The Application of Entrustable Professional Activities (EPAs) within Sport Science Education: An Exploratory Approach

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Abstract

Entrustable professional activities (EPAs) have become a popular topic within competency-based practice-based education programmes. This exploratory paper was written to introduce the application of EPAs within sport science education. After rationalising the use of EPAs as a bridge between a competency framework and a practice-based profession, the paper presents a brief illustration whereby EPAs could be integrated into a postgraduate MSc Sport Science module that was aligned to a National Accreditation Framework (British Association of Sport and Exercise Sciences). This accreditation framework supports practitioner development through to the point of applied nationally endorsed 'entrustment' – that being an Accredited Sport and Exercise Scientist in Applied Physiology Scientific Support. For readers interested in appling the concept in practice, a stepwise approach to curriculum development is presented. The paper concludes with an overview of how EPAs can

have a place in sport science education in developing work-ready graduates within the field of sport science.

Introduction

Entrustable professional activities (EPAs) have become a popular topic within competency-based training over recent years (O'Dowd et al., 2019). This in part results from the concern that competency-based training does not entirely bridge the gap between personal skills, knowledge and attitudes and units of professional work activity so sought after by industry and professions (Kwan, 2016). This had led to widespread evaluation of their value and application across disciplines aligned to practice-based client-centred education (Ten Cate, 2005; 2013; 2018; Ten Cate et al., 2015).

This rise in popularity is based on the notion that EPAs constitute the description of work and are independent of individuals undertaking the activity. EPAs are units of professional practice, defined as 'tasks or responsibilities to be entrusted to the unsupervised execution by a trainee once he or she has attained sufficient specific competence' (Ten Cate, 2013, p.157). They operationally define a professional activity and the associated day-to-day operational tasks that that profession requires for the work to be undertaken safely and effectively (Ten Cate, 2018). An EPA is an essential unit of work which demands adequate knowledge, skill, and attitude (i.e. the individual's competency). Such units of work are observable, independently executable within a time frame, and incorporate one or more core competencies (Ten Cate and Scheele, 2007). The objective of effective teaching and learning through curricula delivery is to ensure that EPAs become entrusted to the student at a point of mastery. Entrustment defines the point where the educator invests within the individual the responsibility (or charge) to carry out specified work duties with independence, efficiency and professionalism. The development towards the stage of entrustment is reflected by four steps of decreasing supervision: (1) no task execution; (2) task execution under direct supervision; (3) task execution with supervision quickly available on call; (4) and unsupervised practice (Ten Cate, 2005).

The purpose of the short exploratory paper is to provide a brief account of how EPAs could be effectively integrated into the practices of an applied sport science curriculum. To the authors' knowledge, this is the first time such application has been documented and presented within this context and therefore provides an important gateway into further applied pedagogic research exploring the effective use of EPAs with sport science education. To articulate this value, the paper presents a brief illustration whereby EPAs were aligned to a postgraduate MSc Sport Science module that was coordinated to a National Accreditation Framework (British Association of Sport and Exercise Sciences). This accreditation framework supports practitioner development through to the point of applied nationally endorsed 'entrustment' – that being an Accredited Sport and Exercise Scientist in Applied Physiology Scientific Support. Recommendations are presented as to how EPAs could be developed into sport science curricula, particularly given the similarities such professional activities have to professions where these have been embedded for some time (e.g. medicine-related and healthcare education). Given the growing body of evidence that shows the value of EPAs in effective and enhanced patient (client/athlete) management and support, this paper presents an exciting opportunity for sport (and exercise) science educators to reflect on their own practice-based curricula as a vehicle to further develop the next generation of work-ready practitioners.

Value of EPAs in Applied Practice-based Settings

Many activities undertaken by applied practitioners require training specifically aligned to that profession. Within the context of applied sport science practice, reflective practice, self-assessment, building and maintaining positive relationships, and applying professional standards are essential (Fletcher and Maher, 2013; Winter et al., 2016). Fletcher and Maher (2013) further explore the need for functional domains, such as athlete diagnosis, consultation and assessment administration, and intervention management as key benchmarks that lead to competent practitioners. In educational settings, these are typically delivered through practical laboratory and field-based activities and assessed by way of competency-based evaluations. These may come in the form of applied practical observation, or through laboratory reporting or portfolios of evidence that document the individual's activities, actions administered, and identified outcomes. Such competency-based training in this context ordinarily describes the individual and measures their personal skills, their applied knowledge and their attitude (e.g., professional conduct and behaviour).

Learners who become competent, being those that have reached a required standard of proficiency in accordance with a learning outcome, are deemed to have the necessary ability to undertake similar forms of activity. However, just because a level of competency is reached does not imply that the individual has been entrusted to carry out work activity the profession deems necessary (Chen et al., 2015). For example, a student may be able to independently demonstrate effective calibration on equipment, explain with scientific understanding the way a system operates, organise their work station to ensure hygiene control, or operate an ergometry system with precision, but the requirement to undertake a complex physiological assessment of an athlete within a specific timeframe demands more than the sum of these individual competencies. Although these are all critical for the student to master, they do ensure complete entrustment at a level deemed necessary by the profession.

Critics of competency-based training argue that personal competencies alone do not themselves enable entrustment to whole professional work activity (Touchie and Ten Cate, 2016) and may not entirely translate from one context or circumstance to another (Chen et al., 2015). The literature is consistent in its reference to the notion of competency 'tick-box' assessments, whereby the ability to do something successfully or efficiently is binary and may not recognise the need to undertake professional activity in complex and changeable environments (Chen et al., 2015). Furthermore, deconstructing professional work activities into single competency-based outcomes may risk individual's personal development, may prevent the discovery of new ways to practice, and may not enable holistic patient (athlete) care (Glass, 2014; Chen et al., 2015).

In accordance with McCloskey et al. (2017), critical attributes of EPAs are that they:

i. Are part of essential professional work in a given context;
ii. Must require adequate knowledge, skill and attitude, generally acquired through training;
iii. Must lead to recognised output of professional labour;
iv. Should usually be confined to qualified personnel;
v. Should be independently executable;
vi. Should be executable within a time frame;

vii. Should be observable and measurable in their process and their outcome, leading to a conclusion; and
viii. Should reflect one or more of the competencies to be acquired.

Given that entrustable professional activities are units of professional practice or descriptors of work, defined as specific tasks or responsibilities that practitioners are entrusted to perform without direct supervision once they have attained sufficient competence, EPAs operationalise professional work-based activities. They acknowledge that care can be complicated, necessitating and assessed by linking them with professionalised standards. When this is conducted clearly, disputes about the value of competencies may disappear and students, educators and clients can begin to know precisely what a competent practitioner can and cannot perform in accordance with the requirement of the profession.

Application of EPAs within an Applied Practice-based Curriculum

By way of an illustration, a 30 CAT point module entitled ‘Sport Physiology’ that ran across the first term of a postgraduate MSc Sport Science programme will be used to describe how EPAs can be effectively aligned into curriculum constructive alignment (Biggs, 1996). The reason for selecting a postgraduate level module was that:

i) All students entering onto this module already had acquired basic ‘threshold’ knowledge and skills therefore enabling higher level professional activity (Mossley, 2017);
ii) The module needed to prepare students for independence in term two (i.e. entrustment) as they would be expected to undertake unsupervised applied sport science support activity with an athlete; and
iii) The ambitions of the practical curriculum were to align the activities to a National Accreditation supervised experience programme. Such accreditation requires the development of a portfolio of applied physiological support activity and a postgraduate level qualification. Therefore, successful completion of the practice-based curriculum would provide the student with a source of evidence towards the accreditation approval, if they chose to make an application for accreditation.

The module’s practical component, contributed to half of the overall module curriculum was assessed by way of an applied athlete-centred physiological support evaluation (i.e., live roleplay) and contributed to 40% of overall module grade (the remaining being a 40% critical physiological issue debate and 20% assessment case report). The defining module objective for this practical component of the curriculum was that the ‘applied sport scientist’ (i.e. the student) should be able to complete, without supervision, an athlete physiological assessment in a safe and effective manner, capturing the desired outcomes in accordance with agreed athlete-centred goals. The determination of this outcome and associated competences were based on principles of practice established from the British Association of Sport and Exercise Sciences (BASES) Physiology Testing guidelines (Winter et al., 2016), Physiological Tests for Elite Athletes (Australian Institute of Sport) (Gore, 2000) and sport physiology assessment guidelines stipulated by Eston and Reilly (2013). Each source provided key requirements necessary to undertake effective and safe physiological assessment and established the critical competences that were considered vital to fulfil the overarching component outcome. Furthermore, to compliment this, the British Association of Sport and Exercise Sciences define the required competencies needed to fulfil the award of National Accreditation in Applied Sport Science Support. By pooling the available evidence, the following principles that govern effective and safe applied physiological assessment were established. These underpinned the defining component outcome. It was deemed critical that the practitioner (student) must therefore:

i) Possess the required level of knowledge of exercise physiology to underpin their support activities (e.g., select or design appropriate testing procedures which are appropriate to the athlete group/individual). Included within this would be an applied knowledge of the physiological demands of the sport and/or specific issues related to the athletic group, such as age or disability;
ii) Correctly perform the procedures and techniques for the collection of data. Included within this would be an awareness of calibration and maintenance requirements;
iii) Show knowledge of reliability and factors that could impact on measurement error;

iv) Be able to use the equipment safely, appreciating the limitations of procedures being deployed;
v) Correctly interpret physiological information gained from the assessment (in a range of settings and situations);
vi) Communicate information both written and verbally with appropriate authority;
vii) Show awareness of ethical issues (e.g., informed content, professional codes of conduct, athlete welfare) associated with the sport science support activities; and
viii) Perform all work in accordance with designated health and safety requirements (i.e., local School regulations, BASES).

If a student was able to demonstrate these principles throughout observational assessment, it was deemed that the module component objective had been met and the overarching professional activity reached (entrustment would be granted to the student). These principles were broadly grouped into two themes based on BASES recommendations (Winter et al., 2016). These being: i) athlete safety and welfare is ensured and maintained throughout the assessment period; and ii) the assessment is undertaken effectively. In this context ‘effective’ meant that the agreed/required measurements were successfully captured. In accordance with McCloskey et al. (2017), and given these two critical professional ‘work units’ are considered essential for effective athlete management (and care), the terms EPA 1 and EPA 2 were aligned to these two key units of required practice. This recognised that these entrustable elements were required for athletic assessment in applied sport science.

	Component Outcome: The practitioner reaches entrustment when they can complete, without supervision, an athlete physiological assessment in a safe and effective manner, capturing the desired outcomes in accordance with agreed athlete-centred objectives									
	EPA 1: Ensuring Athlete Safety and Welfare					**EPA 2: Undertaking the Assessment Effectively**				
	1A	**1B**	**1C**	**1D**	**1E**	**2A**	**2B**	**2C**	**2D**	**2E**
BASES Accreditation Domains	Compliance to Health & Safety measures	Respecting athlete dignity	Athlete preparation	Proactive response to Athlete needs	Maintenance of communication throughout	Agree goals, priorities and assessment approach	Communicate assessment rationale	Implement and manage assessment protocol	Capture data correctly in accordance with guidelines	Accurate record keeping
Professional Relationships & Behaviour	✓	✓								
Understanding delivery environment			✓			✓		✓		
Management of self, others & practice				✓	✓			✓		✓
Problem solving and impact				✓						
Self-evaluation & professional development				✓						
Understanding & use of research						✓	✓			
Application of knowledge and skills	✓							✓	✓	
Communication			✓		✓	✓	✓			
Scientific Knowledge						✓	✓		✓	
Technical Skills	✓							✓	✓	✓

Figure 1 – Matrix that maps the BASES Accreditation Domains (As indicated in the National Accreditation framework) with the overarching component outcome, the two aligned entrustable professional activities (EPAs), and the underpinning competences. Students were provided with key information that enabled them to clearly map to required practical evidence, assessment expectations, and accreditation requirements.

It is critical to note that for the developing practitioner (i.e., the student) to reach the benchmark of a module component pass, that is to say reach the outcome, they needed to have demonstrated both independently executable units of professional practice. The reasoning for this was that the student could take an athlete through an assessment safely but fail to capture the intended measure (effectiveness) or measure what was required but perform the assessment in an unsafe manner (athlete safety and welfare). It was therefore essential that the student was able to accomplish both aligned EPA 1 and EPA 2 (entrustment to undertake the activity with independence). These two units of practice were not directly referenced to as EPAs, rather the terms ‘safe’ and ‘effective’ units of practice were repeatedly referred to throughout. These was made explicit to all students at the start of the module, with a clear rationale as to their link to: i) the BASES Accreditation professional domains (see Figure 1); and ii) the required core competencies that would be developed throughout the practical curriculum (see Figure 2).

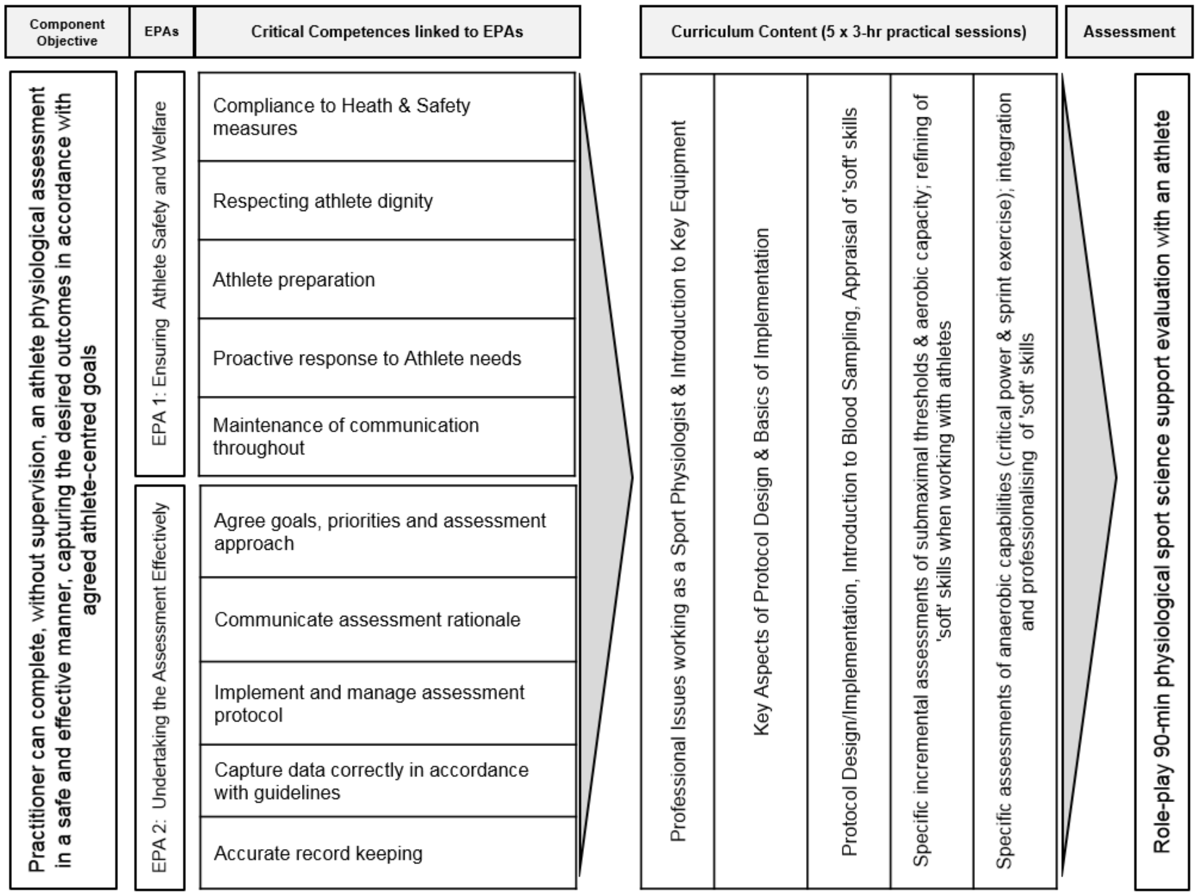

Figure 2 – Diagram that shows mapping of the component outcome through to assessment. Built within the model is the linkage to entrustable activities deemed critical by the profession.

Assessment of the component objective was in the form of a 90-minute (max.) live ‘athlete assessment’ roleplay, whereby the developing practitioner (the student) was provided with athlete information ahead of their assessed interaction. Athletes were selected from a pool of external volunteers, considered competitive in their sport. Based on a completed athlete questionnaire, training log, signed consent form and a self-reported medical checklist, the student had to decide upon the most suitable assessment from a suite covered within the practical curriculum (see Figure 2). Throughout the module, students developed a portfolio of practice that enabled them to build a physiological assessment plan (see Figure 3) and map these to the key competences (see Figures 1 and 2). As they developed their proficiency, they undertook peer-to-peer support sessions working together to refine their practice. In addition, students were provided opportunities to engage in sport science support with staff and research data collection activities.

Each live roleplay was observed by two independent assessors. To align to institutional grading criteria, students were allocated a grade along a spectrum of descriptors. This ranged from ‘Outstanding’, ‘Excellent’, ‘Very Good’, ‘Good’, ‘Pass’ (entrustment reached), ‘Marginal Fail’ and ‘Absolute Fail’. A programme-level categorical marking matrix was adopted to differentiate attainment outcomes above or below the pass mark. Where a student was graded as a fail in this component it was deemed that they were in need of further development in one or both units of professional practice and that they could not be granted ‘entrustment’ until they had successfully demonstrated these during independent activity with an athlete. This was not explicitly built into assessment regulations for the module, but was a notional hurdle that was required given that the student needed to demonstrate independence ahead of progressing into the second term. Where a student was unable to independently execute the either of the two units of professional practice (i.e., EPAs) they were further tutored and provided an opportunity to repeat the assessment until they were able to demonstrate success.

Timing	Process	Information to Support Entrustment Decision
0 – 5 min	Athlete meet and greet Introductions	• Introduce themselves as the Sports Physiologist • Engage in friendly informal conversation • Set out expectation/objective of the athlete assessment • Outline Health and Safety/Risk (as well as benefits)

5 – 20 min	Explanation of the Assessment Process
	
	Background Info Check
	
	Collection of the Athlete Anthropometric Data/Resting Blood Lactate
		• Overview of the assessment process
		• Discuss/Question the athlete on the following:
		  o Any injuries/medical conditions (recent)
		  o When/what they last ate/drank
		  o When they last trained/frequency/type
		• Collect the following data from the athlete:
		  o DOB/age
		  o Height
		  o Weight
		• Attach Heart rate monitor, sync to the computer and take resting H/R
		• Take resting blood capillary sample:
		  o Wear rubber gloves
		  o Wipe area with alcohol wipe and dry
		  o 'Prick' on the thumb and wipe first drop of blood
		  o Using 'Finger and Thumb technique', rake a blood sample.
		  o Apply tissue
		• Select gas mask for participant (correct size)

20 – 35 min	Assessment Prep / Warm-up	• Ensure the athlete wearing the appropriate attire for the assessment.
		• Allow athlete to become acquainted with the assessment tool (step onto the apparatus etc.)
		• Run through the safety aspects. These include:
		  o Emergency stop button
		  o Placement of the treadmill
		  o When to hold the front bar
		  o Introduce them to the Borg scale and how it will be used (position where they can point to it)
		• Start the warm-up. This should include:
		  o Time limit of five minutes
		  o No more than 50% (8kmph) of maximal effort
		  o Option of stretches and fan if the athlete requires
		• While athlete is on treadmill, input athlete anthropometric data in to the computer
		• Check the athlete is comfortable with how the treadmill stops and with the process thus far
		• Water option for the athlete
		• Apply the gas mask, ensuring that it is air tight

35 – 60 min	Assessment	• Use rubber gloves
		• Athlete returns to the treadmill.
		• Set gradient to 1.0.
		• Attach gas/air to the mask and check that the computer to ensure that it is reading correctly
		• Start assessment (5-7 stages)
		• Every 2/3 minutes (last 30 secs of each stage), check the following in order:
		  o HR
		  o RPE
		  o Blood lactate
		  o Flag (on computer)
		  o Increase speed
		• On final stage, stop the treadmill (using safety) to remove final blood lactate

60 – 70 min	Cool-down	• Stop the athlete to remove gas mask (consider H&S) • Restart the assessment tool with decreased speed/effort (approx. 50%) • Duration of five minutes, slowly decreasing the speed until athlete is into a walk • Constant visual checks on the athlete • Option of stretches and fan • Advise athlete to take on fluids, while checking for dizziness etc. (option of fan to cool down) • Ensure time is created to have a look at the athlete results, checking for what was expected and anything that may not be expected (brief)

70 – 85 min	Athlete Debrief	• Discuss with the athlete (at first glance) their results. Remember to consider:
		  o Data that you may expect/not expect to see
		  o Comparatives to normative data
		  o Any data that is not considered normative
		  o Relate the data to the athlete's initial expectations (what they were hoping to use it for etc.…) > implications to performance and possible training solutions

85 – 90 min	Athlete Departure	• Be sure to thank the athlete for their participation • Check welfare and fit-to-leave safely (if more time required indicate to athlete) • Give athlete a deadline for which they will receive the their report

Figure 3 – Example of a co-developed physiological assessment plan that: i) the students used during session-based and independent practice; and ii) the assessors used during the observable roleplay activity.

The student voice provides an important evaluation of learner experience (Austen, 2018) and therefore the value of their insight can enable a qualitative account of impact, whether positive or not. Within this exploratory approach, ethical approval was not directly sought and therefore direct reference to extracts of the student voice could not be used. Based on thematic review of the anonymised accounts collated from qualitative responses of internal module evaluations, learners highlighted: i) the value of the applied exposure and expectation to evaluate athletes using a variety of physiological assessments and analysis equipment; ii) the more tailored learning due to the condensed group size; iii) opportunities to get hands on not only during timetabled sessions but also in our own time; iv) a developed interest to pursue a physiology career/applied work with athletes; and v) opportunity to work towards independence.

Building EPAs into a Practice-based Sport Science Curriculum

Applying EPAs into a sport science curriculum can be considered a process that takes several steps and several iterations. According to Mulder et al*.* (2010) and Ten Cate (2018) this should be seen as a developmental process and requires a good understanding of professional standards/expectations, the learner's current knowledge and skillset, and curriculum and assessment.

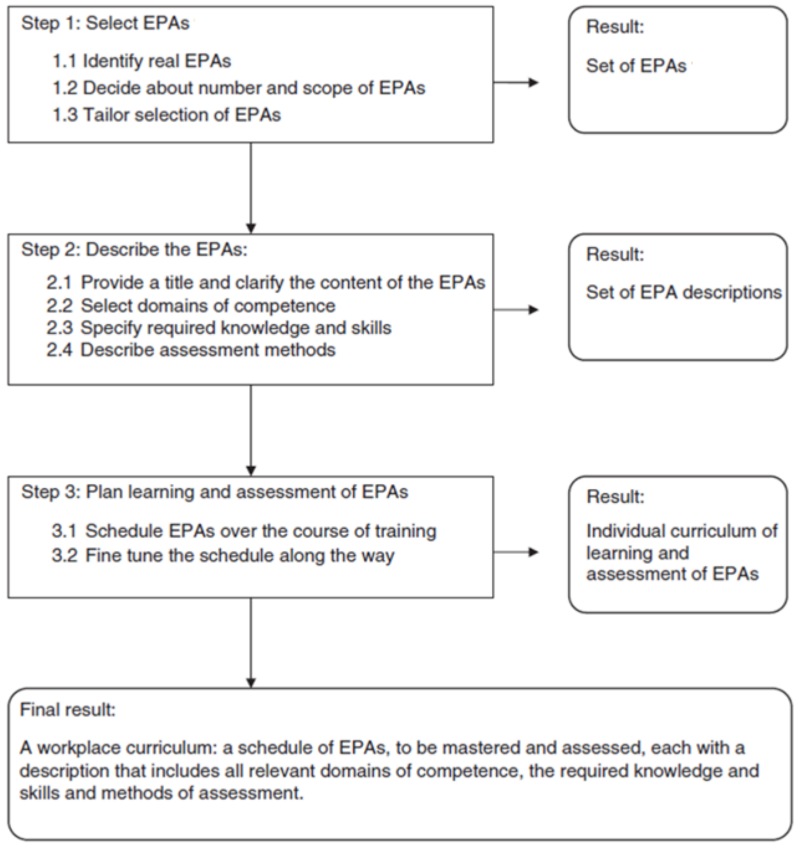

Figure 4. Building an individual practice-based curriculum around EPAs requires a stepwise approach to identification, description, assessment determination, pathways to entrustment, and flexibility in learning. Mulder et al. (2010, p.455) provides a useful framework that can assist the development of EPAs within a curriculum.

Selecting EPAs

Describing a practice-based curriculum in terms of EPAs requires a thoughtful process. EPAs, as units of practice, should be defined so each is unique reflecting activities deemed necessary by the profession. They should be bound to a practice-based environment, and where possible should link to national or regulatory frameworks (e.g., BASES; ACSM; BPS). Various processes have been described to arrive at suitable EPAs, most of which involve reference to industry/professional standards, connection to organisational frameworks of practice, and consultation with industry experts and employers (Hauer et al., 2013; Fessler et al., 2014).

Creating EPA Descriptors

An EPA description should be:

i. Appropriately titled, making it quickly recognisable and linked to professional activity. Each should be distinct from one another and be written in a manner that is understood by the profession, the supervisor (teacher) and the learner. This may require validation of the EPA from industry partners, professional associations, colleagues and students.
ii. Specific in detail and should contain no more and no less than what is exactly meant with the EPA. The specification should link to a list of competencies that collectively enable observable execution of the EPA.
iii. Linked with any prevailing framework of competencies that may already exist within the curriculum. These should be presented in a matrix that articulates how the identified EPAs connect to specific practice-based competencies.
iv. Accompanied with appropriate information to support entrustment decisions. This should be a specification that guides the practice-based activity and provides the supervisor and learner with clarity of expectation for entrustment to be granted.
v. Time-bound and enable formative practical development with a summative entrustment decision. It may also be required to apply a scaffolding approach to curriculum delivery with the inclusion of repeat EPA assessments. Some entrustable activities may expire due to changes in professional standards, altered profession needs or lack of use by the learner throughout their programme.

Determining an Assessment Framework

EPAs should be independently executable, achieved within a defined time frame (both curriculum and assessment-bound timeframe) and be observable and measurable in their process and their outcome. Therefore, any assessment framework needs to provide demonstrable opportunities that mimic professional practice-based work. Evidence suggests that this is best accomplished through live assessment that replicates real-world work-based scenarios.

Accommodating a Flexible Learning Approach

Practical sport science curricula should allow for some flexibility in individual learning paths. Ideally, personalised routes to entrustment should enable the learner to develop their own strategies and timelines towards expertise. Realistically, our prescribed curricula with pre-defined start and end points place constrains as to how and when a learner (and supervisor) may consider themselves ready for entrustment. Nevertheless, where possible providing opportunities for learners to trace their own development and record progress towards entrustment decisions, as well as offering wrap-around extra-curricular opportunities (additional practice time; support science work; engagement with research data collection) can facilitate a student-centred ownership of the pathway to entrustment.

Are EPAs Appropriate for Sport Science Education?

The simple answer is ‘yes’. EPAs can have a valuable place in a practice-based sport science curriculum and can be advantageous to the development of work-ready graduates within and beyond their subject. Meager (2001) defined graduate readiness as the ability of an individual to work effectively in a wide range of contextual conditions from an organisational to a societal level. Flexible attitudes, self-autonomy to practice (entrustment), learning capacity and personal grown, resilience and entrepreneurship creates transferability across workspaces are all essential for the work-ready graduate (Sleap and Reed, 2007). Such an approach, led by the requirements of real-workplace activities, aims to place the learner in unfamiliar situations, develop peer-to-peer collaborative group practice, engages them in live scenarios, and creates opportunities to problem solve ‘as-they-happen’ critical incidences. Framed within a personalised pathway to self-actualisation and independence, EPAs offer a contextual framing in which curriculum outcomes, teaching methods and assessment strategies can be aligned. This can move us beyond binary skill or competency-based learning outcomes to professional activities that demand both learner and teacher engage and develop within a contextualised real-world environment (Minten, 2010). It is acknowledged that a significant amount of learning, particularly at undergraduate level is focused on knowledge and foundational skill-building, where EPAs may not explicitly have a direct role. However, there is an opportunity to reflect upon early year practical curricula and consider whether basic competency-based training (learning) could be better aligned with overarching entrustable professional activities. These provide the student with a direct connection to professional units of work, foster greater independence and require contextual application beyond their immediate discipline and level of study – that is it say the prospective scaffolding of learning.

In the context of this exploratory paper, the purpose of effective sport science education was to ensure students could provide a safe, unsupervised, evidence-informed professional service to a wide range of client groups. Given the diversity of applied disciplines within sport science education and the accompanying professional bodies that require particular professional standards and expectations, such overarching purposes may vary (Fletcher and Maher, 2013). However, arguments made for their [EPA] attractiveness (Chen et al., 2015) seem strong and well-informed (O'Dowd et al., 2019). To their benefit, the application of entrustable professional activities within sport science education, could enhance: i) continuity and developmental progression of learners; ii) the ability to more effectively generalise and apply competences across work spaces and professions; and iii) the self-recognition of quality assurance, in that one has reached an entrusted level to go forth and undertake a professional activity with independence and authority (Chen et al., 2015). There is a growing body of evidence that legitimises these claims (O'Dowd et al., 2019), however given its infancy within sport science education, there is an exciting opportunity to now explore this further. It is broadly acknowledged that best practice guidelines for EPA development are still required and it will be incumbent on professional bodies, in partnership with academic programmes teams, to consider how these may best inform practice (O'Dowd et al., 2019).

Conclusion

Finally, the development and implementation of EPAs in a sport science curriculum presents exciting opportunities to strengthen both student and industry partnerships. Collaborative activity that co-designs/defines professional activities deemed necessary from the profession(s), develops assessment strategies that mimic workplace conditions, and establishes curriculums that promote flexible individual learning journeys can provide an immersive and engaging education directly linked to professionalism and professional practice.

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