

SET 3: for classes with 4 partner-pairs (3 options)

Note: You must have 2, 3, or 4 partner pairs for these screens to operate properly.

Option 1, CO₂-wave 4 pair

Partner-pair display options are for working with groups where people pair up for exploring themselves together. It can take many forms: couples counseling, role playing, coaching, and assisting one another in self-evaluating and learning breathing behaviors. The CO₂-wave pair display option permits simultaneous observation of the PCO₂ waveforms of four partner-pairs. Screens are grouped in pairs and the zooming function brings up specific pairs of screens rather than individual graphs.

Options 2-6

Breath-rate 4 pair and End-Tidal 4 pair

HRV-wave 4 pair, HRV-size 4 pair, Heart-rate 4 pair

The above display options are identical to Options 4-8 described for SET 2, with one exception: the HRV-wave 4 pair does NOT include the superimposed PCO₂ waveform.

SETS 4 and 6: for classes with 5-6 and 3-4 individuals

In each set, options 1-5 are identical to the ones for Set 2.

SETS 5 and 7: for classes with 3 and 2 partner-pairs

In each set, options 1-3 are identical to the ones for Set 3.

SET 8: for classes with two learners, one partner-pair

There are three options available for Set 8.

Option 1, CO₂ learning

The CO₂ learning display option includes three graphs for each learner:

- CO₂ waveform,
- ETCO₂ history graph (20 second averages), and
- Breaths per minute history graph (20 second averages).

This configuration permits simultaneous monitoring of all breathing signals in both learners. Zooming permits you to focus on the specific physiology of either individual.

Option 2 and 3, Mechanics Two and Br-rate Challenge

These screen options are identical to the ones for Set 2.

DATA REPORTS

Read the Quick Start card (or the Quick Start software screen).

- Exit the live screen.
- When prompted to enter a new client name, enter a "group name."
- Breathing data is automatically saved; uncheck signals not desired.
- Click on "Manage Data," rather than on "Run Session"
- Select a "group" name and a session date/time. Click "view."

Once you have entered the Report screen, notice that there are eight report options: one for each learner, 1-8. There is one display option for each learner as follows: CO₂ waveform, ETCO₂ history, breath-rate history

As described elsewhere, you may click on the Excel report icon at the bottom of the screen, and move the graphs you have selected and adjusted into an Excel report, along with numerical values that you may specify as desired.



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Start-Up: Capno-4/8

FIRST: Read Quick Start card.

Powered USB hubs are required for using multiple CapnoTrainers®.

SETTING UP

Hardware:

- Connect an overhead projector to your computer.
- Locate your powered USB hubs.
- You may use any number of hubs, e.g., 4 CapnoTrainers per hub
- Plug the hub(s) into a power source.
- Plug the hub(s) into your computer, OR
- Plug the hubs into yet another hub and then into the computer.*
- Plug in up to 8 CapnoTrainers, positions do not matter.
- Wait for hub position lights to turn on.
- Verify CapnoTrainer power lights are blinking, indicating power.

*NOTE: Plugging all of the hubs into a single additional hub (1) makes connecting to your computer easier, (2) makes it easier to work with 8 people at a time, and (3) avoids possible USB problems associated with power management. You may also elect to use wireless hubs, although they may be temperamental.

Software:

- Click on the CapnoTrainer icon (CO₂ molecule).
- Click on "RUN SESSION." Select **Capno-8** application.
- Wait for about 10 seconds for the system to initialize.
- The power light on each unit should now shine steadily.
- Each CapnoTrainer signal will appear on its own graph display.
- Identify which instruments are in which graphs; then label them with number decals.

ADDING AND SUBTRACTING CAPNOTRAINERS

Less than eight CapnoTrainers may be used. If you plug in less than eight, be sure to use the correct units, e.g., choose CapnoTrainers numbered 1- 6 when using six CapnoTrainers. If you fail to do so the numbers on the instruments will not correspond to the numbers shown in the display windows. If you are using only ONE CapnoTrainer select the "CapnoLearning" application, NOT the "Capno-8" application.

If you have activated the software using less than eight CapnoTrainers and subsequently decide to use additional units, exit the software, plug in the additional unit(s), and then reactivate the software. Do NOT unplug CapnoTrainers while the software is activated. EXIT the software before unplugging units.

CALIBRATION

Each instrument can be zero-calibrated one at a time by engaging the single-user CapnoLearning application. Enter the application and then click on "Calibrate" in the upper left portion of the screen. Click on "zero-calibrate" and follow instructions. Upon exiting the application you will be prompted as to whether or not you want to save the new calibration. Answer "yes." Then re-enter the CapnoLearning application and calibrate another instrument.

USB HUBS

If you do not have enough USB ports on your computer, you will need **AC powered hubs**. If you are using a Capno-4, buy two hubs. If you are using a Capno-8, buy three hubs. They must be **powered by wall current** while using them with CapnoTrainers. Your computer by itself will NOT provide adequate power for hubs running multiple instruments.

Many computer-hub combinations will not manage the power requirements of more than three instruments at a time on each hub. If this is true for you, (1) for the Capno-4 run two instruments with each hub, or (2) for the Capno-8 run three instruments with each of two hubs, and then two instruments with a third hub. These problems have to do with the USB power management system of your computer, while using multiple devices.

SIGN-ON PROBLEMS

Sometimes your CapnoTrainers will not sign-on. Be sure the all of them having blinking yellow lights before running the software; this means that they are getting power. If not, exit the software entirely and unplug them all from the hubs. Plug in each one, one at a time, checking each time to be sure that the yellow light begins to blink. **If problems persist**, reboot your computer to reset the USB power management system.

SWITCHING BETWEEN APPLICATIONS

It is important to note that if you have just been using the single user application, **you MUST exit the software ENTIRELY**, that is, click on "Exit" and go back to the desktop, BEFORE running the Group software application; if you don't, the ETCO₂ readings may inflate.

DIFFERENCES AMONG INSTRUMENTS

End-tidal CO₂ (ETCO₂) readings among instruments may vary significantly, from 4 and 5 mmHg. If one instrument is off 2 mmHg in one direction and the other in the opposite direction, the difference between the two instruments will be 4 mmHg. The acceptable error for medical capnometers is ± 2 mmHg, that is, 2 mmHg in either direction. The CapnoTrainer, an educational capnometer, will likely show at least the same margin of error.

PHYSIOLOGY DISPLAY OPTIONS

The Capno-8 software is designed for teaching and learning optimal breathing behavior in group situations, from 2 up to 8 learners. The software has been configured for use with both individuals and partner pairs.

At the top of the screen there are eight physiology display option headings, such as "CO₂-wave 8." Clicking on any one of these headings will bring up its associated display screen. Click on the **down arrow** to the right of each heading for the **dropdown menu** of up to seven additional display options.

The 8 sets of display screens from left to right are as follows:

SET 1: orientation screens (4 options)

Option 1: Start-up Capno-8: same as card

Option 2: Quick Start Card: same as card

Option 3: Lessons for clients

SET 2: for classes with 7-8 participants (5 options)

Option 1, CO₂-wave EIGHT

The CO₂ waveform is a continuous measurement of **partial pressure carbon dioxide (PCO₂)**, "partial pressure" because it is only part of total atmospheric gases (oxygen, nitrogen, and so on). Gases are measured by the pressure they exert, in millimeters mercury, or **mmHg**. All measurements of PCO₂ are in mmHg.

When a person inhales, CO₂ in outside air is being measured. These readings are near zero (0.3 mmHg). It is not uncommon, however, that CO₂ may accumulate in a room with poor ventilation, or around the nose of some individuals, and consequently read one or even two mmHg rather than zero.

Think of the air you breathe as "tides" of air moving in and out of your lungs. When you exhale, the "tide of air" is out, the "End" of the "Tide." The "peak" level of CO₂ during the exhale is thus known as End-Tidal CO₂, the ETCO₂.

ETCO₂ is NOT a measurement of "how much" CO₂ is being exhaled. It is a measurement of average PCO₂ in the alveoli, the basic gas-exchange units in the lungs. ETCO₂ is highly correlated with arterial PCO₂ (PaCO₂) in healthy people. **Low PaCO₂ is hypocapnia**. Hypocapnia may trigger, exacerbate, perpetuate, or cause all kinds of symptoms and deficits as a result of learned overbreathing behavior.

During exhalation the PCO₂ level will rise to between 35 and 45 mmHg during optimal breathing. Peak levels (ETCO₂) below 35 are evidence of **hypocapnia**: 30-35 mmHg is moderate to mild overbreathing, 25-30 mmHg is serious to moderate overbreathing, and 20-25 mmHg is severe overbreathing. Above 45 mmHg, although uncommon, is hypercapnia.

The CO₂-wave EIGHT display option permits simultaneous observation of the PCO₂ waveforms of eight learners during self-discovery evaluations and behavioral learning sessions supervised by an instructor or practitioner. Examining the CO₂ waveform, also known as the raw signal (or capnogram), permits you to observe breathing rate, rhythm, gasping, breath holding, and the like. In essence, it is a picture of air flow.

There are three boxes to the left of each left-side graph and three boxes to the right of each right-side graph: the CapnoTrainer number (BOX 1), the last 20 sec average of breathing rate (BOX 2), and the last 20 sec average of End-Tidal CO₂ (BOX 3).

You may click on the zoom icon to focus on the breathing of a specific learner. Click on the "freeze" icon at the bottom of the screen to discuss observations. Look at history by clicking on the "fast" and "slow" icons on the left side of the screen. Time scales of all graphs are auto-linked; changing one changes them all.

Option 2, Mechanics EIGHT

Although the breathing mechanics changes frequently and abruptly, as a function of changes in behavior and emotions, chemistry should nevertheless remain consistently within a healthy range, 35 to 45 mmHg PCO₂. The learning objective, using this screen, is to maintain good chemistry while systematically changing breathing mechanics.

Eight breathing templates are presented, each with a set of triangles and a moving ball. Inhale as the ball rises. Exhale as the ball descends. Pause before inhaling, as the ball hesitates between triangles at the bottom of the template. Although "tracking the ball" is preset to breathing at six breaths per minute, you may adjust breathing rate as desired by clicking on the "1" icon (vertical icon bar). A change with the "1" icon changes ALL eight screens.

Option 3, Br-rate challenge

Good breathing regulation means maintaining normal PCO₂ levels over a broad range of breathing rates. Proper PCO₂ levels are maintained by changing the depth (size) of the breath while holding breathing rate constant. This means detecting lower than normal CO₂ levels by learning to recognize the symptoms of hypocapnia, by learning what optimal breathing "feels like."

This display screen is used for testing the effects of breathing rates on PCO₂. Use the "1" icon to set different breathing rates, typically breathing rates between 4 and 25. **Step 1:** Do a baseline on breathing rate for about two minutes. Take note of average breathing rate on a breathing rate screen. Return to the breathing-rate challenge screen. **Step 2:** Set initial breathing rate, with the "1" icon, to the same level observed during baseline. **Step 3:** Start data recording ("red dot"). **Step 4:** Click on the "Event Marker" icon (green arrow pointing down). A box with a "note line" will appear in upper left corner. Enter the breathing rate you just previously set with the "1" icon. **Step 5:** Have your client track the ball with her/his breathing for about two minutes. **Step 6:** Change the breathing rate 5 or 6 times. **Step 7:** Turn off data recording. Save the data under a client or group name. Go to Manage Data and review the results.

Option 4 and 5, Breath-rate EIGHT and End-Tidal EIGHT

The Breath-rate EIGHT display option permits you and your learners to observe the history of breathing rate for eight learners. Breathing rate is calculated based on the distance (time) between waveform peak values, that is, the ETCO₂ values. Each bar on the graph represents a 20 second breathing rate average. You may change the bar averages by clicking on the averaging icon (left side of screen), e.g., 30 seconds.

Breathing rate is often mistakenly interpreted as indicative of optimal, or as less than optimal respiration. A person may be breathing as slowly as four breaths per minute, but yet be overbreathing, or as fast as 30 breaths per minute without overbreathing.

And, the End-Tidal EIGHT display option permits observation of End-Tidal carbon dioxide (ETCO₂) history, 20 second averages, for eight learners.