Developing Pedagogy for Exercise Science in Tertiary Physical Education programmes in the Aotearoa New Zealand Context

Final Report

Dr Nick Draper: Senior Lecturer and Programme Co-ordinator for Physical Education, School of Sciences and Physical Education, University of Canterbury.

Ian Culpan: Associate Professor and Head of the School of Sciences and Physical Education, University of Canterbury.

Susannah Stevens: School of Sciences and Physical Education, University of Canterbury.

Funded 2008 – 2010 by Ako Aotearoa, Southern Regional Hub

Introduction

Contemporary teacher education (pre-service and in-service professional development) necessitates beginning and experienced teachers to have a sound content knowledge and pedagogical content knowledge base. Essentially these knowledge bases are influenced markedly by New Zealand Curriculum requirements including senior school qualifications, such as the National Certificate in Education Achievement (NCEA). 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) with NCEA provide a framework which outlines the learning requirements for every New Zealand school student. This framework in turn provides clear content and pedagogical knowledge's that physical education teachers need to have.

For physical education in schools *Health and Physical Education in the New Zealand Curriculum* (Ministry of Education, 1999) and its revised counter-part *The New Zealand Curriculum* (Ministry of Education, 2007) provided a radical departure from traditional and previous school physical education programmes (Burrows, 2004; Culpan, 1996, 2000; Culpan & Bruce, 2007). This radical departure has necessitated New Zealand physical education/teacher education (PETE) programmes to explore and utilise pedagogies that better address teaching and learning in physical education (Culpan, 2005; Culpan & Bruce, 2007). Culpan & 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 perhaps the pendulum has swung too far in the scientisation of physical education. He suggests that given the dominance of science within physical education, teachers may 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'* can be achieved by teachers beginning to encourage students to utilise reflective

techniques in order for students 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, anecdotal evidence suggests 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 & Bruce (2007) and Culpan & Grant (2007) suggest 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"* (p155). While the exercise sciences in physical education may appear to promote academic legitimacy (Lineham, 2003; Kirk & Tinning, 1990; Culpan, 1996) it may have come at the expense of exploring the socio-cultural aspects of movement (McBain, 2003) and the exploration of alternative pedagogies (Culpan and Bruce, 2007). As a consequence, it is argued here that exercise science within the tertiary physical education domain needs to draw on the pedagogies associated with other aspects of the movement culture and apply them more systematically to the exercise sciences. By doing this engaging inter-relationships can be drawn. These relationships can be between the various functioning components of the human body, the social context in which the body can move, perform and behave. While this project sets out to establish what pedagogies are used in initial teacher education physical education contexts, the authors are mindful of the rich tapestry that science education has woven to provide more engaging pedagogies for its students. The lessons learned from science education per se, particularly around constructivism and other cognitive theories provide a useful genesis for this study. It provides a useful starting point for the investigation into exercise sciences future pedagogical development.

Hipkins, Bolstad, Barker, Jones, Barker, Bell, Coll, Cooper, Ferret, Harlow, Taylor, France, & Haigh (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 reports that the student's engagement in meta-cognitive practices is a critically important feature of effective science education pedagogies. In effect the work that McBain (2003) has been doing around *consciousness raising and critical action* is somewhat consistent with what Hipkins, *et al.* (2002) are suggesting when referring to meta-cognition.

While physical education, and in particular exercise science within physical education may be able to draw on pedagogical developments within the wider field of science education it is important to signal that in Hipkins, *et al.* (2002) work there is frequent reference for the need for authentic learning to occur in context. Taking cognisance of this point means that the exercise sciences within physical education need to carefully scrutinise appropriate pedagogies before unproblematically adopting them. The first step in this process is to determine what are the pedagogies presently being utilised. This first step gives rise to the purpose of this study.

Purpose

The purpose of this research project was to contribute to the Ako Aotearoa vision by:

- Identifying the existing exercise science curriculum content for physical education/teacher education (PETE) students
- Generating data regarding the pedagogical methods employed in the delivery of exercise science in physical education
- Providing base-line data regarding student knowledge in exercise science and preparedness to teach during their PETE training
- Developing a set of practical recommendations that will assist universities and their staff in the development of pedagogies suitable for the enhancement of learning in the exercise sciences.

Methodology

This research project adopted mixed method approach (qualitative and quantitative) and involved three stages. In the first stage, 3 New Zealand universities who teach the exercise sciences within a physical education context were identified. A document analysis was conducted across the 3 organisations 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 employed in the delivery of exercise science in PETE programmes?* A qualitative case study approach using semi-structured interviews was used with 6 staff to gather data and identify themes and patterns.

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 29 student volunteers (13 year 1/2 students and 16 year 3/4 students**)** to determine how their knowledge in the exercise sciences matched with their self evaluation of their preparedness to teach. Quantitative survey data gathered was statistically analysed to determine differences for students between organisations. Thematic analysis was used to analyse interview data to establish student's preparedness to teach.

Data emerging from the three stages was analysed, coded for relationships and a series of recommendations have been made in the resulting discussion.

Results

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

Stage 1

Purpose Statement: *Identifying 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:

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 papers in exercise sciences within the total degree. For University 2 students in their degree take 17% of papers in exercise sciences within their total degree structure. For University 3, students in their degree take 21% of papers in exercise sciences within their total degree structure. The reason for the percentage range for University 1 (21-46%) is that course students were able to choose a range of options. This meant that students graduating from this university might have diverse experiences in regards to the range of exercise sciences courses completed. For Universities 2 and 3 exercise sciences courses were compulsory.
2. The sub-disciplines within the exercises sciences across the 3 universities were very similar however University 1 had a more traditional approach to the design and structure of the sub-disciplines. 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 had established interactions between the sub-disciplines. The sub-disciplines across all 3 universities were: anatomy, exercise/sport physiology, motor learning/control, biomechanics, sport psychology, human growth and development, nutrition, sport injuries and strength and conditioning.

3. There was evidence that the extra time devoted to the exercise sciences in University 1 resulted in more content depth in each of the sub-disciplines.

Stage 2

Purpose statement: *Generating 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. Staff teaching in the exercises sciences drew on a range of teaching approaches and activities but there was little evidence of staff utilising 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.
5. 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.

Stage 3

Purpose statement: *Providing base-line data regarding student knowledge, exercise science subject knowledge and preparedness to teach during each year of PETE training*

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

The data revealed that:

6. 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

	Test Score
University 1	16.03 ± 5.0 pts
University 2	16.22 ± 4.30 pts
University 3	16.67 ± 3.76 pts

7. The means and standard deviations by year group are shown in Table 2. As can be seen from this Table 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.

Table 2. Mean ± SD scores on the quantitative student knowledge survey by year of study

	Test Score
Year 1	14.55 ± 3.55 pts
Year 2	15.65 ± 4.40 pts
Year 3	17.27 ± 4.0 pts**
Year 4	19.23 ± 4.08 pts*

Note. * significantly higher score than year 1 and 2. ** significantly higher score than year 1.

8. 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.

9. 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 seemed to be a critical factor in the preparedness to teach.

Discussion and Recommendations

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 is very clear that students' ability to apply this knowledge is dependent on opportunities to engage in practical delivery in appropriate contexts. This suggests that PETE programmes need to ensure that students are given appropriate opportunities 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 programme planners for the exercise sciences for PETE 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 perhaps suggests that more contemporary course structure and design enabled a breakdown of boundaries between sub-disciplines which assists and facilitates student learning and making links across the sub-disciplines. This move would be reflective of contemporary approaches to the world-wide exercise science research delivery and athlete support. Furthermore this integrated approach is entirely consistent with the holistic perspective evident in the 1999 NZHPE and its successor the NZC 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 Ashworths'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 indicated that the dominant approach to the teaching of the exercise sciences was teacher led and teacher dependent. While two of the lecturers interviewed articulated a knowledge of student centred approaches the emergent data suggested that this was not necessarily a common occurrence. Indeed 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. In particular developments associated with the use of specific pedagogical models as outlined in Joyce, Weil and Calhoun (2000). A number of respondents felt there were limitations to the delivery of courses due to class sizes and financial imperatives. 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. This may create more meaningful opportunities for content knowledge development which would also compliment the need for student exposure to greater application opportunities and the drawing of strong relationships with content and curriculum requirements (signalled above).

Evidence from the qualitative semi structured interviews on pedagogical models used it was apparent that university teachers did not draw on the strong evidence of pedagogical findings emanating from science education research. As signalled in the introduction it maybe appropriate for the future development of exercise science and corresponding pedagogies to draw on lessons learned in science education. 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 the increased need to develop more personal meaning by having learning opportunities with practical situations however the lecturers interviewed made no reference to the importance of meta-cognitive processing which Hipkins, *et al.* (2002) have identified as a critically important variable in the development of science education meaning. Recommendations emerging from this evidence are that university teachers of exercise science do indeed need to explore and consider the evidence from the research on science education with a view to implementing constructivist principles into their teaching programmes.

Summary List of Recommendations

1. That PETE programmes need to ensure that students are given appropriate opportunities to facilitate the application of exercise science knowledge in appropriate and authentic contexts.
2. That to facilitate student's preparedness to teach strong relationships need to be made between exercise science content knowledge and specific content requirements of the school curriculum.
3. That planners of exercise science programmes within PETE further explore opportunities to integrate content across the sub-disciplines.
4. That university teachers of the exercise sciences in PETE contexts actively explore the contemporary developments in teaching and learning with a view to the implementation of specific pedagogies for the exercise sciences.
5. That university teachers of exercise science need to explore and consider the evidence from the research on science education with a view to implementing constructivist principles into their teaching programmes.

This study has provided useful data regarding the delivery of exercise science in PETE programmes. Proposed dissemination of this data will include several peer reviewed journal articles and presentations at national conferences. It is anticipated that these articles and presentations will provide insight into the 'pedagogy of possibility' for the exercise science, in particular at the researchers'

university where specific professional development opportunities will be examined.

References

Burrows, L. (2004). Understanding and investigating cultural perspectives in physical education. In J. Wright, D. MacDonald & L. Burrows. (Eds). *Critical inquiry and problem solving in physical education* (pp105-119). London: Routledge.

Culpan, I. (1996). Physical Education: Liberate it or confine it to the gymnasium? *Delta*, 48, (2), 203-219.

Culpan, I. (2000). Getting what you got: Harnessing the potential. *Journal of Physical Education New Zealand*, 33, (2), 16-29.

Culpan, I. (2005). Physical Education: What is it all about? The muddled puzzle. Retrieved 23 February, 2010 from *http://www.tki.org.nz*.

Culpan, I., & Bruce, J. (2007). New Zealand physical education and critical pedagogy: Refocusing the curriculum. *International Journal of Sport and Health Science*, 5, 1-11.

Culpan, I. & Grant, B. (2007). Physical Education down under: Fusion or confusion. *Journal of Physical Education New Zealand*, 40, (1), 19-20.

Hipkins, R., Bolstad, R., Barker, R., Jones, A., Barker, M., Bell, B., Coll, R. Cooper, B., Ferret, M., Harlow, A., Taylor, I., France, B., & Haigh, M. (2002). Curriculum, Learning and Effective Pedagogy: A literature review in Science education. *Education Counts.* Wellington: Ministry of Education.

Joyce, B., Weil, M., & Calhoun, E. (2000). *Models of Teaching*. Boston: Allyn and Bacon

Kirk, D., & Tinning, R. (1990). *Physical Education, curriculum and culture: Critical issues in the contemporary crisis.* London: The Falmer Press.

Lineham, C. (2003). Senior school physical education: The paradigm and the pendulum. In B. Ross and L. Burrows, (Eds). (2003). *It takes 2 feet*. Dunmore Press: Palmerston North.

McBain, S. (2003) Creating meaning through movement; Experiential learning in physical education. In B. Ross & L. Burrows, (Eds). (2003). *It takes 2 feet.* Dunmore Press: Palmerston North.

Ministry of Education (1999). *Health and Physical Education in the New Zealand Curriculum.* Wellington: Ministry of Education Learning Media.

Ministry of Education (2007). *The Zealand Curriculum*. Wellington: Ministry of Education Learning Media.

Mosston, M., & Ashworth, S. (1994). *Teaching Physical Education.* (4th ed.). New York: MacMillan College Publishing Company.

Ross, B., & Burrows, L. (Eds). (2003). *It takes 2 feet.* Dunmore Press: Palmerston North.