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## INTRODUCTION

The United States Bureau of Labor Statistics projects 26% and 39% growth across coaching professions and in fitness trainers by 2030, respectively (36,37). Both areas are projected to grow “much faster than average” compared to the broader job market. While projections for specific strength and conditioning and sport science careers are not well-defined, the growth of the National Strength and Conditioning Association (NSCA), consisting of 76 strength and conditioning coaches in 1978 when it was formed to today serving over 60,000 members and certified professionals worldwide demonstrates significant advancement in the industry over more than four decades (13,24,32).

Just as athletes adopt novel training approaches to excel in sport, strength and conditioning coaches and sport scientists may consider emerging areas of growth and momentum to strategize professional development (13,31,32). Specifically, technology advancement, the emergence of new professional roles, and the increased focus on psychosocial factors and data processes to best serve athletes are relevant topics for strength and conditioning coaches and sport scientists of today. The purpose of this article is to bring awareness and provide an overview of emerging areas within strength and conditioning and sport science.

## TECHNOLOGY AND INNOVATION INFLUENCE

Technology is a defining factor in society. Definitions of technology include the application of scientific knowledge for practical purposes using specific materials and tools to streamline tasks and processes (33). How technology is viewed, especially within the athletic performance community has evolved dramatically with new inventions and ongoing progress. For example, the American College of Sports Medicine (ACSM) Worldwide Survey of Fitness Trends ranked wearable technology the number one fitness trend in five of the seven years since being added to the survey in 2016 (31). Similarly, online training was ranked the top fitness trend in 2021 during the COVID-19 pandemic, and remained in the top 10 for 2022 with the inclusion of both online-live and on-demand exercises classes as selection criteria. The emergence of online exercise apps and online personal training were also listed in the top 20 fitness trends for 2022 (31). As such trends have emerged, it is important for strength and conditioning coaches and sport scientists to understand technological processes and how technology impacts athletes.

Understanding and defining the role of technology in the program is essential to successfully implementing a new device, app, or service. In simplest terms, technology should lessen the burden of repetitive manual tasks and facilitate staff collaboration across performance disciplines (33). It is beyond the purpose of this article to detail specific performance technology tools. However, the authors highlight certain implications of technology use, in weight rooms, with teams, and for individual athletes, that affect

professional roles and responsibilities of strength and conditioning and sport science practitioners.

Despite the perception of complete automation, implementing technology does involve a significant staffing commitment. For example, in addition to the time required to process and evaluate any data collected, to implement heart rate monitors with a team of athletes, staff must ensure that each device is charged, cleaned, and sanitized before each use. Alternatives may include that the added responsibility of device maintenance falls on each individual athlete, requiring additional training and communication by staff to ensure appropriate care. This example emphasizes the importance of staff and athlete instruction to effectively implement new technology or when new members begin a program.

Determining meaningful context and specific goals are paramount to successfully introducing new technology (2,5,33). In sport science, this may include the selection of apps, devices, services, or programs based on factors beyond specific performance measures, including the ability to visually monitor and track athlete progress over time, the automation of repetitive administrative processes, filtering and reporting on specific performance data ranges, or by enhancing the consistent communication between athletes, coaches, and support staff (5,33). Specific context can be described as the environment, institution, equipment, and people (staff and athletes) working to implement technology effectively.

Christensen suggested that success in implementing technology relies on available resources (both environmental and human), processes (e.g., planning and decision making), and values (e.g., goals, policies, and standards) (2). Further, there are distinctions to be made between sustaining technologies and disruptive technologies (2). Disruptive technologies, as the name suggests, require new processes be created, and therefore significantly alter staff operations and involvement. Disruptive technologies are significant in that they challenge the way the staff thinks and operates. Typically, disruptive technologies offer new and appealing features that have not been previously available (2). A disruptive technology may present as a replacement of a performance technology device or system, such as transitioning methods from measuring vertical jump height with a Vertec device to implementing a portable force plate system. The addition of tablets and cell phones to the weight room environment for communicating programs and providing athlete feedback are examples where strength and conditioning coaches and sport scientists have been required to create new processes for administering sessions.

Alternatively, sustaining technologies offer upgrades to improve current processes (2). An example of a sustaining technology may be the addition of coaching software features with the ability to enter and log anthropometric and performance metrics with

increased functionality to ease and automate calculations of key performance indicators (KPI). Strength and conditioning coaches and sport scientists should recognize that the pace of innovation may be faster than the specific needs of the market, and that factors around cost effectiveness, simplicity to operate, niche focus, and convenience tend to drive appeal and interest around new technology products (2). To provide additional guidance for readers, the authors of this article have proposed a list of 10 performance technology decision factors in Table 1, which should be considered for implementing new technology into programs.

**TABLE 1. 10 PERFORMANCE TECHNOLOGY DECISION FACTORS**

1. Does the device, app, service, or program support and adhere to established athlete safety guidelines?
2. Does the device, app, service, or program fill a specific need, void, or provide a solution to an existing problem?
3. Does the device, app, service, or program allow for new insights or knowledge previously not available?
4. Does the device, app, service, or program support or enhance athlete engagement? Does it improve motivation in training?
5. Do you have sufficient resources to purchase and implement the device, app, service, or program as intended?
6. Does the device, app, service, or program align with your training program, principles, goals, and values?
7. Does the device, app, service, or program improve your ability to target specific improvements and responses with athletes?
8. Does the device, app, service, or program support or improve staff processes and daily administrative workload?
9. Does the device, app, service, or program support communication and collaboration across members of the performance team (including the athlete)?
10. Are the data and information (i.e., KPI) collected from the device, app, service, or program valuable, useful, valid, reliable, and supported by research?

### EXPANSION OF STRENGTH AND CONDITIONING COACH ROLES

In addition to the influence of recent technological advancements, strength and conditioning coach roles are constantly evolving. From a historical perspective, the etymology of the word “coach” derived from the horse-pulled carriage dating back to the 16th century (12). Later in the 19th century, “coach” was used as a metaphor within education and ultimately sport, transporting students and athletes towards an aspired goal. Today, coaching extends beyond sport, including business coaching, career coaching, relationship coaching, and behavioral coaching. This expansion of terminology relates closely to the importance of coaching skills across multiple industries. Tod et al. reported that strength and conditioning practitioners progress in their roles to view the field as broader than they initially thought (32). Coaching

roles require building trust and managing relationships, listening to athletes share sensitive and sometimes distressing information, considerations of how prescribed programs impact other areas of training, and mentoring of both junior coaches and athletes (26,32). Additionally, many strength and conditioning coaches consider psychology-oriented responsibilities as required for the role, emphasizing the need for softer skills that extend beyond programming methodology for improved coaching effectiveness and career sustainability (26).

Professional development in strength and conditioning is a career-long process, during which career advancement is the common goal (32). The path of strength and conditioning coaches, including observation, internships, fellowships, assistantships, full-time assistantships, and head coaching roles, involve a strong component of experiential learning that has been ingrained to the profession (13,32). For example, the Collegiate Strength and Conditioning Coaches Association (CSCCa) requires certificants to have completed an approved 640-hr internship in the field with a qualified mentor (3). The NSCA and Council on Accreditation of Strength and Conditioning Education (CASCE) have established new standards, taking effect in 2030, which will require completion of an accredited education curriculum to be eligible for the Certified Strength and Conditioning Specialist® (CSCS®) exam. The CASCE accreditation for education institutions will also require students to complete a minimum of 300 hr of field experience (see Table 2), which includes supervised experience in two substantially different areas of the strength and conditioning field (6).

**TABLE 2. CASCE REQUIREMENTS FOR STRENGTH AND CONDITIONING FIELD EXPERIENCE**

The field experience must provide a minimum of 300 hr of contact time including:

- a. A minimum of two substantially different experiences that include two or more of the following categories: sport, gender, age range, or other.
- b. Two different supervisors (does not require experiences at two different sites).
- c. Minimum of 75 hr per experience.
- d. One experience must be at least six weeks in length.
- e. Specifically, the field experience must minimally include the following key areas: warm-up, flexibility training, exercise technique, spotting, Olympic-style lifting, progressions/regressions, test selection and administration, program design, speed/agility/plyometric training, anaerobic and aerobic program design, and periodization.

*Reprinted with permission from the NSCA and CASCE. The full resource includes comprehensive curriculum requirements for accredited education programs to take effect in 2030 (6).*

Movement towards formalizing strength and conditioning career pathways, including education and field experience, have contributed to more holistic thinking around how the broad range of strength and conditioning competencies should be developed among practitioners (10). Specifically, the integration of learning theory, psychological-oriented responsibilities, emotional intelligence, and psychosocial competencies are areas for further understanding in the delivery of strength and conditioning education (5,10,26,32). This expansion further into psychosocial domains is believed to support the preparation of higher quality strength and conditioning coaches and fill an existing gap within strength and conditioning education (10). Additionally, as strength and conditioning coaches are often the staff members who interact with athletes the most, the added value of improved psychosocial competencies among strength and conditioning coaches may contribute to athlete mental health, well-being, and safety through early identification and assisting with referrals to qualified mental health professionals (9,11). In a similar pattern to the integration of psychosocial concepts in strength and conditioning, the further integration of data processes and sport science methodology are also contributing to growth and new professional opportunities in performance fields.

### CONSIDERATIONS FOR EMERGING SPORT SCIENCE POSITIONS

How one views sport science today may depend on what part of the world they are from. While a comprehensive review of global sport science organizations is beyond the purpose of this article, at least four global sport science credentials currently exist (7,14,20,30). In North America, the scope of practice for the NSCA Certified Performance and Sport Scientist™ (CPSS™) includes biomechanics, physiology, psychology, nutrition, and strength and conditioning with emphases on assessment of technology and knowledge of scientific research processes (20). Confusion around sport science terminology may derive from the high degree of crossover between sport science disciplines in comparison to existing job responsibilities in sport. For example, content domains for the scientific foundations section of the CSCS exam include exercise science, sport psychology, and nutrition (21,23). Alternatively, these areas of crossover may help characterize the emergence of the interdisciplinary performance team (IPT) in support of improved processes for collecting, organizing, and presenting performance information.

Currently in North America, Major League Baseball (MLB), National Basketball Association (NBA), National Football League (NFL), and National Collegiate Athletic Association (NCAA) have mandated policies regarding strength and conditioning coach credentials (16,17,18,19). While it could be suggested, from existing regulatory requirements, that strength and conditioning roles are more accepted as a profession than dedicated sport science roles, the authors recognize that current momentum in the areas around sport science will further solidify the roles and responsibilities of the sport scientist. For example, the CSCS scope of practice includes reference to organization and administration procedures,

including facility design, layout, professional practice standards, and common litigation issues (21,23). Future considerations of administrative policies, staffing, additional risks for liability exposure with performance technology, and factors related to the permissions and privacy of athlete performance and health information are likely needed to further establish sport scientist roles as professionally viable to employers. Current resources in the strength and conditioning space, such as the NSCA Strength and Conditioning Professional Standards and Guidelines, provide some insight into areas of administration and organization but are not specific to the role of the dedicated sport scientist (23). From a career perspective, awareness of such gaps in emerging sport science practices can aid in providing appropriate support for leadership in determining policy at the institutional level. The authors also encourage researchers and global sport science organizations to work towards clarity and solutions for furthering professional growth.

### IMPORTANCE OF LEADERSHIP OPPORTUNITIES

Many professional and college sports programs now employ staffing beyond sports medicine and strength and conditioning to further support athlete performance and safety. This growth speaks to the evolution of the athlete-centered IPT. The IPT may consist of strength and conditioning coaches, dietitians, mental performance professionals, sports medicine staff, and sport science roles (8). The historical progression of expanding performance departments and new roles within staffs brings about a significant need for effective leadership and processes to manage and guide growing cross-functional operations.

Bob Alejo, 35-year veteran strength and conditioning coach, and current Senior Associate Athletics Director for Performance and Student-Athlete Welfare at California State University in Northridge, has been an advocate for advancement within the profession to include strength and conditioning veterans or experts at the senior executive level. Alejo stated that, without appropriate strength and conditioning leadership in place, “athletic department structures will be less than fully functional” (1). Other universities have also recognized the growing need for leadership around athletic performance. In January 2019, University of Louisville hired 20-year collegiate strength and conditioning veteran Patrick Ivey as the Assistant Vice President and Associate Athletic Director for Student Athlete Health and Performance, overseeing multiple areas within the athletic department (34). In a similar hire the same year, Geoff Head became the Senior Director of Health and Performance for the Cincinnati Reds MLB team (28). While it is optimistic to view such hires as the possible beginning of an emerging path for professional advancement, needs for further research, advocacy, mentorship, and governance remain important for future progress (24,25).

### PARALLEL GROWTH IN THE TACTICAL SECTOR

Another area that has embraced strength and conditioning is the military community. Beginning in 2009, Army Special Operations Command established Tactical Human Optimization Rapid

Rehabilitation and Reconditioning (THOR3), aimed to, “increase physical performance and emotional well-being, prevent injuries, and improve the mental skills necessary to perform optimally in training and combat operations” (29). THOR3 employs qualified allied health and strength and conditioning professionals to create programs for special operations-centric missions. Similarly, United States Special Operations Command (USSOCOM) has the Preservation of the Force and Family (POTFF) program to support Special Operations personnel, improve mission readiness, career longevity, and performance through integrated and holistic human performance programs (35). An emerging opportunity for strength and conditioning professionals interested in tactical coaching is the U.S. Army Holistic Health and Fitness (H2F) system.

Over the course of the next several years, the U.S. Army will hire approximately 1,000 strength and conditioning professionals in support of the H2F system (4). Similar to strength and conditioning coaches working in collegiate and professional sport, H2F strength and conditioning personnel will work within IPTs consisting of allied health professionals such as dietitians, physical therapist, occupational therapists, athletic trainers, and cognitive performance specialists. For highly qualified strength and conditioning professionals, emerging H2F program director positions are tasked with planning, coordinating, and implementing H2F efforts based on the guidance of the Army H2F Steering Committee (4).

For strength and conditioning coaches considering work-life balance as important, civilian opportunities working with the military provide the potential for a more balanced work schedule around base operating hours (e.g., 40-hr work weeks and mandated observed federal holidays). Previous work reported that typical collegiate strength and conditioning coach workloads range between 60 – 75 hr per week, and in some cases, include seasonal team travel assignments (13). While many strength and conditioning professionals agree to high workloads, frustrations around long working hours, time pressures, feeling undervalued, and a lack of respect or understanding by sport coaches or administrators are common (13). From anecdotal evidence and observation, the authors speculate that for many strength and conditioning professionals, lifestyle stressors, such as extensive time away from family as coaches progress beyond initial career stages, could be a contributing factor to developing interests in newer areas within the field.

Strength and conditioning roles are also becoming available in the public safety entities (15,22,27). The substantial physical demands and health implications associated with careers in law enforcement agencies and fire and emergency response departments have demonstrated the need for further strength and conditioning growth in these areas (15,27). From the coaching career perspective, better understanding the requirements and specific environments that coaches work could benefit professionals in approach of planned and unexpected career transitions.

## CONCLUSION

As we look to future generations across strength and conditioning and sport science, it is important that students and aspiring professionals understand the various roles within an IPT. Veteran coaches and practitioners serve important roles in the field as program leaders and mentors. History has shown that there are many paths associated with professional success, but also that formal education and experiential hands-on learning are increasingly essential milestones.

To optimize collaboration within the IPT, leadership, whether by head coaches, sport administrators, or performance directors, should consider the benefits of regular meetings and exchanges to discuss team performance reviews, updates, goals, and performance data (8,32). Further advancing professional education in strength and conditioning and sport science, to include increased awareness and competency of psychosocial domains, may also support improved cross-functional approaches to performance, health, and safety (5,9,10,11). Considering the multitude of advancements we have already experienced with technology, as well as new and emerging career opportunities for strength and conditioning and sport science practitioners, our field can be united in viewing the prospects ahead.

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