Propensity for Movement Specific Reinvestment by Physiotherapists: Implications for Education

Catherine M. Capio[1,2]

Liis Uiga[1,2]

Neha Malhotra[3]

Kathlynne F. Eguia[4]

Rich S.W. Masters[1,2]

[1] Te Oranga School of Human Development and Movement Studies, University of Waikato, New Zealand

[2] School of Public Health, The University of Hong Kong, Hong Kong

[3] School of Psychology, University of Waikato, New Zealand

[4] Therabilities Inc., Pasig City, Philippines

Corresponding author:

Dr. Catherine M. Capio

Te Oranga School of Human Development and Movement Studies

University of Waikato

Hamilton 3240, New Zealand

Tel # +64 7 838 4466

Email: ccapio@waikato.ac.nz

ABSTRACT

Previous studies have shown that the propensity for conscious monitoring and control of movement (i.e. movement specific reinvestment) influences the acquisition of movement skills. Physiotherapists, whose primary function is to promote effective human movement, also develop specialized movement skills that are necessary to perform diagnostic and therapeutic procedures. To explore the implications for promoting expertise, this current study examined physiotherapists' propensity for movement specific reinvestment. Practitioners and students in physiotherapy, and other rehabilitation, and non-health professionals, completed the Movement Specific Reinvestment Scale, which measures two dimensions of reinvestment – conscious motor processing (CMP) and movement self-consciousness (MS-C). Physiotherapists scored significantly higher than other professionals on both CMP and MS-C. Specifically among physiotherapists, those with relatively fewer years of practice tended to have higher MS-C scores. Movement specific reinvestment appears to be a characteristic of physiotherapists that could be relevant for understanding the ways in which novices think and act as they progress to expertise. Further research is recommended to examine the role of reinvestment in performance of different tasks of varying complexity by novice physiotherapists.

Keywords: physiotherapy, reinvestment, expertise, movement self-consciousness

INTRODUCTION

Movement and function are keystone concepts in physiotherapy, as the profession is concerned with developing, maintaining and restoring human movement (WCPT, 2011). Because physiotherapists promote effective movement amongst their clients, it is likely that awareness of their own movements is heightened in comparison to other professions that are less directly concerned with movement. The tendency to consciously monitor and control movement has been referred to as movement specific reinvestment (Masters, 1992). An individual's predisposition to reinvest has been shown to influence skill learning and performance in medical and non-medical professionals (e.g. Malhotra et al., 2014; Masters, Polman and Hammond, 1993). This is potentially relevant in physiotherapy education, because the transition from novice to expertise is concurrent with acquisition of movement skills that are necessary to perform physiotherapy procedures.

Physiotherapists acquire specialized skills to perform therapeutic and diagnostic procedures that may include soft tissue manipulation, movement facilitation and physical handling. They also learn to monitor and evaluate clients' movements to perform diagnostic procedures, such as gait and posture analysis, which potentially promotes heightened awareness of their own movements. If physiotherapists develop a higher tendency to consciously monitor and control their own movements, this may signal a novel approach to understanding the development of physiotherapy expertise.

Physiotherapy expertise development has been largely examined with respect to clinical reasoning (e.g. Chipchase and Prentice, 2006) and the cumulative amount of time in practice (e.g. Jensen, Gwyer, Shepard and Hack, 2000). While emerging research has investigated physiotherapy expertise with respect to the forms of acquired knowledge (e.g. Tynjälä and Gijbels, 2012), there has been limited exploration of how physiotherapists understand their own movement, and the changes that occur as they progress from novice to expert professionals. This is a potentially important aspect of physiotherapy education given the specialized movement skills that physiotherapists need to acquire during their education.

Motor skill acquisition has been described as typically progressing from a cognitive stage during which individuals utilize rule-based knowledge to monitor and control actions, to an autonomous stage during which performance is carried out with little reliance on rules to facilitate movement performance (Fitts and Posner, 1967). Specialized physiotherapy skills presumably progress through such a process as they develop to expertise. The theory of reinvestment suggests that under certain attention-demanding conditions (e.g. under pressure), some individuals are more likely than others to revert back to the cognitive stage of performance (Masters and Maxwell, 2008). In such cases, conscious monitoring and control of movements may disrupt automated performance, leading to less effective outcomes. For instance, medical surgery students who displayed a high predisposition to reinvest, in comparison to students who displayed a low predisposition, were less able to meet the demands of time pressure while performing a laparoscopic task (Malhotra et al., 2012). Recently, however, it has been shown that although conscious monitoring and control of movement is detrimental to skilled performance under pressure, it may facilitate identification of effective movement strategies for novice surgeons (Malhotra et al., 2015). In other words, the individual propensity for movement specific reinvestment may be associated with either detrimental or beneficial effects for novices, depending on the context.

Individual reinvestment differences have been measured using the Movement Specific Reinvestment Scale (MSRS; Masters, Eves and Maxwell, 2005), which captures two dimensions of the propensity to reinvest: movement self-consciousness (MS-C) and conscious motor processing (CMP). MS-C refers to an individual's propensity to consciously monitor one's style of movement, while CMP represents the propensity to consciously control the mechanics of one's movements. Taken together, these two dimensions form the single construct of movement specific reinvestment. Recent research, however, suggests that these two dimensions influence skill learning in different ways, depending on the context. Among medical students who were being trained in laparoscopic surgery, those with a higher propensity for MS-C tended to perform slower than those with a lower propensity for MS-C

early and later in learning (Malhotra et al. 2014). It was suggested that medical students were more self-conscious of their movements, possibly because in the early stages of learning they typically learn in the presence of supervisors. In subsequent research, however, it was found that a higher tendency for CMP was associated with a faster rate of learning a fundamental laparoscopic task (Malhotra et al. 2015). This last finding was taken to suggest that a greater propensity to consciously control movement mechanics helps an early skill learner to determine effective movement strategies, which leads to faster development of skills proficiency.

Considering that movement is a key concept in physiotherapy (Wikström-Grotell and Eriksson, 2012), and that clinicians' skills are based upon observation and performance of movement, we hypothesized that physiotherapists would have a higher propensity for movement specific reinvestment compared to other professional groups. This study therefore aimed to contrast the propensity that physiotherapists have for movement specific reinvestment with other health and non-health professionals. Since MS-C and CMP have been shown to have different effects on skill acquisition depending on the context, we analyzed the participants' reinvestment propensity according to the two separate constructs. If physiotherapists display higher tendencies for MS-C and CMP, we may begin to explore the implications for how novices acquire skills for specialized therapeutic and diagnostic procedures. As previous research has shown that a higher propensity for CMP is advantageous in the early stages of skill acquisition (Malhotra et al. 2015), it is relevant to examine reinvestment propensity across a range of expertise (i.e. represented in this current study by the number of years in practice and being a student or a professional).

Kurunsaari and colleagues (2015) noted that research in physiotherapy education has not been concerned enough with how students gain their skills. This current research contributes to closing that gap by unlocking a new perspective on the understanding of physiotherapists' development. By measuring physiotherapists' propensity for movement

specific reinvestment, this study could help to identify strategies that promote expertise more effectively and efficiently.

METHODS

Participants

Participants were recruited through the researchers' professional and academic networks. A convenience sample (*N*=711; 495 females, 216 males) consisting of practitioners and students in rehabilitation disciplines (i.e. occupational therapy, *n* = 158; physiotherapy, *n* = 268; speech therapy, *n* = 71) and non-health disciplines (i.e. business, banking, engineering, *n* = 214) was formed. The sample distribution is also illustrated in Table 1. Participants mean age was 24.74 years (*SD* = 7.63). The inclusion criterion for practitioners was at least one year of professional experience, while students were required to be in their final year of tertiary education. The practitioners' average experience was 7.46 years (*SD* = 6.06). For the students in rehabilitation professions, their final year of tertiary education consists of 10 months of internship (i.e. supervised clinical practice).

Instrumentation

All procedures were reviewed and approved by the ethical review board of the university. Participants responded to a questionnaire that included the Movement Specific Reinvestment Scale (MSRS) and some background information (i.e. years of experience, student/professional status, and rehabilitation/non-health discipline). The MSRS consists of 10 items, forming two subscales (5 items each) that correspond to CMP (e.g. "I am always trying to think about my movements when I carry them out") and MS-C (e.g. I'm concerned about my style of moving"). The items are rated on a 6-point Likert scale ranging from strongly disagree (1) to strongly agree (6), where higher scores are indicative of a greater propensity for reinvestment. The MSRS has been shown to be valid, and has good test-retest reliability and internal consistency (Masters et al 2005). Exploratory and confirmatory factor analyses also support the two dimensions of CMP and MS-C.

Data analysis

To ensure validity, internal consistency – the extent to which the items in the questionnaire test the same construct (Tavakol and Dennick, 2011) – was examined by calculating the Cronbach's alpha (Cronbach, 1951). When comparing non-clinical groups, Cronbach's alpha values that range from 0.70 to 0.80 are deemed satisfactory, with higher values representing greater internal consistency (Bland and Altman 1997).

Multivariate analysis of covariance (MANCOVA) was used to compare the dependent variables (Huberty and Petoskey, 2000) of CMP and MS-C scores, with professions (occupational therapists, physiotherapists, speech therapists, non-health disciplines) and status (practitioner/student) as independent variables. Number of years in practice was included as a covariate. Pairwise comparisons and correlations were performed to follow-up significant MANCOVA findings. Effect sizes were calculated and statistical significance was set at $p < 0.05$ for all tests.

RESULTS

Satisfactory internal consistency was found for both subscales with *Cronbach's alpha* being 0.72 for CMP and 0.85 for MS-C, supporting the validity of the questionnaire in measuring the two constructs. For the descriptive information, CMP and MS-C scores are summarized in Table 1.

MANCOVA results showed that profession (F (1394,6) = 7.59, $p < 0.001$, $n^2 = 0.06$) had a significant effect on CMP and MS-C scores. This finding was explained by follow-up paired comparisons, which showed that physiotherapists scored significantly higher than the other rehabilitation and non-health professionals on both CMP (p = 0.015 to 0.001) and MS-C (p = 0.002 to 0.001). Other rehabilitation and non-health professionals scored no differently from each other (CMP p = 0.10 to 1.00; MS-C p = 0.07 to 1.00).

The multivariate analysis showed that the number of years in practice (F (696,2) = 7.30, p = 0.001, $n^2 = 0.02$) was a significant covariate of the CMP and MS-C scores.

However, follow-up correlational analysis showed that physiotherapists' number of years in practice had a significant weak negative association only with MS-C scores (r = -.14, p < 0.001). There was no association between years of practice and CMP scores (p = 0.63).

There was no significant effect of status (F (696,2) = 0.96, p = 0.39, n^2 = 0.003) on CMP and MS-C scores, suggesting that no differences existed between students and professionals. Furthermore, no significant interaction between the independent variables was found (p's > 0.05).

DISCUSSION

The findings of this study support the hypothesis that physiotherapists have a higher propensity for movement specific reinvestment compared to other professionals, presumably because their professional role is concerned with developing, maintaining and restoring movement (WCPT, 2011). This was apparent among both practitioners and students, suggesting that their discipline-specific tasks may tend to promote a greater tendency for reinvestment regardless of their stage of professional development (i.e. novice/expert). However, we cannot discount the possibility that individuals who have a higher propensity for reinvestment may have a greater inclination to take up physiotherapy as a profession. Other rehabilitation professionals, particularly occupational therapists, may also be concerned with movement performance, but our findings show that their propensity to reinvest is no different from people in non-health professions. Occupational therapists are more focused on promoting independent participation in activities of daily living (WFOT, 2013) than on movement performance, which may explain this finding.

While both student and practitioner physiotherapists displayed a greater tendency for both dimensions of movement specific reinvestment compared to other professional groups, only movement self-consciousness had an association with the number of years in practice. The negative association suggests that less experienced physiotherapists are particularly more self-conscious, possibly because they are at a stage when they are working out the movement strategies that produce effective performance of therapeutic and diagnostic

procedures. Previous research among medical students has suggested that movement self-consciousness might be heightened among novices (i.e. laparoscopic surgery task) because experts normally supervise them during the early stages of skill learning (Malhotra et al., 2014). This current study offers evidence in the context of physiotherapy expertise development, which suggests that indeed there tends to be a higher tendency for movement self-consciousness among novices. Similar to medical students, physiotherapists go through the novice stage under the supervision of expert colleagues.

The inclination to reinvest has been linked with accumulation of knowledge, related to movement performance during the early stages of skill acquisition (Poolton, Maxwell and Masters, 2004). It is likely that for novice physiotherapists, who must learn to examine their clients' movements, greater propensity for movement self-consciousness is a consequence of efforts to learn diagnostic procedures such as postural and gait analysis. However, as years of experience accrue (along with expert therapeutic and diagnostic skills) the need for reinvestment may abate. It is therefore worth examining whether promoting movement self-consciousness among novices is beneficial or detrimental for the development of physiotherapy expertise. On the other hand, no relationship between conscious motor processing and number of years in practice was found. It appears that the propensity for conscious motor processing persists among physiotherapists, perhaps as a consequence of their professional task of analyzing clients' movements. Further research could seek to establish how one or both aspects of reinvestment propensity changes as physiotherapists gain expertise. It is possible that besides the years in practice and clinical reasoning strategies, reinvestment propensity may be a novel aspect that needs to be considered as educators lead novice physiotherapists to expertise.

Previous research offers evidence that the nature and complexity of the task is relevant for understanding the distinctive influence of the two dimensions of MSRS on skill acquisition (Malhotra et al., 2015). Movement self-consciousness appeared to slow down performance of relatively simple tasks, while conscious motor processing tended to facilitate

learning of more complex tasks. One way of examining this in a physiotherapy context is for future research to examine the influence of reinvestment propensity on physiotherapists' performances in tasks of varying nature and complexity. For instance, it would be informative to examine the influence of reinvestment propensity on novices' performances during supervised and unsupervised tasks. It might also be useful to compare motor performance during structured laboratory examinations for isolated tests (e.g. measurement of range of motion) and during more complex integrated diagnostic examinations (e.g. comprehensive evaluation of a musculoskeletal condition involving the performance of a number of tests).

Individual propensity for reinvestment has also been known to have implications for domains in which conscious monitoring and control of performance might be disruptive (Masters and Maxwell, 2008). For example, when individuals are under pressure or highly motivated to display proficiency, the tendency to revert to conscious control of movement can have detrimental effects on performance (Masters, Polman and Hammond, 1993). Physiotherapy novices are often subjected to situations in which they have to perform under pressure. Novice physiotherapists have, in fact, been reported to experience higher levels of stress compared to experts (Dunford, Reeve and Larmer, 2011). This is not surprising and might be linked to routine supervision and evaluation of novices by more senior colleagues (i.e. experts). While it is plausible that in the early novice stages reinvestment propensity might facilitate physiotherapists to acquire diagnostic and therapeutic skills, it would be of value to determine the impact of reinvestment propensity when more experienced physiotherapists are subjected to pressure. Future research is needed to help clarify the beneficial or detrimental effects of reinvestment in physiotherapy education.

Limitations

We acknowledge that the current findings represent only a cross-sectional general picture from a convenience sample. Longitudinal research is needed to verify the role of movement specific reinvestment in the development of physiotherapy expertise. A further

limitation of this study is that the link between reinvestment propensity and clinical skills performance has not been examined.

It has been suggested that the future of the physiotherapy profession may be influenced by how well educators explicate the concept of movement (Wikström-Grotell and Eriksson, 2012), and multiple perspectives are relevant in understanding the ways in which novices think and act. The propensity for reinvestment is one such aspect of thinking, which clearly has consequences for the acquisition of professional skills. We propose that while the evidence presented in this study is preliminary, it nevertheless justifies further research that will lead to a clearer understanding of a novel aspect of the development of physiotherapy expertise.

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TABLE

Table 1. Movement specific reinvestment scores of physiotherapists and other health and non-health disciplines

	CMP Mean (95% CI)	MS-C Mean (95% CI)	MSRS (total) Mean (95% CI)
Physiotherapists (n_s = 198; n_p = 70)	21.05 (20.35 - 21.74)	20.70 (19.96 - 21.43)	41.74 (40.50 - 42.98)
Occupational therapists (n_s = 82; n_p = 76)	19.04 (18.27 - 19.81)	17.95 (17.14 - 18.76)	36.98 (35.62 - 38.36)
Speech therapists (n_s = 19; n_p = 52)	17.60 (16.31 - 18.89)	16.99 (15.64 - 18.36)	34.59 (32.29 - 36.89)
Non-health disciplines (n_s = 98; n_p = 116)	19.25 (18.58 - 19.91)	18.28 (17.59 - 18.98)	37.53 (36.35 - 38.72)

n_s= number of students

n_p= number of practitioners