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STEP-BY-STEP USRPT PLANNING AND DECISION-MAKING PROCESSES

and

EXAMPLES OF USRPT TRAINING SESSIONS, MICROCYCLES, MACROCYCLES, AND TECHNIQUE INSTRUCTION

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PART A[1]

STEP-BY-STEP USRPT PLANNING AND DECISION-MAKING PROCESSES

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[*Editor's Note*: Readers should be aware of the growing number of imposters who claim they *"know all about race-pace training"*, who *"have been using it for years"*, *"have tried it but it did not work"*, *"have taken it one step further"*, etc. USRPT is a training format built on scientific evidence. It is race-pace training using the ultra-short training format. In its structure are training effects that exceed most of the claims made for the beneficial effects of traditional training. USRPT is not low-yardage. To the contrary, USRPT facilitates more work in the pool than traditional training. The work is high-intensity and race-specific so that training effects transfer to racing performances. It reduces injury and prevents excessive fatigue by moderating the workload for all swimmers as individuals. Claims made on bulletin boards and in newsgroups and discussion groups mostly originate from individuals endowed with deep-seated ignorance and propensities to display publicly that which they do not know. USRPT is very structured in terms of format but extremely flexible in terms of content. This manual defines most of the USRPT parameters which should be understood by swimmers and coaches so they can advance their swimming experience and performances.

Some of the misconceptions that have been spread about USRPT are: i) it is only for sprinters, whereas its real strengths are equally manifested with distance swimmers; ii) swimmers do not work hard enough, whereas they really do in the work that is relevant for racing; and iii) the lack of drills, strength training, and kicking does not prepare a swimmer fully. That last point is a matter of locating the scientific studies that show irrelevant training is not associated with improvements or high-level performances in the sport. (BSR 10/16/2013)]

[1] The author is indebted to Melinda Wolff for her editorial assistance in the preparation of this bulletin.

STEP-BY-STEP USRPT PLANNING AND DECISION-MAKING PROCESSES

The purpose of this manual is to explain the steps and decision-making criteria that need to be observed to truly utilize the science behind the USRPT format. The adherence to documenting every statement that has been present in most other USRPT papers and descriptions will not be fully followed in this product. Only when new concepts are presented will a reference for its content be cited.

Unless stated elsewhere, it is assumed that training will occur in a 25 y/m pool. This guide only addresses the conditioning/energizing aspects of USRPT. Equally important are the development of specific race-pace techniques and psychological strategies. Implementing techniques according to valid principles of pedagogy has been presented at length by Rushall (2011, 2013c).

The planning of USRPT practices requires considered decision-making. Since every set has the express purpose of specifically training for a competitive event, a total practice will consist of working on different events to the extent that time will allow. USRPT requires criteria be followed when building the content of sets and the practice. The steps outlined below are appropriate for the sets and how those sets fit into the total time-frame of a training session will be suggested.

Terminology

- When a set of repetitions of swimming, a particular type of exercise in the weight room, or a session on a swim-bench is planned, each block of exercises attempted is a *training stimulus*. At the completion of the training stimulus experience, the body should have changed in the way the stimulus provoked. In accordance with the Principle of Specificity, specific exercises train specific movements and do not generalize to other activities.
- How the swimmer reacts to the training stimulus is a *training response*.
- What results from a full exposure to a training stimulus is a *training effect*.
- The degree of demand of the training stimulus is the level of *training stress* (Rushall, 2013a; Rushall & Pyke, 1991).

Age and Swimming Session Concepts with Relevance For 10-and-under Swimmers and Their Relationship to Older Age-groups

USRPT sessions are not purely USRPT of surface swimming. A substantial amount of the daily and microcycle training experiences should include skills development (e.g., turns for all strokes, dives, relay changes, etc.), technique instruction (mostly in conjunction with USRPT repetitions but also as sole introductory activities (Rushall, 2013c)), and 50-m training for all strokes. Thus, on some occasions two USRPT sets might be all that can be accommodated in one two-hour pool session.

Very young swimmers do not need to participate in heavy, demanding training of a traditional nature nor do they need to overdo USRPT. Two growth periods need to be accommodated. The first is the skill development phase which occurs in both boys and girls between the ages of 7 and 10 years. The time of onset, the time of completion, and the length of time in the phase varies considerably across this age group, although a majority of children exit the stage before 10 years. Consequently, for ages 10 and under a heavy emphasis on technique and skill instruction at USRPT pace is a sound investment in the development of young people with a view to their enjoyment of swimming as a life-long physical activity. The second growth period includes and follows the onset of puberty. There is a suppression of performance capacity factors (e.g., VO_{2max}) from growth for a short time

either side of and during the gender changes associated with puberty (Astrand, 1952; Rushall, 1960). Again there is considerable variation in the length of time spent in this suppression stage among individuals. It demands that the coach and parents support the swimmer through this phase rather than encourage/demand maintaining a previous rate of performance improvement.

The skill development phase is very important for girls as it is the only phase where their skill development is accelerated. With boys there is also a post-pubertal stage of skill development that occurs approximately 12 months after puberty and can last for as long as 18 months.

Below is a broad suggestion of the progression of swimming training experiences for children 8 years-old and up. The suggestions can be modified to reflect the stage of growth (e.g., early vs. late maturers) and the reaction of individuals to the social environment and the activity as it is presented through a coach's programs. The amount of training is the minimum for USRPT. Adding one or two more sessions per week as long as the children continue to enjoy their swimming experience is quite acceptable.

Suggestions

- 8 years and younger – three practice sessions per week emphasizing fun and technique. One USRPT set per session.
- 9 years – four sessions per week emphasizing fun and technique. Two USRPT sets for two sessions and one for each of the other two sessions.
- 10 years – five sessions per week emphasizing skills, technique, and fun. Two USRPT sets for two sessions and one for each of the other three sessions. [At this stage the coach/parent should evaluate if the swimmer is still enjoying swimming: (i.e., they look forward to going to practice at the pool).]
- 11 years – six sessions per week emphasizing skills, technique, and enjoyment. Two USRPT sets for three sessions and one for each of the other three sessions. Begin special 50 m training; three 30-minute activity sessions within a week's practices.
- 12 years – seven to eight sessions per week emphasizing skills, technique, enjoyment, and achievement. Three USRPT sets for two sessions; two USRPT sets for two sessions; and one for each of the other three or four sessions. Program these sets in sequence as heavy, moderate, and light USRPT work, in that order, over the week. Schedule eight sessions and if a swimmer appears fatigued to the extent that quality swimming will be compromised, give the swimmer that session or the next session off. Three activity sessions focusing 40 minutes on 50 m training within the week's practices.
- After puberty – eight sessions per week emphasizing skills, technique, and training/ competition achievements. Three or four USRPT sets for three sessions, and two USRPT sets for the remaining sessions. If the swimmers appear tired, reduce the number of sets in the scheduled 3-4 set sessions. Four activity sessions focusing 40 minutes on 50 m training within the week's practices.
- 14 years and older – eight or nine sessions per week emphasizing skills, technique, race-strategies and simulations at practice, and training/competition achievements. Three or four USRPT sets for four sessions, and two sets per session for the remainder. If the swimmers are judged to be adapting well, increase the number of 3-4 set sessions. If the swimmers appear tired, reduce the number of sets in scheduled 3-4 set sessions. Continue to place great emphasis on skills and technique. Four activity sessions focusing 40 minutes of 50 m training within the week's practices.

The above stages and the progressions in USRPT activities for developing swimmers are summarized in Table 1.

TABLE 1. A SUMMARY OF THE DEVELOPMENTAL STAGES SUGGESTED FOR MINIMAL USRPT PROGRAMS

AGE IN YEARS	SESSIONS/ WEEK	CONTENT	USRPT / SESSION
8	3	Fun and technique	1
9	4	Fun and technique	2 for 2; 1 for 2
10	5	Skills, technique, and fun	2 for 2; 1 for 3
11	6	Skills, technique, and enjoyment	2 for 3; 1 for 3
12	7-8	Skills, technique, enjoyment, and achievement	3 for 2; 2 for 2; 1 for 2/3
After puberty	8	Skills, technique, training/competition achievements	3/4 for 3; 2 for 6
14+	8/9	Skills, technique, race strategies and simulations at practice; training/competition achievements	3/4 for 4; 2 for 4/5

Step 1: Develop a General Outline of the Practice

Since a practice consists of providing training stimuli (i.e., several USRPT sets for different events), it is wise to have a reasoned structure for a practice that will use time wisely and provide the best experiences for the swimmers. In doing that, the coach has to decide what events will be trained for and what swimmers will be exposed to the training stimuli for those events.

It is possible to have the whole pool training for the same event as is outlined in Example 1 below. Alternatively, it is possible to have lanes requiring swimmers to complete different sets that are designed to meet the special needs of individual swimmers. Planning a time x event schedule for a practice is the first step to organizing effective USRPT.

As has been pointed-out elsewhere (Rushall, 2013b), the general structure of a USRPT format is as below. Coaches need to make decisions that fulfill the criteria steps outlined.

i. A brief warm-up (a maximum of five minutes). Swimmers should be warm from land warm-up work, and the pool work is basically a brief familiarity experience. Getting straight into repetition work is more like the competitive experience where swimmers spend more than 20 minutes not in the pool before racing. [Twenty minutes is the length of time for a pool "warm-up" to wear off (West et al., 2012). Thus, USRPT simulates close to realistic racing circumstances.]
ii. Since swimmers are not fatigued, the first activity in a practice is the best time to learn skills (e.g., dives, turns, finishes, double-leg kicking) and/or perform 50 m event practices. These activities do not have to be practiced every day but do make a welcome variation in swimmers' training experiences.
iii. The first USRPT set and the amount of time that will be allocated.
iv. The first recovery activity to prepare the swimmers for the next set.
v. The second USRPT set and the amount of time that will be allocated.
vi. The second recovery activity to prepare the swimmers for the next set.
vii. The third USRPT set and the amount of time that will be allocated.
viii. The third recovery activity to prepare the swimmers for the next set (if time allows) or to recover prior to leaving the pool.

In two hours of pool availability with good time management, it is possible to perform four USRPT sets for four different events as well as allow sufficient time for beneficial between-sets recovery. When skill practices are included, the usual number of specific race-pace training stimuli is three.

It is sufficient to only provide one training stimulus for a particular race per practice session. Multiple training stimuli in the same session run the risk of excessively fatiguing swimmers and diminishing the relevance of training effects for an event. It should be understood that in a USRPT set, swimmers complete greater total yardage at race-pace than is possible in any traditional set format. That greater exposure to higher-intensity activity that is repeated until performance quality failure is a sufficient stimulus to warrant extended recovery (a minimum of four hours and possibly as much as 12 hours and in special cases more). One intense exposure to a training stimulus is all that is required to produce a training effect (a race-pace "overcompensation"; Rushall & Pyke, 1991) as the training response.

Training has to at least be as demanding as competing. An important feature underlying USRPT is its simulation of race demands. Those demands influence the programming of USRPT sets. Simulation warrants considering more than single races. In many school, college, and age-group meets, swimmers often are required to perform in as many as three individual events plus one or more relays, mostly within the span of approximately two hours. Thus, the programming of three or

four USRPT sets in a two-hour training session is supposed to approximate the demands of many swim meets. USRPT requires performances and recoveries. The frequency of exposure to multiple training stimuli and the recoveries between sets trains the ability of swimmers to sustain performing at high levels and to recover quickly between different performances in competitive settings (Blair, Glover, & Roddie, 1961, p. 217; Faulkner, 1964, p. 81; Koroxendis & Shepherd. 1961, p. 234; Rushmer, Smith, & Franklin, 1959 p. 621). Consequently, swimmers who will compete in multiple events in a single competitive session should prepare for those demands by training for multiple events in the USRPT format in a single training session. This is one of the primary reasons for advocating three to four USRPT training stimuli in a single training session. For real specialist swimmers who do not have a great variety in competitive participations, the number of training stimuli might not be so great.

Before making specific plans, the coach needs to determine the general structure of the practice and how it accommodates the varied needs of the squad and individuals.

Step 2: Form Like-groups of Swimmers in Every Lane for All Sets

USRPT is formulated to accommodate each individual rather than groups of swimmers. That being said, groups of swimmers can train under the same general format in the same lane but individuals will adhere to their own performance criteria. In every lane there should be swimmers whose race-pace targets are close/similar which facilitates good organization.

Example 1

The overall set is to train crawl stroke for 400 SCm across the squad in attendance. The actual set is 30 x 50 at 400 SCm race-pace. It is assumed that swimmers are in a good stage of stimulus adaptation.

1. ***Lane 1*** has swimmers who record between 4:50.0 and 5:10.0 as best times. That means each 50 SCm would have a target time of 36+ to 39- seconds[2]. Allowing approximately 20 seconds for recovery, the interval time (work + rest) would be 60 seconds. For the fastest swimmers there would be ~23 seconds rest and for the slowest swimmers ~21 seconds rest. This would mean that every swimmer would start on the same time on the pace clock despite the exact recommended 20 seconds not being adhered to. The orderliness of the organization within the lane is more important than the exactness of the rest time. Orderly training means the quality of each repetition can be accomplished in good water if the swimmers start at least five seconds apart. The quality of the swimming in each repetition is important so that training specificity can be experienced.
2. ***Lane 2*** has swimmers who record between 4:40.0 and 4:49.90 as best times. Each 50 SCm would have a target time of 35- to 36+ seconds. The closest interval time would be 55 seconds. Those swimmers repeating in close to 35 seconds would have a 20 second rest interval. Those doing 36+ would have slightly more than 18 seconds rest. Once again the easily-timed interval of 55 seconds allows good organization and close to the desired rest time.
3. ***Lane 3*** has swimmers who record between 4:15.0 and 4:25.0 as best times. There is no one in the total squad who has recorded between 4:25.0 and 4:40.0. Each 50 SCm would have a target time range of 32- to 33+ seconds. The closest interval time would be 55 seconds, the same as the group in Lane 2. Although lanes 2 and 3 have the same interval time, the higher level performance in lane 3 probably could use a few more seconds rest. The fastest swimmer in lane 3 would have ~23 seconds rest and the slowest ~21+ seconds rest. That is as close as one could plan for ~20 seconds rest and still preserve good organization.
4. ***Lane 4*** has swimmers who record between 4:00.0 and 4:10.0 as best times. Each 50 SCm would have a target time range of 30- to 31+ seconds. The closest interval time to accommodate near 20 seconds rest is 50 seconds. The fastest swimmer would have ~20 seconds rest and the slowest ~19 seconds rest.
5. ***Lane 5*** has swimmers who record between 3:46+ and 3:58 as best times. Each 50 SCm would have a target time range of 28+ to 30- seconds. As with the group in Lane 4, the interval time would be 50 seconds, with the swimmers in this lane resting for slightly more than 20 seconds.

[2] 36+ implies more than 36 seconds but less than 37 seconds. On a sweep-hand pace-clock, the hand would have just passed the 36 second mark and left clear space before the 37 second mark. Thus, a plus sign implies closer to 36 than 37 seconds. 39- implies less than 39 seconds with the clock-hand closer to the 39 than 38. A time of 37 implies the clock-hand is over the 37 second mark. With these rules swimmers learn to make reliable judgments about their performance times after a small amount of practice.

6. ***Lane 6*** is a lane dedicated to active recovery. When swimmers finally "fail" in the set they leave their lane and perform the recovery activity in this lane. That means there will be swimmers who have left the USRPT set and started recovery while others continue on with the set. Thus, each individual swimmer abandons the set when the failure criterion is reached. That is how USRPT accommodates individual responses. [In situations where a lane has to be used for a training group, usually to decrease the density of swimmers per lane, recovery can begin satisfactorily out of the water on the pool deck. If out-of-the-water recoveries are to be used, allowable activities should be made known and appropriate safety precautions taken.]

This example produces orderly training with swimmer interference minimized when swimmers pass each other going in different directions in the lane. A 5-second difference in interval-start times within every lane almost guarantees swimmers will be able to execute race-pace quality turns and surface swimming, something not accommodated in most traditional training sets.

The coach has to be flexible in interval times allowing a few seconds more or less than 20 seconds of rest. Generally the estimation should be slightly more than 20 seconds rather than less although a few swimmers above would have slightly less than 20 seconds rest. By structuring the squad into groups of "similar" performances and rests for each lane, all swimmers will have their own program. With all swimmers monitoring their own successful and failed intervals, the total amount of swimming will be appropriate only for the individual. That is how USRPT accommodates individual capacities and performances in a group setting.

Example 2

Following the strategy of matching swimmers into relatively homogeneous groups, lanes can be assigned to accommodate specialist swimmers. The span of performance standards should not be so great as to allow passing or swimming in another's wash. The same could be done to accommodate distance freestylers performing one set, sprint freestylers engaging in a completely different set, and so on with breaststroke, backstroke, and butterfly specialists all in their own assigned lanes with appropriate sets of repetitions.

When one lane is dedicated to recovery, swimmers always have an alternate activity when they fail. It is up to the coach to decide how different or at the other extreme how similar the sets assigned for every lane are. With that in mind, USRPT requires considerable planning of not only what training sets will be but also of how the organization of a practice will proceed. It is imagined that such planning will fall into microcycle and macrocycle constructs.

The first requirement of USRPT programming is to plan the complexity of practices and to schedule lane changes for swimmers and lanes for particular sets. With practice and familiarity, that is not an onerous task. It does focus the coach on adhering more to the Principle of Individuality (Rushall & Pyke, 1991) which is something overlooked very frequently in traditional swimming practices.

Step 3: Determine the Stroke(s) To Be Swum in All Sets

This requirement carries over from Step 2. Most coaches have their own ideas about how much specialist swimming should occur. Quite often, much of many practices is spent performing strokes at different velocities when those strokes are likely never or at best seldom swum in competitions. Each set in a USRPT practice should clearly delineate the stroke to be completed.

Training for butterfly stroke warrants special consideration. Butterfly is the lowest rating stroke and requires an extremely wide space in which to perform uninterrupted practices. If butterfly swimmers are required to pass another swimmer coming in the opposite direction, stroke sequencing and forward velocity are disrupted greatly. In this writer's opinion, there is no value in programming interrupted repetitions for butterfly. What coaches have to do is restrict butterfly repetitions to 25 m or open up pool space whereby uninterrupted multiple laps are possible. Since 25 m is one of the repetition distance options for both 100 and 200 butterfly it could well be the main distance for training the stroke. The aims and benefits of USRPT are not met if a race-simulation repetition involves several interruptions.

Often coaches program mixed sets, varying velocities and strokes within one set. Such experiences do not benefit swimmers because the training effect is one of coping with frequent changes rather than improving in a race-related performance. Even those who swim individual medley races should practice each stroke independently incurring training effects of the particular nominated stroke for the set (see below). When practicing skills, time should be allocated so that individual medley swimmers can have substantial repetitions of turning from one stroke form to another. Those turns should also be practiced in blocks of substantial numbers of repetitions so that learning can occur. A suggested minimum limit of skill trials would be greater than 15. Fleeting exposures to skills, such as four trials, are insufficient for any credible learning to occur. Traditional coaches rarely foster the actual learning of skills because insufficient practice trials of the skills are what is programmed.

It should be noted right from the outset that there is no credible scientific research that supports benefits from a low number of trials for learning complex skills or incurring training effects. Equally, there is no credible research that supports race-performance benefits from varied experiences of mixing velocities, distances, and/or strokes. That means traditional ascending and descending sets are a waste of time and only stimulate a general coping response which has very little transfer, if any, to specific races. The dogmatic excuse that variety is needed to maintain swimmer's motivations is not supported by any credible research on superior or successful swimmers. Swimming coaches would do well to remember a basic adage of coaching:

Mixed training produces mixed results.

Training for Individual Medley Races

The models for training 200 and 400 y/m medley races are similar.

200 IM. Two types of USRPT prepare swimmers to perform in this shorter medley race.

1. Surface swimming is performed in sets that are structured for 100 y/m races in all strokes. A swimmer training for 100 y/m breaststroke would also be training for the 50 y/m leg of a 200 y/m IM. For swimmers who do not normally race 100 y/m for a particular stroke, they would have to perform the set as if they were preparing to race to transfer benefits to a 200 IM. Consequently, it is beneficial to occasionally race events that are not preferred by the swimmer. The race performances would demonstrate improvements in stroke velocity which would infer that 200 IM performances would also improve. If a swimmer can improve in the four strokes over 100 y/m USRPT sets, the expectation of 200 IM race performances improving should be

high. Surface-swimming velocities for the four competitive strokes are trained in the same set as those being used to improve in 100 y/m races.

2. Transitional turns from one stroke to the next need to be practiced at race-pace. Medley swimmers would know their 25 y/m times for 100 y/m stroke events. To practice the transition turns it is advised that the following set be programmed.

   10 x 50 on 200 IM race-pace BF – BK;
   10 x 50 on 200 IM race-pace BK – BR; and
   10 x 50 on 200 IM race-pace BR – FR.

   The time for each 50 is derived by adding the 100 y/m race-pace for 25 y/m of butterfly stroke to the 100 y/m race-pace for 25 y/m of backstroke swimming. The time for the 50 y/m IM set to practice race-pace stroke transition turns is the sum of both stroke's 25s.

   The time for the backstroke to breaststroke transition practices and the breaststroke to crawl stroke transitions are calculated the same way, that is, the sum of the strokes' 25 y/m times. Calculating in this manner gives a 50 m target time for the three stroke combinations and transition turns.

   In the conduct of the 30-repetition set, failures are treated normally for each block of 10 repetitions. When a new set of 10 repetitions is begun, the number of failures from the previous set of 10 is disregarded.

400 IM. Two types of USRPT prepare swimmers to perform in this longer medley race.

1. Surface swimming is trained in the same manner as for the 200 IM except that the stroke sets are for 200 y/m events. A swimmer training for 200 y/m breaststroke would also be training for the 100 y/m leg of a 400 y/m IM. When swimmers do not normally race 200 y/m for a particular stroke they would still have to perform the set to prepare for the 400 IM. Consequently, it is beneficial to occasionally race 200 y/m events that are not preferred by the swimmer.

2. Transitional turns are trained in exactly the same way as for 200 y/m IMs. No adjustment for pace should be entertained. Why? The muscles and energy used in IM transition turns are very different to what are used in surface swimming for all strokes. After each turn, the turn muscles recover during the surface swimming phase of the race. If the turn-muscles are rested from surface swimming in 200 and 400 IM races, why would one turn slower in the 400 IM than in the 200 IM? Consequently, in the USRPT format for IM races, the surface-swimming velocities are different but the turn velocities should be similar. In 400 y/m IM races, the turns should be very fast in comparison to the surface swimming race-paces. This departure from traditional swimming thinking is logical and in accordance with what is known about the energy consumptions and uses for the different phases of pool swimming races.

Step 4: Determine the Repetition Distances for the Sets

Table 1 illustrates the repetition distances that are most appropriate for targeted races. To a large extent, the distance will be determined by the training facility. The most convenient and versatile pool distance is 25 m. That allows 50 m and longer to be repeated with a race-quality turn(s). Long-course 50 m pools make it virtually impossible to repeat distances that are less than 50 m and longer if they are not whole-number multiples of 50 m. Distances of 12.5, 25, and 75 m cannot be effectively accommodated because swimmers need to be able to time themselves for each repetition. The imprecision of finishing in the middle of a 50 m pool length does not provide the self-reinforcement that is a hallmark feature of the self-control and responsibility built into swimmers' experiences in a true USRPT format. See Step 8 for further discussion about training in long-course pools.

TABLE 1. SUGGESTED REPETITION DISTANCES FOR STANDARD INTERNATIONAL SHORT- AND LONG-COURSE MEETS.

	Race Distance					
Repetition Distance	50	100	200	400	800	1500
12.5	**X (rarely)**	-	-	-	-	-
25	**X**	**X**	**X**	**X (rarely)**	**X (rarely)**	-
50	-	**X (rarely)**	**X**	**X**	**X**	**X (rarely)**
75	-	-	**X (rarely)**	**X**	**X**	**X**
100	-	-	-	-	-	**X**

Although many competitions are held in 25-yard pools in the United States, pools of that dimension are rarely found in other countries. International meets are not held over multiples of 25-yard distances. In the USA, training in a 25 SCy pool is justified if pools of that dimension are used in major competitions (e.g., college, high school, and organizations such as YMCA and YWCA).

- For 50 m training, repetitions of 12.5 (rarely) and 25 m length are the most advisable. If 25s also include a dive they are possibly the most frequently programmed distance. The shorter 12.5 m distance is not accommodated in many pools. Usually, it is across a narrow six-lane pool and/or in hotel/resort establishments.
- For 100 m practices, repetitions of 25 and occasionally 50 m are preferable. The longer distance proves to be quite difficult when the number of repetitions is 20 or more. As a suggestion, it is recommended that three times as much 25 m training be completed as is done over 50 m for 100 m events.
- For 200 m training, as well as 25 and 50 m distances, 75 m can be attempted but rarely is it successful. The most demanding of swimming events are 200 y/m races. They develop the highest lactate levels of all swimming races, 75 m repetitions are especially demanding. However, repeating 75s allows swimmers to experience the levels of effort and discomfort that occur in 200 m events. From the outset, the number of successfully completed 75 m repetitions will be remarkably low (e.g., starting at 2-3 successful repetitions and after possibly 6-8 weeks building that number to 5-8). The main value of 75s for 200 m races is the experience of learning to cope with sustained discomfort. Exposures to that experience should be rare.

- For 400 m race-practices, 25 (rarely), 50, and 75 m repetitions are recommended. Since the repetition velocity will be slower than for 200 m, the execution of a higher number of 75s is likely.
- For 800 m training, the same repetitions as for 400 m training are proposed. There is not a great deal of difference in stroke techniques and energy demands between 400 and 800 m races and so the training should be similar with the slight slowing of repetition velocities to accommodate the longer distance.
- For 1500 m repetitions, 50 (rarely), 75, and 100 m are the suggested distances. The 25 m possibility is just too short to perform without having to perform a huge number of repetitions, which would be a waste of valuable pool time. The majority of repetitions would be 75 and 100 m distances, and 50s used when swimmers are "tired" within and between practice sessions.

The coach's responsibility so far includes deciding on the specific features of the slate of competitive swimming events for a session, planning on which swimmers will participate in the various groups for each USRPT set, and determining which strokes and repetition distances will be swum in what the lanes in each set across the whole session.

Step 5: Assign the Maximum Number of Repetitions for Each Set

Table 2 indicates suggestions as to what might be the maximum number of target repetitions in a USRPT when training for a race represented by the column heading. The reason why these are called "target repetitions" is that they appear on the swimming squad's information board when the swimmers review the session's program. In actuality, if programming has been determined correctly, no swimmer will complete the maximum number. Hopefully, in less than the maximum number of repetitions all swimmers will have experienced enough failed repetitions that they need to abandon the set. [Some coaches opt not to use the maximum number because it is easily confused with traditional training where the number stipulated has to be completed. In USRPT, completing the maximum number of repetitions is rarely contemplated. What is important is that in every USRPT set a neural-fatigue failure is experienced. Without failure, no performance improvement will occur.]

Training for 50 m events is somewhat different to the standard USRPT protocol. Those shortest of competitive events have a number of characteristics that sets them apart from all other events.

- They are highly hypoxic, that is they are performed mostly without any oxygen intake. At the highest level, 50 m long-course events are usually swum without a breath being taken. When performed in a short-course pool, it is advisable to take a breath before the turn so that the turn features can be emphasized. Whether the swimmer breathes after surfacing on the second lap is a matter of choice.
- All competitive events require swimmers to pace races evenly. The exhortations of many coaches to urge swimmers to "go out fast" or have fast early splits is foolish in a physiological sense. With a 50 m race, pacing is not so important for the race is a series of defined stages that have to be performed perfectly (i.e., i) the dive and dive depth; ii) surfacing with the most gradual of direction changes; iii) swimming maximally to the 15 m mark; iv) then holding a high rate and propelling the swimmer at least one-inch further than normal every stroke; and v) finishing the race with head buried, exaggerated streamline, increased rate, and a vicious thrust of the hand/arm at the timing board to complete the event). All those features are done observing the breathing restrictions.
- All 50 m training elements should stress one or more of the features listed above in blocks of from 10-15 trials. That usually results in only one feature being stressed every practice session.

TABLE 2. A SUGGESTED MAXIMUM NUMBER OF TARGET RACE-PACE REPETITIONS OVER PARTICULAR INTERVAL DISTANCES TO PRODUCE MAXIMAL USRPT

	Race Distance[a]					
Repetition Distance	50	100	200	400	800	1500
12.5	**4 x 6**	-	-	-	-	-
25	**Frequent but indi-vidualized**	**30**	**40**	**40**	**50**	-
50	-	**20**	**30**	**30**	**40**	**50**
75	-	-	**20**	**24**	**30**	**30-35**
100	-	-	-	-	-	**25-30**

[a] Repetition distances are appropriate for yards or meters.

The number of target repetitions in a USRPT set is quite high when compared to traditional training sets. Given that swimmers will not complete the maximum number, what is experienced in the set is as follows. Assume the set being swum is 30 x 50 FS on 50 at 200 m race-pace (30 seconds per rep).

1. When starting an exercise, it takes considerable time for all the body's functions to adapt to the exercise demands. With high-intensity exercise in trained individuals, the length of time before the body responds as well as it can ranges from 1.25 to 2.0 minutes. This initial disruption to the body's state and then the mobilization of its resources (e.g., circulation, respiration, movement coordination) happens with any exercise including USRPT. With the assumed set in this example, that means the first 4-6 repetitions will be changing functions within swimmers. When athletes are in that change or adaptation phase of the exercise no training effects or skill learning can or will occur. So, in the 30 targeted repetitions of the exampled set, one has to complete the initial adaptation repetitions before meaningful training effects can begin to be developed.

   The repetition-adaptation phenomenon normally does not occur after any extensive rest (for swimming that would be ~60 seconds or longer). Even in a traditional set that might allow up to two minutes rest between repetitions, a large part of each repetition would be re-adapting to the training task which reduces the training value or potential of the experience markedly.

   In a USRPT set, the longest rest period in any set is 20 seconds. During 20 seconds rest, the aerobic system continues maximally and restores almost completely the stored oxygen and phosphate energy sources used in the repetition. The next repetition starts before the aerobic system has waned in any manner. Consequently, the brief rest period does allow some recovery of the energy resources within the swimmer but its highly taxed oxidative/aerobic capacity continues. When the next repetition swim is initiated, a swimmer's oxidative system is already functioning near maximum and does not require any time to get used to working in the swimming performance. The short-work – short-rest ultra-short training format prevents accumulations of time spent in readapting to the work, which is actually "wasted" time because it yields very little benefits for a swimmer. The extent of maximal oxidative/aerobic work in the USRPT format is the total of time exercising plus the total time recovering between repetitions. That amount of maximal circulorespiratory functioning far exceeds anything that is possible in the longer work and rest period structures commonly seen in traditional programs.

2. Once adaptation has occurred in the start-up repetitions in the USRPT set, the remainder involves valuable experiences for the swimmer. The body has "warmed" (adjusted) to the nature of the task and the training stimulus is exactly as planned. For a number of contiguous repetitions, the body learns how to energize the technique that is being repeated. The training is having an effect. It is hard to stipulate how many contiguous repetitions will be completed for a training stimulus (the set of repetitions) because there is such wide variation between swimmers. It is desirable to have swimmers complete at least 3-4 times the race distance in these steady repetitions before the first failure[3]. The work demands would have to be adjusted to allow that much practice. However, there will be some (possibly sprinters) who can only complete less than the average for the squad. Since the assumed set is for a 200 m race, apart from the initial 4-6 adaptation-repetitions, 12-16 more repetitions of 50 m would be the desirable minimum number

[3] Why 3-4 times the race distance? The pre-WWII work of Gerschler and those who adopted his recommendations and even experimented further discussed this concept. As best as this writer can recall, although he is looking for references of about the 1950-60 era, is that the total distance covered in the work portions of an interval set would be three to five times the race distance. That is how the "three times" reference here was made. The recommendation is also done within reason. One would not believe that three times a marathon is what is needed in a practice session when training for a marathon.

of successful repetitions. When a USRPT is first attempted or a new velocity is introduced it is likely that less than the minimum number of repetitions will be completed before the first failure.

3. A USRPT set contains three stages: i) several repetitions where the energy systems are progressively adapting to the performance standard requirements, which accounts for the first 4-6 repetitions; ii) an extended series of successful criterion swims where the training benefits are developed; and iii) the onset of neural fatigue and a requirement for high levels of exertion – finally resulting in two successive or a total of three failed repetitions. In this format the swimmer has been sufficiently stimulated and has incurred a specific effect for 200 m FS race-pace.
4. A USRPT set is continuous and rhythmical. Some persons claiming to know USRPT do not understand this requirement.

    - *Example 1. "I have been swimming your USRPT for the past two months training for 100 and 200 SCy distances. My standard set that I use to judge if I have improved has been 4 (4 x 25 yd FS on 30 seconds). I have added one minute rest between each of the sets."*

    This example is not a USRPT set. It is four sets of four-repetitions with one minute of rest between each set. What happens with this format is that each repetition in the four goes through the transition from inefficiency to efficiency. It is likely the desirable set of conditions that need to be repeated is not met at least in the first set of four. The one-minute between-sets rest is too long and the various working systems recover and start to reduce their involvement in metabolism because they are not needed when not exercising. Then, in the second set of four-repetitions, the progressive activation of the systems occurs and efficient movement [4] is approached possibly in the fourth repetition. The second one-minute rest again changes the metabolism requiring the next step to repeat the progressive start-up functions. The similar shut down of system activation levels in the excessive rest followed by re-starting to find the "balanced and optimal" provision of energy occurs in the last set. No consistent repetitions of training stimuli are performed.

    This example does not provide the consistent technique and energy provision of the USRPT format. It is four sets of progressive adaptation with no specific training effect for the targeted 200 m event. Just because the set required a total of 24 repetitions does not deem it to be a form of USRPT. There is no guarantee the swimmer will experience the optimal training effect by failing to perform to criterion on two successive repetitions. The work and rest periods are critical in a beneficial USRPT set. They cannot be violated by hedging back toward what might be traditional training. It should be understood that 4(4 x 25 on 30 seconds) is actually four sets of four-repetitions, those four-repetitions being too few to produce any training effect for 200 m swimming although the swimmer might be fatigued in the fourth set. That fatigue is general and non-specific.

- *Example 2*. Many coaches claim they program race-pace training in a variety of ways. It is the assertion of this paper that high-intensity stimuli must be applied in a consistent-format USRPT structure. A national coach claimed that a broken 200 m swim with interval distances of 25, 25, 50, 50, 25, and 25 meters was "race-pace swimming". Race-pace it may have been but race training it was not. When the work to rest ratios are varied, different metabolic responses are elicited (Gosselin et al., 2010); that is, sets which mix demands and rests are less than effective and/or desirable than extensive consistent task forms. The coach's error stems from only

[4] Within a USRPT set, efficient movement is when technique and energy provision are race-pace specific allowing a considerable number of repetitions to be performed at the desired standards.

considering training intensity. He failed to consider the technique and energy interdependency that exists in races as a necessary criterion for race-specific training effects. As well, there were insufficient repetitions performed to establish any training effect. The swimmer would attempt to survive (use whatever resources are available) to produce a series of performance levels. Within-set task alterations promote within-set reaction alterations. Training the correct race-pace relationship to the highest level of proficiency can only be achieved by consistent interval formats so that consistent repetitions of the task demands can be repeated, accommodated, and promote adaptation.

- *Example 3*. The following interaction occurred between a coach and a self-proclaimed swimming "*Guru*".

  Coach: *"Interesting read on Ultra-short Training by Dr. Brent Rushall. Any comments on this training methodology?"* Guru's reply: *"Hi. This has worked for me. Remember that my core set is 20 repeats at 25 percent of race distance at 100 percent of goal speed at exactly 100 percent of race protocols i.e., stroke rate, stroke length and breathing patterns etc. must be exact in execution. I know Eddie Reese and the Carlile organisation utilise this principle."*

  The point that the "*Guru*" is missing is the method of invoking a training effect to yield beneficial training. Neural fatigue (as opposed to lactic acidosis, accumulated oxygen deficit (AOD), etc.) must be experienced to stimulate the brain to organize the specific characteristics associated with race-pace overload. As well, the ultra-short format is designed to promote the greatest number of strokes (cumulative yardage) at the intended race-velocity. The length of the rest is critical. Too long and the potential benefit of work is diluted markedly. Those three features do not exist in the *Guru*'s description.

  The main reactions to the *Guru's* statement are first, he implies that ALL SWIMMERS do the 20 repetitions. That is hard to believe because it violates the Principle of Individuality when training for sports fitness (Rushall & Pyke, 1991). As well, the same number of repetitions for all strokes and distances? Remarkable naivety -- 20 x 25% (375 m) at 1500 race-pace would hardly be achievable no matter what the rest period! Second, there is no one stroke rate or length or breathing pattern for a race. It is well documented (http://coachsci.sdsu.edu/swim/bullets/table.htm) that stroke rates and lengths change as a race progresses as does the breathing pattern (it is modified by the purpose of the race section being swum and the state of the AOD). How would one settle on a single value when a range of values exists?

The lesson here is to be wary of individuals claiming they have been expounding the USRPT format as part of a common occurrence for a long time. As can be seen by the examples here, it is not an effective or sufficient training procedure to set the only criterion as swimming at race-pace.

The biggest task for coaches and swimmers when converting from traditional to USRPT formats is changing the criterion for a successful set completion. Traditional programs require swimming all the repetitions nominated for the set. In the hypothetical and real examples above, traditional programs would have all swimmers perform all repetitions with little regard for performance standard or variation and no concept of what training effect, if any, might have been achieved. On the other hand, in a USRPT format, a successful performance is to fail before the maximum repetitions are completed. Success is experiencing a maximum task-specific training effect, which can only be achieved by getting to the stage where the performance standard can no longer be maintained. In particular, the neural system no longer can harness resources to produce the desirable performance. The commonality of that situation with a racing situation should be obvious. Table 3 summarizes the stages that occur in a USRPT set.

TABLE 3. WHAT HAPPENS IN AN ULTRA-SHORT RACE-PACE TRAINING SET

The set: 24 x 25 on 30 at 100 m race-pace [target time 14 seconds]

Repetition Number	Energy Events Occurring	Fatigue Index
1	Stored oxygen, alactacid, minor initiation of lactacid, and aerobic systems.	**At first work is hard and inefficient.**
Rest 1	Respiration pays back stored oxygen, most alactacid, and possibly some lactate.	A minor increase but not enough to worry the swimmer.
2	Stored oxygen, alactacid, minor initiation of lactacid, and slightly more aerobic work.	
Rest 2	Circulation rate increases to pay back stored oxygen, most alactacid, very small amount of lactate.	Slightly greater increase but still not enough to worry the swimmer.
3	Stored oxygen, alactacid, minor amount of lactacid, and increased aerobic systems.	
Rest 3	Respiration rate increases to pay back most stored oxygen, most alactacid, very small amount of lactate.	Higher respiratory rate. Aerobic system is paying back most but not all debts.
4	Stored oxygen, alactacid, and a very minor amount of lactacid systems as aerobiosis increases.	
Rest 4	Respiration rate increases to pay back most stored oxygen, most alactacid, most lactate, all oxidized because of greater aerobic contribution.	Respiration nearing the level to pay back energy stores but not completely.
5	Stored oxygen, alactacid, minor lactate, and aerobic contribution maximal but insufficient to completely repay debts during the swim.	
Rest 5	Aerobic system at very high level. Aerobiosis maximal but not quite able to repay all debts. All systems adjusted and active.	Respiration working maximally but not quite able to repay AOD. Alactacid debt, stored oxygen, and lactate debts growing but tolerable.
6-16	Aerobic system maximal. Stored oxygen, alactacid system still exploited fully. Lactate might increase but generally level.	**The work of swimming gradually mounts to become harder and harder to maintain.**
Rests 6-16	Respiration high. Aerobic system as active in recovery as in work. Neural fatigue increasing.	Stored oxygen and alactacid debt climb. Lactate at a steady low level. Conscious effort to swim fast required.

TABLE 3. WHAT HAPPENS IN AN ULTRA-SHORT RACE-PACE TRAINING SET (continued)

Repetition Number	Energy Events Occurring	Fatigue Index
17 Fail	Work at the target level insufficient to maintain desired pace.	**Neural fatigue interrupts performance standard.**
Rest 17	Aerobic system pays back as much of the energy cost of the last swim as possible.	Stored oxygen, alactacid, and lactate debts very uncomfortable.
Miss 18 and Rest 18	Recovery continues as accumulated debts are reduced.	Conscious effort to return to criterion velocity is needed.
19	Almost full-out effort to reach target time. Stored oxygen and alactacid maximal; lactate debts increase. Some Type IIb fibers have been stimulated to Type IIa.	
Recovery 19	Accumulated debts partly repaid because aerobic system is working fully.	Each repetition is now a great effort.
20 Fail	All systems working maximally. Type IIa stimulation continues. Technique altered. Failure to reach target time.	Neural fatigue likely cause.
Rest 20	Accumulated debts partly repaid because aerobic system is working fully.	Repetition effort increased.
21 Fail	All systems working maximally. Type IIa stimulation continues. Failure to reach target time. Swimming looks "desperate".	Despite an increased effort, time failure.
Two failures in a row. Set abandoned.	Full recovery occurs. Within 30-45 seconds the swimmer is comfortable and should participate in active recovery.	
Result of Set	Stored oxygen, alactacid system, and aerobic system maximally taxed. Lactate increased but to a low tolerable level. All debts repaid within one minute. Respiratory rate slower to recover than energy sources. Some stimulation for Type IIb fibers to become oxidative accomplished. All systems that are maximally taxed will improve in capacity and speed-up in responsiveness.	

Step 6: Determine the Total Interval Times for Each Lane in Each Set

The rules for the length of rest intervals are simple:

i. For repetition distances of 12.5 and 25 m/y, the rest should be ~15 seconds; and
ii. For repetition distances of 50, 75, and 100 m/y, the rest should be ~20 seconds.

The most common question regarding these simple fixed rules is that they allow recovery to occur without the main recovery mechanisms, respiration and oxidation, being completed and then winding down. For the greatest value to be derived from USRPT, it is essential that the aerobic system is taxed maximally during work and rest across the set (given that the first 4-6 repetitions build to that state). As was explained in the two examples in the previous step, longer rest periods shut down some systems which then have to be "re-awakened" in the next swimming repetition, causing a reduction in the volume of beneficial work and disrupting the continual race simulation.

In Step 2, Example 1, an explanation of how the target pace-time and rest intervals were combined to provide an easy full period of time for each interval (work + rest) was explained. This is where the coach develops the skill of making such assignments and adhering to the rules of providing rests of close to 15 and 20 seconds. One would not plan on 30 seconds rest because that is too long and allows the fast-component of recovery to be completed and some slow- or extended-recovery to begin (see Rushall, 2013b). Even if swimmers complain they need more rest, particularly in the early stages of introducing this work, the rules have to be followed. It should be remembered that only after a repetition failure will an extra interval-time of recovery be allowed. That is done as a way of teaching swimmers that when they are tired they can focus on continuing to swim at the required velocity – it is a practice activity for a task-focusing behavior.

The number of repetitions completed will vary considerably within a heterogeneous squad. Sprinters generally will do less and achieve a lower maximum number of repetitions than distance swimmers. Some strokes (back and crawl) usually achieve more repetitions than the symmetrical less energy-efficient breast and butterfly strokes. This should be kept in mind when structuring a program and assigning lanes, particularly if a lane has swimmers performing mixed strokes (which should only occur in IM training).

The Situation with "Drop-dead" Sprinters

There are some swimmers who have a limited ability to perform aerobically-dominated swimming events. Even when performing 12.5 or 25 m repetitions, the number completed for such persons is quite small (in the 5-7 range when using 15-second rest periods). As well, with longer 20-second rests, work is still limited. It is suggested that with such individuals, and they are a small minority, that longer rest periods of 30-seconds or slightly more be tried. A rest-interval duration needs to be determined that allows a significant number of repetitions to be completed so that a training effect from the repeated work-distance is achieved. With adequate repetitions skill precision and efficiency improve.

Since 50 y/m races are largely hypoxic, what use is a lot of aerobic work anyway? Technique is the most significant technical feature of swimming events. With ultimate sprinters the skills associated with swimming 50 m in hypoxic circumstances takes precedence over classical conditioning. Iirrespective of the rest interval for very short sprints (where hypoxia dominates), it is completing a beneficial volume of strokes that makes sense rather than adhering to general USRPT guidelines.

Adaptations for 10 years and under swimmers

Initially for 8, 9, and 10 years swimmers, do not use race-pace targets. It is likely that across those years performances will change substantially because of technique improvements and growth. Continued performance improvements should be usual phenomena. Thus, instead of using race-pace targets encourage swimmers to perform "fast" swimming or for short repetition distances, their "fastest" swimming. Those performance descriptions should be used in lieu of calculated race-pace times but should always be related to what the swimmers will do in particular races.

This accommodation will allow for reasonably easy interval time determination. As long as swimmers have between 15 and 25 seconds rest between repetitions, they should complete a substantial amount of training that will yield a training effect.

The two-failure rule is irrelevant in this modified format. The conduct of this work is more like traditional high-intensity short-interval work with most swimmers completing the programmed number of repetitions. The coach is advised to give swimmers who struggle in a set an early exit to actively recover. It would be better for a coach to err on the side of being too lenient than too demanding when executing this discretionary move.

However, in time when young swimmers are fully conversant with the modified execution of USRPT sets, race-paces derived from competition performances should be introduced. A number of coaches have indicated that this is successful. At the start, the transition also involves swimming race-paces for strokes and events for which times have been recorded. For other non-raced events, the "fast" and "fastest" instructions are retained. In time, as race-performances are finally recorded the use of "fast" and "fastest" instructions are removed. Apparently, when race-pace times are used young swimmers better relate what is done at training to what should be achieved in races.

Step 7: Teach Swimmers How to Conduct Their USRPT Repetitions

There are a number of behaviors that swimmers need to do to control themselves in USRPT. They need to be instructed so that the swimmer develops responsibility for evaluating and conducting their performances. For coaches who primarily act as traffic directors and timers (their most frequent behaviors are calling out times while looking at a stopwatch), it is good practice to not take a watch onto the deck.

1. *Swimmers Need to Know the Target Repetition Time to Be Sustained.* Most swimmers should have a target time that is unique to them for the stroke and race-distance for which they are training. Knowing the time should be a result of each swimmer calculating the time for the distance to be repeated. Usual distances will be 12.5, 25, 50, and less often 75 m. For 1500 m races, 100 m repetitions might be considered.

   In the calculation, the dive should be included as if it was surface swimming. When the approximately two seconds advantage usually attributed to a dive is included in calculating the repetition time, it means the training pace for surface swimming will be slightly faster than the actual race from which it was calculated. With that assumption, every ultra-short training set at race-pace will contain an inherent "improvement factor" which should lead to continual race-improvements.

   If the team is able to train in a short-course pool, only short-course times should be used. Short-course swimming is faster than long-course swimming and so swimming fastest is preferable. When long course season rolls around, some long course sessions, mainly using 50 m as the repetition distance and long-course times as the repetition times, should be experienced. Long-course times should never be swum in a short-course pool because they actually will be slower than the desirable long-course repetition time.

   There are a number of ways to instruct swimmers how to determine their target-swim time. They first need to know their best time for the event being practiced. That time is divided by the number of repetition distances in the target-race (e.g., if 50 m is to be repeated at 200 m race-pace, the 200 m time would be divided by four). Calculating these times will be part of serious instruction for the younger swimmers and often the help of parents to assist learning the skill as part of "swimming homework" will be helpful.

   When executing an interval, swimmers will need to know the total interval and what time they are to swim. That requires a further number of skills.

2. *Know When to Start*. If the pool has a sweep-hand clock like that pictured to the right, they have to work out when the next repetition is to begin. That is not difficult if the interval is one minute. After the swimmers add in the length of time they wait for the swimmers before them to go, they add that time and then always start on the same time (e.g., "red 40" or "black 10"). However, if the interval time is not a minute, all successive trials have to start 5, 10, 15, seconds earlier than the previous interval. With young swimmers this is an instructional task for the coach.

3. *Know How to Start*. If a swimmer is to start on "red 40", it is almost universally common for swimmers to duck under the water two to four seconds before the actual start time. This is meant to allow the wall push-off to occur on the actual start time but usually it is before that time. Consequently, repetition times are under-reported and the swimmers only fool themselves. To avoid this problem the coach should be strict about the leeway and should adopt a single rule that is always in force. One such "wall-start" rule is as follows:

   > ***The Wall-start Rule****: After the clock hand has passed two seconds before the interval start time, the swimmer can reposition underwater and push off the wall.*

   It is assumed that less than two seconds repositioning will get swimmers commencing the repetition with a push off the wall very close to the stated time for the interval start. If the repositioning-time is more than two seconds, the length of the swimming time normally will be under-reported. Coaches should experiment with this feature. However, the overwhelming majority of coaches find that the less-than-two-seconds leeway is very satisfactory.

4. *Know How to Finish*. So that times are consistent (reliable) and accurate, all swimmers have to adopt a fixed routine for completing the interval distance. This involves NOT doing a sloppy finish but approaching the wall as if it were the finish of a race. At the time the arm(s) extend to touch the wall, the swimmer should turn his/her head to the clock-side and at the moment of touch open the eyes and mentally "photograph" the image of the hand position of the clock. Then the swimmer should work out the time for the repetition.

   It is important to develop an habitual behavior (a skill) of reading the clock without developing bad finish features or beginning the read too early. To allow for the time to focus on the clock, it has become acceptable to set target times as plus and minus values. For example:

   i. 35- seconds means complete the swim before the 35 second mark is passed by the clock-hand.
   ii. 35+ seconds means complete the swim just after the clock-hand has passed 35 seconds but before it reaches the 36-second mark.
   iii 35 seconds means complete the swim as the clock-hand passes over the 35-second mark.

   With practice, swimmers can become quite adept at timing their swims without needing to resort to falsely reporting the time. False reporting only hurts the swimmer and that fact should be frequently stressed, particularly in the early stages of the swimmers/squad learning the self-discipline and honesty of self-evaluation that is a feature of USRPT.

   While it has been hinted above that coaches leave their stopwatches in the pool office, periodically it is helpful to actually time individual swimmers and note their time on several occasions. On each occasion ask the swimmer what their time was for the repetition and then reconcile the reported and stop-watch times. Constant under- or over-reporting of times should be corrected.

5. *Know How to Dictate Participation and Failures*. Swimmers are responsible for monitoring their times for all repetitions and how they are performing relative to the race-pace target. For each repetition, a swimmer must decide if the target was beaten or equaled or if the time was missed ("failed"). Each repetition evaluation is an opportunity to self-reinforce and to use the performance-feedback to modify the next repetition if necessary. The routine of evaluating and modifying performance through the set is not only in accord with basic principles of goal-setting and motor-performance development, but it does partly simulate the race-focus that is needed for concentration to be appropriate in a race.

Several rules for evaluating compliance with USRPT conduct within a set follow.

i. Since the first five trials involve adjusting to the task and increasing the efficiencies of propulsion and energy provision, performances could vary. Swimmers should be encouraged to *"settle into the correct pace as soon as possible because that is what is needed to successfully start a race."* A repetition that is slower than the target time is deemed a *"failure"*. However, because of the flux in swimmer responses in an average of the first five trials, there is no penalty for a failure so early in the set. The swimmer's task is to get into race-pace as soon as possible and be consistent from then on. Consistent USRPT training should shorten the time it takes for a swimmer to adapt to attain the most beneficial physiological functioning for the planned race-pace.

ii. For the remaining trials, the performance standard is monitored. Swimmers should be trying to complete as many *"successful swims"* (i.e., the repetition time is better than the race-pace standard) as possible before the first failure. The number of completed trials before the first failure (including the first five and disregard any failure that might have occurred within those five[5]) is the most important performance indicator. In successive similar sets in future training sessions, swimmers should be trying to improve on the number of successful swims before the first failure. As that number improves, it indicates that the swimmer is getting fitter for or more proficient at swimming at that pace, that is, the swimmer is *"learning/adapting"*.

iii. After the first failure, the next repetition should be missed. The swimmer should move to the side against a lane line and avoid interfering with other swimmers. The purpose behind this extended rest is to allow more recovery to occur and to provide the swimmer with an opportunity to refocus effort and technique precision in order to be successful on the next repetition. The missed repetition is counted and the swimmer joins into the lane-group's organization on the repetition after the rest.

    When a swimmer misses a trial when doing 25s or 75s, he/she will be out of synchrony with the rest of the group. That is, the next trial would be swum in one direction and the group would be coming in the other. Suggestions for correcting those anomalies even though they might violate pure-USRPT protocol are presented in Step 8 and include the following:

    a. When swimming 25s miss two repetitions so that the first repetition after the rest is swum in the normal place within the group.
    b. In 75s, have the swimmer swim a slow length to the other end of the pool from where the group will begin the next repetition.

iv. Usually, it is possible for a swimmer to follow the fail-rest-success sequence for a few successful repetitions. However, since the first failure occurs as fatigue is mounting (particularly neural fatigue), it should be obvious that the swimmer is approaching the limit of sufficient fatigue to incur a meaningful specific training effect.

    The neural fatigue that is meant to indicate the cessation of USRPT sets is assumed to be the closest approximation to the end-of-race fatigue that can be programmed in a training environment. To describe to swimmers the level of effort that should be exerted in the second-in-a-row or third failure in a USRPT set, suggested wording could be: "The fatigue

[5] Assuming that the first five trials are the body's attempt to settle on energizing and technical features that will lead to a successful repetition completion, any failure within those five is likely for reasons other than those associated with the training stimulus. The training effect of interest is that which is marked by performance failure after a string of successful trials.

you feel in the last repetition in a USRPT set should be the same as the fatigue you feel at the end of the race for which the set is designed". Such wording can be altered so long as the phenomenon is correctly communicated.

When the specific sequence of failure-rest-failure occurs, that is, two failures in a row, participation in the set should end and the swimmer should embark upon active recovery in preparation for the next USRPT set. Usually one lane in a pool is designated as the recovery lane and swimmers follow their own wisdom or whim as to what recovery activity they perform while other swimmers are still participating in and/or completing their repetitions. If no lane is available, an out-of-water recovery should be performed.

v. When two failures in a row occur, the swimmer leaves the lane in which the set was being swum. Since there is to be a period of active recovery, as soon as the set is terminated that recovery should start. The recovery period comprises a time where only some swimmers are recovering and then when all are recovering.

6. **The USRPT Concept of Failure.** One of the more difficult concepts of USRPT is "failure" and its two uses. In traditional training failure is not completing a set of repetitions. In USRPT, failure has two meanings.

   i. When a repetition set establishes a maximum number (e.g., 30 x 50 at 200FR R-P), it is generally expected that swimmers will not complete 30 repetitions. Ideally, they would complete perhaps 22 repetitions before the first repetition that is slower than race-pace, that is they "failed" to hold race-pace velocity. Thus, in this sense a failure to hold race-pace could be by a small, moderate, or large amount. What is important is the number of contiguous trials where race-pace was equaled or bettered. When a swimmer slows and "fails" to hold race-pace that indicates when a swimmer is nearing the capacity to perform repetitions at or better than a stipulated velocity. After one repetition interval of rest the swimmer rejoins the set and attempts to gather more resources to perform at the desirable pace. Eventually, a total of three failures or two consecutive failures occur and the swimmer's attempt at the set is abandoned and active recovery begun. In this sense, failure is not a complete disaster but simply a single-term that indicates not performing at the target race-pace. When swimmers perform more successful repetitions prior to exhibiting the first failure than in the previous attempt at the same set, that is a good outcome because the swimmer has improved in endurance capacity to perform at a set pace.

   ii. When a swimmer "fails" to complete the maximum number of repetitions that is not a negative occurrence. If the total 30 x 50 were successfully completed, that is an indication that the total set at the exhibited race-pace was too easy. The reaction to total completion should be to increase the velocity of swimming for each repetition so that the swimmer will fail to complete the total number for the set. Total completion indicates to the swimmer they have maximized their capacity to perform at the race-pace over the repetition distance for the target swimming event. In traditional swimming, completing all the repetitions is good, but in USRPT it indicates that the training set was too easy and the swimmer did not experience a maximum training stimulus that would produce a full training-effect. Thus, in USRPT completing all repetitions (i.e., not failing) is not good because training was not as effective as it could be.

   In both senses, missing a target time and not completing the maximum number of repetitions, failure has good connotations. In the first it indicates the swimmer is nearing the limit of race-pace endurance for that day. In the second, it means the swimmer has experienced the major

training stimulus for the set. In discussion with a number of masters swimmers an attempt was made to suggest a better term than failure. However, it was conceded that failing to hold a race-pace and failing to complete the maximum number of repetitions were the best use of the word "failure". When introducing this aspect of USRPT it is worthwhile to explain the use of the term and its two senses and to indicate that in its context failures are desirable because they indicate the benefits of USRPT are occurring.

7. *Recover well*. When only a few swimmers are recovering, the active work should occur in one lane dedicated to recovery swimming or on the deck out of the water. Active recovery can involve any safe movements in or out of the water. Once all swimmers have ended participating in their sets, all the pool should become available for recovery swimming. The length of the recovery should be long rather than short and should allow the swimmers to approach the next USRPT set positively and seek improvement.

   For swimmers to improve in pool performances, training has to be fatiguing to the point of the inability to perform at a race-pace criterion level. That edict adheres to the Specificity of Training Principle. On the other hand, recovery activities can be any movement that sustains circulation at or near a workload that would approach an anaerobic threshold[6] (McMaster, Stoddard, & Duncan, 1989). Active recovery promotes faster recovery than passive recovery. The coach can dictate the activities to be performed, allow swimmers to freely choose, or provide a mix of both.

8. *Record the set performance*. Swimmers should remember features of the completed set: the fastest time(s) and how many there were of them; how slow were the failures; how many repetitions were completed before the first failure after the first five repetitions (the "adjustment" repetitions); and what was the total number of successfully completed repetitions (once again counting the first five as all successful).

   When sets are repeated, swimmers should be aware of what happened the last time the set was attempted. In all repetitions, swimmers should attempt to improve on two performance features: i) how many successful repetitions are completed before the first failure (the primary goal), and ii) what is the total number of successful repetitions. Interpreting the most recent set's performances and comparing them to those of the previous set can lead to several conclusions.

9. *Interpreting one set's performances*. Since there are two criteria involved in determining if the completion of a USRPT set is an improvement, an equal best, or a worsened performance, the decision is not as clear cut as when only one criterion is applied. The possibilities for inferences about swimming capabilities based on two criteria are listed in Table 4.

Two criteria for evaluating the quality of completion of a USRPT set means that the motivation to complete the set is more than when only one criterion is used.[7] When an "indeterminate" or "worse" conclusion is drawn, it would be a good coaching ploy to discuss the outcome with the swimmer and determine if a better approach to the task is possible; if there are factors that could be modified that would allow better completions; or if there are external factors that affected the conduct of the set.

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[6] During work, it is possible for energy from the glycolytic system to be restored, thus, lactate production and removal is balanced. The highest level of that *"balancing"* is the anaerobic threshold. Beyond the anaerobic threshold lactic acid accumulates.

[7] The number of incentives to complete a behavior determines the level of motivation involved in the task. The two discrete criteria used in this description enhance a swimmer's motivation to complete the set more than if only one of the two criteria was used.

TABLE 4. INFERENCES ABOUT SWIMMING CAPABILITIES FROM TWO SET-COMPLETION CRITERIA IN USRPT WHEN COMPARED TO PREVIOUS USRPT COMPLETIONS.

Number of Repetitions to First Failure	Total Yardage Achieved	Decision About Swimming Status
More	Increased	Improved
Same	Increased	Improved
Less	Increased	Improved
More	Same	Improved
Same	Same	Same
Less	Same	Indeterminate
More	Reduced	Improved
Same	Reduced	Worse
Less	Reduced	Worse

The number of repetitions completed before the first failure is the performance feature that should be emphasized. The total race-pace yardage achieved, although still valuable information, provides less inference about future performances.

Not all swimmers adopt the initial stance of swimming as many repetitions as possible before the first failure. Some take a voluntary rest when the level of difficulty becomes notably high. Others inject rests for other reasons. These various ploys are designed to yield the greatest race-pace yardage possible. While acquainting swimmers with the possibility of them taking a rest not necessarily after a failure is not encouraged, it should be allowed because it allows swimmers to begin thinking about allocating resources to a task, which is a major ingredient in learning to correctly pace a race. To avoid swimmers adopting a ploy of swimming a few successful repetitions, failing and resting, and repeating that sequence to the extent that the nature of the intended USRPT set is changed, participation in a set should be terminated when a maximum of three failures have occurred even if two successive failures have not been recorded. The most desirable swimmer behavior is to swim as many successful repetitions as possible before the first failure.

Step 8: Adjustments for Group Sizes and Pool Lengths

The descriptions offered for USRPT are generally for the ideal situation of one swimmer per lane in a short-course pool. When the lanes are occupied by groups or the training pool is long-course, adjustments have to be made in the organization of practices.

In 25 m pools

In 25 y/m pools, when there is more than one swimmer in a lane, the "miss one repetition" after a failure suggestion poses a problem when swimming 25 y/m repetitions. When a swimmer "misses" a repetition, the other swimmers travel to the other end of the pool. If the failed-swimmer executes on the next interval the other swimmers will be swimming toward him/her. That violates the desired organization of minimizing passing swimmers in a repetition. Since the repetition interval times of 25 y/m repetitions are the shortest of all program offerings, it is expedient to have swimmers miss two repetitions (rather than the desirable one) to preserve the smoothness of task execution and to reduce the occurrence of passing other swimmers in the same lane.

When 75 y/m repetitions are performed and a failure results, a situation similar to what happens with 25 y/m repetitions results – the failed swimmer would end up at the opposite end of the pool to the position of the successful swimmers in the lane. However, to miss two repetitions of 75 y/m work is much too long for a swimmer to rest. It is recommended that after the last swimmer in the group has turned for the third lap in the failed-swimmer's "rest" period, the failed-swimmer joins in and swims to the other end and recommences to participate normally with the group. The velocity of the join-in swim would have to be fast enough to allow the failed swimmer to participate in his/her usual group position.

50 m Pools

USRPT does not work exactly in 50 m pools. Not having a wall on which to turn at increments of 25 y/m takes away opportunities to do timed work in some repetition distances.

When the distance selected to be covered in a USRPT set is a multiple of 50, there does not seem to be much of a problem in executing a set. However, when a swimmer fails and misses a repetition to attempt some recovery, a difficulty does arise. While the "Failed" swimmer is standing at one end of the pool, the rest of the swimmers in the lane are at the other end. Thus, on the next repetition swimmers will be moving towards each other which negates one of the features of USRPT, that of minimizing the amount of times swimmers have to cross when simulating a portion of a targeted event. There are two common solutions to this problem.

i. The failed swimmer can follow the rest of the group down the 50 m length without trying to achieve a target time. In that situation, the swim could serve as active recovery. The swimmer would then continue with the group with the next trial being a normal race-pace attempt.

ii. The failed swimmer could rest and recover at the end of the pool and wait until the group returned. That would mean the failed swimmer would miss two repetitions (for rest and recovery). What results from that is the nature of the first re-joined repetition would be very different in energizing functions to that which is desirable in a continuous set. However, the swimmer would get more swimming performed, would perform the technique that is appropriate for race-pace, and perhaps towards the end of the first re-joined repetition start to approximate the desirable physiology for the approximated stage of the race.

This writer has no preference for one or the other of the above scenarios. It might even be worthwhile to change between each option to promote some variety.

The main difficulty with 50 m pool training is that the important distance of 25 y/m and to a lesser extent 75 y/m, cannot be conducted with the swimmers' having total control over timing and sequencing of repetitions. One option for 25 and 75 y/m work is to forgo timing the swims over the preferred distance.

i. When 25s are swum, instruct swimmers to perform at some effort level, and for such a short distance the velocity should be faster rather slower. This is tantamount to swimmers performing 25 at 100 or 95% effort and then cruising over the remaining 25. Executing the next repetition would be on a very short rest-interval. With three or more swimmers in a lane, timed rest-intervals are dispensed with and the first swimmer goes as soon as the last swimmer in the lane touches the wall. As best as possible, swimmers should commence repetitions five seconds apart.

ii. When 75s are swum, the coach has an opportunity to time swimmers at the feet touch after the first 50. However, most swimmers will not be timed, unless there is a battery of timers available (a low probability event) and the repetitions are once again completed at a percentage of a desirable velocity that will yield roughly a race-pace time.

There are likely to be other innovations by coaches that are alternatives to the above two options. It should be remembered to at least approach the character of USRPT sets, the work and rest/active-recovery periods should be short, with the rest/recovery periods manipulated as best as possible.

Long-course pool training presents problems. Despite the dogma of the swimming world preferring long-course training to short-course training, particularly for long-course competition preparations, there are too many negative features of long-course swimming to practice it very much. Perhaps the only benefit it can offer is it allows swimmers to become familiar with the distance.

Long-course swimming is harder than short-course swimming (Keskinen, Keskinen, & Moro, 2007). Significantly higher blood lactate values were found in a 50-m pool compared to a 25-m pool at a variety of swimming velocities. The highest post-test lactate level was for long-course compared to short-course swimming. Maximum swimming velocity was significantly greater (4.5 %) in the 25-m pool versus the 50-m pool. Heart rate values were significantly lower in short-course than in the long-course at all points of submaximal velocity. Heart rate was equal after the maximum swims in both short and long-course. The turning benefit in the short maximum swim was averaged slightly more than 8%, correlating positively (r = 0.59) with the difference in maximal swimming velocity between the short and long-course swims.

Long-course training and coaching are less productive than short-course work. In an unpublished investigation, this writer observed that swimmers used turns in long-course swimming as rests but in short-course race-pace quality was sustained in USRPT. The higher velocity short-course training speeds carried over to long-course training visits while the opposite was true for long-course swimmers in short-course pools. With regard to coaching, long-course training had significantly fewer swimmer-coach interactions than in short-course pools. The frequency of the coach yelling directions was higher in long-course environments and the frequency of individual coach-swimmer interactions significantly lower. The distance traveled by coaches on the pool deck was significantly less than in short-course pools as were the physical visits of the coaches to the non-starting end of the pool. In long-course environments, the coaches gave many more group instructions than in short-course pools. Within-pool interactions between swimmers and coaches were >60% less in long-course environments than in short-course pools.

Short-course training is preferable to long-course training. The skills executed are of race-quality, stroke lengths are longer, and the velocity of surface swimming is higher in short-course environments. While some long-course practices serve to familiarize swimmers with the long-course format, the quality of swimming in long-course pools is degraded. Since long-course swimming events are used in important competitions, competing in long-course events is most beneficial to a swimmer, not the majority of training being conducted in long-course pools.

Step 9: Incrementally Adjust Performance Criteria in a Set to Stimulate Improvement

Step 5 required the coach to assign the number of repetitions for each set in the practice session. Periodically (usually within a microcycle) the set should be repeated to determine if training effects are being achieved and to assert swimmers' performance progress. Initially, if the set is designed as 30 x 50 at 400 SCm race-pace on a 55 seconds interval, it is expected that the number of successful swims before the first failure and/or the total number of successful repetitions will increase. However, in selecting 30 repetitions it is expected that no one would complete the 30. If that occurred, then the set was too easy for the swimmer. The task involved in the set should always guarantee that swimmers will fail. That feature guarantees that a training effect for the race with which the set is related will occur.

With successive improvements, swimmers will start to approach final participation a few repetitions before or on the final repetition in the set. Other swimmers might have recorded three occurrences in a row that is interpreted as "no improvement". [That usually means they have achieved their upper limit of adaptation.] In either case it is time to make the set more difficult so the swimmer will be challenged to improve again. The single alteration to increase difficulty is to make the time for each repetition marginally faster. The size of that margin has to be sufficient so that the swimmer can judge the repetition time with the timing device, such as the sweep-hand clock illustrated previously.

If the increased swimming velocity is marginal in a repetition, and that repetition is one-quarter of the target race, in the total race it will be a significant improvement. For example, if a swimmer changes from 31+ to 31- seconds for 50 SCm for 200 freestyle, that results in a change from a 2:06 high to a 2:05 low target time for a race. To garner such improvements, the swimmer has to be able to discern a difference between the "new" and the "old" repetition times when timing each new repetition.

It is reasonable to expect swimmers to spend no more than three weeks, and more likely two, repeating the same set. Improvements should come that fast. For example, six exposures to a set should take a swimmer from completing 12 repetitions successfully before failure on the first attempt to improving by one more repetition on every successive attempt at the set. After completing a set six times, swimmers should be approaching the upper limit of their adaptation.

The judgment of altering swimmers' programs and USRPT set challenges is something coaches will have to determine. There are likely to be errors as well as successes in the aptness of incrementally challenging swimmers to improve in all races by appropriately designed training sets. The decisions in this matter are very important and should not be treated lightly. If an error is to be made it would be to challenge changes in swimmers too slowly than too fast.

An Example

The following scenario was described and a question posed (May 15, 2014):

> *"One of my close friends is a 56 year-old middle distance (400-800) swimmer here in Little Rock. He is old, old, old school, brought up in the 70s on tons of aerobic training and has done it all his life…his standard set has always been 10 x 200 on 5-10 seconds rest, and bringing the interval time down over the course of the season. And of course training for one meet a year, tapering, etc. (It's crazy to think that many guys like him would only go "race-pace" 3 or 4 times (time-trial or mid-season meet) before their goal-race). Even before hearing of USRPT, I was trying to bring him into the 21st century, telling him to do more race-pace work and take longer rests.*

I've managed to interest him in USRPT by talking about the theory and showing him some examples like Glenn Gruber. He prefers to swim and train long course, so he has done some sets of 16-20 50s on the minute, going :35s, his 400 race-pace. He makes them all. I've told him he needs to (a) make his interval :55 and (b) do more. He asked about the 800 the other day and I referred him to your table in Swimming Science Bulletin #47, which calls for 40 x 50. He did that the other day, short course as he was forced inside, and used his 1000 pace. He made the entire set with ease. Now, he was going 32s and using a 1-minute interval, so he was getting 28 seconds rest. He said, however, that even at 20 seconds it would have been eminently doable. He said that for lifelong aerobic set devotees, getting 20 seconds rest after a 50 is a luxury.

So, the query, or maybe call it feedback, is that as you slow the race pace to 800, doing 50s USRPT style is not that hard, no matter what the number. He acknowledged that 75s would be more difficult and 100s very hard."

The originator was to all intents and purposes, correct in his interpretations. However, believing that communication is enhanced when the same ideas are expressed differently, the following reply was offered.

"An interesting situation.

First, the 20-second rest rule must be adhered to. An extra 25% (5 seconds), depending on the individual, could change the response requirement. This is particularly so for true distance swimmers. They should be looking at 20-15 second rest intervals not more than 20.

Second, swim more repetitions. 50s for 800 and 1500 are quite easy when adapted to a velocity. Time has to be allowed for fatigue to develop. Sets of 50s should be 30 up to 40. For true distance swimmers, which sounds like your friend, I would be asking for 100s and some sets of 75. I would only use 50s when the race-pace was changed to a new higher level.

Third, swim faster and modify the interval to allow less rather than more than 20 seconds rest.

The purpose is to go to failure. That is a good thing. It indicates that a maximum neural effort was expended. If a swimmer completes the set, then no maximum training effect will result because no maximum effort of the neural kind was expended. It would be just like swimming a race and finishing with "gas in the tank". That is explained in the Step-by-step manual (http://coachsci.sdsu.edu/swim/bullets/47GUIDE.pdf)

Your understanding stated in your last paragraph is correct. As the race-distance increases, repetition distances increase, but the rest interval (~20 seconds) remains constant (plus or minus a few seconds so that each interval starts on a convenient 5-second mark on the pace clock). For example, repeating 75s in 55.0 with 20 seconds rest means every repetition would start on 1:15 seconds. If the swimming velocity is changed to 54, the rest would increase to 21 so that it is easy to see the start on 1:15 seconds. If the velocity changes to 53, the rest could increase to 22 or be reduced to 17 and start on 1:10 seconds. ["Goers" would opt for the 17 seconds.] Those in-between sets, when they are very tough is where shorter swimming distances (e.g., 50s) come in handy until the adaptation to the new velocity improves.

I hope this makes sense. If not, let me know what I need to improve. FAILURE IS GOOD!!!"

Closure

Having swimmers participate in USRPT sessions and sets has a number of benefits that do not exist in traditional training.

- The quality of swimming in a set is consistent rather than variable. That eventually develops an expectation to perform consistent pacing – and hopefully will kill once and for all the foolish admonition of many coaches "to go out fast".
- From one practice session to the next, swimmers will be able to judge if they are improving in performance and the endurance for a particular standard of race performance. That is impossible in traditional training where it is only after a taper that swimmers are given the opportunity to perform well.
- USRPT sets push swimmers to the limit of their ability to perform repeatedly at a desirable velocity that is relevant for their own races. The excessive exhaustion of traditional training is thwarted. USRPT produces specific-training effects that are race-relevant. The general coping response to exhaustion when completing a *"hard"* traditional training set is prevented. In this sense, USRPT is self-regulating because swimmers are instructed not to go beyond performance failure in terms of the level of fatigue experienced.
- In a USRPT set, swimmers are responsible for timing each repetition, analyzing their progress, developing strategies for completing more repetitions/total-distance at race-pace than before, and for disciplining themselves to adhere to rules that provide accurate performance times. Those are features that arise in a race. Consequently, USRPT programs develop the race-management and stress-coping abilities that are needed in competitions. That changes a coach's role from a traffic director and timer to becoming *"a teacher of technique."* USRPT should focus on the techniques of swimming at different velocities in different strokes and races and conditioning those velocities. With swimmers assuming responsibilities for following the designed activities to promote conditioning, a coach can compliment that by being a good teacher of techniques. [Programs for adapting to that coach's role have been published (Rushall, 2011, 2013c).]

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PART B

EXAMPLES OF USRPT TRAINING SESSIONS, MICROCYCLES, MACROCYCLES, AND TECHNIQUE INSTRUCTION

Table of Contents for Part B

A. TRAINING SESSIONS

Reference: Rushall, B. S. (2013). Swimming Energy Training in the 21st Century: The Justification for Radical Changes (Second Edition). *Swimming Science Bulletin, 39***,** http://coachsci.sdsu.edu/swim/bullets/energy39.pdf

EXAMPLES OF RACE-PACE TRAINING STIMULI (Incomplete model).

Repetitions	Distance	Stroke	Intensity	Recovery	Recovery activity
20 x	Across pool (20 m)	Fly	100-m race-pace	Remainder of 20-25-sec interval	Float
20 x	Across pool (20 m)	Back	100-m race-pace	Remainder of 20-25-sec interval	Float

A SAMPLE TWO-HOUR PRACTICE SESSION WITH THREE RACE-PACE SETS AND ONE SKILL SET.

Number	Activity	Duration
1	**Warm-up:** 2 x 200 IM at 80% and 90% effort. Rest one minute.	7 minutes
2	**Underwater kicking skill**: 12 x 15 m double-leg kicking deep. On 45 seconds.	9 minutes
3	**Recovery 1**: 300 m backstroke at own pace.	9 minutes
4	**Race-pace Set 1**: 20 x 50 m crawl stroke at 200 m race-pace. On 55 seconds.	19 minutes
5	**Recovery 2**: 400 m kicking. Choice of two strokes.	10 minutes
6	**Race-pace Set 2**: 30 x 25 m butterfly or breaststroke at 100 m race-pace (include underwater work). On 35 seconds.	18 minutes
7	**Recovery 3**: 200 m backstroke kicking.	8 minutes
8	**Race-pace set 3**: 30 x 25 m backstroke at 100 m race-pace (include underwater work). On 35 seconds.	22 minutes
9	**Recovery 4**: Leave pool. Pick-up and stow equipment.	3 minutes

Reference: Rushall, B. S. (August 28, 2013). *Ultra-short Race-pace Training and Traditional Training Compared.* An invited presentation at the 4th Annual Hall of Fame Coaches Clinic, August 28-30, 2013 in Clearwater, Florida. [Powerpoint presentation.]

ONE DAY'S TRAINING USING THE USRPT FORMAT

MONDAY MORNING – ALL SWIMS 200 PACE; 50 M/Y REPS

Item Number	Content	Duration
1	Warm-up 200 – BF 85%; BK 90%; BR 95%; FR 99%	5 minutes
2	BK –16 reps; Group 1 55 seconds; Group 2 65 seconds	18 minutes
3	400 m/y recovery kicking – use 2 strokes	5 minutes
4	BF –16 reps; Group 1 60 seconds; Group 2 70 seconds	20 minutes
5	400 easy swimming – vary strokes	5 minutes
6	BR – 16 reps; Group 1 60 seconds; Group 2 70 seconds	20 minutes
7	400 easy swimming or pool break	5 minutes
8	FR – 20 reps: Group 1 50 seconds; Group 2 60 seconds	20 minutes
9	Medley relay change-overs	20 minutes
	Total 1 hour 58 minutes	

MONDAY AFTERNOON – ALL SWIMS 100 PACE; 25 M/Y REPS

Item Number	Content	Duration
1	Warm-up 200 – reverse medley order FR 85%; BR 90%; BK 95%; BF 99%	5 minutes
2	BF -24 reps; Group 1 30 seconds; group 2 35 seconds	15 minutes
3	300 kick in pairs talking	5 minutes
4	BR – 24 reps; Group 1 30 seconds; Group 2 35 seconds	15 minutes
5	6 x Dive 25s racing stroke – Maximum speed and energy expenditure: Full recovery between repetitions.	15 minutes
6	FR - 30 reps; Group 1 25 seconds; Group 2 30 seconds	15 minutes
7	400 easy or pool break	5 minutes
8	BK – 24 reps; Group 1 30 seconds; Group 2 35 seconds	15 minutes
9	Dive for distance; Leg explosions	15 minutes
	Total 1 hour 45 minutes	

Reference: Rushall, B. S. (April 28, 2007). *Facts and fictions in conditioning swimmers: The emergence of a new paradigm.* A three-hour workshop presentation at the 2007 Arizona Swimposium, Phoenix, Arizona.

A SAMPLE TRAINING SESSION

INTRODUCTORY SWIM: [Goal – stimulate swim patterns.]

2 x 200 IM 90% BF; 100% BK; 90% BR; 100% FS
100% BF, 90% BK; 100% BR; 90% FS

STROKE INSTRUCTION: [Goal – introduce stroke finish for FS] -- 30 minutes

IMPROVEMENT SET 1: [Goal – 100 BF pace – 750 m]

30 x 25 BF at 100m RP – Rest interval slowest swimmer or 15 seconds

RECOVERY SET 1: Kick on boards in pairs; 300 m FS; 200 m BS

IMPROVEMENT SET 2: [Goal – 400 FS pace – 1,500 m]

30 x 50 FS at 400m RP; 20 seconds rest

RECOVERY SET 2: 200 m BK; 200 m BR; 200 m BF all easy

IMPROVEMENT SET 3: [Goal – 200 BR pace – 1000 m]

20 x 50 BR at 200m RP; 20 seconds rest

RECOVERY SET 3: Bathroom break; cruise a reverse 400 IM

IMPROVEMENT SET 4: [Goal – 200 BK pace – 1000 m]

20 x 50 BK at 200m RP; 20 seconds rest

RECOVERY SET 4: 400m warm-down; swimmer's choice

B. MICROCYCLES

Reference: Rushall, B. S. (August 28, 2013). *Ultra-short Race-pace Training and Traditional Training Compared.* An invited presentation at the 4th Annual Hall of Fame Coaches Clinic, August 28-30, 2013 in Clearwater, Florida. [Powerpoint presentation.]

ONE MICROCYCLE OF TRAINING USING THE USRPT FORMAT

Day and Time	Content
Monday morning	**200s – all strokes over 50 m/y**
Monday afternoon	**100s – all strokes over 25 m/y**
Tuesday morning	**200s – all strokes over 25 m/y**
Tuesday afternoon	**50s – all strokes; turns, double-leg kicking skills**
Wednesday morning	**Off**
Wednesday afternoon	**100s – all strokes – a few 50s but mostly 25 m/y**
Thursday morning	**100s – all strokes over 25 m/y**
Thursday afternoon	**200s – all strokes over 50 m/y**
Friday morning	**50s – all strokes; turns, double-leg kicking skills**
Friday afternoon	**200s – all stokes over 25 m/y**
Saturday morning	**50s – all strokes and skills**

Reference: Personal communication to Coach Peter Andrew and swimmer Michael Andrew. [circa August, 2012.]

SAMPLE MICROCYCLES FOR MACROCYCLE 1

Day	Session	Content
One	Morning	50s some 75s for 200 FR and 200 BR
	Afternoon	Skills; 50 FR; 25s and 50s for 100 BK and 100 FL
Two	Morning	50s some 75s for 200 BK and 200 FL
	Afternoon	Skills; 50 FR; 25s and 50s for 100 FR and 100 BR
Three	Morning	50s some 75s for 200 BR and 200 FR
	Afternoon	Skills; 50 FR; 25s and 50s for 100 FL and 100 BK
Four	Morning	50s some 75s for 200 FL and 200 BK
	Afternoon	Skills; 50 FR; 25s and 50s for 100 BR and 100 FR
Five	Morning	50s for 100 BK and 100 FL
	Afternoon	50s for 100 FR and 100 BR
Six	Morning	Make-up for any missed morning
	Afternoon	Make-up for any missed afternoon
Seven	Morning	Make-up for any missed morning
	Afternoon	Make-up for any missed afternoon

Reference: Rushall, B. S. (April 28, 2007). Facts and fictions in conditioning swimmers: The emergence of a new paradigm. A three-hour workshop presentation at the 2007 Arizona Swimposium, Phoenix, Arizona.

WEEKLY PLAN/MICROCYCLE

DAY	TIME	INSTRUCTIONAL CONTENT	PERFORMANCE CONTENT
Monday	Morning	Finish-position FS	1500 FS; 200 BR
	Afternoon	Finish-position FS, FL	400 FS; 100 FL
Tuesday	Morning	Finish-position FS, BK	200 BK; 400 FS
	Afternoon	Finish-position BR, BK	50 FS; 100 FS; 200 IM
Wednesday	Morning	Finish-position all strokes	400 IM
	Afternoon	Finish-position all strokes	100 FS; 200 FS
Thursday	Morning	Finish-position all strokes	1500 FS; 200 FL
	Afternoon	Finish-position all strokes	100 BK; 100 BR
Friday	Morning	Finish-position all strokes	400 FS; 400 IM
	Afternoon	Finish-position all strokes	100 FS; 50 ALL STROKES
Saturday	Morning	Finish-position all strokes	REVISIONS
	Afternoon	Off	

C. MACROCYCLES

Reference: Personal communication to Coach Peter Andrew and swimmer Michael Andrew. [circa August, 2012.]

SUGGESTIONS FOR THE FIRST MACROCYCLE

If you are looking for suggestions, this is what I would have in macrocycle.

Every Odd Week of the Macrocycle

Morning Sessions

Two strokes at 200 race-pace per session. Complete stroke #1 swimming a set of 75s followed by 50s. Then complete the next stroke the same way. The next time these two strokes are trained, reverse the order so that each week, all strokes initiate a training session.

Do the above for the remaining two strokes on the next day.

Balance out the rest periods between sets. If, when doing the second stroke, the task is obviously increasing in physical demands, then provide a longer rest between sets for the second stroke. Cramming as much swimming into the shortest time is not the plan. Providing the opportunity to produce the greatest number of race-pace repetitions is the central aim. If longer between-set recoveries will foster that then that is what should be done.

Afternoon Sessions

First do sets and tasks for the 50. Spend about 20-30 minutes on it. This will be done every day so it will be the most trained-for event.

Then do a structure similar to the morning session that will cover four practice days.

Two strokes at 100 race-pace per session. Complete stroke #1 swimming a set of 50s followed by 25s. Then complete the next stroke the same way. The next time these two strokes are trained, reverse the order so that each week, all strokes initiate a training session.

Do the above for the remaining two strokes on the next day.

Balance out the rest periods between sets. If, when doing the second stroke, the task is obviously increasing in physical demands, then provide a longer rest between sets for the second stroke. Cramming as much swimming into the shortest time is not the plan. Providing the opportunity to produce the greatest number of race-pace repetitions is the central aim. If longer between-set recoveries will foster that then that is what should be done.

For the fifth session, select content of interest to both children and train that. For example, if more BR and FR work is needed then do a session of 100 race-pace work for those strokes even though two sessions would have already been completed. If need be, such as when travel time to a meet is needed later in the macrocycle, this is the training session/day that can be sacrificed.

I would like to think that four days of two sessions will always be completed every week of the macrocycle except in the last week when the load is halved as an unloading for the final meet.

Every Even Week of the Macrocycle

Repeat what was done in the odd weeks with one exception.

That exception is to do with the order in which sets are done. In the odd weeks they were longest to shortest (e.g., 75s then 50s for 200s, 50s then 25s for the 100s). In these even weeks reverse the order (e.g., 50s then 75s for 200s, 25s then 50s for the 100s).

Otherwise, it should be business as usual each week with the ability to endure more repetitions before "missing" a target time gradually increasing.

Reference: Personal communication to Coach Peter Andrew and swimmer Michael Andrew. [circa September, 2012.]

MACROCYCLE RECOMMENDATIONS FOR MICHAEL ANDREW

1. Dates	September 3 to September 30 [4 weeks]
Emphases	Two sessions per day. Morning - 200s for two strokes; Afternoon – skills and 50; 100s for two strokes not done in morning. Content emphasis is on completing more total race-pace yardage in every set. Stroke technique maintenance, especially keeping low in BF and BR and straight in BK and FR.
2. Dates	October 1 to October 28 [4 weeks]
Emphases	Two sessions per day. Morning - 200s for two strokes; Afternoon – skills and 50; 100s for two strokes not done in morning. Content emphasis is on technique – end of stroke, middle stroke, entry, and quick breathing. Conditioning emphasis is to complete best volumes of previous macrocycle but improve target race-pace speed by .5 secs for 100s and 1 second for 200s
3. Dates	October 29 to December 2 [5 weeks]
Emphases	Two sessions per day. Morning - 200s for two strokes; Afternoon – skills and 50; 100s for two strokes not done in morning. Content emphasis is on technique – symmetry, fluency (smoothness), and diving, turns, and underwater work. Conditioning emphasis in half of all sets is to combine thinking from strategies in appropriate balance with blocks of repetitions within sets.
4. Dates	December 3 to December 9 [1 week]
Emphases	Preparation for and participation in Junior Nationals
5. Dates	December 10 to December 30 [3 weeks]
Emphases	Two sessions per day. Morning - 200s for two strokes; Afternoon – skills and 50; 100s for two strokes not done in morning. Content to be determined based on performances at Junior nationals.

Reference: Personal communication to Coach Peter Andrew and swimmer Michael Andrew. [circa November, 2012.]

CONDITIONING MACROCYCLE 1 – RACE-PACE CONDITIONING MINOR EMPHASIS ON STROKE DYNAMICS								
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Work **75 (16)** **50 (20)** **25 (30)** **Rest 15 seconds**	50% 200 *75/50* 30% 100 *25* 20% skills (turns, starts, underwater) Measure distance x time / strokes at start of microcycle	50% 200 *75/50* 30% 100 *25* 20% skills (turns, starts, underwater)	50% 200 *75/50* 30% 100 *25* 20% skills (turns, starts, underwater) Measure distance x time / strokes at end of micrcycle Possible competition - 200s mostly Formulate race-preparation strategies	40% 200 *75/50* 30% 100 *25* 10% 50 20% skills (turns, starts, underwater) Formulate race-recovery strategies	40% 200 *75/50* 30% 100 *25* 10% 50 20% skills (turns, starts, underwater) Measure distance x time / strokes at end of micrcycle	20%200 40% 100 30% 50 10% skills Possible competition at end -200s and 100s Revise strategies	Rest/taper 20% 200 20% 100 20% 50 Measure distance x time / strokes at end of micrcycle Possible competition pick target events with adequate rest within the competition	Unloading 3 days training as in week 7 Possible competition at end with fewer events

TECHNIQUE MACROCYCLE 2 – TECHNIQUE WITH CONDITIONING MAINTENANCE								
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Work	Repeat conditioning macrocycle Measure Reduce resistance – streamlined bodies; keep low	Repeat conditioning macrocycle End of stroke – Finish with greatest momentum/power	Repeat conditioning macrocycle Measure Mid-stroke – greatest propulsive surface; accelerate Possible competition Revise strategies	Repeat conditioning macrocycle Initiate strokes – as far in front as possible – very quick reposition	Repeat conditioning macrocycle Measure Breathing actions – smooth, quick, low, end of work phase	Repeat conditioning macrocycle Stroke smoothness and symmetry No breathing – for finish, fly, crawl, underwater Possible competition	Repeat conditioning macrocycle Measure Compare to previous macrocycle – set up for next four months of planning Possible competition	Unloading Repeat conditioning macrocycle Possible competition

D. TEACHING TECHNIQUE IN USRPT FORMAT

Following are Dr. Rushall's weekly notes from his involvement with the SDSU women's swimming team in the latter part of 2011.

USRPT stresses both conditioning and technique at various race-pace velocities. The following exhibit contains the notes that Dr. Rushall developed and used to introduce a few features of technique for all strokes at a given race-pace velocity. The adaptation of the swimmers went very well. Nay-sayers who "believe" slow swimming is most appropriate for technique change would not have felt comfortable witnessing the quick learning displayed by the team of ~22 young women. Technique concepts are taught and then swimmers are challenged to evaluate themselves and others and make appropriate adjustments to existing techniques at race-pace.

September 1, 2011

TURNS AND BREAK-OUTS

Presentation Points

1. Turns and underwater work can be as much as 80% of a race.
2. Swimmers can go much faster underwater than on the surface. Dive-entry 4 m/s; Explode off wall 3 m/s; Surface swimming ~1.8+ m/s.
3. Improvements will come easiest from turns and underwater work.
4. Concept of Turn Zone: 5m before wall and 15 m off the wall is where accelerated velocity can and should occur.
5. We do not expect everyone to swim 15 m underwater after a dive/turn but have to do it more than the above average collegiate swimmer.
6. Expectations for the establishment of a "turn and break-out" culture.
   - Accelerate with rate in the turn zone.
   - Rotate with "gymnastic" speed (i.e., using the form of a gymnast performing a somersault in floor exercise).
   - Explode off the wall with vertical jump effort.
   - At a minimum, completely underwater until feet are out of the turn zone. [Build on this as the season progresses.]
7. These are skills that can be practiced and always improved. Never should be complacent with the standard achieved.
8. Today – A focus on aspects of turns and the break-outs. Not a typical training session but one emphasizing instruction, focused practice, and improvement (that will result from your trying so hard).
9. You are asked to give everything you will be told and directed to do a chance to work. Do not limit yourselves to past thinking. We should be able to prove to you that these things work. If we as coaches cannot, then you do not have to do them.
10. Turns should not be opportunities to rest (their habitual role) but opportunities to go faster than other swimmers.
11. Handout: Details of every stroke. Not to be shared with any other swimmers!

12. General features to be stressed today. With the information you have in the handout, you can experiment with adding more features as you train in the future.

- **Approach**
  - Big breaths – one outside the turn zone, one inside as you approach the wall.
  - Increase rating by speed of movement but not through effort (set-up to perform a very fast turn).
- **Turn**
  - Very tight tuck with head bent and legs folded.
  - Extend legs at wall as a continuous drive (legs should be straightening as they contact the wall as they do in a vertical jump).
- **Double-leg kicking**
  - Not dolphin kicking.
  - Go deep (2 m) – close as possible to the bottom when depth is less than 2.5 m.
  - Kick from hips down.
  - Small and very fast – error of bigness.
  - Perfectly still torso, head, and arms.
  - Stay deep until out of turn zone.
  - Transition gradually to surface.
  - Last double-leg kick is when the arms first start to stroke (except BR).

13. That is all for now. Let us go out and swim. Your coaches will set up the lane assignments, etc.

INSTRUCTIONAL PROGRAM

Warm-up

2 x 200 IM – FL 80%, BK 90%, BR and FR 100%. On 3:30. 10 seconds apart if more than one in a lane. Coaches assign lanes (not BSR)

Program

1. DL (double-leg) kicking

2 x 6 x 12.5 deep DL kicking – concentrate on fast and small. On 30 seconds (put up with fatigue), 5 seconds apart. Stop after first 6 repetitions. Then repeat on coach's signal.

Swim 200 easy to recover

Test if deep kicking is valuable.

- Keep explosion effort constant for every trial.
- Push and glide about half depth or shallower.
  Push and glide as deep as possible remain deep, keep head and shoulders down.

10 x 12.5 deep DL kicking – concentrate on fast and small. On 30 seconds (put up with fatigue. 5 seconds apart.

2. Tightness of tuck

Rotation in water. Sprint 12.5 then two somersaults. 8 attempts under my direction. Concentrate on tight small ball. If you do two somersaults, try for three.

Rotation on deck. Away from deck long and high. Tight tuck and open before hitting the water.

- Angular momentum is set at take-off. Pulling the swimmer's mass inward toward the axis of rotation produces an increase in angular velocity (rate of spin).
- Full extension up and out; compress tightly; as soon as feel the tightness open out.
- The feeling of successful rotations is what is needed in the water in a turn.
  Practice this every turn, no matter what the effort level.

3. Combine kick and rotation

10 x 50 on 1:30 – 12.5 build, turn zone, rotate, DL underwater for 12.5, two strokes for 200 m calibration, slow down to wall.

6 x 25 double rotations again on 45.

Repeat 10 x 50 on 1:30 – 12.5 build, turn zone, rotate, DL underwater for 12.5, two strokes, slow down to wall.

4. Test if deep kicking is viable again but from a dive

3 x dive and glide on top.

3 x dive and glide as deep as possible.

Repeat 10 x 50 on 1:30 – 12.5 build, turn zone, rotate, DL underwater for 12.5, two strokes, slow down to wall.

5. Warm-down

200 easy swimmer's choice

October 4, 2011
BODY POSITIONS (STREAMLINE)

Presentation Points

1. Swimming with the flattest body position and in the symmetrical strokes with the least vertical movement possible, results in the least frontal resistance, a reduction in a major cause of slowing a swimmer.
2. In crawl and backstroke, the head and shoulders should be very low and no higher than the hips/buttocks. If correctly positioned, water should flow over the top of the head requiring crawl breathing to be in the bottom of the bow wave and in backstroke to be done as one arm exits the water. The trailing body should slide through the area occupied by the head and shoulders (aka "swimming in the upper torso shadow").
3. In the symmetrical strokes, the shoulders, hips, and knees should move up and down as little as possible. Any excessive vertical movement will cause the hips to drop and frontal resistance to be increased. Breathe as low to the water as possible. In butterfly recover as low as possible. Keep the shoulders underwater, which should be possible.
4. Look at the pictures that are circulating.
5. The aim is to swim through the smallest hole in the water that is created by the leading cross-sectional surface of the swimmer.

Test Activities

1. On the deck, lie face-down with nose and forehead on the ground. Raise the head to look forward at 45 degrees and feel where the pressure increases across the body. Where the pressure is increased is the part of the body that will be forced down increasing frontal resistance.
2. Repeat the above but on the back. Raise the head to look back at 45 degrees. Feel the pressure increase.
3. In the water, prone float looking ahead at 45 degrees. Move nothing so that can see how the swimmer settles in the water.
4. Then prone float with the head almost covered, eyes looking directly at the bottom, and face profile parallel to the water surface.
5. Push and glide on the surface (not underwater) twice with head looking forward until fully stopped. Note the distance.
6. Push and glide on the surface with head down and looking at the bottom until fully stopped. Note the distance.
7. Swim 50 crawl with eyes looking 45 degrees ahead. Count the strokes taken on the second 25.
8. At the same velocity (effort level) swim 50 crawl with head and eyes down. Count the strokes taken on the second 25.
9. See if any conclusions can be drawn.

Training Sets to Practice Streamlining, Head Positions, and Reducing Verticality

A. SDSU 800 warm-up

B. Stroke counting to see if less resistance is developed

Distance swimmers. 12 x 50 on 60 at 200 race-pace. Every odd repetition, swim as usual. Every even repetition change the head and shoulder positions to elevate the hips and legs. Count the number of strokes for the second lap in each repetition. Count half strokes at the end.

Sprint and backstroke swimmers. 12 x 50 on 60 at 200 race-pace. Every odd repetition, swim as usual. Every even repetition change the head and shoulder positions to elevate the hips and legs. Count the number of strokes for the second lap in each repetition. Count half strokes at the end.

Breaststroke and flyers. 10 x 50 on 1:10 at 200 race-pace. Every odd repetition, swim as usual. Every even repetition reduce the vertical movements to elevate and reduce the oscillation magnitude of the hips and legs. Count the number of strokes for the second lap in each repetition. Count half strokes at the end.

Compare the number of strokes for the second lap between normal and streamlined. If fewer strokes are developed then that is a better way to swim.

Follow-up with 10 minutes of recovery kicking.

C. Full set using new body alignment

Distance swimmers. 20 x 25 on 25 at 200 race-pace. Use new head and shoulder positions.

Sprint and backstroke swimmers. 18 x 25 on 30 at 100 race-pace. Use new head and shoulder positions.

Breaststroke and flyers. 18 x 25 on 30 at 100 race-pace. Use new head and shoulder positions.

Follow-up with 10 minutes of easy swimming alternating 100s between preferred and second stroke.

D. Full set using new body alignment

Distance swimmers (second stroke). 12 x 50 on 60 at 200 race-pace. Apply head-leading streamlining to the stroke.

Sprint and backstroke swimmers (second stroke). 12 x 50 on 60 at 200 race-pace. Apply head-leading streamlining to the stroke.

Breaststroke and flyers. 12 x 50 on 60 at 200 race-pace. Apply head-leading streamlining to the stroke.

Follow-up with SDSU warm-up 800.

E. If time, repeat B to see if the original difference still holds.

October 6, 2011

TRAINING SETS TO PRACTICE STREAMLINING, HEAD POSITIONS, AND REDUCING VERTICALITY

A. SDSU 800 warm-up

B. Stroke counting to see if less resistance is developed

Distance swimmers. 20 x 50 on 60 at 200 race-pace. Every odd repetition, swim with new head and body alignment. Every even repetition exaggerate the changes being attempted to the head and shoulder positions to elevate the hips and legs. Count the number of strokes for the second lap in each repetition. Count half strokes at the end. See if exaggeration improves stroke count even more.

Sprint and backstroke swimmers. 20 x 50 on 60 at 200 race-pace. Every odd repetition, swim with new head and body alignment. Every even repetition exaggerate the changes being attempted to the head and shoulder positions to elevate the hips and legs. Count the number of strokes for the second lap in each repetition. Count half strokes at the end. See if exaggeration improves stroke count even more.

Breaststroke and flyers. 20 x 50 on 1:05 at 200 race-pace. Every odd repetition, swim with new head and body alignment. Every even repetition exaggerate the changes being attempted to the head and shoulder positions to elevate the hips and legs. Count the number of strokes for the second lap in each repetition. Count half strokes at the end. See if exaggeration improves stroke count even more.

Follow-up with 10 minutes of recovery kicking.

C. Full set using new body alignment

Medley practice for all swimmers. 10 x 50 FL on one minute at 95+% effort.
10 x 50 BK on one minute a 95+% effort.
10 x 50 BR on one minute a 95+% effort.
10 x 50 FR on one minute a 95+% effort.

Follow-up with SDSU warm-up 800.

D. Full set using new body alignment

Distance swimmers. 24 x 25 on 25 at 200 race-pace. Use new head and shoulder positions.

Sprint and backstroke swimmers. 20 x 25 on 30 at 100 race-pace. Use new head and shoulder positions.

Breaststroke and flyers. 20 x 25 on 30 at 100 race-pace. Use new head and shoulder positions.

Follow-up with 10 minutes of easy swimming alternating 100s between preferred and second stroke.

E. If time, repeat B to see if the original difference still holds.

October 10, 2011

REVIEW BODY POSITIONS AND INTRODUCE FOREARM-HAND PUSH

Revision

- Look at pictures of good positions again.
- Reduce vertical movements in BF and BR.
- Work on all four strokes for 15 minutes.

Introduce Forearm-hand Push at End of Stroke

- Show pictures of crawl stroke and BF.
- Explain forearm-hand combination and where center of push should be.
- Explain the reason for the release velocity of the final push being the most important part of the stroke.
- With crawl stroke, show how push is followed by round-out and where thumb should touch thigh on exit.
- Emphasize feeling in forearm.
- Acceleration and greatest feeling of push.
- Do not allow head-body alignment to be compromised.
- Repeat with BK, BF, and BR.
- Introduce peer evaluation.

Training Sets to Practice Streamlining, Head Positions, and Reducing Verticality

A. SDSU 800 warm-up

B. Stroke counting to see if less resistance is developed

Distance swimmers. 20 x 50 on 60 at 200 race-pace. Every odd repetition, swim with new head and body alignment. Every even repetition exaggerate the changes being attempted to the head and shoulder positions to elevate the hips and legs. Count the number of strokes for the second lap in each repetition. Count half strokes at the end. See if exaggeration improves stroke count even more.

Sprint and backstroke swimmers. 20 x 50 on 60 at 200 race-pace. Every odd repetition, swim with new head and body alignment. Every even repetition exaggerate the changes being attempted to the head and shoulder positions to elevate the hips and legs. Count the number of strokes for the second lap in each repetition. Count half strokes at the end. See if exaggeration improves stroke count even more.

Breaststroke and flyers. 20 x 50 on 1:10 at 200 race-pace. Every odd repetition, swim with new head and body alignment. Every even repetition exaggerate the changes being attempted to the head and shoulder positions to elevate the hips and legs. Count the number of strokes for the second lap in each repetition. Count half strokes at the end. See if exaggeration improves stroke count even more.

Follow-up with 10 minutes of recovery kicking.

C. Full set using new body alignment

Medley practice for all swimmers. 10 x 50 FL on one minute at 95+% effort.
10 x 50 BK on one minute a 95+% effort.
10 x 50 BR on one minute a 95+% effort.
10 x 50 FR on one minute a 95+% effort.

D. Follow-up with SDSU warm-up 800.

E. Full set using new body alignment

Distance swimmers. 30 x 25 on 25 at 200 race-pace. Use new head and shoulder positions.

Sprint and backstroke swimmers. 24 x 25 on 30 at 100 race-pace. Use new head and shoulder positions.

Breaststroke and flyers. 24 x 25 on 30 at 100 race-pace. Use new head and shoulder positions.

Follow-up with 10 minutes of easy swimming alternating 100s between preferred and second stroke.

F. If time, repeat D to see if the original difference still holds.

October 18, 2011

REVIEW BODY POSITIONS, FOREARM-HAND PUSH, AND INTRODUCE THE POWER-PHASE

Revision

- Head and buttocks (FR) and head and hips level (BK).
- Reduce vertical movements in BF and BR.
- Work on all four strokes for 15 minutes.
- Emphasize forearm pressure as the final feeling and stage.

Introduce the Power-phase

- Whole arm and hand move as a unit and transition into end of the pull. This is the make or break stage of stroke development.
- Use back muscles to power action. Pull with back muscles (why?).
- Elbow bend less than 90 degrees (hand(s) should be across under the body, mid-forearm under the shoulder in crawl).
- Position according to diagrams.
- Build pressure (acceleration) from the front, through the pull, to the release. This emphasizes acceleration more than in the previous lesson that only emphasized the end. This should produce an increase in basic swimming velocity.
- Center your thinking on the elbow region to produce a more direct pull. The pull will never be straight but any vertical and/or lateral movements should be minimized rather than eliminated.
- Avoid moving the hands vertically or laterally.
- Swim over the power of the arms. If to the side, then correction actions will be needed to keep going straight.
- Anchor the whole arm(s) and move past it(them). Do not pull the arms or let them slip through the water.
- Most important. Roll the body and hips together at least 45 degrees so that a feeling of leaning on the arm is developed as the swimmer works over the top of the arm in crawl and very close to the arm with partially under the shoulder in backstroke.
- Avoid having the arms go too deep (particularly in butterfly).
- Focus on propelling with the mid-forearm and the elbow. Stop thinking of the hands leading the action. Power with the back muscles.

Training Sets to Practice Streamlining, Final Force Application, and the Power-phase

A. SDSU 800 warm-up

Work on streamlining, end of pull, and experiment with changing body roll, working over the arms, and constant acceleration.

B. Stroke counting to see if less resistance is developed

20 x 50 on 60 at 400-200 race-pace. Odd laps streamline and finish; even laps body roll, back muscle force, accelerate with whole arm under you. Get a clear feeling for what needs to be done.

20 x 50 on 60 at 200 race-pace in your stroke. Odd repetitions swim old way. Even repetitions swim with all the new features. Count the number of strokes in the second lap of each repetition to see if there is any difference between new and old approaches.

C. Easy kicking for five minutes

D. Full set using new arm propulsion

Distance swimmers. 30 x 25 on 25 at 200 race-pace. Use new arm and shoulder positions.

Sprint and backstroke swimmers. 24 x 25 on 30 at 100 race-pace. Use new arm and shoulder positions.

Breaststroke and flyers. 24 x 25 on 30 at 100 race-pace. Use new arm and shoulder positions.

E. Easy swimming for 10 minutes

10 minutes of easy swimming alternating 100s between preferred and second stroke.

E. Full set using new arm propulsion and acceleration

Distance swimmers. 30 x 25 on 25 at 200 race-pace. Use new arm and shoulder positions.

Sprint and backstroke swimmers. 24 x 25 on 30 at 100 race-pace. Use new arm and shoulder positions.

Breaststroke and flyers. 24 x 25 on 30 at 100 race-pace. Use new arm and shoulder positions.

F. Recover with the SDSU warm-up

G. Coaches' Choice

Suggest 50s with attention to all details to simulate settling in during the first lap of a race.

October 25, 2011

REVIEW BODY POSITIONS, FOREARM-HAND PUSH, THE POWER-PHASE, AND INTRODUCE THE INITIAL SET-UP

Revision

- Head and buttocks (FR) and head and hips level (BK).
- Reduce vertical movements in BF and BR.
- Work on all four strokes for 15 minutes.
- Emphasize forearm pressure as the final feeling and stage.
- Back muscle power in the power-phase.
- Fix arm in water and swim past it.

Introduce Initial Set-up

- Concept of longest effective pull.
- No straight arm.
- As soon as touch water, bend at the elbow and rotate upper arm outward.
- This should lead into the power-phase.
- Concept of inactive arm being a resistance maker.

Training Sets to Practice Streamlining, Final Force Application, the Power-phase, and Initial Set-up

A. SDSU 800 warm-up

Work on streamlining, end of pull, and experiment with changing body roll, working over the arms, and constant acceleration.

B. Stroke counting to see if less resistance is developed

20 x 50 on 60 at 200 race-pace. Odd laps streamline, finish, and the power-phase (body roll, back muscle force, accelerate with whole arm under you);. Even laps quick initiation. Get a clear feeling for what needs to be done.

10 x 50 on 60 at 200 race-pace in your stroke. Odd repetitions swim old way. Even repetitions swim with all the new features, particularly swimming past a fixed arm. Count the number of strokes in the second lap of each repetition to see if there is any difference between new and old approaches.

C. Easy kicking for five minutes

D. Full set using new arm propulsion

Distance swimmers. 20 x 25 on 25 at 200 race-pace. Use new arm and shoulder positions.

Sprint and backstroke swimmers. 18 x 25 on 30 at 100 race-pace. Use new arm and shoulder positions.

Breaststroke and flyers. 18 x 25 on 30 at 100 race-pace. Use new arm and shoulder positions.

E. Easy swimming for 10 minutes

10 minutes of easy swimming alternating 100s between preferred and second stroke.

E. Full set using new arm propulsion and acceleration

Distance swimmers. 30 x 25 on 25 at 200 race-pace. Use new arm and shoulder positions.

Sprint and backstroke swimmers. 24 x 25 on 30 at 100 race-pace. Use new arm and shoulder positions.

Breaststroke and flyers. 24 x 25 on 30 at 100 race-pace. Use new arm and shoulder positions.

F. Recover with the SDSU warm-up

G. Coaches' Choice

Suggest 50s with attention to all details to simulate settling in during the first lap of a race.

November 1, 2011

REVIEW PREVIOUS FEATURES AND INTRODUCE EFFECTIVE STROKE LENGTH AND ANCHORING

Revision

- No straight arm after entry.
- Immediate and fast reposition (flex at elbow, medial rotation of the upper arm).
- Continuous stroke acceleration.

Re-introduce Effective Stroke Length

- No wasted time under water – only doing things that propel the swimmer forward.
- Minimize any slippage to anchor the arm and pull the swimmer past it.
- No wavering or sudden position change of any part of the arm (causes loss of power and slippage).

Practice Sets with Peer Coaching

400 of SDSU Warm-up

4 x 25 200 FS race-pace analyzing straight arm positions. If none, look for symmetry of actions.

4 x 25 200 FS race-pace analyzing hand or arm "wobbles". Apply force continually and as acceleration.

4 x 25 200 FS race-pace analyze slippage if possible. Look for long accelerated force.

Training Sets to Practice Effective Stroke Length and Race Strategy

20 x 25 on 30 at race-pace 100 for strategy.

- 10 working on technique feature.

Precede with at least three minutes rest/easy swimming.

10 x 25 on 30 at race-pace 100 for strategy; Distance 10 x 50 on one minute at race-pace for strategy.

- 8 working on technique.
- 12 working on strategy second lap (make sure have thoughts to cover every stroke). For distance swimmers, practice second 50 in total race strategy.

Precede with at least three minutes rest/easy swimming.

20 x 25 on 30 at race-pace 100 for strategy; Distance 10 x 50 on one minute at race-pace for strategy.

- 8 working on technique.
- 12 working on strategy third lap (make sure have thoughts to cover every stroke). For distance swimmers, practice third 50 in total race strategy.

Precede with at least three minutes rest/easy swimming.

20 x 25 on 30 at race-pace 100 for strategy; Distance 10 x 50 on one minute at race-pace for strategy.

- 8 working on technique.
- 12 working on strategy fourth lap (make sure have thoughts to cover every stroke). For distance swimmers, practice fourth 50 in total race strategy.

15 minutes of easy swimming/kicking – swimmers' choice

Boardless kicking (mainly to appease those who believe in kicking**)**

6 x 25 on 45 FS – roll body and hips, bi-lateral breathe, head underwater.
6 x 25 on 45 BK – roll body and hips, hips on surface, locked hands, head mostly under.
6 x 25 on 45 BF – rhythm of small then large, breathe every four kicks, keep flat.
6 x 25 on 45 BR – hold hands firm (no sculling), kick directly backward so that effective kick stops at least hip-width apart. Keep flat, glide for one second after each kick, breathe every three kicks. KEEP COMFORTABLE AND KICK SMALL AND FAST.