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EDITORIAL

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Evidence-Based Scholarly Review and “Strong Inference”

Readers of the first two editorials may have noted the emergence of a “broken record” theme: Aquatics is the Rodney Dangerfield of academic fields. Aquatic scholars and studies just don’t get any respect! I have often attributed this phenomenon to the fact that too few scholars really study swimming and aquatics for their own sake but more often use water and aquatic tasks as tools for investigating questions related to other disciplines (e.g., exercise physiology, biomechanics, motor development, learning). I also feel that too few aquatic scholars (myself included) have conducted sufficiently extensive or rigorous lines of inquiry devoted to aquatic research questions to allow us to deserve greater respect and recognition.

In my experience aquatic specialists have tended to be ultimate pragmatists, seeking answers from our own anecdotal experience rather than using more traditional research approaches such as conducting well-controlled empirical studies. For example, when I served on advisory committees for revising Red Cross and YMCA of the USA learn-to-swim programs over the past 20 years, these groups mainly tended to use what I have termed the coffee-table approach. The many experienced members of these advisory committees (these committee members did have excellent credentials and extensive years of swim-teaching experience) essentially suggested revisions based on mutual experiences while we sat around a figurative “coffee table.” Interestingly, the revisions often contained changes that are consistent with what most practitioners were currently using, which made retraining and widespread acceptance easier. Unfortunately, this approach often leads to perpetuating traditional and questionably effective practices simply because “that is the way we have always done it.” I recall often having a strong sense that we needed to do some research on this idea before we put it into a nationwide program. Unfortunately, the timelines and demands for program revisions meant that we created the programs and hoped that at some time in the future perhaps someone would do the study to determine whether the approach worked or was the most effective method available.

In other, more empirically rigorous areas such as biology, environmental science, or psychology, practical programs are based more often on valid and reliable research studies. Before programs are instituted, either an extensive review of the existing literature is conducted or a series of studies is designed and conducted. As a result, such programs tend to produce effective results and concomitantly are better respected than some of our aquatic programs.

Something New: Evidenced-Based Practices

I am pleased to report what I think may be a sea change in the process being employed to revise aquatic programs in the United States. During the past year the U.S. Lifeguard Standards Coalition was formed, composed of voting representatives

from the American Red Cross, U.S. Lifesaving Association, and YMCA of the USA plus observers from other related organizations such as the Boy Scouts. The stated purpose of the coalition is to identify uniform lifeguarding practices that are based on existing empirical and scientific research studies, a so-called evidence-based approach.

While such an approach certainly is not particularly new or radical, it is unusual, at least from my experience, in devising or revising aquatic-related programs. I find the prospects of using an evidence-based approach to be personally very heartening and exciting. Of course, employing an evidence-based approach is not particularly easy, and it certainly has the potential for slaying any number of “sacred cows,” those ways of doing things the way that we have always done them, which may not be particularly popular for many persons. The advantages of using evidence-based methods include producing much more effective and perhaps efficient program practices, ones based on more valid and reliable information.

So what does an evidence-based approach look like? There is not one single accepted method, but I thought readers might be interested in a brief overview of the approach being used by the Lifeguard Standards Coalition. Perhaps those of you involved in aquatic curriculum development or revision will find the steps to have some usefulness in creating more effective programs.

The first step in this evidence-based approach is to clearly and explicitly state the question to be addressed along with related subquestions. The question needs to be stated in a specific enough manner and with sufficient specificity to be answerable once a literature review has been accomplished. For example, if one were investigating appropriate pedagogy for teaching swimming to young children, a question might be “Are there types of techniques for teaching young children that are more effective in helping them learn to swim than other techniques?” Related subquestions might ask whether there are some techniques that are particularly ineffective, dangerous, or unreasonable to use with children of certain ages. Furthermore, we might ask, “Among the effective teaching techniques for young children, what are the specific advantages and/or disadvantages of each that might recommend one over the others?” To paraphrase a quip I heard an eminent biomechanist make once, “It is important how well one ‘puts the question.’”

A second step in the evidence-based approach is to place the need for the question into a context by providing an introductory background. For example, using my earlier pedagogical example, one might provide an overview of the parent and child swim programs currently available through the YMCA of the USA or American Red Cross, as well as the several position statements opposing infant swimming issued by the Academy of Pediatrics over the years. In addition, the current sets of guidelines for young child swim programs might be reviewed and summarized.

The third and most critical step is to conduct a thorough and comprehensive literature review. Fortunately, in today’s world of extensive technology and the ever-increasing number of library and information databases, searching the literature has never been easier. The challenge actually is not to become overwhelmed by the vast array of information. Because there is so much information currently available on many topics, one must also categorize the quality “level of evidence” provided by each source. There are a number of taxonomies or classification systems by which one can categorize articles. Generally they all represent a rough hierarchy ranging from population-based, randomized prospective studies that present the

strongest evidence to anecdotal literature that simply states commonly accepted, or commonsense, practices.

As I suggested earlier, my experience suggests that the latter type of evidence unfortunately has been the predominant source for many aquatic curriculum revisions in the past. It is not that common sense and commonly accepted practices are somehow inherently bad, but they may be based simply on tradition and not on well-founded facts and empirical evidence.

The traditional approach is summed up by one of my favorite stories about a woman who is cooking a holiday ham. Before placing the ham in the oven, she cuts off both ends. Her daughter asks her why she does that. Her answer: "Because that is how your grandmother always did it and I am sure it has something to do with how well the ham will cook and taste." So, the daughter gets on the phone and calls her grandmother inquiring why she cuts the ends off the ham. The grandmother is caught up short and replies that was the way her mother always taught her to do it and certainly it had something to do with cooking the ham evenly. Fortunately, great grandmother is still alive so they ask her. She smiles and replies, "Well, my oven was too small to take a large pan and the only pan that would fit in the oven required me to cut the ends off the ham!" I love this story because it reminds us how important it is to check our sources and reasons for doing things "the way we always have done them." The reasons we always have done them that way may be very different than merited in our current situation.

After we have investigated and classified each study or article that we have referenced according to its level of evidence, we create a summary table of evidence. This table allows one to look at each piece of literature; classify it as supportive, opposing, or not taking a position; and then glean a broad picture of the situation related to the main question. The use of a summary evidence table reminds me of a personal decision-making process that I call the Ben Franklin technique, presumably originated by old Ben himself. I have found it very valuable when trying to make a complicated decision. One lists each of the possible options available (e.g., each type of automobile one could purchase). For each option, one then lists the pros and cons (e.g., purchase cost, gas mileage, styling, color, seat capacity). It is amazing how simply listing pros and cons for several options side by side suddenly can produce an obvious choice and separate fact from emotion! The summary evidence table works the same way, allowing observers to see where the weight of evidence lies.

The evidence-based approach then concludes by using the information garnered and, based on the strength (or lack thereof) of the evidence, making an appropriate decision. When there is overwhelming, high-quality evidence that the benefits clearly exceed the risks or harms, a *standard* can be established. If the benefits exceed the risks, but the evidence is less robust, perhaps a *guideline* is called for. When the evidence is either not particularly strong or contains contradictory results, *options* can be provided that indicate the different possibilities available. And finally, in the case where there is a lack of pertinent evidence or the balance between risks and benefits cannot readily be determined, *no recommendation* may be the best choice. I suggest that the reason we have so few standards by which we operate in aquatics may be that we have not used a solid evidence-based approach to our program development, as well as having a lack of a solid literature in many areas.

Strong Inference

In 1964 in *Science*, Platt authored an intriguing and challenging article titled “Strong Inference” (Platt, J.R. [1964]. Strong inference. *Science*, 146[3642], 347-353. Readers can locate a reproduced copy of Platt’s article at the following URL: www.krisweb.com/biblio/gen_science_platt_1964_stronginference.pdf). Platt’s work is a true research classic but unfortunately is not well known 43 years after its publication. This lack of contemporary recognition is a shame because Platt presents what I think is an important perspective and approach to helping any complex field of study make advances using a logical, valid, and reliable evidence-based process.

The key for what Platt labels strong inference relies on two important but oft-ignored ideas related to the scientific method: the consideration of multiple alternative hypotheses and attempts to disprove hypotheses. The first element of the strong inference approach requires that a scholar consider all possible ideas or explanations (also known as hypotheses) for various phenomena. Using my previous pedagogy example, instead of hypothesizing that command-style teaching is the most efficacious means for helping someone learn a swimming skill (by the way, it probably is not!), one should actively be investigating the effectiveness of various direct and indirect teaching approaches such as exploration, guided discovery, programmed learning, or task setting. In other words, instead of adopting a pet hypothesis to explain one’s actions (why do we cut off the ends of that ham, anyway?), strong inference leads one to consider each and every alternative hypothesis.

How one weighs the evidence among alternative hypotheses using a strong inferential approach is the second key to the strong inference method. Instead of conducting experiments to “prove” one’s favored hypothesis, strong inference takes the perspective that one should carefully design experiments to *disprove* hypotheses. Platt argues that one needs to spend at least an hour a day just pondering and thinking about a problem as a means for designing elegant disconfirmatory experiments. His approach reminds me of the carpenter’s maxim “measure twice, cut once.” In Platt’s case, the comparable maxim is “think and ponder an hour daily, perform one one elegantly designed experiment.”

Research under a strong inference approach becomes a series of a few elegant well-designed experiments, each of which eliminates one or more alternative hypotheses. As a result, more questions and alternatives are constantly evolving. A research line becomes a “tree” of branching questions that each logically flow from one to the next. In essence one never proves any hypothesis; it simply gains strength by being unable to be *disproved*.

The reason I am attracted to the strong inference approach is not because of its ease of use. Like other evidence-based approaches, it is a lot of hard work. It requires extensive and continual daily pondering of a question and a thorough and tremendous understanding of the context and literature surrounding the question. It requires logical examination attempting to disprove all possible alternative explanations, not just trying to prove that one’s preferred solution is the best. I like strong inference because it truly focuses on the process of science, which is a process of asking the right questions, not answering questions. I urge readers to read (and reread) Platt’s classic article and consider whether it might provide some benefit to their own research line and to the broad aquatic field. If more aquatic practitioners and scholars followed evidence-based approaches to developing curricula and

courses or used strong inference methods in our research, we likely would begin gaining much more respect.

In Volume 1, Issue 3

In Issue 3 of *IJARE*'s Volume 1, readers will continue to find a diverse set of interesting aquatic articles including several additional international submissions. Following this editorial, we publish our first letter to the editor, from B. Chris Brewster, who has provided some corrections to inaccuracies and oversimplifications in lifesaving history that I provided in my very first editorial. I think you will be interested in his information and perspective. I encourage you all to peruse it. I also encourage other readers to consider writing their own letters to the editor, which can be sent directly to me, or, preferably, through Manuscript Central like other manuscripts and submissions. See my Editor's Note following Chris's letter for a bit more detail about writing and submitting letters to the editor.

This issue's first research article was submitted by Adriana Degani and Alexander Danna-dos-Santos from Penn State, who investigated how the lower limb movements of older adults were coordinated and controlled while walking in chest-deep water. Notably, their article examined biomechanical variables with reference to dynamical systems, a relatively new and different approach to understanding how movements are controlled. I anticipate that readers will be hearing much more about dynamical systems in the future. A second research article, focusing on water-sanitation practices, comes to us from Paolo Paez and Catherine Strohhenn. This article describes the degree to which agencies and organizations comply with exemplary water-sanitation practices. Stathis Avramidis, Ronald Butterly, and David J. Llewellyn, representing several universities in the United Kingdom, have contributed an article summarizing the 4W drowning model, which they have created based on an investigative approach called qualitative content analysis. This evidence-based approach employed a review of videos of drowning incidents, as well as interviewing individuals involved in drownings. Another research article comes from "down under," authored by Nat Benjanuvattra, Katie Edmunds, and Brian Blanksby from the University of Western Australia. It examines whether there are any relationships between standing long-jump and swimming grab-start performances by elite and recreational swimmers. Phillip Conatser provides us with a wide-ranging literature synthesis dealing with many variables associated with adapted aquatics and water rehabilitation. An article authored by Jamie Brass and Linda Federoff investigates whether fibromyalgia patients enrolled in water aerobics programs achieve any psychological benefits from their participation. Finally, Melinda Biro, Balazs Fugedi, and Laszlo Revesz provide us a study on whether there is a culture of health consciousness among Hungarian swimming instructors and aquatic programs.

Our third issue wraps up with an educational article, an invited review, and a book review for a recent publication. *IJARE*'s most frequent contributor to date, Lee Yarger from Ball State University, provides readers with another of his professional contributions, this time an article describing his ideas on how to address the challenge of high staff turnover in aquatic programs, especially for seasonal (i.e., summer) facilities. Lee's article is followed by a review of water exercise prepared

by Terri Lees. Readers may remember last issue's media review of Terri's new text, *Water Fun*. In the current review, Terri summarizes a large number of water exercise research articles and presents what we know and do not know about water exercise practices. This article is very much in line with the thrust of my editorial about our continuing need to use evidence-based approaches in aquatics. I believe that Terri provides us an excellent example with her review article about summarizing literature to propose recommendations and changes in our practices. Bringing up the end of this issue, I have authored a media review of Ruben Guzman's new text, *The Swimming Drill Book: 128 Drills for Every Stroke, Turn, Start, and Finish*, which many of our readers who have responsibilities for coaching age-group, high school, college, or Masters swim teams may find of interest and great use. Enjoy!

I'll conclude this editorial with yet another invitation to readers who would like to become more involved to log on to our Manuscript Central Web site (http://mc.manuscriptcentral.com/hk_ijare) and create your own account whereby you can submit articles or simply become available as a reviewer for *IJARE*. When you create your account, please do indicate your areas of interest and expertise in aquatics by choosing as many key words as possible that describe your interest and expertise areas so that when I do a search for manuscript reviewers I can locate you appropriately. As I continue to emphasize, producing any journal, but especially a new one like *IJARE*, requires the contributions of as many authors and reviewers as possible, a true collaborative effort. Thank you in advance for helping with our exciting adventure. I'll be writing to you again in the next (fourth) issue on some thoughts about assessment in aquatics.

Stephen J. Langendorfer

Editor