



APPROACHING PERFECT SWIMMING: **IMPLEMENTING DELIBERATE PRACTICE**

By Rod Havriluk, Ph.D.

This document is part of The Approaching Perfect® series which explores the increasing use of technology to improve performance and enhance competitiveness. Although athletes at any level can use the series, swimmers who have already mastered some basic skills may be better suited to apply the principles presented throughout the program.

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IMPLEMENTING DELIBERATE PRACTICE IN TEAM TRAINING

The following activities (all 96 bullets) are not merely recommended but required for a swimmer to approach his/her potential. The list of activities is based on Ericsson's deliberate practice and yields the best results when followed explicitly. Many of the activities are designed to simplify the critical movements and/or to remove movements that make it difficult to identify the technique elements that need to change.

Swimmers on any team, including seasonal teams, need repetitions of the first 35 bullets (Instructions). Year-round swimmers initially need repetitions of the first 47 bullets (Instructions and Video Capture, Above Surface, Front or Side View).

A schedule for each group of activities is included. Coach can vary the schedule depending on skill level, however, all activities are appropriate for all skill levels.

Instructions - Daily, Weekly, or Monthly

Coach instructs swimmers in classroom.

- Coach uses clear instructions to explain all four strokes with a model of optimal technique.
- Coach explains cues to see and feel on all four strokes with respect to a model of optimal technique.

Coach demonstrates optimal arm motion in classroom. Swimmers simulate arm motion in front of mirrors. Coach identifies technique elements to change.

- Swimmer simulates breaststroke arm motion.
- Swimmer simulates butterfly arm motion.
- Swimmer simulates freestyle arm motion.
- Swimmer simulates backstroke arm motion.

Coach demonstrates deck drills. Swimmers simulate deck drills. Coach identifies technique elements to change.

- Swimmer simulates streamline lying on the back.
- Swimmer simulates breaststroke kick lying on the front on a hip-width bench (or on the ground).
- Swimmer simulates breaststroke and butterfly breathing by sitting or standing and completely extending at the neck.
- Swimmer simulates finish of butterfly and freestyle push phase with wall push-ups.

Instructions - Daily

Coach instructs swimmers on pool deck.

- Coach demonstrates a cue.
- Coach reminds swimmers of a cue to see and/or feel.

Coach constantly adjusts swim distance, swim complexity, breathing frequency, effort level, and fatigue level to make task difficulty appropriate for age and skill level of swimmer(s). Coach identifies technique elements to change on each swim.

For young swimmers, coach stands in the pool where the swimmers stop – initially, between 5 and 10 yds from wall, depending on age and activity. As swimmers progress, coach can gradually increase the distance from the wall. For older and/or more advanced swimmers, there is no need for coach to get in the water as swimmers can be instructed to stop at a certain point.

Swimmer pushes-off on his/her front, glides in a streamline,

- and stops at the coach or when there is a need to breathe.

Swimmer pushes-off on his/her front (or back for backstroke), glides in a streamline,

- kicks breaststroke, and stops at the coach or when there is a need to breathe.
- kicks butterfly, and stops at the coach or when there is a need to breathe.
- kicks freestyle, and stops at the coach or when there is a need to breathe.
- kicks backstroke, and stops at the coach.

Swimmer pushes-off on his/her front (or back for backstroke), glides in a streamline,

- swims breaststroke, without breathing for one stroke, and stops at the coach.
- swims butterfly, without breathing, using only the arms, and stops at the coach or when there is a need to breathe.
- swims freestyle, without breathing, and stops at the coach or when there is a need to breathe.
- swims backstroke, and stops at the coach.

Swimmer pushes-off on his/her front, glides in a streamline,

- swims breaststroke, alternating non-breathing and breathing strokes, and stops at the coach.
- swims butterfly, alternating non-breathing and breathing strokes, and stops at the coach.
- swims freestyle, alternating non-breathing and breathing strokes, and stops at the coach.

Swimmer pushes-off on his/her front (or back for backstroke), glides in a streamline,

- swims breaststroke, and stops at the wall.
- swims butterfly, with limited breathing, and stops at the wall.
- swims freestyle, with limited breathing, and stops at the wall.
- swims backstroke, and stops at the wall.

Swimmer pushes-off on his/her front, glides in a streamline,

- swims freestyle, breathing every other stroke (towards coach), and stops at the wall.

Swimmer pushes-off on his/her front, glides in a streamline as far as possible,

- swims breaststroke, glides as far as possible after each stroke, counts strokes for the length, and stops at the wall.

Swimmer pushes-off on his/her front, glides in a streamline only until slowing to racing speed,

- swims freestyle, counts strokes for the length, and stops at the wall.
- swims butterfly, counts strokes for the length, and stops at the wall.
- swims backstroke, counts strokes from the flags to the wall, and stops at the wall.

Swimmer gradually increases stroke rate, as instructed by coach.

Coach reminds swimmers of one cue before swim.

- Swimmer focuses on one cue.

Coach provides feedback to swimmers after swim.

- Swimmer compares coach feedback to self-feedback.

Video Capture, Above Surface, Front or Side View - Weekly or Monthly

Coach videos swimmers above surface from a front or side view on a weekly or monthly basis (depending on skill level).

Coach analyzes videos in classroom and identifies technique elements to change. The following variables can all be analyzed for the position of the body part with respect to the surface.

Coach analyzes breaststroke:

- Non-breathing (gliding) head position
- Breathing head position

Coach analyzes butterfly:

- Non-breathing head position
- Breathing head position
- Hip motion
- Arm recovery

Coach analyzes freestyle:

- Non-breathing head position
- Breathing head position
- Arm recovery

Coach analyzes backstroke:

- Head position
- Chest position
- Foot position
- Arm recovery

Instructions – Daily or Weekly

Coach analyzes the hand position and hand orientation of a swimmer wearing hand paddles from an above the surface front and side view and identifies technique elements to change.

Coach analyzes breaststroke:

- Glide
- Outward scull

Coach analyzes butterfly:

- Entry phase
- Pull phase
- Exit phase

Coach analyzes freestyle:

- Entry phase
- Pull phase
- Exit phase

Coach analyzes backstroke:

- Entry phase
- Pull phase
- Exit phase

Video Capture, Underwater Front View - Weekly or Monthly

Coach videos swimmers underwater from a front view on a weekly or monthly basis (depending on skill level).

Coach analyzes videos in classroom and identifies technique elements to change.

Coach analyzes breaststroke:

- Streamline head position with respect to torso
- Knee width with respect to hips
- Knee depth with respect to hips
- Outward scull hand position with respect to elbows

Coach analyzes butterfly:

- Head position with respect to torso
- Push phase hand position with respect to legs
- Pull phase hand position with respect to elbows and shoulders
- Entry hand position with respect to shoulders

Coach analyzes freestyle:

- Head position with respect to torso
- Push phase hand position with respect to leg
- Pull phase hand position with respect to elbow and shoulder

- Entry hand position with respect to shoulder

Coach analyzes backstroke:

- Head position with respect to torso
- Push phase hand position with respect to leg
- Pull phase hand position with respect to elbow
- Entry hand position with respect to shoulder

Video and Hand Force Capture, Underwater Front View - Monthly or Quarterly

Coach captures underwater video (from a front view) and hand force data on a monthly or quarterly basis (depending on skill level).

Coach analyzes underwater video and hand force data in classroom and identifies technique elements to change.

Coach analyzes breaststroke hand position and force during:

- Outward scull
- Inward scull
- Glide

Coach analyzes butterfly hand position and force during:

- Push phase finish
- Pull phase to push phase transition
- Entry phase
- Beginning of elbow flexion

Coach analyzes freestyle hand position and force during:

- Push phase finish
- Pull phase to push phase transition
- Entry phase
- Beginning of elbow flexion

Coach analyzes backstroke hand position and force during:

- Push phase finish
- Pull phase to push phase transition
- Entry phase
- Beginning of elbow flexion

Coach calculates advanced analysis variables from underwater video and hand force data on a monthly or quarterly basis (depending on skill level).

- Active drag coefficient (C_d), expressed as a dimensionless number

$$C_d = (\text{average hand force}) / (.5 * \rho * \text{body cross-sectional area} * \text{velocity squared})$$
- Symmetry index (SI), expressed as a percentage

$$SI = (100 * PFD) / (.5 * PFS)$$

PFD = peak force of left hand - peak force of right hand
PFS = peak force of left hand + peak force of right hand

- Time of propulsion phase and time of non-propulsion phase, expressed as time
 Propulsion time for freestyle, backstroke, or butterfly = pull phase time + push phase time
 Non-propulsion time for freestyle, backstroke, or butterfly = entry phase time + exit phase time
 Propulsion time for breaststroke = outward scull phase time + inward scull phase time
 Nonpropulsion time for breaststroke = recovery phase time + glide phase time
- Index of Coordination (IdC) for freestyle or backstroke, expressed as a percentage

$$\text{IdC} = 100 * (\text{Gap time average} / \text{Stroke cycle time})$$
 Gap1 time = end of left hand propulsion – beginning of right hand propulsion
 Gap2 time = end of right hand propulsion – beginning of left hand propulsion
 Gap time average = (Gap1 time + Gap2 time)/2
- Total Gap Time (TTG) for butterfly or breaststroke, expressed as time

$$\text{TTG} = \text{Gap1 time} + \text{Gap2 time} + \text{Gap3 time} + \text{Gap4 time}$$
 For butterfly:
 Gap1 time = beginning of arm catch - beginning of first downward kick
 Gap2 time = beginning of arm pull - beginning of first upward kick
 Gap3 time = beginning of arm push - beginning of second downward kick
 Gap4 time = beginning of arm recovery - beginning of second upward kick
 For breaststroke:
 Gap1 time = end of leg propulsion - beginning of arm propulsion
 Gap2 time = beginning of arm recovery - beginning of leg recovery
 Gap3 time = end of arm recovery - end of leg recovery
 Gap4 time = 90° flexion in arm recovery - 90° flexion in leg recovery

Video Capture, Underwater Side View - Quarterly or Yearly

Coach videos swimmers underwater from a side view on a quarterly or yearly basis (depending on skill level). (A horizontal distance reference is necessary to calculate the swimming velocity or the intracycle velocity fluctuation.)

Coach analyzes videos in classroom and identifies technique elements to change.

Coach calculates advanced analysis variables from a side view underwater video.

- Swimming velocity (SV), expressed as distance per time

$$\text{SV} = \text{distance that the body moves horizontally} / \text{the time for the body to move the horizontal distance}$$
- Intracycle velocity fluctuation (IVF), expressed as a percentage

$$\text{IVF} = 100 * ((\text{average of multiple instantaneous body velocities}) / (\text{mean body velocity}))$$