



Figure 6 COPDTrainer training approach. Our smartphone app is meant to enable individual training options of a patient, besides the training with therapists. (1): Patient/therapist selects Teach-mode or Train-mode. (2): Select an exercise, here Arm extension. (3): Begin exercising after pressing start. (4): After exercising different summary screens are shown, depending on the operation mode.

### 3.3.1 Teach-mode operation

The Teach-mode allows therapists to personalise the system for a trainee under direct supervision, e.g. during the regular physiotherapy practicing times. Any selectable exercise can be performed and the trainee learns from the therapist how to attach the phone and perform a particular exercise. Illustrations are shown on the screen after selecting an exercise to remind the patient about the exercise execution independently of the operation mode. In Teach-mode, the therapist initially guides the patient during the first trials to perform the exercise accurately. Subsequently, the Teach-mode recording is started by pressing a large button on the phone's screen. A pre-set number of exercise repetitions (ten in the current implementation) will then be acquired from the phone's inertial sensors. From the recorded data, all necessary exercise model parameters, i.e. mean and variance of the duration and of the range of motion of the limb during the ten repetitions) are estimated and stored for further use in the Train-mode. The derived parameters are shown on the smartphone, such that the therapist and trainee can review them. If the therapist judges that the trainee did not perform the exercise with sufficient quality, the session could be repeated. Moreover, the system checks consistency of the exercise repetitions