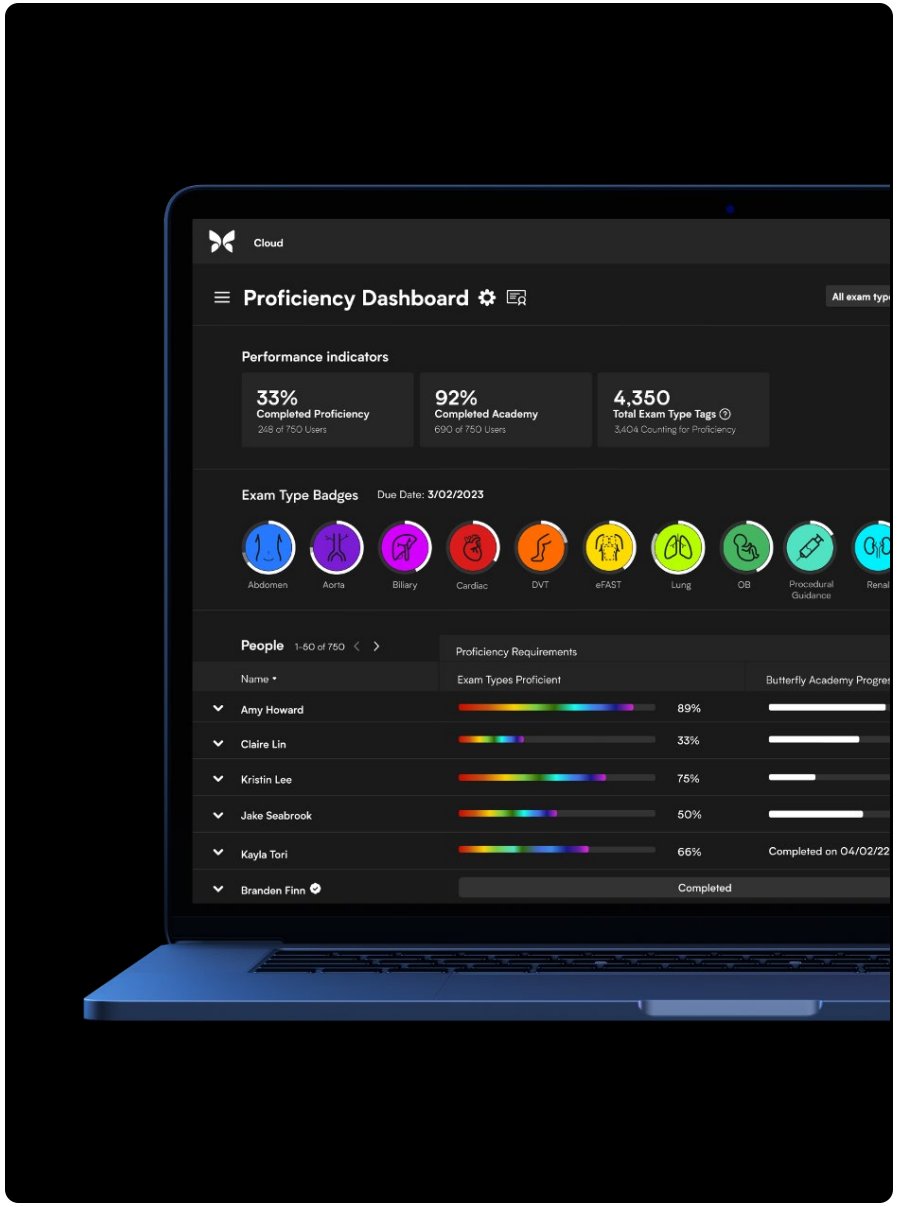
Next, our students “do one” at a one-hour workshop in which we average 2-3 workshops per student per month. To enhance the learner’s experience, we set up three separate video feeds at the front of the room: one is connected to a camera filming the probe placement on the model patient, another shows the ultrasound image transmitted in real time, and the third shows a “quick-hits” educational slide show including normal still/motion images as well as pathology. We have an incredible partnership with our Osteopathic Manipulative Medicine colleagues and utilize their lab space consisting of approximately 25 beds enabling us to train 50 students at a time, so with our typical class size, it takes four 1-hr workshops to train a particular ultrasound skill/topic.

Teach one

Students teaching one another to scan.

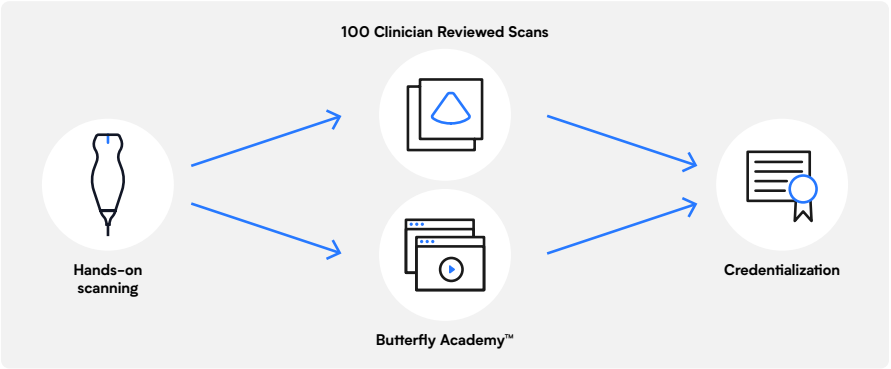
Finally, students “teach one” in independent, self-practice, self-paced workshops in which they work with each other to sharpen their scanning abilities. Not only is this an efficient teaching method, but it’s also an engaging way for students to gain deeper proficiency through explanation and demonstration.

Utilizing Butterfly's Robust Software To Drive Curriculum Forward



The power of unified workflow

Butterfly's secure cloud-based software platform records every single ultrasound exam that happens within our program and collects them into one streamlined, unified workflow. With students' scans captured, documented, and reviewed, we as professors are able to leverage Butterfly's Proficiency Management tool to get a birds-eye view of all of the scanning that our students are doing. We can assign scans to students by scan type and create proficiency goals connected to the QA grades we give each image. At our program, we require each student to obtain 100 clinician-approved ultrasound scans evenly split over 5 different exam types.* Each student gets instant feedback as I quickly evaluate the quality of the images, and students don't get credit for getting close or guessing—this is how I ensure true competence is developing. Alongside successful completion of Butterfly Academy, obtaining 100 ultrasound images, each with a passing score, is a critical requirement for our students to obtain their certification in the basics of point-of-care ultrasound.



100 Clinician-Reviewed US Scans
20 Echocardiograms
20 Gallbladder/Biliary
20 Renal/Bladder/GU/Ob
20 Vascular (Aorta/IVC)
Focus Assessment with OSonography in Trauma (eFAST) *10% Abnormal Utilizing SonoSim©

Building A Comprehensive Curriculum

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Many professors I've talked to are worried about finding time to teach POCUS on top of their existing curriculum. I found that POCUS training lends itself well to the natural course of learning med students experience in the first year.

My first-year curriculum, for reference:

OMS II Fall			
	Date	**Butterfly Avademy™**	**Ultrasound Workshop**
INTRO	8/10	Introduction to POCUS (15 min) and Introduction to POCUS guided Procedures (15 min)	Intro to Ultrasound
HEME/ONC	8/24	Abdominal Aorta (15 min), Cardiac Ultrasound 4 — Inferior Vena Cava (30 min), Central Venous Access (30 min) and Arterial Line Placement (15 min)	Vascular: Aorta, IVC
	8/31	Lower Extremity DVT (15 min) and POCUS Screening for Peripheral Artery Disease (15 min)	Vascular: DVT, Peripheral Artery Disease
	9/7		Simulation
CARDIOVASCULAR	9/28	Caption AI (15 min), Cardiac Ultrasound 1 — Basic Caridac Views (15 min), and Cardiac Ultrasound 2 — Pericardial Effusion (15 min)	Echocardiogram
	8/31	Cardiac Ultrasound 3 — Left Ventricular Syostolic Function (15 min) and Cardiac Ultrasound 4 — Right Ventricular Assessment (30 min)	Echocardiogram
	10/12		Simulation
RESPIRATORY	11/12	Introduction to Lung Ultrasound (30 min), Lung Ultrasound COVID-19 (30 min) and Thoracentesis (15 min)	Respiratory/Lung
HEENT/EMERGENCIES	11/9	eFAST Exm (30 min)	eFAST
	11/30		Simulation

OMS II			
	Date	**Butterfly Avademy™**	**Ultrasound Workshop**
INTRO	1/4	Ocular Ultrasound	Oculaar
RENAL/ENDOCRINE	1/11	Renal Ultrasound and Bladder Volume Measurement	Renal/Bladder
	1/25		Renal/Bladder
	1/25		Simulation
REPRODUCTION	2/1	Gynecological Ultrasound, Obstetrics - 1st Trimester	Pelvic
	2/15		Simulation
MSK/SKIN	3/1	Introduction to Musculoskeletal POCUS, Skin and Soft Tissue Ultrasound, and Ultrasound Guided Peripheral IV Insertion	MSK/Joint
	3/22	Lung Ultrasound - B-lines, Lung Ultrasound - Pleural Effusions, and Lung Ultrasound - Pneumothorax	Practice
GI	4/5	Gallbladder POCUS, Small Bowel Obstruction, Paracentesis	Biliary
	4/12		Biliary
	4/26		Simulation

> **Earlier integration of ultrasound into the assessment process leads to better patient care and outcomes.**

The Benefits Of Our Pocus Training Program

Driving success for our school and our students

Partnering with Butterfly has helped William Carey establish broad competency across a multitude of clinical domains. Ultimately, our robust point-of-care ultrasound program serves as a massive benefit to our students, our local GME program, their future patients, and our medical school as a whole.

Take one example: anatomy. Without applying any extra focus to this domain, our program has become excellent in anatomy instruction, because our students have hands-on learning opportunities and can visualize on their ultrasound devices what they're seeing in their anatomy lab.

And of course, developing ultrasound proficiency sets our students apart on their rotations in the clinics and hospitals. It's not unusual for our students to help teach ultrasound to other medical students and residents while on their clinical rotations. This unique sharpness with a critical modality should help them compete for positions in residency and beyond. Brittnie, the second-year in my program, agrees: "The future is ultrasound, and I feel like a lot of residency programs are really going to love that we have that knowledge and that background."

Key Requirements For Implementing A Point-Of-Care Ultrasound Program

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Of course, a level of focus and effort is necessary to create a successful program. In my experience, these are some of the key requirements for medical schools hoping to integrate POCUS effectively:

1

Faculty champion

A faculty champion in ultrasound, such as an ultrasound program director, to drive implementation, assess quality and ensure accountability. Butterfly's education and clinical team can help develop program champions by providing hands-on training and sharing best practices of point-of-care ultrasound education.

2

Sufficient probes

Enough probes to allow each student to get a substantial amount of 'hands-on' with the ultrasound probe. With ultrasound, practice makes perfect.

3

Trained faculty

Trained faculty to help the students during the ultrasound workshops. Butterfly's Solution Consultants are able to respond to questions and help train faculty.

4

Abnormals method

A method for teaching students how to recognize potential pathology or "abnormals." We use a simulated ultrasound training platform, but another option for schools is to switch to a 1:1 platform so they can obtain abnormals in their 3rd and 4th year as a medical student.

5

Adequate funding

Adequate funding to furnish and extend the program year after year. We had incredible financial support from Dr. Italo Subbarao, Dean of William Carey College of Osteopathic Medicine, as well as Dr. Stephanie Roberts, Director of Simulation at WCUCOM, but it also helped that the Butterfly system is cost-effective.

Conclusion

Ultrasound probes today are making the kind of impact on clinical practice that the stethoscope did when it was introduced 200 years ago. As other medical schools develop point-of-care ultrasound programs, I hope they will find partners like Butterfly that can help them drive effective adoption and curriculum development. We are seeing the transformative results firsthand. Our medical students enjoy a deeper educational experience and will be uniquely prepared for their future medical careers because of their training in POCUS.

The patients of today and the patients of the future need our doctors to be ready to take advantage of all point-of-care ultrasound has to offer.

*The five types are echocardiograms, gallbladder/biliary, renal/bladder/GU/Ob, vascular and eFAST exams.

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Butterfly Tutorials are not a substitute for professional clinician training and experience and may not include all possible patient-to-patient variations. Clinicians are solely responsible for patient care and for exercising their independent clinical judgment at all times.

Dr. Anderson is a Butterfly-compensated consultant.