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# Instructional Materials for STAC 139 Course

Jesse Welsh
jesse.welsh@gmail.com

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Jesse Welsh

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Committee:

Richard West

Jason McDonald

Randall S. Davies, Chair

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## Project Description

Every semester, nearly 150 undergraduate and graduate students enroll in STAC 139 courses at Brigham Young University in Provo, Utah. This course, a .5-credit, pass/fail course, was initially aimed to inspire physical activity and wellness in BYU students interested in running. Over time, the course has evolved and matured in its objectives as new instructors have made alterations to the course in both structure, content, and execution as they have worked within loose-fitting parameters.

This project reports the development of instructional materials for the STAC 139 (Jogging) class. Specifically, the project included the creation of an instructor's manual and additional, supplementary instructional aids. Recognizing the tension between the broad objectives held by the current STAC department and course-specific objectives understood by STAC 139 instructors, the project aimed to relieve this tension. Doing so, it was believed, would help STAC 139 instructors (and the STAC department as a whole) better accomplish the aims of this individual class within the greater context of the department.

### Needs Analysis

A needs analysis was conducted in the early stages of the project. This needs analysis was generated from interviews with Glenna Padfield, the administrator overseeing the STAC department, and several current and former STAC 139 instructors.

**Vaguely-defined learning objectives.** From the view of the STAC department, the primary learning objectives of the STAC 139 course are defined by the loose, overarching objectives of every STAC course. These include helping students (1) stay in good physical shape (promote wellness), (2) develop skills, and (3) enhance their knowledge. Beyond these three

central objectives, secondary objectives including: stress relief and making social connection were also in the minds of STAC administration.

Beyond these vague objectives, little direction is given to STAC 139 instructors on how these general objectives apply to the context of their specific, running-focused course. Some direction is given, in the form of a rough calendar/schedule on the kinds of runs that can be performed by the class to promote "wellness" and physical health of the student-runners. Similarly, some of the "knowledge" to be enhanced in the course is prescribed for STAC 139 instructors in the form of a 90-page supplementary document. This is tested using a mandatory written final exam on which each student must score greater than 75% to pass the course. Outside of these two scaffolds, no direction is given to STAC 139 instructors about the specific kinds of skills that student-runners are expected to develop during the semester.

**Instructor-empowered decision-making.** Instead of precise, specific direction on STAC 139 objectives, the STAC Department focuses on hiring "quality, experienced instructors" and providing them with freedom to define for themselves the objectives of their class. The definition of "quality, experienced instructors" is fundamental to many of the needs identified by the project. This pursuit of "quality, experienced instructors" is defined by Glenna Padfield as hiring older students (upperclassmen and graduate students) that have extensive experience within their specific sport. The needed experience is vetted in a thorough interview process that turns away many otherwise willing candidates. Specifically, Glenna has identified competitive former athletes and coaches as the type of individuals she seeks to hire. Following a hire, new STAC instructors are put through a 3-day pre-service training session and a mandatory block-length course (STAC 585) on pedagogy. Emphasis is on training new hires up generally as

instructors rather than providing them with direction for their specific courses.

Taken together, the vague direction provided by administration, coupled with the empowerment of the instructors, has, over time, led STAC 139 instructors to generate their own ideas regarding: (1) how to best promote physical fitness and wellness with running; (2) which skills are most important for novice runners; and (3) what running-specific knowledge is most valuable to novice runners informed by a mixture of their knowledge of the course materials and their own, personal experience with running.

**Instructor-generated learning objectives.** With the organization-level focus on the instructors coupled with the autonomy provided to them, it was important to solicit feedback from current and former STAC 139 instructors on how they saw these program-defined objectives apply to their courses and how well they felt the current structure of the course allows them to accomplish those objectives. While the instructors each had some nuance in the articulation of the objectives of their version of the course, there was still a great deal of harmony in their priorities. Interviews with STAC 139 instructors found the following three STAC 139-specific understandings of the program-wide goals of the STAC program.

***Staying in good physical shape/promoting wellness.*** Within the context of their course, STAC 139 instructors interpret this goal to mean improved running fitness. Improved running fitness is demonstrated by students' increased ability to complete runs and workouts, especially as these activities increase in volume and/or intensity. This is also manifested in improved or decreased mile time-trial times, which are done at least three times throughout a semester.

***Skill development.*** One skill reiterated by all STAC 139 instructors interviewed (which was comprehensive of all active STAC 139 instructors) was the importance of appropriate pacing by student-runners. STAC 139 instructors felt that all runners need to develop the ability to understand, recognize, and regulate their pace in both workouts and "races" (e.g., mile time trials). This skill was seen by the instructors as the most common mistake made by novice runners. Similarly, literature shows this skill as one of the most essential for increased running performance and one that can be taught.

***Enhance knowledge***. The knowledge that new runners needed, according to the instructors, focused on a series of three sub-topics: training, pace, and injury prevention.

*Training.* Instructors felt runners needed to understand the basic logic and physiology of running training that informed common workouts. Understanding this would allow runners to ultimately become more autonomous in their future running pursuits. Runners also needed to increase their knowledge about local training locations as well as tips to make training more fun/enjoyable. Such knowledge would promote the long-term wellness of student-runners.

*Pace*. Fundamental to the skill of pacing, runners need to know what different paces should feel like in meaningful terms and through meaningful experiences. This knowledge could be referential to the revisited mile time trial pace; it can be put in terms of Borg's rate of perceived exertion (RPE), it can be based on physiological cues (heart rate, respiratory rate), or one-offs of physiological cues, such as conversational ability.

*Injury prevention and treatment*. STAC 139 Instructors felt runners need to understand (1) what the most common running-related injuries are, (2) what causes them, and (3) what can be done to prevent them and/or treat them.

**The problem with instructor-autonomy.** While the autonomy of the instructors is felt as liberating and empowering by both the instructors and the STAC organization, this autonomy, when coupled with the encouragement to individually define learning objectives for their STAC 139 courses, has cultivated a perceived disconnect between the running-specific objectives generated by the instructors and the STAC-mandated, legacy course elements. More precisely, instructors feel that the essential running knowledge defined by the current final exam and the workout schedule prescribed by the calendar provided to STAC 139 instructors conflict with their self-described objectives.

Beyond this tension between older, prescribed elements of the course and the current direction of instructors, little training and direction is provided to support and scaffold instructor-led efforts to help runners develop running skills. As a result, instructors either cobble together disparate components to form a class period or abandon those elements they feel do not connect with their personal objectives with the course. As an example, one new instructor fumbled through a collection of running facts with some illustrations on a white board before quickly pivoting to explain the workout of the day without connection to the instruction. Similarly, a more experienced instructor completely abandoned the instructional component of the class period and instead elected to spend the class period focused on setting up the day's workout and pushed the "instruction" and preparation for the final exam to a study guide he expected students to review outside of class. Taken together, these experiences highlight the feeling of many instructors that the course is a mess of several loosely related parts, most of which fall short of accomplishing their aims in teaching the course.

Recognizing this, this project sought to reconcile the goals of the STAC organization

with the creative efforts of STAC 139 instructors by creating materials that help facilitate the aims of both parties. More specifically, an instructor's manual was created to clarify the learning objectives of the STAC 139 course, harmonize objectives, and provide clarity to the assessments that can be leveraged to recognize when these objectives are being met. Additionally, the instructor's manual and additional instructional aids were intended to provide help to STAC 139 instructors in understanding of (1) how they can conduct appropriate workouts within the constraints of the course, (2) how they can structure the workouts to become meaningful learning experiences, (3) how they can help others develop the skill of appropriate pacing, and (4) how they can organize the material of the final exam to aid in instruction. Doing so, it was hoped, would improve STAC 139 instructors' abilities to increase student-runner fitness; improve skill-acquisition and development; and improve the enhancement of running-specific knowledge.

## Front-end Analysis

### Constraints

The STAC 139 course has several significant time, logistical, and structural constraints that affected the overall redesign.

**Time constraints.** The time constraints of the STAC 139 course exist at both the macro-course level as well as the micro-class level. At the macro level, the STAC 139 course is only a single-semester class that meets twice a week for 15 weeks for a total of only 30 class sessions. The individual class sessions also have significant constraints. Each class session is only 50 minutes long. Additionally, it is STAC policy to not begin class until five minutes after the hour (to provide students with additional time to change into appropriate attire) and to end class five minutes early to provide additional time to shower and change into appropriate attire for the rest of their day. These policies effectively make each session only 40 minutes in length. Lastly, it is the expectation of the STAC department that each class session will have some specific time set aside for instruction. This last constraint is perhaps the most flexible and can be addressed and folded into more meaningful, learning activities within workouts.

**Logistical constraints.** The nature of the STAC 139 course, with its emphasis on running, limits where certain learning activities and workouts can be done. For safety reasons, workouts must be conducted on a surface and in an area that is appropriate for running sidewalks that are safely away from cars and wide enough to accommodate a large group of 30+ runners, low traffic, free from ice during colder weather, etc.). Similarly, the parameters of common running workouts (e.g., 3 x 1000m) necessitates that many runs be done on a track. The location of workouts and other runs can also be affected by weather with cold, icy conditions

forcing classes to stay indoors. Lastly, because of the diverse abilities of the student runners in STAC 139, many workouts often stretch the group in ways that make meaningful, personalized instruction difficult, if not impossible.

**Structural constraints.** In addition to time and logistical constraints, the STAC 139 course and the STAC 139 instructors must navigate structural constraints prescribed by the department. To secure and maintain accreditation, STAC courses must contain two key assessment components: (1) a summative, objective exam at the end of the semester that requires students to pass with a 75% or higher and (2) an attendance policy that allows students only five absences each semester. Each of these assessment components is understood by the department to tie to the broad learning objectives of STAC courses (enhancing knowledge, the development of skills, and the promotion of physical health). The instructor's manual and additional instructional aids would need to focus on and harmonize with the summative assessment and attendance policy.

**Other constraints and considerations.** In addition to the above, it was also important to understand some of the other constraints and resources affecting the STAC 139 course. First, it was important to recognize that the average STAC 139 student-runner registers for the class with the simple intent and desire to run. This desire was expressed by both the learners themselves and reinforced by experienced instructors when they were asked to identify the motivations of their runners. While this may seem an obvious non-problematic issue, when coupled with the STAC department expectation for learning and teaching to take place, beyond physical activity, it creates an important tension that must be navigated. Additionally, STAC 139 classes are taught in several different rooms throughout the Smith Fieldhouse on BYU's campus. While most

rooms do contain many similar resources (video projectors and white boards), some resources are not shared between different classrooms (e.g., computers, floor space to do stretches, and more), which informed the design and creation of materials.

**Learner Analysis**

Throughout the project, it became clear that I had two unique groups of learners that were important to recognize and understand: the STAC 139 students and the STAC 139 instructors. While the STAC 139 instructors were the intended, direct audience of the materials I was creating, it was important to understand who and how they would be interacting with their students, as they would inform some of the design choices made.

**STAC 139 students**. The STAC 139 learner population is comprised of college students at Brigham Young University in Provo, Utah. They are, on average, aged in the late-teens to the mid-twenties. They are undergraduate, graduate, and post-graduate students, with undergraduates being the group with the greatest representation. Males and females are roughly equally represented. STAC 139 student runners come from a variety of running and athletic backgrounds ranging from current collegiate runners to others that have never run before. From this diverse set of backgrounds come a variety of motivations for registering in the class. Many student runners register simply to make running a part of their weekly lives while others have a nebulous goal of getting "fitter". Others have more specific ambitions of making running a habit or are preparing for a specific race. Despite these differences, there is a single common theme for all these runners—the desire to make a commitment to running.

**STAC 139 instructors.** STAC 139 instructors are also college students at Brigham Young University in Provo, Utah. However, they tend to be almost exclusively graduate

students, aged in their mid-twenties to early-thirties. Males and females are roughly equally represented (of the group of STAC 139 instructors engaged with this project, three were male and three were female). As backgrounds, STAC 139 instructors are primarily selected for their meaningful experience with running as a discipline. This meant that STAC 139 instructors were often former or current competitive runners, former or current running coaches, or a combination of the two. Rarely, circumstance would require a STAC 139 instructor to have some other background in another sport (rugby or soccer) that had only a peripheral understanding of or experience with running-specific training and coaching. Table 1 provides an overview of the athletic, coaching, and teaching experience of the instructors involved in the project.

Table 1

*STAC 139 Instructor athletic, coaching, and teaching experience*

| Instructor | Athletic experience | Coaching experience | Teaching experience |
|---|---|---|---|
| Aubree | Former high school runner; Current recreational runner. | None. | None. |
| Trent | Runs recreationally. | None. | None. |
| Jared | Former high school runner; Trained with the BYU "farm team" | Current high school track coach. | None. |
| Nathan | Former high school runner. | Current high school track coach. | None. |
| Angela | Former Division I runner. | None. | None. |

## Current Resources and Training

The population of student runners and instructors that make up a STAC 139 class have access to several different resources to train and teach them the various learning objectives of the course. Previous coaches, current coaches, family members and friends, and other media like websites, books, and videos may all have an influence on the previous training of students prior

to their registration in the STAC 139 course. While such resources are available, it is important to recognize the broad spectrum of exposure to such resources. Some student runners have daily access to professional coaches on campus; for others, especially those that have never run or learned about running with any regularity, no such support is available.

Recognizing this broad range of exposure, it was important to adopt a perspective of universal design; meaning, tailoring both the objectives and activities of the course to accommodate a wide range of talents and understandings. To this end, it was helpful to recognize that many of the running activities lend themselves well to adaptation for both experienced and inexperienced runners.

**Competing Products/Precedent**

The competing products and resources for the STAC 139 instructor's manual and the supplementary instructional aids take many forms. They include: previous experience with in-person coaches, to information repositories like online forums and running-focused websites to more media-based resources like books and videos. This diverse set of resources all aim to train runners on the same basic skills and knowledge, and, in the case of STAC 139 instructors, equip them with to be the one to lead such training.

**In-person coaches.** While coaching, coaching philosophy, and coaching style are all individualistic, there are a few takeaways from in-person coaching that were considered in the design process. First, the individualism that defines coaching had to be maintained. As mentioned previously, the STAC courses are designed to empower and encourage the autonomy of STAC instructors to coach and teach in their own way, according to their own experiences and perspectives. It was be important to ensure that the materials created by the project did not

interfere or limit individualism and autonomy. Second, in-person coaching allows for immediate observation, analysis, and feedback to be given to student-runners. STAC administration often derides the model of indifferent, inattentive coaching defined by simply "throwing out the ball." The fact that student-runners have direct access to an experienced, attentive teacher coach was necessarily utilized, especially in helping runners better understand and interpret physiological signals from their body mid-run.

**Online resources.** Student-runners and STAC 139 instructors have access to a plethora of online resources that cover and aim to accomplish the same objectives of the STAC 139 course. Examples of such websites include LetsRun.com and RunnersWorld.com. While the format of these websites may differ (e.g., forums versus articles), a key component is the value of experience. On issues of training, injury treatment, and even diet, these websites offer opportunities for student-runners and STAC 139 instructors to read and learn from the experiences of others. Where much of the science and precision of running is difficult to articulate and monitor, reflection is helpful for runners to better understand their own experience as they run.

**Books.** Books, like online resources, offer student-runners an opportunity to glean from the experiences of more mature runners. Unlike websites, many running focused books offer up more technical, scientific explanations for different running theories. Examples of such technical knowledge or science heavy books include *The Science of Running* by Steve Magness and *Daniels Running Formula* by Jack Daniels.

One important implication taken from both books and the online resources is the need for meaningful articulation of effort and pacing. Online training resources, like their more thorough

printed counterparts, offer student-runners and their instructors guidelines on workouts including details on their execution, their purposes, and a logical progression between workouts. Additionally, these written resources attempt to articulate how the different efforts and paces of the workouts are meant to feel. Paces are often described in three ways (1) physiologically, (2) verbally, and (3) referentially. Physiological descriptions of paces include such information as its relation to a runner's VO2Max and/or maximum heart rate. Verbal descriptions of paces are often subjective re-articulations of perceived effort (e.g., "comfortably hard" for a tempo effort). Lastly, referential descriptions of paces make use of a previously known and understood race effort and describe the new pace in comparison to the previous pace (i.e. 30 seconds per mile slower than 5K race pace). Occasionally, a fourth type of description called a functional description is utilized. With functional or practical descriptions, runners are provided with observable physiological cues to the pace such as conversational ability or respiratory rate.

This myriad of descriptions to pacing made clear that (1) appropriate pacing and an understanding of pacing is an important skill with running, and (2) the ability to describe and articulate how a given pace feels is difficult. A multi-modal approach to pace description were used in the design process.

**Videos.** Lastly, with the popularity of platforms like YouTube, student-runners have access to an almost limitless supply of running-related videos covering a broad range of topics. While such videos regularly lack the technical depth of written resources and cannot provide the immediate observation and feedback of a coach, they do illustrate the value of modeling within running instruction. Such modeling can be helpful in teaching proper form as well as offering another opportunity to understanding the effort associated with different paces and workouts.

## Nature of the Problem and Objectives of the Project

The front-end analysis for this project made clear the root of the issue for STAC 139 in its current form. The autonomy provided to STAC 139 instructors has, over time, led to a re-defining of course learning objectives. Coupled with a department mandate to adhere to and maintain legacy elements of the course (e.g., the current multiple choice final and course structure) has fostered a perceived divergence between objectives of the course instructors and the department. This divergence is magnified by a lack of instructional designs and materials to help instructors accomplish their objectives for the course.

With this understanding in mind, the objective of this design project became clear. The project sought to align instructor and department objectives. Secondarily, the project aimed to generate materials to help instructors to better accomplish their objectives in ways that are still aligned with departmental guidelines.

**Instructor-generated, course-specific objectives.** The next significant takeaway from this analysis was an elaboration of what the STAC 139 instructors feel are the specific adaptations of the general STAC department objectives of the course. The learning objectives of the STAC 139 course, according to the current instructors are as follows: (1) promote physical wellness through running as measured in improved mile time trial times throughout the semester, (2) help student-runners develop running skills, specifically the ability to properly pace workouts and “races” (mile time trials), and (3) enhance student-runner running specific knowledge, especially regarding training theory, injury prevention, and pacing.

**The need to preserve instructor autonomy.** One of the key features of the STAC program that was proudly touted by the department heads is the autonomy and empowerment of its instructors. Glenna Padfield celebrates her ability to find experienced athletes and coaches and develop them into teacher-coaches. Additionally, she relishes the fact that these instructors can come in and make the classes their own. While this instructor autonomy underlies some of the current problems with the course, it is also a defining characteristic, and one worth preserving. As such, it was important in the creation and implementation of the project to respect that instructor autonomy. Learning materials and activities sought to enhance and support instructor autonomy rather than undermine and restrict it.

**Diverse learning population.** The population of student-runners that fill a STAC 139 course is that they come from a broad range of running backgrounds. This necessitated the adoption of a universal design philosophy to ensure that objectives have applicability to all student-runners and that the learning activities were effective in helping those runners accomplish those objectives.

**Broader applications of the project.** While the proposed project had well-defined parameters, namely the creation of an instructor's manual with additional instructional aids for a class on the BYU campus, it was hoped that the work to design instruction necessary for proper pacing could provide a model for instructional designers in teaching and designing for abstract learning.

## Literature Review for Course Content

It can be easy to consider running and running performance a purely physical endeavor. Central to this design project was understanding the place, role, and influence of cognition within the act of running. This literature review expands on what is currently understood about the role of cognition within running, how that understanding is used to train and teach runners, and, finally, the pedagogical trends in physical education and physical education assessment.

### Role of Cognition in Running

Cognition's role in running has been captured in many ways. Perhaps the most fundamental explanation of the brain's role in running performance is the so-called "Central Governor Theory". The Central Governor Theory posits that self-selected exercise intensity may be regulated continuously within the brain based on a complex algorithm balancing peripheral sensory feedback against anticipated workload remaining (St. Clair Gibson et al 2006; Noakes, St Clair Gibson, Lambert 2005; Noakes, Peltonen, Rusko 2001; Smits, Pepping, Hettinga 2014). Mauger (2014) later explained more thoroughly how this cognitive process operates:

> "...before exercise begins, an exercise template or schema of the estimated required work rate is calculated in a feedforward manner. This process requires knowledge of the exercise endpoint and is strengthened by prior experience of the same or similar activity. When exercise begins, the starting intensity is reliant on this preset schema; however, refinements to the individual's work rate are made once afferent feedback becomes available (i.e., once a short period of "lag time" is complete). The exercise expectations (schema) are compared with the current physiological demand (afferent feedback) against the projected exercise duration (proximity of endpoint), which creates a sensation of the "difficulty" or

> "intensity" of exercise. This conscious sensation (or emotion, as defined by Noakes) then drives the adjustments in work rate which are defined as pacing." (p.210)

Mauger's explanation brings with it a number of implications that drove many of the design decisions of the project, namely: (1) the importance of helping student-runners to recognize and understand so-called "afferent feedback" or the physiological cues from their bodies; (2) the potential benefits of distraction and deception on running performance; and (3) the need for meaningful experience to help student-runners create meaningful exercise schemas for individual workouts and "race" efforts during mile time trials.

**Recognizing afferent feedback.** Many researchers have described the role of afferent feedback in regulating self-directed exercise intensity (see St. Clair Gibson et al 2006; Noakes, St Clair Gibson, Lambert 2005; Noakes, Peltonen, Rusko 2001; Mauger 2014). For the purposes of this current project, the basic explanation that "afferent feedback" is the collection of neuromuscular signals sent to the brain that allows for a constant monitoring of the body (Mauger 2014). More important for the present project is an examination of how coaches and athletes traditionally make use of this understanding.

As discussed previously, run pacing and efforts are often described and presented to runners in a myriad of ways (see New York Road Runners; American Running Association 2004). These descriptions of the abstract concept of how a pace should "feel" are traditionally categorized in three different ways: (1) physiologically; (2) verbally; and (3) referentially. Physiological descriptions are often given as percentages of optimal oxygen intake (VO2Max) and/or maximal heart rate (see American Running Association 2004). Verbal descriptions take these physiological definitions and repackage them in moderately more meaningful language

(e.g., tempo runs are “comfortably hard”, see American Running Association 2004). And referential descriptions of pace take a known effort and compare the new pace against that experience (e.g., tempo pace being 25 seconds slower than 5K race pace, see Emery and American Running Association 2004).

All these descriptions fail to provide a meaningful framework for runners to be able to interpret afferent feedback mid-activity or mid-run. This deficiency has given rise to a fourth type of pace description: functional description. Taking all the previous descriptions, coaches are beginning to provide runners with observable, physiological cues for different efforts so that they can develop the capacity to understand how paces should feel (Gaudette 2012). As one-off markers of oxygen intake and heart rate, the most traditional cues provided to runners are respiratory rate and conversational ability (e.g., at this effort, you should be able to speak only a few words at a time, see Gaudette 2012).

**Potential benefits of distraction and deception on running performance.** While providing runners with a meaningful framework to interpret afferent feedback is beneficial, especially to new runners and during training, there is a growing body of research that shows some benefit to manipulating some of that feedback, especially during race efforts. If the brain is understood as a Central Governor, regulating exercise effort based on a continuous reflection of current effort and afferent feedback against an expected schema, there are things that can be done to manipulate the brain to potentially improve running performance. Most basically, two possibilities exist: (1) deafen the afferent feedback or (2) manipulate the schema.

Competition has been widely demonstrated to have a positive effect on athletic performance (Williams et al 2015a; Williams et al 2015b; Tomazini et al 2015). While different

disciplines have speculated on why this is seen, in the context of the Central Governor theory, competition is understood to offer a distraction to athletes from the afferent feedback (and pain) that their body is attempting to communicate to them. Put another way, by diverting their attention to their competitors rather than the internal signals of their bodies, experienced athletes can increase their effort and improve their performance.

Alternatively, coaches can manipulate the Central Governor by adjusting the athlete's pre-conceived schema. The most common way of doing so is through deception, specifically regarding the amount of time and distance remaining in a race. If our perceptions of effort are the result of comparing our current energy expenditure against what we believe to be the amount of energy and distance remaining (see Noakes 2008), we can drive down our perceived effort (and consequently improve performance) by adjusting our perception of the location of the finish line (Taylor & Smith 2017).

## Pedagogical Implications

With the role of cognition in running understood, the experience of running transforms in its meaning.

**The need for experience in running.** The need to be able to readily interpret afferent feedback and even manipulate this feedback drives the importance of and need for meaningful experiences for runners. With the specific focus of developing the skill to recognize, interpret, and respond to afferent feedback, workouts take on a dual purpose of training both the body and the mind (New York Road Runners; Gaudette 2012). Workouts are not only opportunities to develop the physical systems used during running but also opportunities to develop the cognitive skill to interpret specific afferent feedback associated with a variety of specific running paces.

One way that this cognitive skill is developed in younger, more inexperienced runners is by exposing runners to specific efforts or paces but in smaller, more manageable and repeatable distances (New York Road Runners). Over time, this repeated exposure to a variety of paces (and the intrinsic, afferent feedback with them), runners can develop an almost sub-conscious ability to "feel" a pace (Gaudette 2012).

**The need for experience in physical education.** Beyond running, the need for meaningful learning experience is well understood in the field of education and physical education. Experiential Learning Theory ("ELT") is built on this understanding. Experiential Learning Theory is built on six propositions: (1) learning is best conceived as a process or reconstruction of experience; (2) all learning is relearning; (3) learning requires the resolution of conflicts dialectically opposed modes of adaptation to the world; (4) learning is a holistic process of adaptation to the world; (5) learning results from the interactions between the person and the environment; and (6) learning is the process of creating knowledge (Kolb 2005). From these propositions, Kolb (2005) explains experiential learning as a "cycle or spiral where the learning 'touches all the bases'— experiencing, reflecting, thinking, and acting— in a recursive process that is responsive to the learning situation and what is being learned" (p.194). While the current project and aim to develop the skill of pacing during running may not explicitly draw on all these propositions, this experiential learning cycle will be foundational to many of the design choices that will be made.

Many of the propositions defining ELT have become well accepted within physical education pedagogy. Within physical education, pedagogical paradigms of "participatory action" and "critical inquiry" are taking hold (Oliver 2001). Within these methodologies, students not

only participate in the physical activities set before them but are also provided with a chance think on, reflect, and analyze those experiences in a process called “critical inquiry” (Oliver 2001). Considering the dual purpose of our running workouts, a similar pedagogical framework within the STAC 139 redesign will be essential.

**Assessments in Physical Education**

This foundation of experiential learning theory within physical education coupled with the difficulty to assess such abstract concepts as effort has driven the creation of meaningful, valid assessments in physical education. (Lopez-Pastor et al 2013; Bailey 2001; Piotrowski 200). Three interrelated categories of assessment have been found: (1) formative; (2) authentic; and (3) alternative. It is important to understand that while these categories of assessments carry different definitions, they are not mutually exclusive.

**Formative assessments.** Formative assessments have a growing role in physical education (Chronin & Cosgrave 2013; Plant 2007; Richard & Godabout 2000). Chronin & Cosgrave (2013), found that formative assessments have a positive effect on both teacher and students by providing structure to instruction and “made learning explicit and allowed learning to be acknowledged” (p. 230). Similarly, Plant (2007) found that many physical educators “[got] assessment horribly wrong” by focusing only on summative assessments or ability to perfect and showcase a skill (p. 26).

**Authentic assessments.** Running is a performance, and, as such, a more authentic and valid assessment of running is to have students run. While researchers offer different definitions of authentic assessment, a few common principles are found, specifically: a) the use of real-life (“authentic”) tasks and contexts and b) multiple methods of assessment (Cumming & Maxwell,

1999; Lund 1997). Desrosiers et al (1997) added to these themes by suggesting that authentic assessment be integrated within the teaching-learning process and that the methods of assessment for the students is openly communicated to the students.

**Alternative assessments.** The pursuit of authentic assessments in physical education has given rise to alternative assessments as the traditional assessments rooted in the classroom fell short. By looking for new ways to more readily integrate assessments into the teaching-learning process, practitioners developed new instruments to assess learning outcomes. Moreover, the generation of these instruments was often done in concert with learners to great success, specifically helping move learners away from a so-called "test culture" toward an "assessment culture" (Desrosiers & Godbout 1997). Hopple (2005) offered four tools for alternative assessment in physical education, which illustrate its relationship to authentic assessment: (1) specific and varied assessment tasks, (2) explanations for performance and solutions, (3) a portfolio for collecting demonstrations of student learning, and (4) observable behaviors of skills and competencies.

## Implications for Project

This literature review provided four key implications for this project. First, the extant literature made clear the role and importance of cognition within physical education and performance. This necessitates a broader understanding for both STAC administrators and STAC 139 instructors about the possible objectives of their courses beyond "just" physical activity and development. Second, the literature provided an operationalized definition of the skill of pacing as it relates to running—the recognition, response, and execution of running according to a series of physiological feedback. Third, the literature suggests a decentralization of the learning

experience within a physical education course, away from direct instruction (as is common in the STAC 139 course) toward the physical experience itself. And fourth, the literature reinforces the value of the mile time trials throughout the course as meaningful, authentic assessments for students to demonstrate not only their improved fitness but also their development of the skill of pacing.

# Design

## Task Analysis

The task analysis included the development of new learning objectives of the course that aligned the instructor-generated and department-prescribed objectives, a definition of the guiding instructional design theory, the broad specifications of the STAC 139 course, and the assessments that would be used within the course to measure learner outcomes.

**Learning objectives.** Taking the feedback from the STAC 139 instructors and marrying them to both the STAC department objectives and the associated legacy elements of the course yielded the objectives specific to the STAC 139 course presented in Table 2.

Table 2

*Learning objectives of STAC 139 instructors*

| Original objective | STAC 139 specific objective | Notes |
|---|---|---|
| Promote student physical health and wellness. | Improve student running fitness. | Improved running fitness was defined by instructors as an increased ability to perform workouts and would be measured by improved times during mile time trials. |
| Help students develop skills. | Help students develop the running skill of pacing. | Pacing was defined by instructors as an ability to identify, recognize, and respond to the physiological feedback associated with different running paces to ensure a runner runs at the correct pace for a given workout. |
| Enhance student knowledge. | Enhance running-specific knowledge in the areas of training, pace, and injury prevention. | The existing final exam provided the content of this running-specific knowledge. |

**Instructional Design Theory/Approach**

Experiential Learning Theory (ELT) was the underlying theory of this design project. Because the STAC 139 class is structured around the experience of student runners (with the workout portion of each class occupying 75% of each class period), it was necessary to adjust to this constraint. ELT provides a framework with which to better understand the objectives of the course and to make best use of the runners' experiences in class to accomplish those objectives.

As mentioned previously, Experiential Learning Theory is built on six propositions: (1) learning is best conceived as a process or reconstruction of experience; (2) all learning is relearning; (3) learning requires the resolution of conflicts dialectically opposed modes of adaptation to the world; (4) learning is a holistic process of adaptation to the world; (5) learning results from the interactions between the person and the environment; and (6) learning is the process of creating knowledge (Kolb 2005). From these propositions, Kolb (2005) explains experiential learning as a "cycle or spiral where the learning 'touches all the bases' -- experiencing, reflecting, thinking, and acting-- in a recursive process that is responsive to the learning situation and what is being learned" (p.194). This recursive process is illustrated in Figure 1.

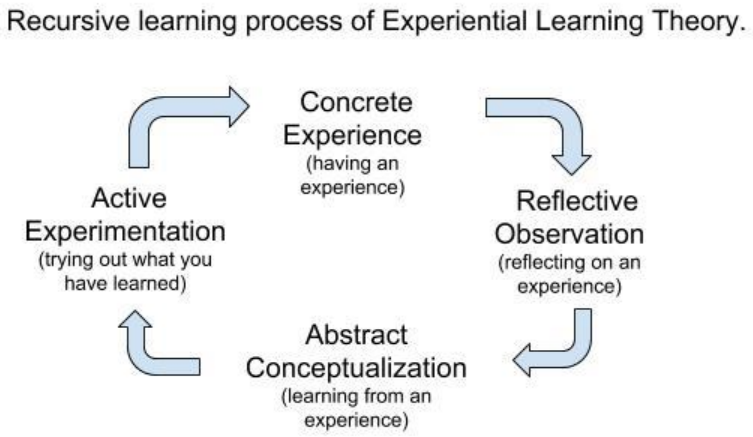


*Figure 1*. Recursive learning process of Experiential Learning Theory.

With 75% of each class period spent within the running experience, meeting twice a week, repeating workouts, and revisiting the mile time trial experience throughout the semester, this framework provides the structure that will define the course. Student-runners will be able to have running experiences, reflect on those experiences in ways that drive forward an understanding of pacing, and then provided future opportunities to experiment on those new understandings to reinforce what has been learned or to learn and achieve something new.

**Design Specifications**

Figure 2 is provided to illustrate the overall design of the STAC 139 course. The structure of this course informed both the decision on the kind of materials that were created within the project (the instructor's manual and the pacing cue cards) as well as the content that populated these materials.

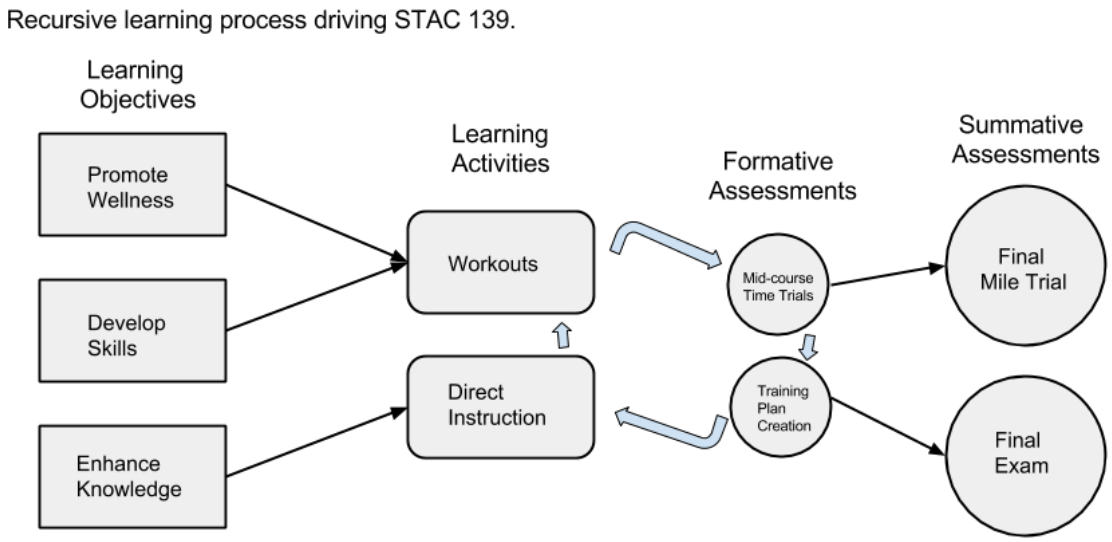


*Figure 2*. Recursive learning process driving STAC 139.

The diagram is intended to highlight two features of the course: (1) how each learning objective drives individual, specific learning activities within the course (direct instruction or the running workouts), how those learning activities recursively drive and are driven by formative assessments throughout the course (mid-semester time trials and other workouts), and how those learning objective will be ultimately assessed with the end of semester, summative assessments (final mile time trial and written final); (2) how the learning activities that make up each class

period (direct instruction and running workout) influence and are influenced by the formative assessments.

Each class period affords teachers two types of learning activities-- five minutes of direct instruction in the classroom followed by three to five minutes of workout setup and thirty minutes of running workout instruction. The instructional portion of the class can be dedicated to those types of learning outcomes that lend themselves more to direct instruction and, more specifically, benefit from access to resources available in the classroom (whiteboards, open space for exercises, and audio-visual resources). This is where the enhanced knowledge regarding training theory and injury prevention can be targeted. Additionally, time within this instructional component of the class period (with the time setting up workouts) can be used to set up the specific running experience of the day (providing runners with their physiological cues and afferent feedback to be looking for, etc.). The thirty minutes of running provides student-runners an opportunity to experience the specific stimuli intended by their instructor and provide instructors opportunities to help student-runners recognize, reflect, and learn from these experiences.

The relationship between these learning activities and the formative assessments, is paramount in the ELT model. The bi-weekly workouts provide opportunities for runners to prepare for meaningful experiences in the formative, mid-semester mile time trial assessments. These mid-semester mile time trials will, in turn, affect the workouts given to the athletes, allowing student-runners to experiment with different efforts and paces. By cultivating this recursive pattern of experience, reflection, learning, and experimentation between the learning activities and the assessments, the assessments (both formative and summative) take on a more

authentic nature and a culture of assessment rather testing, which has historically existed within the course.

**Assessments**

The STAC 139 course will continue to utilize both formative and summative assessments. Formative assessments will be used, as the literature supports, to provide structure to the course and create a learning process of experience and reflection that is essential for an ELT-based course. Summative assessments will be employed at the end of the course to meet the structural demands placed on the STAC department.

Formative assessments will take the form of intermediate mile time trials (two). The bi-weekly workouts were considered a form of formative assessment as runners are engaged in evaluating their own efforts and paces throughout the session. These formative assessments provide student-runners with opportunities to develop and demonstrate their improved fitness, developing running skills, and enhanced running knowledge.

Summative assessments will take two forms: (1) the final mile time trial at the end of the semester and (2) the written final exam. The final mile trial will be the crowning event of the semester where student-runners are able to demonstrate their mastery of pacing as well as their increased running fitness. Additionally, the written final exam provides student-runners an opportunity to demonstrate the culmination of their enhanced running knowledge relating to training, pacing, and injury.

Both formative assessments and summative assessments employ principles of authentic and alternative assessment to enhance student engagement and ultimately promote student ownership of the learning and training process.

## Development Narrative

### Design Phases

With the front-end analysis completed, and with feedback from committee members, I began the development process for the project. The development process was broken into four major phases: (1) review/confirm; (2) define; (3) design; and (4) build. The objectives of each of these phases along with details of who was involved is outlined below.

**Review/Confirm**. With a time gap between receiving feedback from initial stakeholders (current STAC 139 instructors and administrators) and from IP&T committee members, I thought it prudent to return to my stakeholders, review with them the implications of my needs analysis, confirm with them the work I had already done, and share my plans for the project. This need was especially heightened given that all the STAC 139 instructors that provided the initial input that informed my needs analysis were in the process of finishing their time teaching the course and were soon to be replaced by a group of new, inexperienced instructors.

First, I returned to these outgoing instructors and confirmed the implications of the analysis I had done on the needs they shared: (1) clarity on learning objectives, (2) resources to empower instructors to make independent decisions that could still accomplish the objectives of the course within its unique constraints, and (3) a way to harmonize with legacy elements of the course. While each instructor acknowledged that there may be a few other, specific needs they may have, there was consensus that these three areas were of greatest need for STAC 139 instructors. Additionally, I reviewed once again the new, STAC 139-specific learning objectives with these instructors to confirm that they still reflected their understanding. I also reviewed and

confirmed the same with Glenna Padfield, who oversees the STAC program, to ensure that they harmonized with broader goals of the STAC program.

Second, after confirming these implications of the needs analysis, I shared with the group the feedback provided by the IP&T committee and the work I had already done in beginning to assemble an instructor's manual. With that sharing, I solicited feedback on some of the subject or topic areas that should be included in the manual as well as their concerns on how the manual could be best utilized by STAC 139 instructors. The group identified their one-hour preparation period as the central time that they would use the manual. While the instructors are given expected to spend an hour preparing for each class session, as full-time student of the university themselves, it was the concern of the group that the manual would need to be "lean" in its approach to delivering information.

Third, I shared with the group the project plan. I outlined what the design and development process would look like, how I intended to involve STAC 139 instructors throughout, and how I would solicit feedback. This group of outgoing instructors provided positive, reinforcing feedback that the manual could supplement the training on pedagogy provided to all new STAC instructors. They also helped me identify meaningful times to solicit feedback and involvement of the new STAC 139 instructors, specifically in connecting with these new instructors during the first two weeks of the term, as often that time is underutilized by new instructors as they wait for their class rosters to finalize.

Lastly, separate from interacting with the group, I took time to review the content of the final exam. Rather than simply acquainting myself with the content, this review was focused on

ways to align the 50 different questions to provide meaningful subtopics or content areas and how they might fit with the content areas of focus previously identified by STAC 139 instructors.

**Define.** Following the review and confirm phase of development, I began with phase two: Define. Specifically, within the Define phase, I aimed to define the content or content areas needed by the STAC 139 instructors within the teacher manual. This definition process was informed by the objectives and needs confirmed during the Review/Confirm phase and balanced by some of the concerns brought up by the group of STAC instructors. Rather than structure, layout, or overall design, during this phase was focused on defining and scoping the content.

Starting first with the need for "clarity on learning objectives", I knew that the manual would need to outline, in clear, simple language, the specific objectives of the STAC 139 course. Additionally, to help situate and align the STAC 139 course with the STAC program, I decided at this point that it would also be important to include the broader goals and objectives for the STAC program. The specific content for both the broader STAC objectives and the STAC 139-specific objectives was derived from my interviews with stakeholders during my needs analysis.

Moving on to providing resources and information to STAC 139 instructors to meet these course objectives while respecting and preserving instructor autonomy, I hit one of my first roadblocks in the project: how could I provide enough content to be helpful to instructors without becoming prescriptive in my approach? Not recognizing a way to navigate this issue, I started first by identifying what I did *not* want to create: a teaching schedule.

One resource that was provided to me as a new STAC 139 instructor (and was similarly provided to the other STAC 139 instructors) was a teaching schedule that outlined a scope and sequence for the entire course with details on the topics to be taught along with the workouts to

be done. It was my experience as a STAC 139 instructor (and confirmed in my interactions with other STAC 139 instructors) that this resource felt overly prescriptive and restrictive to the point that it affected my (and my colleagues') perception of our own autonomy. Universally, the schedule was ignored by the instructors.

So, if not a schedule, what could I provide that would be meaningful, helpful, but not overbearing in its content? Still unsure, I elected to focus on defining the broader content areas that were needed. With objectives covered, I focused on what content STAC 139 instructors needed to accomplish the objectives of their course: staying in shape, skill development, and enhancing knowledge. With these large content areas identified, I then began to more closely define the needed content to populate these areas.

To accomplish the goal of staying in shape, STAC 139 instructors needed a variety of information. First, instructors would need an idea of *what* the different types of workouts they could or should perform. While most STAC 139 instructors have an extensive running background, not all do. This initial exposure to and articulation of the purpose of various workouts could help inform their understanding of training theory. This improved understanding of training theory could then be shared with student-runners. Second, instructors would need a clarity on the details and structure of these workouts, that is, *how* these workouts could be carried out. Lastly, they would need to understand *where* they could conduct these workouts.

To meet the need to help students develop their pacing skill as runners, instructors would need information on the afferent or physiological feedback associated with different paces as well as an understanding of how to utilize the experiential learning theory framework to help runners recognize, internalize, and learn from their experiences running at different paces.

Lastly, to meet the objectives of helping students enhance their running-specific knowledge, STAC 139 instructors would need to understand all the content of the final exam. More than just understanding that content, they'd need to understand it in connected ways that helped move each question on the exam from existing on an island to, instead, being presented as part of a connected whole with the rest of the course's content. Lastly, they would need to understand this content in simple, clear ways that could be re-articulated to students quickly at the start of the class period because of the limited time provided to instruction.

It was here that I realized what I could offer to STAC 139 instructors that would be helpful without being restrictive: concise information within these various areas that specifically addressed how the instructor could navigate and accomplish these various objectives within the constraints of the course. Rather than providing examples of general aerobic workouts, I could provide examples of how such workouts could be structured within a 30-minute time frame. Rather than an elaboration on all the physiological mechanisms and adaptations that occur with anaerobic workouts, I could provide simple definitions of their purpose within a training block. Rather than providing an 89-page manual on the various information covered by the final exam (like currently exists), I could take the content of the final exam, translate it into declarative statements, and then group it into meaningful, logical sub-groups that correlated with the goals of the STAC 139 instructors and could be covered within the first five minutes of class periods.

**Design.** With the definition and scope of my content solidified, I next moved into the design of the resources. One of the first realizations I made during the design phase was that I had two distinct offerings I was creating that would be utilized in distinct ways, which would affect their designs. First, I was creating an instructor's manual. Second, I was creating some sort

of resource or tool that instructors could use mid-workout with their runners to provide appropriate scaffolding to the running experience to help students develop the skill of appropriate pacing, specifically recognizing and responding to physiological feedback.

***Instructor's manual.*** The instructor's manual was to be a document that would *not* be going out on the run with teachers. Instead, this was a static—even stationary—document that provided information to an instructor prior to a class session. It would be the resource instructors turn to in their given hour of preparation time prior to a class session. It would be used to review plans for the instruction and workout for the day. It would be left in the classroom until the next prep period. However, as mentioned before, the static nature did not provide me with the liberty to be verbose. These instructors are not full-time instructors. Instead, they are full-time students with additional, other jobs outside of the work they do as STAC 139 instructors. The language and content needed to be concise and to the point. While the definition phase helped me to clarify the information that was needed within the manual, I still needed to design the layout of the information throughout the manual and within the individual sections.

Driven by the previous define phase, my design phase of the instructor's manual was broken into macro and micro level organizations. At the macro/manual level, I organized the manual into broad sections informed by the objectives of the project but ultimately defined by the elements of a STAC 139 instructor's role within the class: 1) to be advocates for the objectives of the course; 2) to organize and conduct meaningful workout/running experiences; and 3) to be instructors. From these, the five specific sections were created: Learning Objectives, Assessments, Experiential Learning, Workouts, and Instruction.

The first three sections (Learning Objectives, Assessments, and Experiential Learning) were intended to help guide the overall efforts of STAC 139 instructors. First, a STAC 139 instructor would need to understand the specific objectives of the course as well as how they are situated within the broader STAC program. Second, STAC 139 instructors need to understand how those objectives would and could be assessed. This assessment specifically includes the formal assessments used by the STAC program to determine passing grades and other assessments specific to the STAC 139 course that could be used by instructors to assess for themselves their own success in achieving the aims of the course.

Last, to bridge the objectives with the assessments, STAC 139 instructors would need to understand at a basic level the concept of experiential learning and how the workout/running experiences that constitute a majority of their class periods can be seen, understood, and leveraged as meaningful learning activities.

The Workouts section of the manual was organized, roughly, by the four key types of workouts runners would likely experience in STAC 139: easy, aerobic, mile time trial/race, and anaerobic. For ease of instructor use, I decided to keep a consistent structure to each of the workout sub-sections. Remembering the objective of this content, specifically in providing instructors with information that would increase their understanding of training theory and information that could help them to execute workouts within the constraints of the STAC 139 course in a way that would improve running fitness and developing pacing skill, I identified five necessary subsections: description, purpose, pace, afferent feedback, and examples.

The Description subsection would include information about the type of workout that helped instructors understand the general function of the workout but also some of the common

pitfalls in executing these workouts, especially with the types of runners that are enrolled in the STAC 139 course.

The Purpose subsection would include the short, declarative purpose of these workouts. While the description section provided a bit more contextual information about the type of workout for the instructors, the purpose subsection was the distilled, simplified explanation that instructors could communicate to their runners about the objectives of the workout.

The Pace subsection would provide the information to the instructors on how to setup and determine the pace of the workouts for their students. Rather than percentages of max heart rate or VO2 max, as is common in the running community, these paces were communicated in terms that were based on referential data that STAC 139 instructors could readily measure and have access to, like Mile Time Trial results and expressed in terms of seconds per lap on both the indoor and outdoor tracks available.

The Afferent Feedback subsection would provide the instructor with the physiological feedback that would be elicited by running at the outlined paces. More specifically, the afferent feedback provided was the rating of perceived effort (RPE) on a scale from 1 to 10, conversation-ability, and breathing cues/control.

The Examples subsection would provide an example or two of the specific type of workout, which provided instructors with three things: an example of how the workout could be organized that would fit within the specific time constraints of the class; an example of where and how the workout could be executed that would allow access to and coaching-ability to each student-runner; and an example of where these workouts could be conducted that was in appropriate proximity to the Smith Fieldhouse, which houses all STAC 139 courses.

The Instruction section of the manual contained the reorganized grouping of the content of the final exam. Again, rather than providing a specific scope and sequence for instructors and potentially limit their autonomy, I chose to organize the content into larger groups that they could then take and execute on their own. Additionally, I adjusted the content of the Final exam from their question form into new, short declarative sentences.

***In-workout resources.*** While the instructor's manual was specifically designed with the intent to stay in the classroom, this secondary resource, because it would be providing the scaffolding for the workouts as well as information to be used during the workout, *would* be "going on the run" with instructors. As such, this resource needed to be light, small, and easy to stand alone or attach to the clipboards given to instructors. This constraint would require efficient use of space on whatever object or material upon which it was created.

The content of this resource was already defined within the instructor's manual: rating of perceived effort, conversation-ability, and breathability. While not as directly measurable for instructors, I also added percentage of max heart rate. While few, if any, instructors or students within STAC 139 utilize heart rate monitors, heart rate can be another form of identifying RPE, which can be helpful to newer runners. In addition to the afferent feedback, I also elected to include the purpose of the workout. This, I felt, broadened the utility of tool beyond simply pace skill acquisition toward the broader development of understanding of training.

Bridging the need for concision with the defined content, I soon began to consider the need to leverage visual or graphical depictions of information. Additionally, I recognized the need for this information to be tangible, accessible, and durable for instructors. Simple print outs or pieces of paper would degrade over time from sweat and other elements encountered on the run. From

this recognition, I planned to put this information together into a notecard of some kind—thicker card stock that, when laminated, could handle traveling and accompanying instructors on their runs.

While the content within the instructor's manual informed the content of these "cue cards" I was creating, an additional level of simplification was required. Descriptions of type of afferent feedback were replaced with graphical icons; descriptions of afferent feedback were truncated to short, simple sentences; and the purpose of each workout was reduced to a single sentence. While the instructor's manual afforded more space and time for explanation, these cue cards, because of their utilization in mid-workout, where runners would be fast approaching and fast departing the physical proximity of their instructors, needed content that could be delivered in quick, easily digested and acted upon ways. Figure 2 shows a final version of one of the four cue cards created. Images of the remaining three cue cards are found in the Appendix.

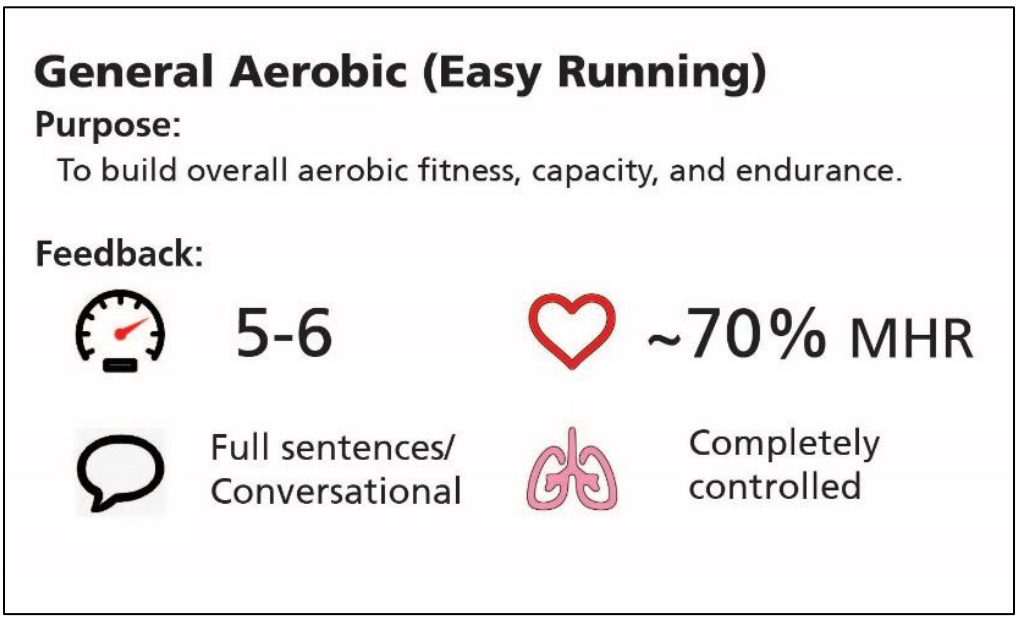


*Figure 2*. Cue card 1: General aerobic (easy running).

**Build.** Building the two different resources was the proverbial “tale of two cities” or a pair of very different narratives. Building the instructor’s manual was as simple as using Microsoft Word as a landing place for the various information and content I had determined needed to be included. Initially, this document was built using a page size of 17” x 11”, with the understanding that this could be helpful to provide a bit more real estate to include helpful maps and graphics of different workouts on adjacent pages. Over time, mostly from a limitation of printing resources, the digital copy of the manual was changed to the more standard 8.5” x 11” format with the understanding that the manual could still be assembled in a way that graphs, images, and maps could be located within the same eye-line as written material.

Consideration was again given to ensure that the build and organization of the material followed logically with the various roles that a STAC 139 instructor fills. These broader sections were given the largest headings with the individual, specific elements within them given smaller but consistent headings and weights. Again, understanding that this resource would be used in quick but unrushed preparation period by instructors, the aim in the overall build was to provide just enough information in a consistent format to aid in its use and utility.

Building the cue cards was a much more involved and iterative process. The cue cards were initially sketched by hand, then imported and designed using Adobe Illustrator to ensure consistency in size and design when it was clear I would be using icons. Figure 3 illustrates the initial, text-heavy design of the cue cards.

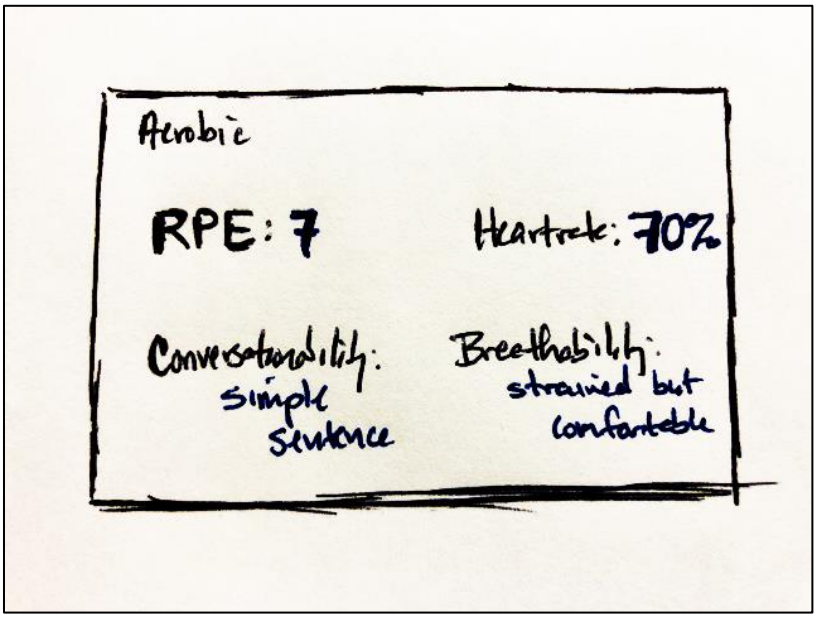


*Figure 3*. Aerobic cue card draft.

Illustrator allowed for more convenient manipulation of the visual icons and graphics that I learned I would need to use. Populating the cue card template artboards within Illustrator started with sourcing icons for the different types of afferent feedback: RPE, heart rate, breathing effort, and conversation-ability. Initially, RPE was represented simply with the text “RPE”. This iteration of the cue cards is demonstrated in Figure 4.

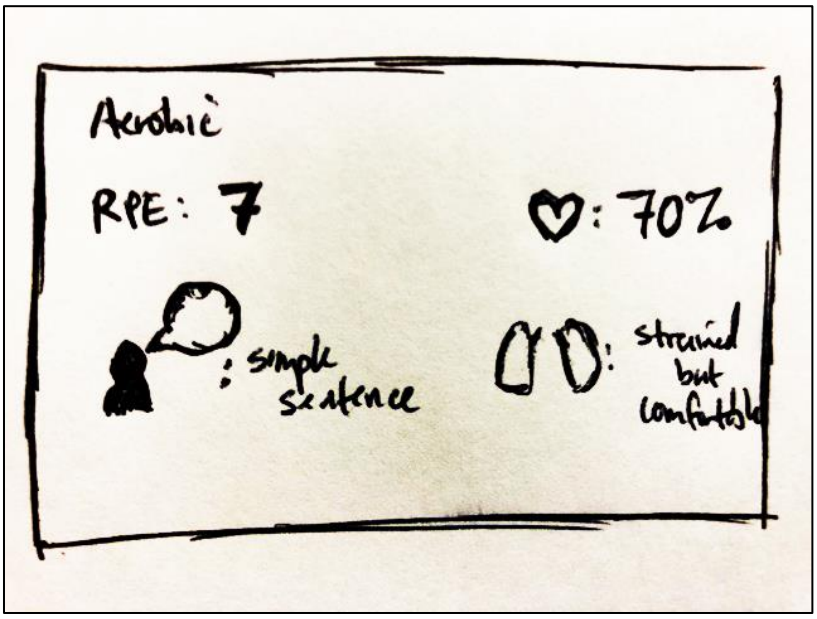


*Figure 4*. Aerobic cue card second draft.

This felt basic and clear enough. However, as I represented each other type of feedback with a simple icon and left the measure of that feedback as written text, leaving RPE as text felt distracting and not as clean and digestible for users. As such, it was replaced with a speedometer, as a visual representation of that perceived physical exertion. The other icons used followed logically: a heart for heart rate; a pair of lungs for breathing effort; and a speech/conversation bubble for conversation-ability. Figure 5 illustrates the final sketch that informed the final version that was created within Illustrator.

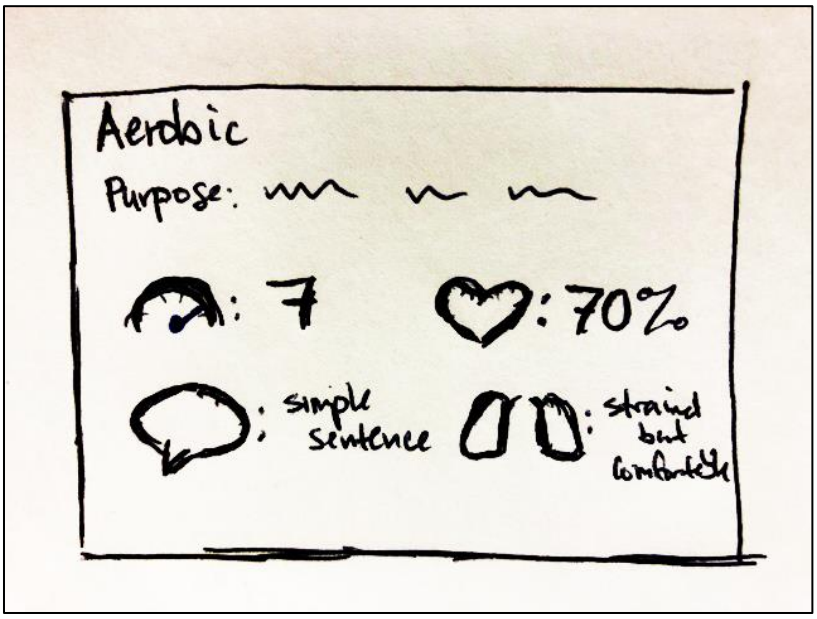


*Figure 5*. Aerobic cue card final rough draft.

Icons were taken from open license sources and then adjusted with modified colors and borders to fit the needs of the project. Specifically, I added color to the original black, flat icons to pull instructors' eyes to that area of the cue cards and added black borders to add greater contrast with the white background of the cue cards to enhance clarity.

With icons identified and in place, adding the accompanying text and specific values of those feedback cues was a simple process of carrying over the content from the instructor's manual. Again, care was given to simplifying the language so that the text could be easily digested by instructors and parroted to their runners. Additionally, text size was also increased to improve readability while also keeping a clean overall look with appropriate separation between elements to avoid muddying the layout of material.

Similar care was also provided to the title of the workout cue card and purpose. Font size and weight was intentionally kept similar to the rest of the card so as to convey similar importance to the instructor. However, the addition of the color from the icons does naturally draw the eyes to the afferent feedback when the cards are in use during a workout.

Originally, the cue cards were one sided. The single sided cue card included the title/type of workout and the various afferent feedback associated with it (see Figures 3, 4, and 5). However, based on the feedback from instructors that had early versions of these cards and recognizing some of the material included in the manual regarding experiential learning theory, I elected to add the same, basic ELT model to the reverse of each card. Doing so would serve as a guide and reminder to instructors on how to: set up the workout experience to specifically bring out the intended afferent feedback; direct the attention of runners during the workout to reflect on that feedback; and guide the conceptualization and application of those reflections. This re-focus on what should be accomplished during the workout helped re-shape the workouts as learning experiences.

**Design Evolution**

Throughout the design and building process, there were several evolutions to the project. These evolutions included changes to the content of the materials created, adjustments to the focus and scope of the project, and an emerging understanding of my stakeholders.

**Changes to the content.** Some changes to the content of both the instructor's manual and cue cards was previously mentioned. In addition to those changes, some other changes included the addition of maps and graphics to the instructor's manual and the inclusion of the ELT model. Figure 6 shows a sample of some of the maps and images that were added.

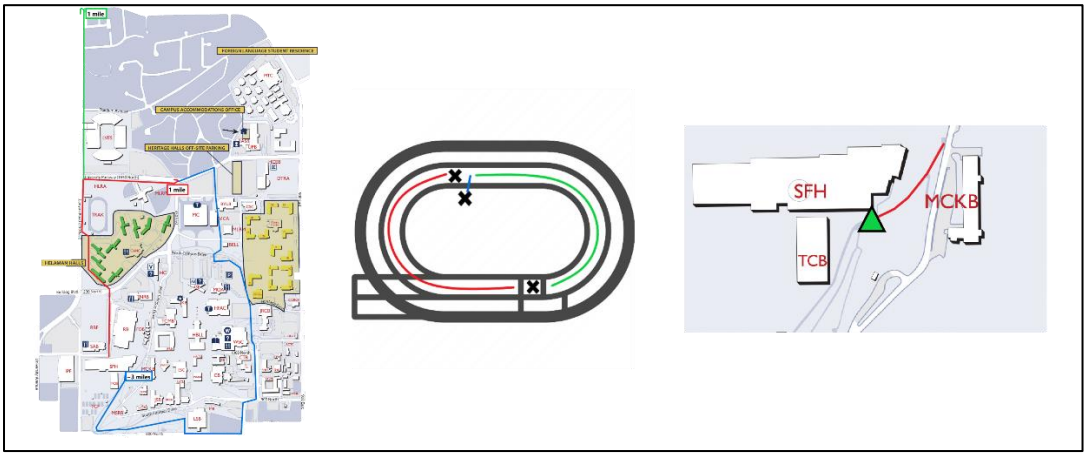


*Figure 6*. Sample of manual maps and images.

The addition of the maps and graphics to the instructor's manual seems like a simple, even obvious inclusion. However, the original instructor's manual included only written descriptions of the locations for workouts. Additionally, the Route Maps for easy runs also evolved over time from a collection of several smaller maps, to a broader BYU campus map with black lines indicating routes, ultimately landing on the current version with cleaner, bolder colors indicating routes along with distances.

The inclusion of the ELT model to the manual was also a later addition. This inclusion came as a result of a growing perception of the value cue cards for the instructors, which will be outlined the below. Suffice to say here that it became clear that direction was needed for the instructors on how to use the cue cards and how they fit pedagogically within the STAC 139 course. Additionally, this re-emphasis on the instructional value of the workout experience pulled back some of the initial design objectives of the project.

**Adjustments to the scope and focus of the project.** The most significant evolution to the project that occurred during the development process was to my understanding of the scope and focus of the project. Initially, the project was intended to be a complete re-design of the STAC 139 course, including the creation of new assessments, lessons, and other learning materials. However, based on feedback from my committee, the project was focused to providing an instructor's manual for course instructors.

In building the instructor's manual, it became clear early on that a static, cumbersome manual would not be sufficient to meet all the needs uncovered by my needs analysis. Specifically, the instructor's manual would not be a sufficient resource to help STAC 139 instructors develop the pacing skill within their students, which would naturally and inescapably occur within the workout portion of the class experience. Something smaller, more portable, and more condensed was needed. Enter the cue cards.

In the development process, the instructor's manual and the cue cards came to be developed in parallel with each other and with a similar importance. However, that changed when getting these materials into the hands of instructors. While instructors' self-assessment placed much of the content of the instructor's manual (specifically in organizing the content of the Final exam) as the greatest need, the feedback and response I received when meeting with instructors to deliver and train on the use of these materials made clear the actual value of each. In sum, the cue cards were the real, helpful offering while the manual was helpful, but unexcitedly so.

In response to this feedback, I was left to wonder why and what impact it made on the future development efforts. I was initially unsure whether this feedback implied that I should

abandon continued development on the manual. Perhaps it's content was not truly necessary and perhaps the cue cards were.

This confrontation with the mortality of some of the major, even primary elements to my project forced me to recollect the function of each. I was reminded that the instructor's manual was aimed at helping STAC 139 instructors: (1) understand the objectives of the STAC 139 course and how they could assess whether those objectives were being met; (2) understand how different workouts could be conducted within the specific constraints of the course; and (3) understand how the various material and content of the Final could be organized into meaningful groups to clarify their presentation during the instruction portion of the class period. These objectives were important and, while novel, the cue cards would not meet these needs.

Conversely, I was reminded of the specific purpose of the cue cards. The cue cards were aimed at equipping STAC 139 instructors with the information and guidance necessary to help novice runners acquire the more expert level skill of understanding, recognizing, responding to, and executing at pace. While initially perceived as a simple task, I think seeing these materials in person helped STAC 139 instructors recognize the novelty of such an objective.

In considering these divergent purposes of the learning materials, I also recognized another influencer in the perceived value of the different resources I was creating: instructor influence. The course and student objectives associated with or targeted by the instructor manual were not perceived to be significantly impacted by the instructors. If the objective of the STAC 139 course was to improve fitness, specifically running fitness, as measured and assessed by mile time trial times, these STAC 139 instructors, I believe, recognized that regardless of whatever specific workouts they introduced to their students, their running fitness would improve. That is

simple physiology, especially with a group of inexperienced runners like would populate a STAC 139 class. While the content of the instructor manual would be helpful for these instructors and remove some of the "learning curve" associated with their new job, it wouldn't necessary cause a huge, noticeable impact on their students.

This same perceived lack of instructor influence existed for both an understanding of the objectives and with acquiring the running-specific knowledge. While helpful to know the STAC 139-specific learning objectives, that knowledge was not seen to have a meaningful impact on the STAC 139 student experience. Similarly, while it would be helpful for STAC 139 instructors to have a resource that transformed the questions of the final exam into short, declarative statements and organized them into meaningful and more digestible groups, it wasn't seen to have much of an impact on student learning outcomes because the average pass rate for the final exam each semester is near 100%.

In short, I believe the help offered by the instructor's manual—while needed and helpful—was not valued as highly by instructors because it wasn't perceived to have a measurable impact on learner outcomes. Conversely, the cue cards represented a tool that, if used, could drive a meaningful learner outcome. Not only that, it was a learner outcome that was perceived to be valuable, novel, and difficult to achieve.

**Emerging understanding of my stakeholders.** From this reconsideration of the perceived value of what I was offering, my understanding of who my actual stakeholders were emerged. While I engaged STAC 139 instructors and STAC program administrators on the frontend of my project, I always held a belief that the STAC 139 students were equally my stakeholders, if not my primary or ultimate stakeholders.

That belief drove the mortality crisis in those middle stages of development. If the materials I was creating were not going to have a meaningful impact on learner outcomes, what was their collective value? In addressing that question non-rhetorically, I realized that the value of these materials was in how they impacted *instructor* outcomes—they equipped instructors to better accomplish the aims of the course, even if that increased preparation could not be measured by student outcomes.

It became clear that STAC 139 instructors were my actual stakeholders with the project. Rather than the hopeful, optimistic belief that the STAC 139 students were my stakeholders, which, I admit, is a belief that sounds right—that the learning objects we create ultimately drive toward and effect meaningful changes with the eventual learners—it was helpful and necessary for me to understand that the actual target audience of my offering were the instructors. Doing so ultimately informed the final design decisions I made as well as how I ultimately came to evaluate (and not evaluate) the success of the project.

**Actual Product**

Two distinct products were created in the course of this development process: an instructor's manual and a collection of four cue cards for the four different types of workouts conducted within a STAC 139 course.

## Implementation

With the products created, implementing them, or getting the instructors to appropriately use them was, like the development process, a "tale of two cities". The implementation required for the instructor's manual was notably different than what was required by the cue cards. This difference stemmed from differences in outcome (the manual was meant as a helpful offering to address some perceived instructor needs while the cue cards would have tangible results with the students themselves), the novelty of the outcomes, and the nature of resources of themselves (the manual being more of a passive resource while the cue cards were a tool to be used). Despite these differences, the current implementation of the products and what is required for their future implementation centered on two pillars: training and material resources.

### Training

The training required for instructors to be able to utilize the manual was minimal. The "training" provided to ensure its proper use was a review of its contents and organization along with an acknowledgement of how it could be used specifically within the hour preparation period provided to an instructor. Outside of that minimal direction, no training was perceived to have been needed, which was reinforced during the evaluation process addressed later in this write up.

For the afferent feedback cue cards, more training and more nuanced training was needed. That recognition led to the inclusion of some added direction to the instructor's manual that addressed how the cue cards fit within the broader framework of the course as a whole, how the cue cards could be leveraged within time trials, and how they could help convert workouts into learning experiences. Additionally, similar scaffolding was added to the reverse of each cue card in the form of an ELT model applied to pace mastery.

Beyond these passive forms of direction, additional coaching was also provided to demonstrate how the tools could be used. This coaching took the form of modeling their use to STAC 139 instructors both before a class period and during a class period/workout that the instructors had set up in advance.

**Resources**

Financial, material needs are the primary drivers for resources required to ensure future implementation and use of these products. For this project, I was able to print the instructor's manual with a personal printer. However, for future implementation, given an average of three new STAC 139 instructors each semester, greater production would be necessary. Additionally, greater effort and financial resources could be provided to bring greater polish to components of the manual—higher quality visuals/photos, higher quality printing and construction, etc. However, such quality is not a necessity.

Similarly, financial investment would be necessary to drive future utilization of the cue cards. For this project, I was able to print the cue cards onto 3" x 5" notecards using a personal printer, then laminate these cue cards (to protect against the elements that may be present by conducting workouts outside or from sweat in the hands of running instructors), and assemble the cue cards together with a hole punch and a binder ring. Mass production of these cards would require additional financial investment.

From a training perspective, while I did orient instructors to the content and organization of the manuals, such training is not a necessity as much of it is self-explanatory. However, the training provided on the utilization of the cue cards would require some additional, different resource investment to provide scalability. For example, while I was able to model, in person,

their utilization as a supplement to the direction provided within the manual and on the reverse of the cards, such modeling would need to be provided in a form that would be forever available and not dependent on my presence. A simple solution would be to film a short video of myself (or some other instructor) utilizing the cue cards—before a workout (setting up the experience and expectation); during the workout (facilitating the reflection); after the workout (conceptualizing and digesting the experience); and into the next run or workout (experimenting on what was learned). The short video could be a simple, scalable training accompaniment to the cue cards themselves. This video was not created within the scope of this project however.

## Evaluation

As mentioned previously, throughout the entire project, my understanding of my actual stakeholders evolved. This evolution necessarily impacted how I evaluated the success of the project. The shifting focus from the students to the instructors informed the criteria, procedures and type of evaluation used, the evidence collected to support that evaluation, and my ultimate takeaways and what I hope others learn from the process.

### Criteria

In the early stages of the project, I understood that the STAC program administrators and the STAC 139 instructors were my stakeholders. This understanding was reflected in my focus in engaging them early in the process to identify needs and define objectives of the project. To wit, my early understanding of how I would evaluate the success of the project was defined by how well I could equip and empower STAC 139 instructors to confidently and independently accomplish the objectives of the course.

However, my understanding of the role these stakeholders shifted, and I began to see the STAC 139 students as my actual, final stakeholders, with the STAC administrators and STAC 139 instructors occupying a place as an intermediate stakeholder—a group of individuals with meaningful, specific needs, but needs that were to be met as I sought to more meaningfully meet the needs of the students they were serving. I believe this focus on the STAC 139 student is what led to my initial desire to completely re-design the STAC 139 course. Doing so would provide a better, more meaningful experience for these students and would address the needs of my intermediate stakeholders.

However, constraining the scope of this project to producing an instructor's manual (and accompanying teaching aids) solidified the STAC 139 instructors as my true stakeholders. The limited scope of the project coupled with the directive from STAC administrators to preserve the autonomy of the instructors made clear to me what I should *not* aim to accomplish with the project, what I should, and how I might go about measuring the success in accomplishing those aims. I could not, in my mind, focus on and design toward the specific outcomes of the STAC 139 students without being overly prescriptive in my approach and thus reducing instructor autonomy. Additionally, as a former STAC 139 instructor, I recognized learner outcomes as measured by the existing assessments of the course (the mile time trials and final exam), which I would no longer be changing, were already exceptional (the majority of students seeing significant improvements to their mile time trial times and more than 95% of students passing the final). Without meaningfully changing these assessments, it would be incredibly difficult to measure changes to learner outcomes.

With the understanding that STAC 139 instructors were my stakeholders, I defined success of the project in terms of providing instructors with a set of materials that they felt were helpful to them in accomplishing their objectives with the course. With such a small population size of STAC 139 instructors (five instructors were engaged in the project, with three currently teaching the course and using the materials in their classes), surveys were sent to collect feedback in three areas: (1) the perceived helpfulness of the materials, (2) how the materials were used, and (3) how often the materials were used. While the first area of feedback directly assessed the success of the project, the other two areas provided additional, indirect feedback on their perceived value by the instructors.

**Procedures**

An online survey was provided to the three instructors that used the materials during their teaching. The survey was given at end of their full semester of teaching and contained the following questions:

1. On the whole, how useful/helpful did you find the materials (the manual and cue cards)?
   1a. What was most helpful about them?
   1b. What was least helpful/what would you change?
2. How did you use the materials?
3. How often/when did you use the materials?
   3a. Do you still use them now? Why/why not?
4. Any other concerns or feedback (i.e. the cue cards fell apart over time)?

The open-ended nature of the questions provided instructors with the freedom to explain more of their own experiences with the material, which provided a more holistic view of how the instructors perceived their value and provided information that could be used to steer future iterations of the materials.

**Evidence and Outcomes**

Feedback from the instructors was collected and grouped around common themes and unique differences. As the survey centered on the three key areas of utility, use, and frequency of use of the materials, the outcomes will be presented in a similar way.

**Utility.** The instructors universally described the materials provided—both the manual and the cue cards—as “very helpful”. The instructors identified the example workouts and the cue cards as the two most helpful elements of the materials. The example workouts provided meaningful illustrations of how the instructors could design their desired workouts within the unique constraints of the course. As one instructor put it, the example workouts helped her

"figur[e] out how to scale typical workouts to the skill level of students in the class. [She] knew what types of workouts [she] wanted to do but was worried about finding the balance between pushing [her] students to help them to improve and pushing them too hard."

As hoped, the cue cards provided guidance to the instructors on how they could help instruct their students on the abstract concept of pacing. Specifically, it was felt that the cue cards provided more concrete, recognizable ways to understand different running efforts. As one instructor explained:

> I liked that the cue cards helped to explain at a beginning runner's level how to gauge how hard they are working. This was not something that I anticipated being difficult for students to understand, however, I quickly realized that gauging effort properly is a big challenge for beginner runners. The cue cards helped facilitate this explanation.

Another instructor reiterated the cue cards' ability to help him take the knowledge of pacing and how different running efforts felt, which he had learned through experience and taken for granted, and comfortably present it to less experienced runners. In his words, "it was nice to be able to cue [students] on things that I felt like I understood but had not necessarily been able to explain."

While the workout examples and cue cards were seen as helpful, the introductory elements of the manual—the sections on objectives, assessments, and experiential learning—were universally seen as being the least helpful. In looking back, instructors assigned this lower value to these sections not because of any lack of value in their content but because they felt like these were areas of the instructor's manual that they simply used less repeatedly. As one instructor explained, "While I think the information at the beginning of the packet is helpful

(explaining the learning process and how the class fits into it) I'll be honest in saying that I read through them quickly and didn't return to them."

**Use.** As expected, the materials were primarily used during the instructors' preparation period to help plan for specific class sessions. One instructor reported using the manual as a guide to help her weekly planning sessions ("I used them weekly when I was planning the week's lesson/workout"). Surprisingly, the cue cards, though seen as valuable, were not normally used during the workout portion of the class (as expected) but were instead used during the classroom instruction to set up a workout. As several instructors put it, the cue cards were instrumental in helping them "explain" new workouts to their students but did not accompany them on the run. Despite their smaller size and durable medium, they did not accompany instructors on runs for two reasons: (1) they were inconvenient to carry and (2) their content was simple enough that instructors felt like they were unnecessary to have on hand. As one instructor explained, "I am pretty familiar with the things that I use from it… and do not need the information as reference."

**Frequency.** The short half-life of the content provided by the materials also affected their frequency of use. While the materials were used frequently in the early stages of the semester, the materials took on a role of being the "training wheels" for these STAC 139 instructors, giving them just enough support and guidance to keep them moving forward until they felt more capable of working on their own. While instructors reported using the materials weekly or more frequently in the early part of the semester, when asked if they used the materials regularly *now*, instructors reported that they do not. One instructor added the interesting caveat: "Not directly. I

still apply what I learned from the materials, but I don't use them directly." I think this statement embodies their role as being the training wheels for these instructors.

**Implications.** The results provided direction for how the materials might be improved going forward. First, additional non-passive training needs to be provided to STAC 139 instructors to help them develop as teachers. By background, they are runners and coaches but not necessarily teachers. The current training given to STAC 139 (and all STAC instructors) is only done in a three-day crash course before the semester supplemented by a first-block pedagogy course. It would seem, from these results, that these efforts are insufficient by STAC 139 instructors. Put another way, the impact of providing some direction to these instructors on how to structure workouts and how to prompt new runners on physiological cues connected with pacing suggests that the support they receive from the STAC department is not fully meeting their needs.

Second, more attention must be given to STAC 139 students. While this project focused on the STAC 139 instructors and improving their self-assessed efficacy, ultimately that increased efficacy is meant to effect some meaningful change in their students. Elsewhere, it was noted that many objectives of the course as measured by existing assessments (final exam, mile times, etc.) were a being met at very high rates. However, given some of the feedback from instructors here, it may be worth re-examining these assessments for their validity and value. With newer, better assessments, the efficacy and impact of the materials created here could be re-assessed.

Third, use of the cue cards before but not during a workout suggests a need to re-evaluate their current form. While no instructor reported the content of the cue cards as redundant to what was similarly provided in the manual, it is worth examining how that content should exist going

forward. For example, should the content of the cue cards simply be imported into the manual? Or, is it still worthwhile to have a more portable version of that information for those instructors that do not feel comfortable committing it to memory? Re-engaging the instructors and the STAC program instructors would help orient the future development efforts around these questions.

Lastly, there is no existing assessment to measure students' increased ability to understand, recognize, and respond to how a pace feels. This skill, which was identified as fundamental by the STAC 139 instructors and, as such, is an essential element to one of the objectives of the course, is currently going unassessed. The development of a meaningful assessment to measure this skill would provide a means to identify if this objective of the course is being accomplished. Additionally, it would provide another, more valid means to measure the efficacy and impact of the cue cards that were created for this project beyond the instructors' reported value in helping them to tackle that undertaking.

## Design Critique

As a result of this design project and process, I came away with three distinct "lessons learned" which may be of value to future IP&T students at Brigham Young University and instructional designers in general.

### Lesson 1: Experiential Learning Theory's Place with Abstract Learning

From my own background in teaching, it can be natural to connect instructional design with specific, even concrete learning objectives (e.g., understanding how to find the slope and y-intercept of line, recalling the name of the 14$^{th}$ President of the US, identifying the year of the start of World War II, etc.). However, much of instruction and training targets objectives that are less-concrete, even abstract (e.g., how a Customer Support agent is supposed to feel when a customer calls in with a concern or problem with their software).

In this project, STAC 139 instructors were confronted with the abstract learning objective of helping runners develop the capacity to understand, recognize, and respond to how different running paces feel. While there may be specific, even objective measures associated with different running paces (heart rates, respiratory rates, lactate levels within the blood, etc.) for the average runner during a run, pace is understood in abstract, perceptive ways.

Experiential Learning Theory provided a framework to STAC 139 instructors to help target and meet this abstract learning objective. The cyclical process of setting up an experience (in this case a workout at a particular pace) which would elicit a specific physiological response (afferent feedback), pushing runners to notice and reflect on that feedback from their bodies (how things were "feeling"), and then digest through conceptualization and experimentation on those reflections grounded the abstract. Coupled with direction on the cue cards on what

feedback should be reflected upon, what was originally fleeting and ambiguous became repeatable and targetable.

A similar structure and framework could be applied for other abstract learning objectives. A training manager hoping to help a Support agent develop empathy for customers, could design experiences to elicit a specific emotional response, carry out those experiences, and guide the agent through recognizing, reflecting on, and digesting those emotional responses. With repetition, the abstract could be made more concrete.

**Lesson 2: Goals Evolve Throughout a Project**

The goals and scope of my project evolved throughout the process. At the onset, I had hoped to completely redesign the STAC 139 course—building new lesson plans, re-structuring the course itself, re-designing the final exam, building new assessments, and more. With the perspective of those with more experience (my committee), I was able to see that such ambitions were not practical within the constraints of executing the project as a Masters-level capstone assignment. Additionally, some resources that were deemed as initially less-important ended up becoming the more novel and valued creations.

In the months since the start of the project to its completion, I have worked full-time as a learning specialist and instructional designer and seen this lesson of goal evolution play out professionally. With a fast rate of growth, there have been many times I have been made aware of a training need within the organization. Just as often, I have sought to ambitiously apply what I have learned and what I feel I am capable of by designing and building something significant to meet these needs. However, as a team of one, and in recognition of how quickly the needs of the

organization change, pivot, and evolve, I have learned to appropriately scope and restrain some of these ambitions.

From the experience of this project and my own work experience I have learned to identify when "good enough" is, in fact, good enough. During this project, there were times when I looked at the instructor's manual I was creating and wondered if it reflected the breadth of all that I had learned and if it was sophisticated or complex enough. From consulting with others, including my Chair, I recognized that this was a terrible way to judge the value of a project; it didn't matter how well a project reflected my own abilities, what mattered was how well it would meet the needs of my stakeholders. While unsophisticated, the manual I was creating was "good enough" in that it met the needs of and helped these instructors. The results of the project ultimately affirmed that. I have seen similar trends in my professional work, where often the simplest solution can be the most effective.

Lastly, the lesser resources I was creating grew in perceived value. The cue cards that I originally saw a small supplement to the instructor's manual grew in importance throughout the project. They provided the one element of higher-level learning for instructors within the project. Additionally, they also met a previously underserved need. It was only through engaging with my stakeholders throughout the project that it became clear how important and difficult the STAC 139 instructors felt it was to help runners understand pace. By engaging with these stakeholders throughout the process and being flexible enough to evolve the focus of my project, I was able to create a resource that I think informed one of the more significant takeaways of the entire project regarding the place of ELT within teaching for abstract learning.

**Lesson 3: Defining Stakeholders is Tricky**

As mentioned elsewhere, my understanding of my stakeholders in the project evolved throughout the process. I think this brought an unnecessary anxiety to the project. While I had a clear understanding at the onset of the project that the STAC 139 instructors were my key stakeholders, by identifying the STAC administrators and the STAC 139 students as additional stakeholders, I found myself uncertain at times about the value and impact of what I was doing and how I might assess it.

While it is helpful to take time at the start of a project to clearly and explicitly identify all stakeholders, committing to and focusing on a singular group can be helpful. By narrowing that focus, several additional advantages followed including clarity on what is needed, how it will be helpful, the impact of that help, and how the impact can be assessed. Without clarity and alignment, my experience showed that anxiety can creep into the development process. While focusing on STAC 139 instructors initially, in the middle of the project, I found myself wondering about the impact of the project, specifically how helpful the materials would be given the overwhelmingly positive learner outcomes measured by the existing assessments. Similarly, if what I was creating was helpful, how could I effectively assess it, given those already-high outcomes?

It took time and consultation with others to recognize what I was creating and who I was creating it for. By returning and committing my focus to the STAC 139 instructors themselves, things became much clearer. My impact wouldn't necessarily be in student outcomes, at least not as measured by the existing assessments. Instead, my impact would be on instructor's perception

of their own abilities or their self-assessed efficacy. This recognition naturally informed how I would ultimately go about evaluating the project.

To be clear, again, identifying all stakeholders is important for the long-term longevity of a design project. This identification helps drive future iterations of the project and helps identify gaps in a project's current structure. However, those future opportunities to address and meet the needs of all stakeholders must not be allowed to interfere with the opportunity to meet the current, present needs of the key stakeholders.

## Appendix

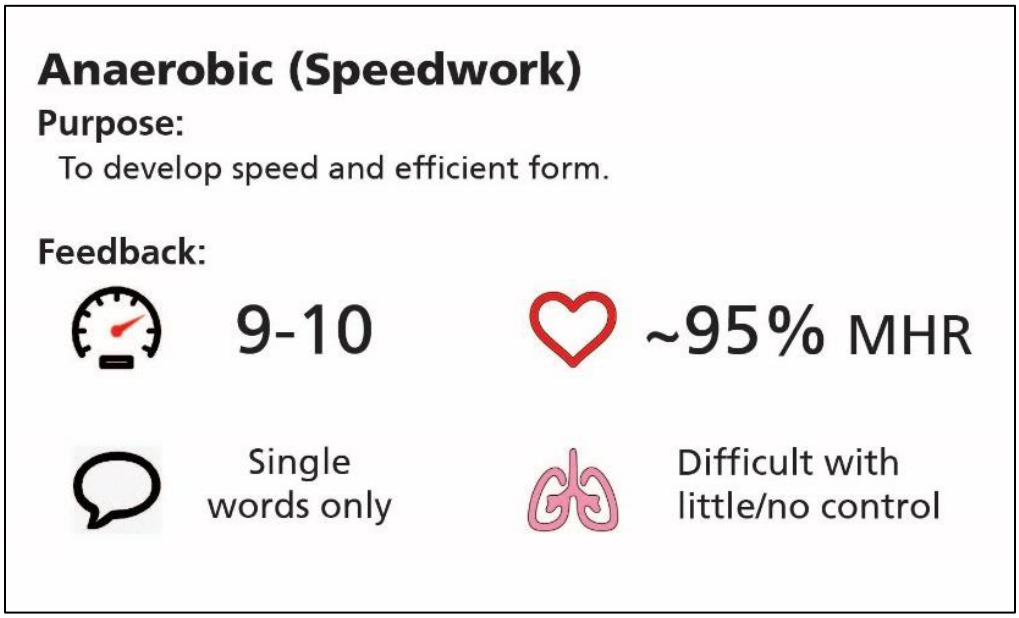


*Figure 7*. Cue card 2: Anaerobic (speedwork).

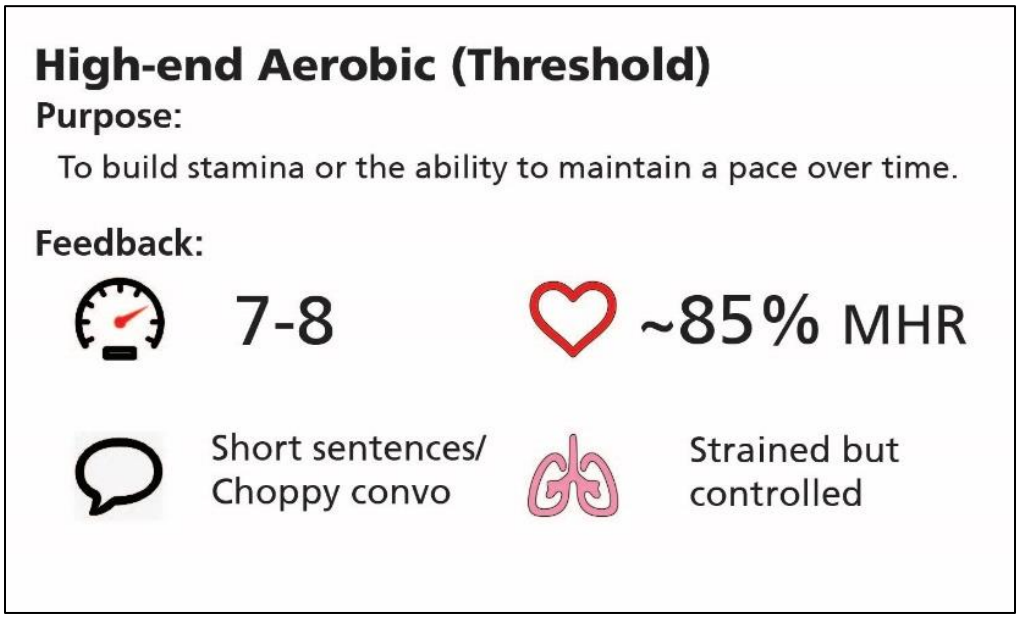


*Figure 8*. Cue card 3: High-end aerobic (threshold).

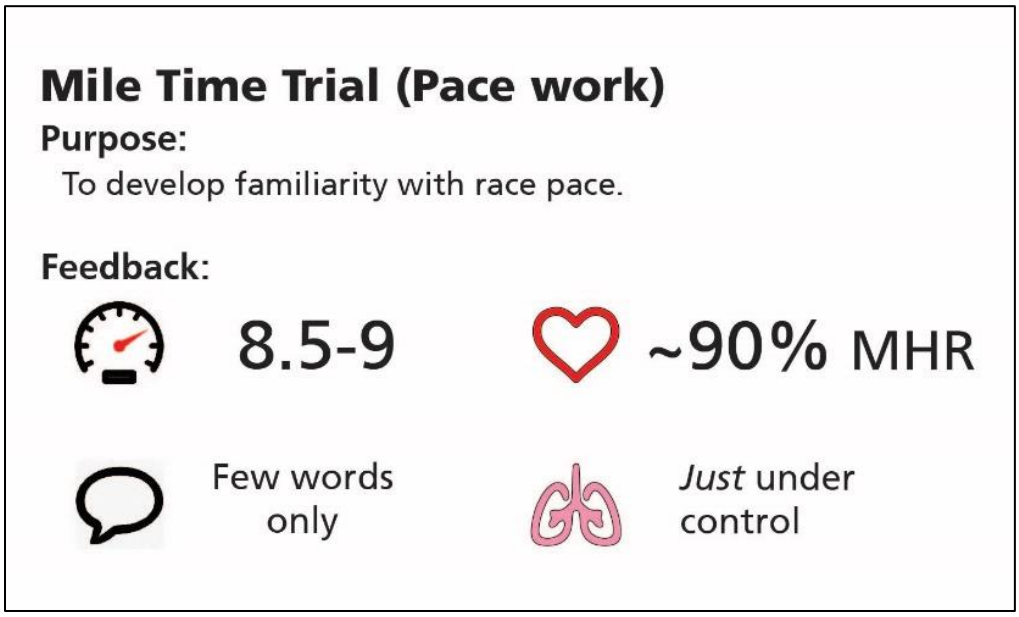


*Figure 9*. Cue card 4: Mile time trial (pace work).

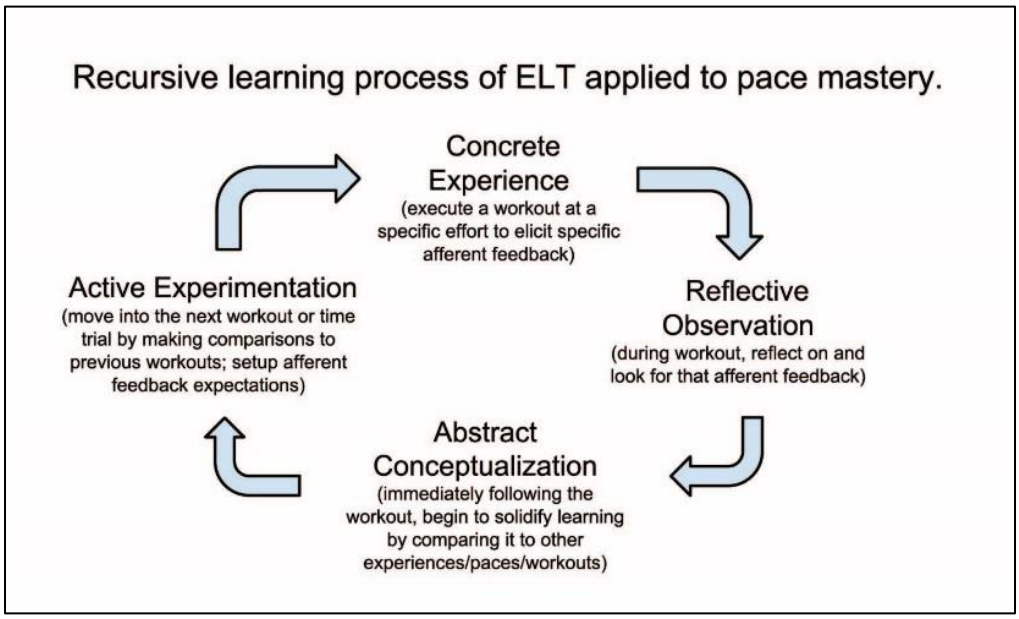


*Figure 10*. Cue card 5: Recursive learning process of ELT applied to pace mastery.

## References

American Running Association. (2004). Understanding proper training pace. Retrieved from https://www.active.com/running/articles/understanding-proper-training-pace?page=1

Bailey, R. (2001). Teaching physical education: A handbook for primary and secondary school teachers. London: Kogan Page Limited.

Chróinín, Déirdre Ní and Caitríona Cosgrave. (2013). Implementing formative assessment in primary physical education: teacher perspectives and experiences, Physical Education and Sport Pedagogy, *18*(2), 219-233, DOI: 10.1080/17408989.2012.666787

Cumming, J. & Maxwell G. (1999). Contextualizing authentic assessment. *Assessment in Education: Principles, Policy, and Practice*, *6*(1), 177-194.

Desrosiers, P., Genet-Volet, Y. & Godbout, P. (1997). Teachers' assessment practices viewed through the instruments used in physical education classes, *Journal of Teaching in Physical Education*, *16*(2), 211-228.

Emery, Lindsey. How to run at the right pace. Retrieved from https://www.active.com/running/articles/how-to-run-at-the-right-pace

Gaudette, Jeff. (2012, October 18). Learn to pace like a pro: Manage your pace to control your race. Retrieved from https://www.runnersworld.com/racing/learn-to-pace-like-a-pro

Kolb, Alice Y. and David A. Kolb. (2005). Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. *Academy of Management Learning & Education*, *4*(2), 193–212.

López-Pastor, Victor Manuel, Kirk, David, Lorente-Catalán, Eloisa, MacPhail, Ann and Macdonald, Doune. (2013). Alternative assessment in physical education: a review of international literature. *Sport, Education and Society*, *18*(1), 57-76.

Lund, J. (1997). Authentic assessment: Its development and applications, *Journal of Physical Education, Recreation, and Dance*, *68*, 25-28.

Mauger, Alexis R. (2014). Factors affecting the regulation of pacing: current perspectives. *Open Access Journal of Sports Medicine, 5,* 209–214.

New York Road Runners. Pacing. Retrieved from http://www.nyrr.org/youth-and-schools/running-start/coaching-videos/middle-school/pacing

New York Road Runners. Pacing. Retrieved from http://www.nyrr.org/youth-and-schools/running-start/coaching-videos/high-school/pacing

Noakes TD. (2008). Rating of perceived exertion as a predictor of the duration of exercise that remains until exhaustion. *British Journal of Sports Medicine*, *42*(7), 623–624.

Noakes TD, St Clair Gibson A, Lambert EV. (2005). From catastrophe to complexity: a novel model of integrative central neural regulation of effort and fatigue during exercise in humans: summary and conclusions. *British Journal of Sports Med*icine, *39*(2), 120-124.

Noakes TD, Peltonen JE, Rusko HK. (2001). Evidence that a central governor regulates exercise Performance during acute hypoxia and hyperpoxia. *Journal of Experimental Biology*, *204*(18), 3225-3234.

Oliver, K. (2001). Images of the body from popular culture: engaging adolescent girls in critical Inquiry. *Sport, Education and Society*, *6*(2), 143-164.

Piotrowski, S. (2000). Assessment, recording and reporting. In *Teaching physical education* 5–11, ed. R. Bailey and T. MacFayden, 49– 61. London: Continuum.

Plant, I. (2007). The complex nature of assessment. *Physical Education Matters, 2*(2), 26–27.

Richard, J. F. & Godbout, P. (2000). Formative assessment as an integral part of the teaching-learning process, *Physical and Health Education Journal*, *66*(3), 49.

Smits, Benjamin L.M., Gert-Jan Pepping & Florentina J. Hettinga. (2014). Pacing and Decision Making in Sport and Exercise: The Roles of Perception and Action in the Regulation of Exercise Intensity. *Sports Medicine*. DOI: 10.1007/s40279-014-0163-0

St Clair Gibson, Lambert EV, Rauch LHG, et al. (2006). The role of information processing between the brain and peripheral physiological systems in pacing and perception of effort. *Sports Medicine*, *36*(8): 705-722.

Taylor, Daniel and Mark F. Smith. (2017). The influence of mid-event deception on psychophysiological status and pacing can persist across consecutive disciplines and enhance self-paced multi-modal endurance performance. *Frontiers in Physiology*. DOI: 10.3389/fphys.2017.00006

Tomazini, Fabiano, Leonardo A. Pasqua, Mayara V. Damasceno, Marcos D. Silva-Cavalcante, Fernando R. de Oliveira, Adriano E. Lima-Silva, Rômulo Bertuzzi. (2015). Head-to-head running race Simulation alters pacing strategy, performance, and mood state. *Physiology and Behavior*, *149*, 39-44.

Williams, E.L., Jones, H., Sparks, S.A., Midgley, A.W., Marchant, D.C., Bridge, C.A., McNaughton, L.R. (2015). Altered Psychological Responses to Different Magnitudes of Deception during Cycling. *Medicine & Science in Sports & Exercise*, *47*(11). 2423-2430.

Williams, E.L., Jones, H., Sparks, S.A., Marchant, D.C., Midgley, A.W., McNaughton, L.R. (2015). Competitor presence reduces internal attentional focus and improves 16.1 km cycling time trial performance. *Journal of Science and Medicine in Sport. 18*, 486-491.