# Self-Audit and Research Training Plan

**Personal Background**

I would describe myself as a mature student who entered academia after 25 years of previously working in diverse applied roles and environments. Including, completing in 1986, a five-year indentured apprenticeship. Achieving a Royal Horticultural Society Gold medal, a Banksian Medal and two flowers created for competition and subsequently released for commerce. This process alone takes seven years from the first cross selection of varieties to the eventual release, one of which being presented to Queen Elizabeth the Queen Mother in 2001. During the 1990s, I became a father to three children along with being the main carer, there was a crossover into sport, building my own sports coaching business providing structured physical education in schools. Management of sports events for Major League Baseball for over seven years, including national programme and Playball World Series manager. With my ever-growing vocational qualifications in sports and progressing employment, including the Rugby Football Union talent pathways, I recognised the need to underpin my hypothesis with science. By doing this would support my work with succinct evidenced facts that would further progress my career. Therefore in 2007 I entered the academic world, and enrolled and achieved undergraduate and postgraduate degrees in sport science.

Whilst working as an applied practitioner working within football academy and senior team environments that has now spanned for over ten years. In addition, I have also worked with wearable technology companies to build develop and manage systems for the sports industry. I feel that these experiences have a common theme throughout, in that, they have all been longitudinal journeys and ones that I successfully completed. Being somewhat of a generalist by not specialising in one sole domain or practice, I do however feel that by thoroughly immersing myself in gaining a broad knowledge of the role in that I have been able to specialise and excel. One of the key attributes to this is by me transferring skills and knowledge gained.

My reasons for undertaking the professional doctorate program is that it will underpin my practice by evidencing with more depth, a scientific rationale to my applied work. It will allow me to examine more deeply the accepted conventions that constitute my field of work, and provide me with the confidence to help to find solutions to questions raised. I have an aspiration to become an expert in the area of research specifically in the use of wearable technology in applied education and sporting environments. Previously when having to perform academic related tasks to gain qualifications it has helped motivate me to continue to research the subject area. I believe this qualification has the potential to complement industry experiences captured over many years. By conducting a series of studies I hope it produce answers to questions and recognise the contingency of human understanding in our complex educational world.

On reflection of my development and career to date viewing as being on a theory to practice continuum, I would gauge it currently more on the practice side. By undertaking, the professional doctorate it will for the next few years give me a more balanced progression in my professional development by providing the motivation and goal of a blended working practice. One that I have taken a great deal of thought about before enrolling, since the Autumn of 2017 was the spent time researching and evaluating the professional doctorate with many meetings with students and lecturers including Professor Barry Drust. These helped me to determine if a professional doctorate was suitable for me and what I needed to do to prepare for such an undertaking as this. One of my goals in achieving the professional doctorate will empower me with a greater depth to my knowledge of the subject area, as well as making a novel contribution to applied practice.

**Self-Audit**

A self-audit is a form of internal assessment of one’s own performance and can be used to monitor progress, the importance of self-audit are well supported in academic literature (Boud, Lawson and Thompson, 2015). My aim here, is to evaluate the skills, experience and training to date and identify my personal strengths and weaknesses in relation to those required of a professional doctorate student. My intention to develop further my research skills and to be in a position to consolidate the level of study required to complete a professional doctorate. Reflection for the purposes of professional development should be a continuous process and therefore I am performing a self-audit at the outset of the professional doctorate experience, and continuing this throughout the process (Baars et al., 2014).

To support me in composing the self-audit, I have used the British Association of Sport Exercise Science (BASES) competency profile, as this provides industry specific and professional standards for the profession. In order to identify my skills and weaknesses and develop my competencies as a researcher I will utilise the Vitae researcher development framework (Vitae 2017). Both of these two competency frameworks will provide me with the necessary measures to monitor my continued progress and allow me to plan how to progress and improve on areas required for this level of study. I have used the process of reflection to help me to identify components that I need to develop in the areas of self, research and professional practice and I will provide further detail and context below.

***BASES Competency Profile***

During my two years supervised experience with BASES, I conducted two case studies that involved the use of wearable technology in football. This experience enabled me to develop key transferable skills including those developed in my first case study that involved working in a professional football academy environment. An example being communication skills, with many different ages, cultures and stakeholders, as this required an understanding of spoken and written word in context. These skills are going to be crucial especially if I am to develop the critical thinking and analytical mind-set, which are integral components of the professional doctorate. With the amount of information being produced demonstrating an ability to disseminate and present to diverse stakeholders, including coaches, players, parents and external agencies, such as colleges will be crucial. The second case study was in the leisure football environment, which involved many similarities including communication, critical thinking and analytical mind-set. Using analytical skills gained in reflective practice, I have been able to identify areas of skills that are needed to ensure that I am successful (Allen, Rhind and Koshy, 2015). Whilst my applied knowledge could be viewed as a strength, I do feel as though my levels of research skills and knowledge is a weakness. As I continue to develop however, I believe that this will improve, and my depth of knowledge and my ability to conceptualise solutions in a more concise, logical and robust manner will evolve. As an example of this in my BASES second case study, I found that I needed to research an area that I did not fully understand. I had to understand another dimension of football that being the leisure industry. This involved me identifying some scientific research to support my work but was very limited. In many ways it set the foundations to my current research.

***Personal Development Analysis***

To support reflection as part of my early Professional Doctorate studies, I completed an online behaviour profile the Personal Development Analysis (PDA, 2019) which involved completing an online questionnaire with multiple-choice answers. This was then followed up with a telephone call with one of their consultants after delivery of the report, which was a descriptive assessment to discuss their findings. The outputs that were reported on, included personal and interpersonal skills such as self-control, patience, decision-making, conformity, risk taking, as well as communication, leadership and management skills. That can be used to support my continuing reflective practice (Thomas-Gregory and Mercer, 2014). Skills identified that require some upskilling are listed below. These skills were to some extent validated during meetings with academics including Dr Neil Clarke associate professor and senior lecturer in applied sport and exercise science at Coventry University. Dr Clarke and I have co-authored two published research journal articles (Tierney et al, 2016; Tierney and Clarke, 2019), and he has been an industry mentor for last five years and continues to support me along my research journey. Other applied practitioners who validated my applied skills include Lee Carsley currently England U21s assistant head coach and Union of European Football Association (UEFA) pro licence holder with over 20 years playing and coaching football in the professional game. He has been my football advisor and mentor since 2010 and continues to mentor me throughout my journey in guiding me within the professional sections of the industry. We hold regular catch up days where we structure informally and a general conversation to more formal with set agenda points to help with both our continued development.

* + Communication

Whilst previously an area of strength the self-audit has highlighted that with further education an area not accustomed to that I need to expand on my network of contacts and communicate as they would want and expect.

* + Personal and interpersonal relationships

The behaviour profile report highlighted the need to improve relationships with those that are new encountered

* + Time management

An area to continue to develop as this being a professional doctorate that requires me to continue with my professional work along with allocating time for study.

* + Task management

Again, an area to develop as this level of study is much higher than experienced before and will now expand on this. Developing and maintaining relationships with people related to my area of research, will help me to gain a better understanding of the many aspects involved, scoring a 3 out of a possible 5, whilst high this is still needed to be developed, especially given the level of study at doctoral level. By identifying and recruiting advisors, ensure that I gain continued insight into their workings and develop the framework for my studies, as well as providing support and guidance.

Time management scored 4 out of a possible 5 in my self-assessment. Whilst this is relatively high on the rubric, it does highlight that to remain at this level and improve, I must transfer my previous experiences to my current practice. To achieve this I will continue to use electronic and paper diaries and review weekly as I have done in the past. This was reflected in my BASES competency profile as being an area of strength when a detailed timeline is produced and updated regularly such as a Gantt chart. In keeping with previous work, I have constructed a detailed timeline in excel so that I am able to update and track progress of each stage of the process, through to completion. This is included in my module one submission, giving an overview of my progress and where I am at any given time, as well as the capacity to drill down into each stage further. Thus it will ensure that with the many components involved in this mode of study that I am able to easily identify any issues and adapt my plan accordingly, this also helps with task management as they impact on each other. Good examples of evidence of my time and task management are in the form of the two case studies that I completed during my BASES supervised experience. Being in live environments can be unpredictable such as bad weather, therefore, having a plan enables me to evaluate and make changes so that the overall project remains on track. These have also given me a good base of knowledge of my project subject area. 1). Project management for development of sports wearable technology 2). Monitoring performance in football,

***Research Competencies***

Having more applied practitioner knowledge, skills and experiences from my time spent working in industry, and less in academic environments, it was to some extent ‘expected’ that I would score low in this area. This was evidenced in the research component of my self-audit, scoring 2’s and 3s out of 5. To improve my understanding of appropriate research I have identified that I need to develop the ability to better identify, collect, collate, critically analyse, synthesise, summarise, report and disseminate information that relates to my research area and that these need to be communicated in a succinct manner. To achieve this cyclical research process I will need to develop my understanding of adhering to an Action Research (AR) methodology (Dawson, 2012). At the moment my understanding of this methodology is still very much in its infancy, but my initial reading and understanding suggests it is a form of research that explicitly sets out to make a practical difference to the issue, problem or question being studied (Dawson, 2012). By reading similar studies and research that adheres to this methodology and performing mini updates will help me to improve in these areas. These identified skills are detailed further in my training plan, where I have outlined general areas and then have detailed more specifically using components of the Vitae framework. Further supported in the behavioural profile audit I performed. In addition, by having, access to Liverpool John Moores University (LJMU) resources including the library and supervisory staff as well as experienced researchers specifically in my areas will allow me to draw from these to improve. Specifically, these would be lecturers, researchers and management including curriculum leads.

In my professional practice, I am required to present statistical analysis and data visualisation of work. I believe I have the necessary critical analysis skills to successfully complete this work and mode of study. I am motivated and enthused by my two recent peer-review journal publications (Tierney et al., 2016), which evidences my potential to conduct and present research in a credible and robust scientific manner. These publications evidence my ability to conduct, and disseminate scientific research, however, the area of focus was football and wearable technology, and not education *per se* and this will be an area that I will require pedagogic and educational guidance. Organisations such as the association of colleges will help me both locally and nationally in understanding the further education landscape.

***Professional Practice***

For this aspect, I employed the BASES competency framework, which was required for completion of my supervised experience conducted over the last three years prior to my entry onto the professional doctorate with LJMU. Time and task management are two areas that have been previously identified to me and I included in the self-element of this audit. However, it does, like other elements, impact on my professional practice and therefore have included and expanded on in this section. I feel that as time has gone on and in my preparing to embark on the professional doctorate that I have already commenced on addressing these and have started to upskill, which I will continue. As part of this I conducted a series of questions around the research process these were, why I want to do a professional doctorate, what is it about me that thinks I can do it, what would be the challenge to me to complete and what would the project be? These were then shared with my fellow students in the first year of enrolment and helped to focus my area of research and tasks required to help focus my mind. A large part of my BASES accreditation process was to compile a diary of work and conduct regular reflective practice (Knowles, Gilbourne and Tomlinson, 2007). Reflection, I have found, helps me to better understand how I have done something and the processes involved, identifying good and poor practice that then helps form my next steps.

The BASES experience is also further evidence of my continued professional development within the industry working in and adds to my curriculum vitae (CV) that includes many industry related qualifications that remain current in my professional practice. This is supported with me attending various conferences and events, that help my broader understanding of the many areas of the industry I am working in. I recently attended the following conference to support my continued professional development and to gain valuable industry related insights, these being across the football industry from professional to leisure participation. It became clear to me from these, that there is a disconnect between technology and its uses in football. This disconnect is that it appears to be that the commercial providers are dictating the use of rather than the industry getting what it requires to improve performance, which the technology was originally intended for. Added to this, a recurring call for better education on its uses in football as the industry expands at an accelerated rate.

* Football Innovation Summit, (2019) that focused on the latest developments emerging and strategic plans for the future, highlighting integration and education of technology
* The United Kingdom Strength and Conditioning Association (UKSCA) football conference, with panel discussion of industry experts highlighting the need for better education on the use of technology.
* BASES annual conference highlighting the increasing number of roles being created in sport and the impact sport science has on the economy.
* The sports data technology conference in London that had industry presentations on wearable technology. In 2020 I have already committed to attending the Association of Colleges sports and BASES student conferences and am guest speaking at the Wearable Technology expo.

As part of my action plan guest lecturing in further and higher education setting will help develop my Professional practice that are governed by industry professional standards. These will also improve my employability in these sectors. For this, I have had to complete an enhanced Disclosure and Barring Service application, to conform to health and safety at work and normal operating procedures for the industry.

**Research Plan**

**An investigation into the use of wearable technology in football in higher and further education settings in United Kingdom**

**Introduction**

The use of wearable technology in football (soccer) has been established in top professional teams for over a decade (Aughey and Falloon, 2010). It is used for the purpose of helping understanding, quantify and improve performance of the athlete and or team (Seshadri et al., 2017; Luczak et al., 2019). International football federations such as FIFA, UEFA and country governing bodies (e.g. The FA) have permitted the use of wearable technology in competitive match play and as such it’s use during training sessions and in match play has become the norm (Buchheit and Simpson, 2017). There has thus been an exponential growth in its use in recent years (Hennessy and Jeffreys, 2018) and furthermore, it has resulted in the awarding of large, lucrative contracts of three to five years between sporting bodies and commercial providers (Taylor, 2018). Commercial promotion coupled with improved availability has witnessed the use of wearable technology cascading down the football pyramid (Hennessy and Jeffreys, 2018) into more recreational use (Krustrup and Krustrup, 2018), as it has enabled more to access and this number is increasing.

The two most common types of wearable technology include heart rate monitors and Global Positioning Systems (GPS) based devices (Akenhead and Nassis, 2016). These are widely used to gather data that is then analysed and the information produced communicated to key stakeholders to help evaluate three main areas; internal (Bourdon et al., 2017) and external load (McNamara et al., 2018) and tactical traits (Wundersitz et al., 2015; Bradley et al., 2019). Internal load; is where wearable technology was first introduced and is still used today (McCann and Bryson, 2009). Traditionally this was done using heart rate devices in straps that are worn around the chest area (fig.1), monitoring the hearts response to exercise. External load, typically being derived from GPS-based devices that are worn centrally on the upper back (fig.2), incorporating various inertial sensors, for measuring the locomotor and mechanical loading and positional awareness (Portas et al., 2010). Tactical traits are also being derived from these devices, reporting on positional data of players in relation to their position, formation, and playing style (Tierney et al., 2016).

With increased use, a greater number of football teams now employ sport scientists and experts in data analytics to work with this technology to help inform on performance, recovery from injury and talent developmental pathways (Carling, 2013). Data collected from wearable technology is used to measure the demands imposed on players participating in training and match play (Malone et al., 2015). This information, which enables coaches to manipulate training to help develop physical and tactical characteristic that are required to meet the demands of the game (Malone et al., 2017). As mentioned previously the increase in use of wearable technology, and the evolving complexity and understanding of how it impacts on other aspects of team performance and development, has seen a surge and growth of support staff such as sport scientist now being employed in the football industry (Rago et al., 2019). In addition, evidence also suggests that individuals, players and the wider public, now take more of an interest in their own performance and are using devices like wrist worn ones providing insight on their current and past activity (Violino, 2016; Thompson, 2018). Example of use in football is the communication of live feed data to coaches and support staff from players wearing technology whilst training and in match play (Malone et al., 2019). Furthermore, information obtained such as number and type of movements made, speed and position in match play and training is often used to develop and educate players understanding as they transition from youth to adult development phases (Tears, Chesterton and Wijnbergen, 2018). By manipulating training (Beenham et al., 2017), to improve physical characteristics, and to communicate tactical aspects of the game and thus optimising their developmental physical, tactical and educational performance is the modus operandi of wearable technology. However, the way in which physical and tactical components interact and combine to influence the performance of players and teams is poorly understood in the elite performance setting (Bradley and Ade, 2018).

There is also growing evidence of the use of wearable technology in educational environments and this is reflected by the current use of these devices across both Further Education (FE) and Higher Education (HE) settings. Further and Higher education (FE and HE) organisations employ the use of wearable technology in a similar way to as it is used within the football industry (Ravindranathan et al., 2017), with using the technology with their competing teams (Gentles et al., 2018), during components of study and for the purposes of research (Albion et al., 2015). In FEandHE settings students commonly perform a mode of study with some that have an added component of participating in representative football such as students undertaking a Business and Technology Education Council (BTEC) sport course. All of these engaging with the technology, whilst interpreting, visualising and communicating the amount and type of data produced differently, that is relevant to their role, use and setting (Lacome, Simpson and Buchheit, 2018).

These environments along with other sport and exercise science courses are increasing in number (complete University Guide, 2019), to meet the demand of the industry, that has seen an ever-increasing number of roles emerge as this sector of support staff grows (Drust and Green, 2013; Dellaserra, Gao and Ransdell, 2014). In addition, the number of providers that offer a blended learning and participation experience has also expanded (British Universities Colleges and sport (BUCS), 2017). They appear to use data in a similar way to elite teams in providing feedback to players, however this is anecdotal and requires further empirical examination. In contrast to the established use in professional teams (Whitehead et al., 2018) there are no standardised methods or protocols and a general lack of information and conceptual frameworks around their application in educational domains. There is also little known as to how the data generated is used, if at all, in an educational context, as this may make the processes of use different and the effectiveness it has in practice. Furthermore, of the estimated up to 15,000 sport and exercise science graduates each year in the United Kingdom, few are equipped with the skills and knowledge required to work in applied positions, mainly due to a lack of engagement from education with technology (Crook and Gu, 2019) this however still requires further empirical examination.

The increasing use of wearable technology by players and the expansion of support staff using continues to grow at pace (Drust and Green, 2013). However, despite the growth in the use of wearable technology, currently there is an absence of a credible conceptual framework for how wearable technology is used in both performance football and in educational settings. Our understanding of how this technology is deployed and understood in education environments is even less understood. Therefore, the primary aim of this professional doctorate is to examine the current use of wearable technology in football related FE and HEsettings in order to develop a model for the use of wearable technology in a football related FE and HE environment.

*Primary Aim:*

*The primary aim of the project is to design and develop a wearable technology product that can be applied in a football specific* FE *and* HE *environment.*

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*Secondary Aim:*

*With this being a professional doctorate there is an additional aim and that is To forge a stronger bond between academia and business to help evolve wearable technology solutions to identified real world problems in industry and evidenced in the overall project.*

*Objectives*

*1. Identify the extent and type of and approach to the use of technology in football related education programmes in* FE *and* HE *settings*

*2. Describe and contrast the use of wearable technology in elite performance and football related* FE *and* HE *settings*

*3. To plan and design strategies to improve effectiveness of use of wearable technology, specifically communication and feedback mechanisms in football related* FE *settings.*

*4. To propose, construct and disseminate an effective model in the use of wearable technology in football* FE *settings*

Outline of proposed studies

Study 1.

This first study will identify through the deployment of an online survey, what wearable technology is being used, who is using it and how it is being used in both FE and HE settings including; universities, colleges, football academies and commercial providers such as Catapult sports (Canberra, Australia), Polar Electro (Kemple, Finland) and Statsports (Newry, Ireland), being some of the most popular brands to the football industry (Aughey, 2011; Malone et al., 2017). The findings will illustrate what each are using and identify if there are any trends and relationships from the use of in the various settings.

The outline of the process will be as follows;

Part 1. Identification of who is using? By researching the literature to determine who HE and FE providers are, to help in this, organisations that are involved such as the English Premier league (EPL), The Football Association (FA), league football education (LFE), League Managers Association (LMA), British university Colleges Sport (BUCS), Association of Colleges (AOC), University and Colleges Admissions services (UCAS), Higher Education Statistics Agency (HESA), Skills Active (SA) and Sport England (SE) will be approached and request for information such as all that have football and/or sport science related studies included in their curriculum also those that have teams but not attached to mode of study.

Part 2. Identification of individuals that manage the sports departments and or teams and determine if use or have access to any wearable technology and how it is used. These participants from these settings will comprise of coaches, sport science students, staff including lecturers, and any other identified users highlighted from part 1 of this study. Participants recruited will then complete an online survey consisting of a series of online open and closed questions delivered via survey software, mobile phone application and direct contact emails. Closed questions that require a simple yes or no answer will be subject to traditional descriptive statistical analysis. Open questions which require a statement of opinion will be subject to a quantitative content analysis employing a 7 point Likert scale (Maurer and Andrews, 2000) as this is more sensitive in highlighting differences than 5 point or less (Korkut Altuna and Arslan, 2016).

Outcome variables that it is envisaged will be determined from this are illustrated in table 1, with some examples. The completion of these will also help to inform in greater detail what technology is being used and how it is being used within the settings identified.

Table 1.

**Survey questionnaire example**

|  |  |  |
| --- | --- | --- |
| Question | Example answer | Comment |
| What type of wearable technology is being used | GPS units/ Heart rate straps |  |
| What is its primary use  | Educational performance or both |  |
| Who collects the data | Team coach |  |
| How is it collected | Downloaded after sessions onto laptop |  |
| From collection of data to when data has been analysed | 1 day post |  |
| When is data communicated  | 2 days post |  |
| Why is data communicated then | Convenience  |  |
| How is data communicated/presented  | Printed data sheet of results displayed on notice board |  |
| Do you monitor who views the data | No  |  |
| Who is data communicated to | Players, coach |  |
| Why is data communicated to those persons from previous question | Because they were the players and coach and analyst |  |
| What metrics do you record | Total distanceTotal timeRed zones | Need to be more specific on answers |

Part 3.

The analysed data will then be categorised to create a framework, identify patterns and connections. This will scope the landscape that will give a clear picture of the extent, type and approach to the use across football related programmes in the FE and HE settings.

Study 2.

This second study will describe and contrast the use of wearable technology in elite performance and football related FE use. This will expand on the first study and help to further understand how each setting is using the technology. For what, if any interaction there is, between the use for sport performance and education and vice versa. Professional elite academy football focus on performance to produce professional players for the industry. In contrast the FE settings focus on a formal education first and a playing career second, to produce potential support staff with industry related qualifications, or to go onto HE to study undergraduate degrees.

Proposed Sampling Frame

This will be a snowballing sampling technique that will enable me as the researcher to recruit relevant people with sufficient expertise or characteristics to answer the research questions. Non-probability sampling may be considered an issue for this particular study due to the limited number of people with experiences of using wearable technology in applied performance and educational domains. A snowball sampling technique is one which is commonly applied to overcome these issues (Noy, 2008). In addition, with the environments being ones that I have experienced working in, this has been over the last 10 years where I have worked in elite football academies and senior professional team settings at different level clubs in England. Enabling me to gather an extensive network of contacts that will be utilised to help this stage of the process. This will also help me further in study 3 and 4 when I will be seeking access to the various settings identified, as I am used to the mechanics of the day-to-day operating procedures and have the relevant qualifications that may be required for access to certain areas. Specifically, in the educational settings with non-adults contact where I would be required to have an Enhance Disclosure and Barring Services checks.

Table 2.

**Study two recruitment**

|  |  |  |
| --- | --- | --- |
| Industry | setting | Role |
| Football | Professional football club | Senior coach, age group coach at under 18 and under 23 year of age, Sport scientists, Strength and conditioning coaches, heads of performance, Heads of education, Players |
| Football | Football association | National team coach, support staff,  |
| Education | Further Education provider including collegesHigher Education university | lecturers, coaches, and support staff from full time to part time and contracted specialists educators, Players |
| Technology | Sport wearable technology | software and electronic engineers, front end user interface developers and project managers  |

Once recruited, a series of remote, iterative interviews and focus groups consisting of industry experts that meet pre-determined criteria as a pre requisite, will be conducted, that will provide insight into the day-to-day logistics of specific or generic use. Using the participants identified from the settings targeted in the first study, for them to participate in 1-1 interviews and focus group discussions will expand in more detail on the processes involved in each setting.

Outcome variables will be, but not limited to, time spent using for both performance and education in the different settings targeted. The metrics identified that are, or are perceived to be useful and in what context for performance, educational and if any are replicated for both. Level of user engagement, understanding of the technology and feedback mechanisms. These findings will then inform on possibilities for how it can be improved to be more effective for both areas separately.

Study 3.

As a caveat, both study 3 and 4 will start to form better as the project unfolds and meetings with industry advisors and supervisory team progress. Additionally, it will be determined in more detail from the results of the first two studies. However, as a broad outline of what is proposed as follows…

This third study will be to plan and design strategies to improve effectiveness of use of wearable technology, specifically communication and feedback mechanisms in football related FE settings. Given that students studying sport science are potential employees for the industry, then an improved understanding and experience in using the technology would be a most valuable asset. In addition, football academies and further education providers are the first steps within the football and education journey for many. Having effective communication and feedback mechanisms that are uncomplicated, portable and instant would be advantageous. Many of the participants studying BTEC type qualifications at FE level are potential future sport scientists that would be seeking employment within the sport, or go on to *he* if their playing careers do not lead to employment as a professional player. Would further give merit in designing strategies that can improve student engagement, progression and future employability prospects.

With the ever-increasing amounts of data produced a strategy constructed that can better integrate the data to improve its effectiveness throughout the FE settings and stakeholders involved would also be of benefit. With the vast majority of these, not employing a sport scientist whose job in professional elite academy settings it is, to manage and feedback on data produced from the technology as well as being fully conversant in its use. Added to this, the lecturer who is employed to teach more often than not also coaches the team for training and match play.

With the educational as well as the sporting use for wearable technology, there is needed a better understanding of how it is used in both contexts and if the two components interact and how they do. With a potential outcome from this research being the construction of a real world solution that these populations would benefit from an interaction between. This study will therefore be one where observation of how the data is used, will be monitored and assessed to its effectiveness.

A broad framework of how the intervention might work as a study are as follows; 2 groups from FE settings

Setting 1.

Consisting of players and staff working at the under 18 years of age groups that perform developmental football with education included. From two professional football academies within two professional Football club (Category 1 or 2). Group 1 would be monitored in their normal mode of study and day-to-day activity currently being performed. With the other given a novel (add on), to their normal mode of study and day-to-day interaction with wearable technology being used. Then each group would be compared and assessed on usefulness in relations to their studies and performance. This will form conclusions on the most effective methods.

Setting 2

Consisting of two college or other FE provider, that have sport science/coaching as component of their curriculum in the form of the BTEC suite of qualifications, as well as including football activity. This settings two groups, will then replicate the study as outlined for setting one study.

These will then be analysed on their effectiveness measures to assess this would include;

Student engagement, Student satisfaction, Lecturer/supervisor Assessment, accessibility of data, use of data, use of data/technology with other subjects, use of data/technology with other stakeholders. These will be compared against baseline assessment prior to commencement of the intervention. The intervention will last for a period of approximately 12- 16 weeks in length, as this being usually one to two terms and in line with settings periods for formative assessments on progress for both education and performance.

Study 4.

This study would be more refined and determined by the outcomes from the previous three studies. The purpose of this study is to utilise the findings, to help construct a model that can be used effectively in applied settings highlighted. That gives relevant feedback to all stakeholders and in a timely manner communicated in a mode that is suitable for the setting in. An example being the mobile phone that has now become an everyday device, used in all settings as a mode of communication. However, this can vary from setting to setting, as well as users, as to what, when and how it is used. A key to the effectiveness of any intervention is that of communication; therefore by including communication as being a key element, gives the project a more global approach to solving the problems presented. Furthermore, this could help in informing *he* sector to better model their curriculum for the inclusion of wearable technology in teaching, to increase employability within the football and other sports industries using wearable technology.

References

Akenhead, R. and Nassis, G.P. (2016) Training Load and Player Monitoring in High-Level Football: Current Practice and Perceptions. *International Journal of Sports Physiology and Performance*, 11 (5), 587-593.

Allen, G., Rhind, D. and Koshy, V. (2015) Enablers and barriers for male students transferring life skills from the sports hall into the classroom. *Qualitative Research in Sport Exercise and Health*, 7 (1), 53-67.

Aughey, R.J. (2011) Applications of GPS technologies to field sports. *International Journal of Sports Physiology and Performance*, 6 (3), 295-310.

Aughey, R.J. and Falloon, C. (2010) Real-time versus post-game GPS data in team sports. *Journal of Science and Medicine in Sport*, 13 (3), 348-349.

Baars, M., Vink, S., van Gog, T., de Bruin, A. and Paas, F. (2014) Effects of training self-assessment and using assessment standards on retrospective and prospective monitoring of problem solving. *Learning and Instruction*, 33, 92-107.

Beenham, M., Barron, D.J., Fry, J., Hurst, H.H., Figueirdo, A. and Atkins, S. (2017) A Comparison of GPS Workload Demands in Match Play and Small-Sided Games by the Positional Role in Youth Soccer. *J Hum Kinet*, 57, 129-137.

Boud, D., Lawson, R. and Thompson, D.G. (2015) The calibration of student judgement through self-assessment: disruptive effects of assessment patterns. *Higher Education Research & Development*, 34 (1), 45-59.

Bourdon, P.C., Cardinale, M., Murray, A., Gastin, P., Kellmann, M., Varley, M.C., Gabbett, T.J., Coutts, A.J., Burgess, D.J., Gregson, W. and Cable, N.T. (2017) Monitoring Athlete Training Loads: Consensus Statement. *International Journal of Sports Physiology and Performance*, 12, 161-170.

Bradley, P., Martin-Garcia, A., Ade, J. and Gomez-Diaz, A. (2019) Position Specific & Positional Play Training in Elite Football.

Bradley, P.S. and Ade, J.D. (2018) Are Current Physical Match Performance Metrics in Elite Soccer Fit for Purpose or Is the Adoption of an Integrated Approach Needed? *Int J Sports Physiol Perform*, 13 (5), 656-664.

Buchheit, M. and Simpson, B.M. (2017) Player-Tracking Technology: Half-Full or Half-Empty Glass? *International Journal of Sports Physiology and Performance*, 12 (s2), S2-35-S32-41.

Carling, C. (2013) Interpreting Physical Performance in Professional Soccer Match-Play: Should We be More Pragmatic in Our Approach? *Sports Medicine*, 43 (8), 655-663.

Crook, C. and Gu, X. (2019) How new technology is addressed by researchers in Educational Studies: Approaches from high‐performing universities in China and the UK. *British Journal of Educational Technology*, 50 (3), 1173-1188.

Dawson, K. (2012) Using action research projects to examine teacher technology integration practices. *Journal of Digital Learning in Teacher Education*, 28 (3), 117-123.

Dellaserra, C.L., Gao, Y. and Ransdell, L. (2014) USE OF INTEGRATED TECHNOLOGY IN TEAM SPORTS: A REVIEW OF OPPORTUNITIES, CHALLENGES, AND FUTURE DIRECTIONS FOR ATHLETES. *Journal of Strength and Conditioning Research*, 28 (2), 556-573.

Drust, B. and Green, M. (2013) Science and football: evaluating the influence of science on performance. *J Sports Sci*, 31 (13), 1377-1382.

Hennessy, L. and Jeffreys, I. (2018) The Current Use of GPS Its Potential, and Limitations in Soccer. *Strength and Conditioning Journal*, 40 (3), 83-94.

Karampatakis, G.D., Ryan, K., Patel, N. and Stretch, G. (2019) Capturing pharmacists' impact in general practice: an e-Delphi study to attempt to reach consensus amongst experts about what activities to record. *Bmc Family Practice*, 20 (1), 10.

Knowles, Z., Gilbourne, D. and Tomlinson, V. (2007) Reflections on the application of reflective practice for supervision in applied sport psychology. *Sport Psychologist*, 21 (1), 109-122.

Korkut Altuna, O. and Arslan, F.M. (2016) IMPACT OF THE NUMBER OF SCALE POINTS ON DATA CHARACTERISTICS AND RESPONDENTS' EVALUATIONS: AN EXPERIMENTAL DESIGN APPROACH USING 5- POINT' AND 7-POINT LIKERT-TYPE SCALES. *Istanbul University Journal of Faculty of Political Sciences-Siyasal Bilgiler Fakultesi Dergisi* (55), 1-20.

Lacome, M., Simpson, B.M. and Buchheit, M. (2018) Monitoring Training Status with Player-Tracking Technology Still on the road to Rome. *Football Science Evolution*.

Luczak, T., Burch, R., Lewis, E., Chander, H. and Ball, J. (2019) State-of-the-art review of athletic wearable technology: What 113 strength and conditioning coaches and athletic trainers from the USA said about technology in sports. *International Journal of Sports Science & Coaching*, 15.

Malone, J.J., Barrett, S., Barnes, C., Twist, C. and Drust, B. (2019) To infinity and beyond: the use of GPS devices within the football codes. *Science and Medicine in Football*, 1-3.

Malone, J.J., Di Michele, R., Morgans, R., Burgess, D., Morton, J.P. and Drust, B. (2015) Seasonal training-load quantification in elite English premier league soccer players. *Int J Sports Physiol Perform*, 10 (4), 489-497.

Malone, J.J., Lovell, R., Varley, M.C. and Coutts, A.J. (2017) Unpacking the Black Box: Applications and Considerations for Using GPS Devices in Sport. *Int J Sports Physiol Perform*, 12 (Suppl 2), S218-S226.

Maurer, T.J. and Andrews, K.D. (2000) Traditional, Likert, and simplified measures of self-efficacy. *Educational and Psychological Measurement*, 60 (6), 965-973.

McCann, J. and Bryson, D. (2009) *Smart clothes and wearable technology*. Elsevier.

McNamara, D.J., Gabbett, T.J., Blanch, P. and Kelly, L. (2018) The Relationship Between Variables in Wearable Microtechnology Devices and Cricket Fast-Bowling Intensity. *International Journal of Sports Physiology and Performance*, 13 (2), 135-139.

Noy, C. (2008) Sampling Knowledge: The Hermeneutics of Snowball Sampling in Qualitative Research. *International Journal of Social Research Methodology*, 11 (4), 327-344.

Portas, M.D., Harley, J.A., Barnes, C.A. and Rush, C.J. (2010) The Validity and Reliability of 1-Hz and 5-Hz Global Positioning Systems for Linear, Multidirectional, and Soccer-Specific Activities. *International Journal of Sports Physiology and Performance*, 5 (4), 448-458.

Rago, V., Brito, J., Figueiredo, P., Costa, J., Barreira, D., Krustrup, P. and Rebelo, A. (2019) Methods to collect and interpret external training load using microtechnology incorporating GPS in professional football: a systematic review. *Research in Sports Medicine*, 22.

Seshadri, D.R., Drummond, C., Craker, J., Rowbottom, J.R. and Voos, J.E. (2017) Wearable Devices for Sports. *Ieee Pulse*, 8 (1), 38-43.

Shortt, C.A., Webster, C.A., Keegan, R.J., Egan, C.A. and Brian, A.S. (2019) Operationally Conceptualizing Physical Literacy: Results of a Delphi Study. *Journal of Teaching in Physical Education*, 38 (2), 91-104.

Taylor, C. (2018) Irish sports tech firm signs £1bn US soccer deal. *The Irish Times*.

Tears, C., Chesterton, P. and Wijnbergen, M. (2018) The elite player performance plan: the impact of a new national youth development strategy on injury characteristics in a premier league football academy. *J Sports Sci*, 36 (19), 2181-2188.

Thomas-Gregory, A. and Mercer, J. (2014) INVESTING IN OUR EDUCATION? LEADING, LEARNING, RESEARCHING AND THE DOCTORATE. In: Taysum, A. and Rayner, S. (ed.) *Investing in Our Education: Leading, Learning, Researching and the Doctorate.* Bingley: Emerald Group Publishing Ltd. pp. 213-232.

Thompson, W.R. (2018) WORLDWIDE SURVEY OF FITNESS TRENDS FOR 2019. *Acsms Health & Fitness Journal*, 22 (6), 10-17.

Tierney, P.J., Young, A., Clarke, N.D. and Duncan, M.J. (2016) Match play demands of 11 versus 11 professional football using Global Positioning, System tracking: Variations across common playing formations. *Human Movement Science*, 49, 1-8.

Violino, B. (2016) Find a fit for wearable tech. *District Administration*, 52 (9), 67-70.

Whitehead, S., Till, K., Weaving, D. and Jones, B. (2018) The Use of Microtechnology to Quantify the Peak Match Demands of the Football Codes: A Systematic Review. *Sports Med*, 48 (11), 2549-2575.

Wundersitz, D.W.T., Josman, C., Gupta, R., Netto, K.J., Gastin, P.B. and Robertson, S. (2015) Classification of team sport activities using a single wearable tracking device. *Journal of Biomechanics*, 48 (15), 3975-3981.

Fig 1.

Heart rate strap monitor being worn by athlete



Fig 2.

GPS type device being worn by athlete