

Article

The Hazards of a Biomedical Exercise Paradigm: Exploring the Praxis of Exercise Professionals

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Abstract: There is a belief that exercise has a major role to play in the current health and wellbeing agendas. Consequently, health interventions are implemented based upon the recommendations of the ACSM and similar exercise research organizations. However this development has been challenged through both social and political perspectives. Specifically accusations of medicalization have been raised against the increasing relationship between the exercise and medical domains. The purpose of this article is to present a similar critique of the growing emergence of a medical paradigm within the exercise domain. In this instance the focus will examine the relationship between exercise professional, exercise science and the proposed medical paradigm. Through the use of philosophical essay and systematic review of literature, it is argued that a continuing shift by exercise science to mirror the medical paradigm will cause a number of issues and potential hazards in the working practices of its professionals.

Keywords: exercise professional; professional knowledge; health; wellbeing; philosophy; medicalization; scientism; biomedicine

1. Introduction

In 2004 Fred Widland attended his first free personal training session at Manhattan's Crunch Fitness International gym, USA. As reported in the New York Post, Widland, the self-confessed couch potato and ex-smoker, undertook a supervised training session that left him with severe kidney damage through the toxic condition of exertional rhabdomyolysis [1]. More recently in 2013 Rebecca Johnson, from Brighton, UK, participated in a private personal training session. However, as reported in the Mail Online [2], after the session Johnson, an experienced exerciser, stated:

A few times I said to the personal trainer I was finding it tough and I didn't know if I could carry on. 'But he encouraged me to dig deep to do the best possible. As he was the professional. I did as he asked. I thought no pain, no gain'.

As a result, Johnson's experiences ended with a similar outcome to Widland: after observing blood in her urine she was taken to hospital to avoid life-threatening complications and was left with debilitating ill-health for several months. A year later, in 2014, Daniel Popp undertook a supervised training session at SnapFitness in Queensland, Australia and suffered the same issues as both Widland and Johnson claiming: "my urine went as back as leather!" [3]. Again, the filed lawsuit stated that despite the exerciser claiming they were unable to undertake the given exercise regime, the trainer persisted to push the client to a point of physiological danger. Historically, there have been demands to recognize and deal with similar problems in exercise contexts e.g., [4] but evidence suggests these experiences are not an uncommon trend. For example between 2011 and 2014, the reported cases of exercise induced rhabdomyolysis admitted to a single University hospital increased four-fold [5].

Thus concern arises as to the increasing incidence of these and similar reports of other exercise-induced injuries and debilitation.

In attempting to locate 'blame' for the negative exercise experiences the primary focus has been on the exercise professional. As a result, the academic consideration is that "trainers need better education on using the guidelines to initiate and achieve health benefits and avoid problems." [6], (p. 698). Thus blame is considered to be found in the lack of professional education. Furthermore a philosophy for the 'individualism of blame' becomes evident with the recent growth in legal specialists. For example accidentclaims.co.uk now offer Gym Accident Compensation Claims Experts (100% no win no fee); whilst actionsinjurysolicitors.co.uk advertise they have successfully obtained £6000 for a gym client's finger injury¹. Consequently the premise is made that the problem lies with the 'rogue' trainer due to their lack of consideration for, and/or knowledge of, ethical and contextual demands in delivering appropriate exercise experiences [7–9].

This essay is an attempt to present a critical and alternate argument to the current position of blame based on 'individual errors of judgement' and the conclusion that professionals fail to follow the educational guidelines. The thesis presented follows a parallel line to existing challenges of the implied assumption that exercise is a medicine in contemporary definitions, and specifically argues that a deference to the paradigm of medical science has initiated an increasing *scientism* within exercise science and, by association, the domain's professionals [9–11]. Stated explicitly, it is argued that an increasing belief in warranting scientific processes validation beyond their bounds is leading to an exercise nemesis with hazardous consequences for public health [12]. As a result, this paper argues an alternate proposition: the cause of the negative experiences may be due to a deference to the professional exercise guidelines themselves, as opposed to their avoidance in the choices of 'rogue' or, as assumed, insufficiently educated trainer.

In presenting this argument, firstly a very brief overview of the concept of scientism and the issues which have historically beset medical science is presented. There is insufficient space within this paper to comprehensively review the debates surrounding scientism within medical literature. Consequently, a summary is presented of the key issues which may emerge as exercise science aligns the practice of exercise professionals to this paradigm. Secondly, this paper will then explore the results of a systematic scoping review of the exercise professional's knowledge base and consider the implications of these findings.

2. Issues of Scientism in Medicine

Medicine has become regarded as a knowledge system which has shaken off the 'magical' and 'superstitious' past to stand alongside the natural sciences of physics, mathematics and chemistry [13]. Thus, once considered the domain of charlatans and quacks, medicine, through a scientific rhetoric, has emerged as a key factor in determining social policy, technological advancement and bureaucratic governance of 'day-to-day living' in the 21stC [13]. This success has been credited to the application of what is termed the biomedical model; a scientific paradigm which can be summarized through four fundamental assumptions [14]:

1. Disease is defined as a deviation from a statistical norm and measurable level of biological functioning.
2. Each defined disease is a specific and individual 'entity'; generic regardless of culture and context.
3. Medicine is a neutral, objective science without recourse to relational, metaphysical or existential considerations.
4. Medicine allows for an ontological foundation of mind-body dualism.

¹ Websites accessed 15/07/19.

Furthermore the biomedical paradigm is a position in which the body is presented ontologically “as docile—something physicians could observe, manipulate, transform and improve.” [15], (p. 221). Consequently, through a biological machine metaphor, medicine is able to rationalize the body as an object for discipline and control. As Nicholson states, it is this model which provides the most powerful theoretical tool of modern scientific medicine and biology [16].

Increasingly, society has embraced this biomedical and scientific mind-set. Health discourses have become almost singularly based upon a biological and mechanistic linearity, and taught through delineated categories of ‘healthy versus unhealthy’ [17]. As a result, a medical scientism has pervaded contemporary culture in search of therapeutic miracles and ‘magic bullets’ [18]. Defined as a position in which positivistic science is extolled as the only ‘methodology’ and ‘real knowledge’ needed to deal with the human condition, this scientism ultimately suggests that the science of the biomedical paradigm should be applied to the understanding all health and wellbeing discourses [19–21].

Ultimately, through a double hermeneutical process, biomedicine has re-created in secular terms a 21stC belief in Gnosticism [22,23]. That is a ‘faith’ in the power of science to eventually understand all of ‘nature’s secrets’ leads to a medical science which will cure all the ‘evils’ of ill-health [24]. In line with Gnostic beliefs of a ‘true’ knowledge which will provide ultimate enlightenment, there is a faith in Western medical technologies to create a new evolution of society [23,25].

Yet despite this Gnostic scientism, it has been demonstrated that the underpinning biomedical paradigm is a key factor in a number of emergent medical issues. As highlighted 40 years ago in Illich’s *Medical Nemesis*, whilst achievements over some major disease cannot be dismissed neither can the dangers of iatrogenesis which modern medicine creates [26]. That is, biomedicine is in a dangerous position through which it may become its own nemesis. As Illich argues: medicine generates as many problems as it solves. Hence, contemporary scientific medicine has brought with it issues of hazardous side-effects, the medicalization of normal functioning, declining wellbeing and the generation of a morbid society [17,20,26–30]. As a result, there are a number of concerns voiced as to the appropriateness of the biomedical paradigm to meet the demands of society’s health needs e.g., [26,31].

Despite warnings of biomedicine’s dangers inherent in its philosophical position, there is evidence of a growing demand to follow this paradigm in the exercise domain. This is exceptionally evident in the Exercise is Medicine™ (EIM) scheme, a joint project by the American College of Sports Medicine (ACSM) and the American Medical Association (AMA). Initiated in 2007, it is an attempt to align exercise practice with medical intervention [23,32,33]. The project’s objective is the habitual implementation of exercise for the management, prevention and treatment of disease and to “ensure exercise is thought of as a medication to be prescribed to patients” [34], (p. 413). The EIM has now been adopted on a global scale by 43 countries and is considered a key component in the development of public health strategies [10]. Although, at present, there appears to be no formal UK affiliation with the EIM, the ACSM’s philosophy is the dominant principle supported by the majority of UK researchers, practitioners, and related organizations such as the National Institute for Health Care and Excellence (NICE) exercise referral schemes [35].

The dominance of a scientific exercise paradigm is reflected in the mission statements of the major fitness professional organizations and leaders. For example:

The ACSM [American College of Sports Medicine] promotes and integrates scientific research, education and practical applications of sports medicine and exercise science to maintain and enhance physical performance, fitness, health and quality of life. [36], (p. 24)

Furthermore, the ‘National Academy of Sports Medicine’ (NASM) states explicitly its demand for the scientific process in its professional practices:

A new form of exercise may allegedly produce significant results, but if it is not supported by scientific research, it becomes a questionable trend. [37], (p. 8)

As a result, such organizations have created a form of scientism based on a de facto acceptance of a biomedical philosophy [34]. That is: exercise is not only the answer but a scientifically and medically justifiable solution. Yet, these organizations, which promote the advancement of a biomedical exercise science and increasingly call for a scientific evidence base, appear to ignore the considerable dissent to biomedicine's scientism [31]. Accusations of scientism have already been made in sports research [38], and the dangers challenging the 'loss of the person' in the pursuit of a scientific understanding of sport have been voiced [39–43]. But such critiques are limited in the exercise domain with the literature providing any critical analysis focused predominantly political or sociological perspectives as opposed to methodological e.g., [9–11].

The aforementioned lack of philosophical discussion through paradigmatic and methodological criticism may prove problematic. Specifically, it can be argued that through such perspectives evidence of the negative effects of a scientific approach may already be observable in exercise practice e.g., [1–3,7,8,10]. As a result, mirroring Illich's warnings of iatrogenesis, data would suggest that an increasingly 'biomedical' exercise science could lead further down a pathway already criticized as dangerous. Consequently, it is argued that a significant and deeper critical reflection should be undertaken concerning the appropriateness of the biomedical paradigm for exercise science. Crucially, this analysis should focus on the nature of knowledge presented to and utilized by professionals in developing exercise experiences [44,45]. Thus, the hazards of rhabdomyolysis and similar debilitations experienced by participants may be due to a 'nemesis of biomedical exercise' lying at the root of the exercise professional's praxis. As a result it is proposed that the foundational paradigm upon which exercise praxis is built should be the starting point of inquisition.

3. Evidence for a Biomedical Scientism in Exercise Praxis

3.1. Method

To explore the current understanding of exercise professional's praxis a systematic review was undertaken. Similar scoping exercises on the role's demands have been previously described by De Lyon, Neville and Armour [45]. However, rather than re-create De Lyon's et al.'s work, the intention here is to explore the possible formulation of the underpinning paradigm behind professional practice.

Literature searching was undertaken using multiple strategies due to the possible diversity and broad variety of work. The electronic databases—SCOPUS and SPORTSDiscus (EBSCO) were searched for the period 2009–2018. This time period was used based on the initiation of EIM project in 2009. Boolean operators were used and as a result the searches used the terms of "personal train*" OR "exercise profession*" OR "fitness instruct*". A total of nine hundred and thirty-two titles were found. Relevant papers, textbooks, websites and bibliographies were also manually searched for possible grey literature and omissions from the digital search strategy. This strategy yielded an additional seven papers for consideration.

On completion of the search strategy, the removal of duplicates, and the elimination of irrelevant studies, a total of five hundred and thirty seven references for consideration. The remaining references were then analysed via the inclusion criteria question "Does this research present information which allows for the working practices, knowledge base and methods of exercise professionals to become evident?" This criteria was applied via the reading of abstracts and led to the removal of four hundred and ninety six references. After the application of the systematic process forty one papers were available for a final read through. The final screening process utilized an exclusion criteria to remove those papers which did not provide a specific focus or representation of the education and knowledge base of exercise professionals. This final examination left a total of seventeen papers considered appropriate: twelve papers examined the content of the education and knowledge [46–57]; four papers examined the application of knowledge [58–61] and a single paper examined the nature of professional knowledge development [62]. A full schematic representation of the systematic process is provided in the following Figure 1.

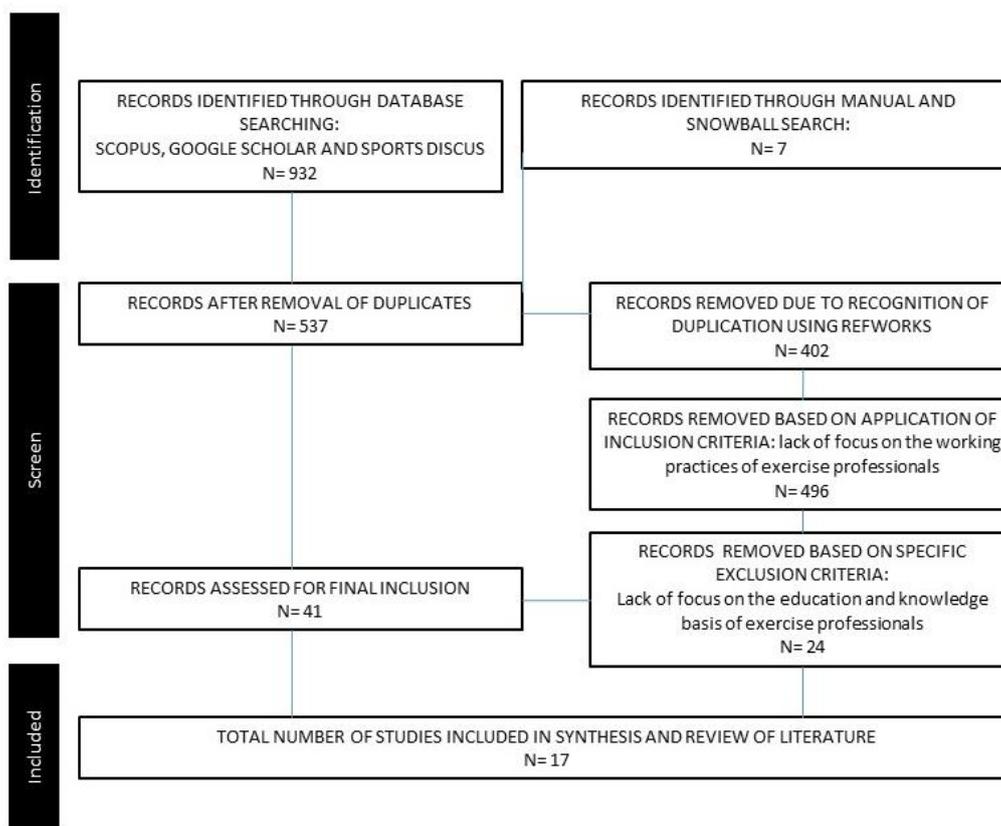


Figure 1. Schematic diagram of systematic process of literature review.

3.2. Analysis

Analysis was undertaken through a thematic categorization using a deductive framework of three themes: Epistemology, Ontology and Axiology. Papers emerging from the review were categorized into a single theme based upon the overarching research aims and objectives of the study in an attempt to begin to illustrate the scope of research being undertaken into the practices of exercise professionals. The theme of Epistemology was defined as research which explored possible interpretations of the knowledge base of exercise professionals. The theme of Ontology categorized research which examined the possible emerging ‘models’ of practice; whilst the theme of Axiology considered representations of the ethical and practical ‘decision-making’ factors considered by exercise professionals.

It is acknowledged that this philosophical and strict categorization is ultimately artificial. The limitations of such a thematic division of interpretation are recognized for their subjectivity and un-natural synthesis of experience in exploring the complexity of praxis. As a result the artificial division is undertaken with a sense of academic liberty. However, the process was undertaken from a perspective which considers that a professional first accumulates knowledge from which they develop a set of ontological propositions. It is these epistemologically derived propositions which guide practice. Thus professional praxis is understood to be the accumulation of professional knowledge for the analysis of a situation and the creation of action. It is conceded that an alternative view can be proposed. That is, the nature of the role, i.e., a professional ontology, is necessary before the recognition of the required knowledge for fulfilment of the role’s demands. However, due to the nature of exercise professional development, students undertake academic study *in vitro* before experiencing the role *in vivo*. Therefore, it is argued here that students learn the ‘true nature’ of a role through a process of academic education. Thus professional epistemology precedes professional ontology. Consequently, the use of the particular boundaries in this work is recognized as an artifice of the underpinning assumptions and an accepted limitation.

3.2.1. Epistemology

In exploring the nature and expectations of knowledge presented to exercise professionals the scientific, propositional underpinnings can be readily observed. Importantly evidence of deference, and a belief in the superiority of a biomedical science is apparent.

Initial evidence of the dominance of science within trainer education is demonstrated in Gray, Smith and James's study of key textbooks from the major certificating organizations [51]. Their findings established that educational content was focused on the technical standardization inherent in biomedical science as opposed to instruction for developing personal exercise experiences. In 2015, Zenko and Ekkekakis surveyed exercise professionals concerning their knowledge of the ACSM guidelines for exercise prescription suggesting that the scientific knowledge was fundamental to practice [57]. This test included knowledge of such concepts as physiological ranges during exercise, metabolic functioning and understanding of similar biological markers. However, the grades suggested that the average score on the examination was less than 50%. As a result their conclusions argued trainers need greater knowledge of the scientific evidence which should underpin exercise practice. Similarly Bennie et al. surveyed fitness professionals concerning their level of education and sources of fitness knowledge [48]. Their exploration was based on the supposition that practice should "align with proven principles of exercise science and exercise prescription" [48], (p. 741). Yet their findings demonstrated that such academic content and sources of knowledge were accessed infrequently by exercise professionals. Consequently, Bennie et al. supports the work of Zenko and Ekkekakis, and Akerson in suggesting that exercise professionals should increase the use of scientific and academic evidence in their practice [48,57].

Accordingly, it can be demonstrated that the intention of the education of exercise professionals is an attempt to associate its content with a scientific propositional form of biomedical knowledge [51,63]. Thus it can be argued that the epistemological foundations of exercise praxis align with the key assumptions and determinants of the biomedical paradigm.

3.2.2. Ontology

A reading of the body of reviewed literature would suggest the epistemological foundations of exercise professional education present a biomedical ontology for practice. That is, the scientific epistemology generates a techno-rational ontology which defines exercisers through the quantification and measurement of physical capability. Therefore, following previous critiques from medical practitioners, it can be argued that any application of this ontological model by exercise practitioners would diminish the client to a biological paradigm. That is, the client is perceived through the lens of biomedical reductionism and statistical categorization [26–31]. This leads to a position of Gnostic scientism in which the client's needs, experiences and wellbeing, and the means for their fulfilment, are reduced to scientific processes. Thus any elements of existential wellbeing are removed and the training program becomes a mechanistic, techno-rational application of scientific data. Clients are considered in terms of their age, gender, weight, heart rate response and similar fitness parameters from which exercise programs are developed [51,57]. However as described in medical literature this ontology is problematic.

The perception of a differentiation between the educational content and the practical demands of the role is a consistent theme with research exploring professional knowledge [45]. Within exercise literature, De Lyon and Cushion examined the sources and acquisition of knowledge development in fitness trainers [62]. The findings of their work demonstrated a genuine discrepancy between theory and practice [62]. Specifically research has suggested the clients of exercise professionals seek a humanistic encounter based on personal interaction, alongside existential and social development [64,65]. However, these motivational factors appear at odds with the biomedical paradigm and the nature of method presented to the practitioner. Consequently, whilst the professional has been taught to approach the client's needs through quantification, the practical context, and language used within it, do not fully

support this ontology. Ultimately, the ontology of exercise becomes one of a routine of linear action to fulfil the expectations of medical data as opposed to an immersive humanistic experience.

3.2.3. Axiology

It is acknowledged the term ‘axiology’ can be ambiguously defined or applied. Therefore, based upon the definition provided by Hart in which the word stems from the Greek *axios* or worth and *logos* or reason [66], the descriptor is utilized here to denote a consideration of the evaluative process through which exercise professionals undertake decision making. To be precise, this category represents the concept of praxis: the means by which, through reasoning, consideration of worth and thus value, professional knowledge is applied within the exercise context. Importantly, the position is taken that the ontology expressed through the educational epistemology creates an accepted set of values which define both the meaning of exercise and the rationale of decision making for the professional role. Therefore, due to the preceding discussion, it is argued here that the key issue facing current exercise professionals lies within the recognition of this philosophical relationship. That is, the problems manifesting within exercise experiences are ultimately a crisis of axiology generated by the biomedical contents of the professional epistemology and ontology.

There is little debate that exercise has a fundamental role to play in human health and wellbeing. An abundance of evidence that active exercise demonstrably reduces illness risk and increases experiences of health and wellness is readily obtainable and this message is presented throughout the exercise science literature [67]. Consequently data demonstrates the quantifiable and calculable impact of exercise on markers of cardiovascular, neuromuscular, endocrine and skeletal functioning. Thus, the value of exercise lies within the apparent irrefutable scientific evidence for accomplishing measurable health objectives. As a result, the axiological foundations would seem unquestionable and not worthy of consideration at this stage of exercise science’s methodological development. However a counter-critique can be made as to the worth exercise has in the human health and wellbeing.

A counter axiological position of the value of exercise can be proposed based upon Huizinga’s conception of *Homo Ludens* [68]. Explicitly, it can be argued that a quintessential element of human activity is the fundamental need for play:

“... even in its simplest forms on the animal level, play is more than a mere physiological phenomenon or a psychological reflex. It goes beyond the confines of purely physical or purely biological activity. It is a significant function... In play there is something ‘at play’ which transcends the immediate needs of life and imparts meaning to the action.” [68], (p. 19)

Consequently within such philosophical considerations the value of exercise lies not just within definitions of health inherent in a biomedical paradigm but within a deeper existential purpose and humanistic conception of wellbeing [43,69]. Therefore the value is argued to emerge from transcendental qualities of experience beyond the mere expectation of a future utility or quantifiable outcome. [70].

However, the reading of the reviewed literature suggests that the major value of exercise appears to be derived not from a concept of *homo ludens* but from what may be coined *homo medicorum*. To be exact, exercise’s value is judged on its ability to impact upon medically defined parameters. Thus, rather than transcendental and existential experiences, the worth is based upon the consideration of scientific, quantifiable, and definable objectives within a biomedical paradigm. As a result, this axiological position creates a linear, techno-rationale approach to decision making and a process of exercise prescription which mirrors the linearity of the medical encounter: test–diagnose–prescribe [71]. The exercise professional records medical data as a basis for diagnosis, and applies an ‘algorithmic’ approach to prescribe an intervention based on a scientifically derived formula. For example, considerations of a participant’s limits within either strength, muscle growth or endurance, scientific resistance training requires a prescription based on intensities of ‘3–6’, ‘8–12’ or ‘15+’ repetitions per exercise set

respectively; within cardiovascular and aerobic considerations 220-age provides a formula for optimal zones of training intensity [36,37].

However it can be argued this axiological position of a medicalized value creates a situation in which the accusation of ‘specialists without spirits’ once levelled at nursing in the 1980’s can be levelled at exercise professionals. Used to highlight the fact that nursing staff had lost their professional skills in ‘bedside medicine’, the ‘specialists without spirit’ was a label to demonstrate nurses had been reduced to the deliverers of precise, technical and linear instructions from a biomedical evidence base [72]. Thus, grounded in a model that claims deductive certainty through mathematics, it is argued biomedicine set the death knell for what has been termed professional ‘Wisdom’ [73] or the experiential art of bedside manner, prognosis, logic and observation [74]. As a result, the importance of existentialism, and the impact of phenomenological experiences of health, became lost [27,74–77].

Arguably with the rise in online personal training and exercise coaching, alongside the increase in fitness technology such as the Fitbit and similar apps for Smart phones, the work of the exercise professional may ultimately lead to similar consequences. The participant simply enters key medical data and quantified responses which trigger the ‘correct’ response from the trainer based upon reference to scientific propositions. Through a techno-rational application of prescribed anato-physiological interventions it is believed a successful exercise experience can be achieved [71]. In such a role the professional is merely a specialist technician dispensing ‘exercise medicines’ without consideration for the spirit of either an existential client or of the value of play available in exercise experiences.

Furthermore this axiological position also brings an ethical dilemma: should the exercise professional stick to the ‘book’ or else apply knowledge not condoned within the current demand for a scientific basis of practice? [36,37]. The content of knowledge presented in professional education fails to appropriately reflect practical reality [62]. Although, research has suggested that trainers are aware of these tensions, the reported epistemology appears to provide limited understanding of a dynamic and humanistic process within the exercise experience [64,65,78]. As a result novice exercise professionals may be left without the understanding of the skills necessary within the role for health and wellbeing. Consequently, the evidence that trainers make the decision to step beyond the boundaries of their qualification, or else appear to fail to account for the individualism within a context, becomes comprehensible [47,60]. Yet, importantly, these tensions have been reported as leading to possibly dangerous and life-threatening occurrences through inappropriate decision making [79]. Therefore the end result of the trainer’s actions may lead to the medical issues and debilitating experiences described in this paper’s introduction. Thus the definition of the value of exercise based upon quantifiable biomedical objectives would seem axiologically inappropriate.

4. Discussion

An analysis of evidence leads to the argument that the praxis of exercise professionals is hindered by the philosophical foundations of knowledge upon which it is built. What becomes evident is that the biomedical paradigm underpinning exercise praxis does not appear to align to foundations of professional knowledge demonstrated as effective in related disciplines [80,81]. Summarizing previous literature, Fox et al. identify that professional knowledge consists of four intersecting dimensions: propositional, process, personal and value-based [63]. As a result, successful professional knowledge is derived from an amalgam of theory, practice, experience and values. Therefore, the decision making process within a professional context is a judgement made based on a broad scopes of knowledge as opposed to the constraints of scientific propositions and mechanistic application [63,80,81]. Research suggests that in practice some trainers may draw upon all four elements described by Fox et al.’s summary [62]. Yet, despite this observation, sources of knowledge beyond propositional science do not appear to be presented as wholly appropriate within the educational process or academic literature. Thus it can be argued that other dimensions of professional knowledge are not considered with a similar level of authority as the biomedical proposition [48,51].

Importantly, it can be reasoned that the future advancement of educational processes will be primarily along increasingly scientific propositional lines and the implementation of the biomedical paradigm [51]. There is an increasing development of online and digital approaches to personal trainer education. For example, companies such as Origym and PTcareer now offer 4 and 5 week online courses². Due to the nature of this delivery, the elements of professional knowledge beyond the scientific and propositional fact conceivably must be limited. Thus, arguably, the exposure to professional experiences and consideration of praxis which draws on, social and humanistic interactions beyond the linearity of data analysis and prescription, may not be limited [64,65]. Utilizing a pedagogical curricula based on linearity, uniformity, and digital efficiency in both teaching and assessment would seem a difficult means through which to express the dynamism inherent in the ludic exercise encounter. Therefore, it can be contended these emerging educational processes support the increasing medicalization of the exercise professional role and the promotion of a biomedical scientism in the supporting exercise science.

The current epistemological foundations demonstrate an emphasis on biomedical science, this in turn creates an ontology of a scientific process. From this position the exercise professional is challenged in the difficult axiological position of experiencing a dynamic, chaotic and humanistic encounter through the lens of a techno-rational biomedical intervention. But, as previously discussed, the dangers of a limited epistemological position have been articulated effectively and discussed in fields such as nursing, medical practitioners and teaching cf. [82–84]. Therefore, there is a need for exercise praxis to move beyond dichotomous assumptions of either/or in professional knowledge [85]. Professional knowledge should be maintained as a development of wisdom through the artful application of science [73,76,77].

As discussed the reductionism to the biomedical paradigm brings inherent disadvantages and a stance which would appear counter to the expectations of those involved with providing health and wellbeing agendas. Thus, whilst academics argue that problems could be avoided through greater education on the scientific and academic guidelines, the argument is that the guidelines should first be questioned through a philosophical perspective [6,48]. As McNamee suggests, the use of science in the development of health, fitness and exercise is beyond debate [86]. However there is a need for critical philosophical reflection on the basis of the science being presented as the panacea for the current societal health and wellbeing issues.

5. Conclusions

Based upon this discussion it is recommended that a critical review of exercise professional education is required if these roles are to provide a key function in future health and wellbeing agendas. There is a need for a greater body of critical literature exploring the nature and construction of both exercise science and its professional praxis. Fundamentally this research should involve not only philosophical analysis but also utilize longitudinal, phenomenological, and case study explorations of both professionals and their contexts. Fundamental to this research should be the questions as to the relationship between science and experience; education and practice. However using the preceding arguments to initiate further discussion, the following considerations are made:

1. Exercise professional education should be structured in a manner which highlights the need for praxis. Professionals should be made aware of both the strengths and limits of a techno-rational process and its scientific foundations.

² Google search "online pt courses uk" undertaken 23/07/19 https://www.google.co.uk/search?source=hp&ei=8sg2XcKhKK2GjLsPlpa_kAQ&q=online+pt+courses+UK&oq=online+pt+courses+UK&gs_l=psy-ab.3..0j0i22i30i5.958.5348..5572...0.0..0.182.1322.19j2.....0....1..gws-wiz.....0..35i39j0i131.PtOJ_zpOPD8&ved=0ahUKEWjC4uKd08rjAhUtA2MBHRbLD0IQ4dUDCAo&uact=5

2. Exercise professional education should consider a greater holistic definition of professional knowledge beyond biomedical propositional concepts and theory.
3. Exercise professionals should be exposed to axiological notions of exercise beyond the linearity of medical data. The values of existential wellbeing and notions of play should be explicitly introduced into the educational process.
4. Exercise professional education should place greater emphasis on pedagogies which explore the issues of ethical programming, individualized physical activity, and client relationships. Consequently research should be undertaken into the appropriateness of utilizing online, digital and blended learning technologies within future education.

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