Physical Education, Exercise Science and Pedagogy: Forging the Links

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Physical education in New Zealand has been subject to a number of significant changes over the last decade. New school curriculum and senior school qualification requirements have necessitated changes to physical education/teacher education programmes (PETE). Inherent in this change has been the need to ensure that PETE’s pedagogical work actually develops appropriate knowledge and facilitates graduating students’ preparedness to teach. Reforms have seen the emergence of strong socio-cultural and socio-critical curriculum perspectives and corresponding developments in the utilisation of alternative pedagogies. However there appears to be little if any base-line data relating to the exercise sciences in PETE contexts. This study set out to determine the curriculum content of the exercise sciences in PETE contexts, what pedagogical models are being used and students’ preparedness to teach the exercise sciences. Results from the research has identified broad content areas in the exercise sciences PETE curriculum, an absence of the utilisation of coherent and specific pedagogical models and that student’s preparedness to teach is dependent on authentic learning contexts. As a result of these finding a series of recommendation are made and discussed.

Keywords: pedagogy, exercise science, physical education, teacher education

1. Introduction

Contemporary teacher education (pre-service and in-service professional development) necessitates beginning and experienced teachers in the secondary teaching service (years 9-13) to have a sound content knowledge and pedagogical content knowledge base (Shulman, 1987). In New Zealand these knowledge bases are influenced markedly by the content contained in the student’s university and teacher education qualifications, Graduating Teacher Standards (New Zealand Teachers Council, 2007) and the New Zealand Curriculum requirements. The curriculum requirements include the senior school qualification such as the National Certificate in Education Achievement (NCEA) (New Zealand Qualifications Authority, 2002). In New Zealand, for physical education teaching, the two documents The New Zealand Curriculum (NZC) (Ministry of Education, 2007), and Health and Physical Education in the New Zealand Curriculum (NZHPE) (Ministry of Education, 1999) along with NCEA provide a framework which outlines the learning requirements for every New Zealand school student. This framework in turn clearly provides the necessary content and pedagogical knowledge requirements for physical education teachers. This includes content knowledge associated with the exercise and sport sciences, the socio-cultural aspects of the movement culture, and behavioural and cognitive pedagogical content knowledge (Culpan, 2004). For exercise science content knowledge, NZHPE (Ministry of Education, 1999) and NZC (Ministry of Education, 2007) list specific objectives relating directly to the exercise sciences within physical education contexts. These specific objectives include students requiring learning opportunities to develop:

Skills for identifying and critiquing the contributions that science, technology and the environment make to sporting performance (Ministry of Education, 1999. p. 45).
Knowledge and understanding of scientific and technological influences on physical activity (Ministry of Education, 1999. p. 43).
Plan, implement and evaluate personal exercise programmes to their well-being (Ministry of
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It becomes very clear from these objective type statements that content knowledge in the exercise sciences along with appropriate pedagogical content knowledge is important in Physical Education Teacher Education programmes (PETE). The importance being that prospective physical education teachers are expected to deliver the mandated curriculum of which exercise sciences is a legitimised component. More recently Culpan and Bruce (2007) have further argued that given recent curriculum requirements, physical education teachers also need to be knowledgeable of socio-critical pedagogies if learning opportunities across the exercise sciences and the socio-cultural aspects of movement are to be maximised.

For physical education in schools, NZHPE (Ministry of Education, 1999) and its revised counterpart NZC (Ministry of Education, 2007) provided a radical departure from traditional and previous school physical education programmes (Culpan, 1996, 2000; Burrows, 2004; Culpan and Bruce, 2007). This departure has necessitated New Zealand PETE programmes to explore and utilise pedagogies that better address teaching and learning in physical education (Culpan, 2005; Culpan and Bruce, 2007). Culpan and Bruce (2007) for instance, argue cogently that for students of physical education to achieve maximum benefit from the mandated curriculum, teacher educators and indeed teachers in schools need to move from a scientised/technocratic model of physical education to a socio-critical model using critical pedagogy. Lineham (2003) argues that the scientisation of physical education needs addressing and that perhaps the pendulum has swung too far towards scientisation. He suggests that given the dominance of science within physical education, teachers struggle to encourage their students to look critically into the socio-cultural dimensions of physical education and sport. Despite suggesting this, Lineham (2003) proposes that the 'mind shift' needed to address the scientisation of physical education can be achieved. This can be achieved by teachers beginning to encourage students to utilise reflective techniques in order for them to make better meaning out of their studies in physical education and sport.

While Lineham (2003) assumes difficulty in physical education teachers moving to new pedagogies to better address the socio-cultural context, there is evidence to suggest that teachers have begun to adapt well in coping with this required pedagogical change. McBain (2003) for instance, in her case study suggests that by merging the Experiential Model of teaching and learning with a strong emphasis on critical thinking, as in critical pedagogy, learners are able to “construct knowledge, acquire skills and enhance values through direct experiences” (p. 66). However, as Culpan and Bruce (2007) and Culpan and Grant (2007) argue, the exercise sciences may have lagged behind somewhat. Lineham (2003) suggests that this problem may simply be the result of a perception that exercise science is “clean, logical, and known to the teacher, while the socio-cultural aspects are messier and more complex in their inter-relationships” (p. 155). While the exercise sciences in physical education may appear to promote academic legitimacy (Kirk and Tinning, 1990; Culpan, 1996; Lineham, 2003; Kirk, 2010; Tinning, 2010) it may have come at the expense of maintaining currency with pedagogical development (Culpan, 1996; McBain, 2003; Culpan and Bruce, 2007). As a consequence, there may be opportunities for exercise science within the PETE domain to draw on and apply the pedagogies that are used with the socio-cultural aspects of the movement culture. By doing this, engaging inter-relationships may be drawn. These relationships can be between the various functioning components of the human body and the social context in which the body can move, perform, recreate and behave. While this project set out to establish what pedagogies are used in initial physical education/teacher education (PETE) and more particularly the teaching of exercise sciences within this context, the authors are mindful of the rich tapestry that science education, mainly through constructivism, has woven to provide more engaging pedagogies for its students. The lessons learned in science education per se, particularly around constructivism and other cognitive theories (Koch, 1992; King, 1993; Hipkins et al., 2002; Bekas and Taber, 2009; Taber, 2010) provide a useful genesis for this study. It provides a useful starting point for the investigation into exercise sciences future pedagogical development.

Hipkins et al. (2002) in their review of research on effective pedagogies in science education report that for effective pedagogies to be employed, students need to be given opportunities to link existing ideas and beliefs to real experiences in order to develop content knowledge. This content knowledge needs
to be developed in unison with procedural knowledge and the nature of science itself. Hipkins et al. (2002) further report that the student’s engagement in meta-cognitive practices is a critically important feature of effective science education pedagogies. Taber (2010) also supports this position. In effect the work that McBain (2003) has done around consciousness raising and critical action is consistent with what Hipkins et al. (2002) are suggesting when referring to meta-cognition. Furthermore McBain’s (2003) work is consistent with Gillespie and Culpan’s (2000) suggestion around the importance of utilising a critical thinking model with an emphasis on meta-cognition within physical education teaching.

While physical education, and in particular exercise science within physical education, may be able to draw on constructivist pedagogical developments within the wider field of science education, it is important to signal that Taber 2010 argues that constructivist learning draws heavily upon key education thinkers such as Piaget, Vygotsky, Bruner, Ausubel, Kelly and Gagnè. Furthermore in Hipkins et al. (2002) work there is frequent reference for the need for constructivism to ensure that learning occurs in context. This they call authentic learning. By authentic learning the authors further draw on the work of Reeves, Herrington and Oliver (2002) who argue that the essence of authentic learning experiences are characterised by ten generic factors that transcend disciplines. They report that authentic learning involves: real-world relevance, tasks that have multiple interpretations, sustained tasks that are complex in nature, the examination of resources from a variety of theoretical and practical perspectives, learner collaborations, reflection, thinking in inter-disciplinary terms and integrated assessment processes. Taking cognisance of these points means that the exercise sciences within physical education may need to carefully scrutinise appropriate pedagogies before unproblematically adopting them. Clearly the scrutiny may involve insuring that chosen pedagogies address the conceptualisation of authentic learning. The first step in this process is to determine through research what are the pedagogies presently being utilised. This first step gives rise to the purpose of this study.

2. Purpose

Within a New Zealand context the purpose of this study was to:
- Identify the existing exercise science curriculum content for physical education/teacher education (PETE) students;
- Generate data regarding the pedagogical models employed in the delivery of exercise science in PETE programmes;
- Provide base-line data regarding student knowledge in exercise science and preparedness to teach exercise during their PETE training;
- Develop a set of practical recommendations that will assist PETE programmes and their staff in the development of pedagogies suitable for the enhancement of learning in the exercise sciences.

3. Methodology

This study adopted a mixed method approach. It followed the research tradition advocated by Johnson and Onwuegbuzie (2004). The mixed method legitimates the use of multiple approaches in answering the research questions. It reduces the restriction and constraint on the researchers’ choices and helped create an expansive form of research which allowed the researchers to be more inclusive in adopting a tradition characterized by an eclectic approach to method selection and thinking about the most suitable manner in which to seek answers to the research questions. In this research project there were three distinct stages for data collection involving document analysis, case studies, survey, semi-structured interviews and content analysis.

In the first stage, three (N = 3) New Zealand universities that teach the exercise sciences within a PETE context were identified. A document analysis was conducted across the three (N = 3) universities to address the guiding question: What is the curriculum content for the exercise sciences component of your PETE programme? Data gathered from the document analysis was examined to identify any emerging themes and patterns in the PETE content.

The second stage of the research project focussed on pedagogical methods used by the same 3 universities who teach exercise science within their PETE programmes. The guiding question used for this stage was: What are the pedagogical methods em-
ployed in the delivery of exercise science in PETE programmes? A qualitative case study approach using semi-structured interviews was used with six (N = 6) staff to gather data and identify themes and patterns. University staff identified for the qualitative part of this research were selected based on their teaching involvement in the exercise sciences. More specifically the Head of the Department from each university was asked to nominate two academic staff members within their university who predominately taught the exercise sciences.

In the third stage of the study, a quantitative survey (N = 169, males = 78, females = 91, Yr.1 = 36, Yr.2 = 73, Yr.3 = 37, Yr.4 = 23) and qualitative semi-structured interviews were used with twenty nine (N = 29) student volunteers (13 year 1/2 students and 16 year 3/4 students) to address the guiding question: How does student knowledge in the exercise sciences match with their self evaluation of their preparedness to teach?

3.1 Data Analysis

As in the mixed method tradition data was analysed being cognisant of the techniques and suggestions promoted by Clough and Nutbrown (2002) and Bogdan and Biklen (2007). In particular, the analysis involved data reduction, data examination and transformation, data consolidation and comparison resulting in data interpretation.

Data gathered from the document analysis in Stage 1 was examined to identify any emerging themes and patterns in the PETE content. The analysis was systematic in that it worked through the documentation in a logical sense carefully categorising and coding the content into the academically and commonly accepted exercise/sport science sub disciplines.

In analysing the qualitative interview data an inductive tradition was adopted to interpret the data generated. This was particularly relevant for the qualitative interviews associated with Stage 2. Themes and patterns were identified which gave insight into the pedagogical methods used. For a particular teaching method to be identified as a possible theme it needed to be mentioned by four (N = 4) of the staff being interviewed. Data from this process was subsequently identified and then compared with the pedagogical models literature to ensure that models identified were commonly known and academically acceptable. The analysis of this data took into account the suggestions and techniques promoted by Perakyla (2008).

Quantitative data for Stage 3 of this study were first assessed for normality of distribution using the one-sample Kolomogorov-Smirnov goodness-of-fit test. Consequently, means and standard deviations were calculated prior to use of ANOVA to assess for statistical differences between the universities and year groups with a two-tailed alpha level of p < 0.05 used to determine significance. Post-hoc significant differences were indicated using Fisher’s LSD test. All analyses were conducted using the Statistical Package for the Social Sciences, version 17.0, for Windows software.

4. Results

In this results section data relating to each of the stages of the study will be presented. It will be presented in a format that corresponds to the specific purpose statements and guiding questions used.

4.1 Stage 1

Purpose Statement: Identify the existing exercise science curriculum content for physical education/teacher education (PETE) students.

Guiding question: What is the curriculum content for the exercise sciences component of your PETE programme?

The data revealed that:

4.1.1 The content of the exercise sciences within each degree structure of the 3 universities is as follows. University 1 has multiple pathways in their degree structure from which students can take anywhere from 21-46% of courses in exercise sciences within the total 4 year full-time degree programme. For University 2 students in their degree take 17% of courses in exercise sciences within their total 4 year full-time degree programme. For University 3, students in their degree take 21% of courses in exercise sciences within their total 4 year full-time degree programme. The reason for the percentage range for University 1 (21-46%) is that students were able to choose a range of course options. This meant that students graduating from this university might have diverse ex-
periences in regards to the range of exercise sciences courses completed. For Universities 2 and 3 exercise sciences courses were compulsory.

4.1.2 The sub-disciplines within the exercises sciences across the 3 universities were very similar, however University 1 have a more traditional approach to the design and structure of the sub-disciplines. They run individual courses in each of the disciplines where the subject matter is related and focussed on declarative knowledge development. In contrast, Universities 2 and 3 have a more contemporary approach to the design and structure of their courses and there was evidence of the development of courses that had established interactions between the sub-disciplines. In particular Universities 2 and 3 appeared to make stronger links between the various aspects of exercise and sport sciences that are required to analyse and improve human movement performance. The sub-disciplines across all 3 universities were: anatomy, biomechanics, exercise/sport physiology, human growth and development, motor learning/control, nutrition, sport psychology, sport injuries and strength and conditioning.

4.1.3 There was evidence that the extra time devoted to the exercise sciences in University 1 resulted in more content depth teaching in each of the sub-disciplines. The additional time devoted to the exercise sciences and the resultant teaching depth in content covered by the lecturers at University 1 did not necessarily mean that that students’ content knowledge or understanding of that content was superior to other students participating in this research project. (See results for Stage 3).

4.2 Stage 2

Purpose statement: Generate data regarding the pedagogical models employed in the delivery of exercise science in physical education.

Guiding Question: What are the pedagogical models employed in the delivery of exercise science in PETE programmes?

The data revealed that:

4.2.1 Staff teaching in the exercises sciences drew on a range of teaching approaches and activities but there was little evidence of staff utilising specific and particular pedagogical models. Instead the data revealed that the staff used an eclectic approach to pedagogy. The eclectic approaches included: direct instruction, group work, reciprocal learning, individual tasks, and student centred activities.

4.2.2 In the semi-structured interviews it became apparent that staff’s ability to articulate their pedagogical approach varied markedly. Two of the 6 staff could identify specific pedagogical approaches that related to pedagogical models but did not utilise these models in a deliberate and or specific sense.

4.3 Stage 3

Purpose statement: Provide base-line data regarding student knowledge in exercise science and preparedness to teach exercise science during their PETE training.

Guiding question: How does student knowledge in the exercise sciences match with their self evaluation of their preparedness to teach?

The data revealed that:

4.3.1 Results from the quantitative student content knowledge survey are presented in Table 1.

The data revealed that:

4.3.1 Results from the quantitative student content knowledge survey are presented in Table 1. There were non-significant differences between the universities with regard to content knowledge of the students.

**Table 1 Mean±SD scores on the quantitative student knowledge survey for students at each university**

<table>
<thead>
<tr>
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<th>Test Score</th>
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<tbody>
<tr>
<td>University 1</td>
<td>16.03±5.0 pts</td>
</tr>
<tr>
<td>University 2</td>
<td>16.22±4.30 pts</td>
</tr>
<tr>
<td>University 3</td>
<td>16.67±3.76 pts</td>
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<tr>
<th><strong>Table 2 Mean±SD scores on the quantitative student knowledge survey by year of study</strong></th>
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<tbody>
<tr>
<td>Test Score</td>
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<tr>
<td>Year 1</td>
</tr>
<tr>
<td>Year 2</td>
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<tr>
<td>Year 3</td>
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<td>Year 4</td>
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Note. *significantly higher score than year 1 and 2. **significantly higher score than year 1.
4.3.2 The means and standard deviations by year group are shown in Table 2. Results in Table 2 indicate that student content knowledge, as demonstrated through the survey, increased by year of study. There was a significant difference by year group ($F_3, 162 = 9.34, p < 0.0005$). The results of further post-hoc testing revealed that year 4 students scored significantly higher than year 1 and 2 students. In addition, year 3 students scored significantly higher than year 1 students. There was a non-significant difference for the interaction effect of university by year group.

4.3.2 As with the results from the survey, qualitative data also revealed that student knowledge of the exercises sciences increased over the duration of their training. Exercise science content was well covered across all 3 universities but it appears that student’s felt that exposure to school teaching situations was an important factor in the development of their ability to understand and apply this content knowledge.

4.3.3 Student confidence with the content of exercise science appeared to increase over time. However this confidence was not necessarily an indicator of their preparedness to teach. Students’ preparedness to teach was directly related to exposure to school teaching contexts and the establishment of the relationship between exercise sciences and curriculum requirements. The application of content knowledge which we argue here is an authentic learning environment seemed to be a critical factor in the preparedness to teach.

5. Discussion

From the data obtained through quantitative and qualitative methodologies all 3 universities are adding value to their students’ content knowledge in the exercise sciences, despite there being differences in the time devoted to this aspect of their PETE programme of study. It was clear that students’ ability to apply this knowledge is dependent on opportunities to engage in practical delivery in appropriate contexts. Appropriate contexts in this case are school contexts where the exercise sciences are a legitimate part of the physical education curriculum. This suggests that PETE programmes need to ensure that students are given appropriate and authentic learning opportunities (see earlier) to facilitate the application of exercise science knowledge during their school teaching practice placements. Further to this, the data revealed that students’ preparedness to teach was also related to strong relationships being made between exercise science content knowledge and specific content requirements of the school curriculum. Given the need for this relationship to be strong, this study urges that PETE programme planners for the exercise sciences need to ensure that these relationships are drawn.

The data collected in this study indicated that students engaged in PETE at Universities 2 and 3 were able to achieve the same degree of content knowledge as University 1 where typically students were exposed to a greater number of exercise science courses. This suggests that more contemporary course structure and design enabled a breakdown of boundaries between sub-disciplines. This breakdown possibly assisted and facilitated student learning and their ability to make links across the sub-disciplines. Furthermore this integrated approach is entirely consistent with the characteristics of authentic learning (Reeves et al. (2002), the holistic perspective evident in the NZHPE 1999 (Ministry of Education, 1999) and its successor the NZC 2007 (Ministry of Education, 2007). Given this situation it is recommended that planners of exercise science programmes within PETE further explore opportunities to integrate content across the sub-disciplines.

This study has revealed that pedagogical approaches to the delivery of exercise science content in PETE programmes is not characterised by particular pedagogy. Instead, at best, data indicated that an eclectic approach was utilised with lecturers drawing on specific approaches from Mosston and Ashworth’s (1994) Teaching Styles Spectrum. The approaches used from the ‘Spectrum’ tended to be more on the left side of the ‘discovery threshold’ (direct instruction, group work, reciprocal learning and individual tasks) which would indicate that the dominant approach to the teaching of the exercise sciences was lecturer led and dependent. It is of particular interest that lecturers drew on the work of Mosston and Ashworth (1994) to explain their pedagogical approach-al-be-it, at best it was eclectic and to one side of the Teaching Styles Spectrum. Indeed utilisation of pedagogies associated with Mosston and Ashworth (1994) within PETE programmes is
consistent with Mosston’s argument that his motivation in developing the spectrum was to:

Construct a framework that offers a different paradigm for the theory and practice of teaching (p. vii).

Limiting exercise science pedagogies to the left side of the spectrum negates Mosston and Ashworth (1994) argument that their spectrum was a result of a search for a unified theory that would serve and provide a cohesive framework to act as a broad and integrated guide for teaching future teachers. What became clear from the data was that lecturers did not utilise the framework and thereby limited themselves to the left hand side of Mosston and Ashworth’s (1994) spectrum. This suggests specific approaches of a constructive type as advocated by Mosston and Ashworth (1994) and more latterly by Hipkins et al. (2002); Reeves et al. (2002); McBain (2003); Richardson (2003); Lombardi (2007) and Taber (2010) were not being employed. This situation indicates that failure to engage in drawing inter-relationships between the various exercise science components and or disciplines may impede the constructivist and authentic learning that is needed. Clearly the need for authentic learning is a priority given the arguments promoted by Hipkins et al. (2002); Reeves et al. (2002) and Taber (2010). From a physical education perspective, to remove and isolate the social context in which the body functions, moves, performs, recreates, behaves and grows does not promote an engaging inter-relationship of content and nor does it promote the person in a holistic learning process. This is most limiting and reinforces Hendry’s (1996) argument that teachers in training may have to undergo a conceptual revolution if they are going to teach in a manner that promotes the notion of learners establishing and drawing inter-relationships between content, students’ and their environment.

While two of the lecturers interviewed articulated a knowledge of student centred approaches, the emergent data suggested that this was not a common or convincing occurrence. The evidence revealed that specific pedagogical models were not used in the teaching of the exercise sciences. Given this evidence it would appear that the teaching of exercise science within PETE programmes tends to be more traditional and may lag behind contemporary developments in the wider teacher education field. Tapping into constructivist pedagogies as outlined by Hipkins et al. (2002); Richardson (2003) and Taber (2010) and the use of specific pedagogical models as outlined in Joyce, Weil and Calhoun (2000) was not evident at all. By failing to make use of these alternative pedagogies it is argued here that opportunities to more effectively integrate exercise science content with constructivist and authentic learning opportunities is somewhat limiting.

A number of respondents felt there were limitations to the delivery of courses due to class sizes and financial imperatives. They believed that this was an actual impediment to the utilisation of alternative pedagogies. However in investigating this situation further, it did become apparent that respondent lecturers where not altogether sure of what alternative pedagogies they could employ. The recommendation emanating out of these findings is that university teachers of the exercise sciences in PETE contexts may find it pedagogically useful to actively explore the contemporary developments in teaching and learning with a view to the implementation of specific pedagogies for the exercise sciences. In particular we refer specifically to making use of Mosston and Ashworth’s (1994) right hand side of their spectrum, constructivist approaches suggested by Hipkins et al. (2002); and Richardson (2003), authentic learning as suggested by Reeves et al (2002) and specific pedagogical models as suggested by Joyce et al. (2002). This may create more meaningful opportunities for content knowledge development which would also compliment the need for student exposure to greater application opportunities, the drawing of strong relationships with content and curriculum requirements (signalled above) and resultant authentic learning.

Data from the qualitative semi-structured interviews on pedagogical models used, it was apparent that university lecturers did not draw on the strong evidence of pedagogical findings emanating from constructivist science education research. As signalled in the introduction, and above, it may be appropriate for the future development of exercise science and corresponding pedagogies to draw on lessons learned in science education and indeed as Culpan and Bruce (2007) argue critical pedagogy. In this study there was little evidence if any that science education constructivist approaches were being used in the development of exercise science knowledge. Certainly the evidence obtained from students indicated there is an increased need to develop more per-
sonal meaning by having learning opportunities with practical situations and processes. Given this evidence, perhaps a starting point to rectify this situation might be to adopt the general constructivist teaching sequence as advocated by Driver and Oldham (1986). They suggest four specific phases to the instructional process: orientation, elicitation, restructuring, and application and review. Building on this generalised process, Yachel et al. (1992) have suggested that for learners to construct acceptable knowledge, techniques such as: problem solving, explaining solutions, listening to and making sense of other explanations and ideas, agreement/disagreement determinations, questioning and clarification seeking, justification of position taking and then further exploration and reflection if interpretations are conflicting are important constructivist processes that have been most successful in science and mathematics education contexts. In this study the lecturers interviewed made little reference to the techniques suggested above. Furthermore there was no reference whatsoever to the importance of metacognitive processing which Gillespie and Culpan (2000) and Hipkins et al. (2002) have identified as a critically important variable in the development of physical education and science education meaning respectively. Indeed there was no evidence at all that exercise science lecturers were encouraging students to critically reflect on their learning and, or the specific content of exercise science. It seems to the authors of this study that failure to do this is inhibiting the development of exercise science in PETE contexts. In making this point we draw on Richardson’s (2003) argument that more contemporary views of constructivism focus on the social aspects of learning and how specific content is a human construct which has been affected by politics, ideologies, values, power, inequalities, religious beliefs and economic self interest. As Richardson argues:

This approach centres on the ways in which power, the economy, political and social factors affect the ways in which groups of people form understandings and formal knowledge about the world . . . (p. 1624).

Given this contemporary development in constructivist thinking, as authors of this article, we do not subscribe to the situation that exercise science knowledge is immune from these human constructs. Rather, we argue that this development in constructivist thinking strengthens the argument of utilising both constructivist and critical pedagogy. In suggesting this we are reminded of Ingram and Simon-Ingram (1992); Fernandez-Balboa (1997); McLaren (2003); and Culpan and Bruce (2007) argument that using critical pedagogy provides students with a useful tool by which they can analyse the social construction of knowledge and in this case, exercise science knowledge. Particularly in regards to the scientific, economic, social, political and moral beliefs and structures that are dominant in the exercise sciences. As Culpan and Bruce (2007) argue the adoption of a more critical perspective allows the establishment of new visions, voices and intellectual curiosities for the exercise sciences. It, as Richardson (2003) argues this:

represents a process, in the best of all possible worlds, that is dialogical and rational, and that creates a shared and warranted set of understandings (p. 1625).

Clearly what is being suggested here is a complex arrangement that needs further examination. However what has emerged from this study are recommendations that university lecturers of exercise science need to explore and consider the evidence from the research on science education, constructivist pedagogy and critical pedagogy with a view to implementing constructivist principles and critical pedagogical practices into their teaching programmes. This, we argue, would be a most positive step forward in ensuring that the content of the exercise sciences is legitimately aligned to trying to achieve holistic and socio-critical PETE programmes.

6. Concluding Remarks

This study has provided useful data and discussion regarding the delivery of exercise science in PETE programmes within the New Zealand context. In particular this study has recommended that PETE programmes: provide students with appropriate opportunities to apply their exercise science knowledge in authentic contexts, facilitate the student’s preparedness to teach by forging strong links to content knowledge and curriculum requirements, explore opportunities to integrate content across the sub-disciplines of exercise science, and to actively promote contemporary pedagogies particularly of a constructivist and critical kind.
By activating these recommendations, it is argued here, that PETE programmes containing exercise sciences will be enhanced become more complete, more holistic, more meaningful and will be in a better position to promote authentic learning. Furthermore it has been argued that if this sort of learning is desired in both PETE and in school contexts, then PETE classes, as Richardson (2003) suggests need to be conducted in a constructivist manner for the ethical reason to simply increase the legitimacy of the theory and to assist student teachers in developing deeper and more meaningful critical understanding of the teaching process.

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