THE PATH TO TRANSLATING FOCUS OF ATTENTION RESEARCH INTO CANADIAN PHYSIOTHERAPY

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Abstract

For over two decades, research has shown that providing instructions and feedback to promote an external focus (i.e., mentally focusing on movement effects or outcome) leads to enhanced motor performance and learning, compared to an internal focus (i.e., mentally focusing on the muscles and joints, or movement kinematics). Notably, while a majority of the research has been on healthy young adults, the external focus benefit has also been found to extend to individuals recovering from musculoskeletal dysfunction. Despite the potential benefit of an external focus for rehabilitation, observational studies have revealed that physiotherapists provide their clients with more internal, than external, focus statements and have little awareness of the focus of attention literature. Consequently, the end goal of this doctoral research was to translate the focus of attention research findings into Canadian physiotherapy practice through the design, delivery and assessment of an educational workshop for practicing physiotherapists. With this in mind, the first step became to determine whether such a workshop was warranted by assessing the self-reported focus of attention provision by Canadian physiotherapists. Thus, in ***Study 1*** a study-specific questionnaire, titled the "Therapists' Perceptions of Motor Learning Principles Questionnaire" (TPMLPQ), was designed and completed by 121 Canadian physiotherapists. Results showed an overall low relative frequency of self-reported external focus promotion (M = 31.3%, SD = 14.9), across six hypothetical rehabilitation scenarios. Markedly, descriptions of a functional reaching (M = 55.5 %, SD = 37.0) and pelvic floor task (M = 65.6%, SD = 32.9) resulted in a greater self-reported promotion of external, than internal, focus of attention. These results suggested that Canadian physiotherapists could benefit from an educational workshop on focus of attention, and that there was a potential task dependency for their focus of attention promotion.

Study 2 employed virtual one-on-one interviews with eight Southern Ontario-based physiotherapists, all whom completed the TPMLPQ just prior to the interview. The first few questions gathered participants' perceptions on factors that influence physiotherapists' focus of attention use, as well as barriers to promoting an external focus and potential solutions to them. Coding of the interview data generated four themes related to factors that influenced focus of attention use: (1) physiotherapist experiences and characteristics, (2) client experiences and characteristics, (3) task characteristics and (4) focus of attention statement provision strategies. Moreover, the barriers to external focus promotion were organized into three themes: (1) educational experiences, (2) reinforcement of internal focus encouragement once in practice and (3) research aspects. All interviewed physiotherapists proposed continuing education on focus of attention as a solution to these barriers. Questions in the second half of the interview garnered input on how to get physiotherapists to attend a focus of attention workshop, and what activities to include before, during or after the workshop to promote physiotherapists to use more externally focusing statements in their practice. This information was used to inform the workshop design and delivery.

In addition to the physiotherapists' input, I also considered previous research that has emphasized the importance of evidence-based training programs to be based on theoretical frameworks. In this regard, Bandura's social cognitive theory was selected as a theoretical foundation. Further, knowing that the target population for the workshop consisted of adults with higher education, Knowles' adult learning theory was also selected as a complimentary theoretical foundation. Additionally, the Kirkpatrick model for training evaluation was selected to guide the assessment of the workshop, due to its strong overlap with constructs from both theoretical frameworks adopted. A final contribution to the workshop design process was

holding a virtual group session with four focus of attention researchers in order to gain input on workshop content. The final workshop product consisted of two parts: seven self-directed asynchronous website modules and a synchronous virtual group session.

Ultimately, in ***Study 3***, the workshop was delivered to fifteen Canadian physiotherapists. In addition to completing the two workshop components (asynchronous and synchronous), participants completed assessment packages at three time points: (1) one-week pre-synchronous workshop, (2) immediately post-synchronous workshop, and (3) one-week post-synchronous workshop. Analysis of the data revealed a chain of evidence supporting the merits of the workshop. Explicitly, physiotherapists reported high satisfaction (Mdn = 4.60), perceived relevance (Mdn = 4.83), and engagement in the workshop (Mdn = 4.83). Comparing one-week pre- to immediately post-workshop, analyses revealed significant improvements to physiotherapists' (1) scores on the knowledge assessment (pre M = 51.30%, SD = 22.30; post M = 84.30%, SD = 11.50; $p < .001$, d = 2.06) with an accompanying decrease in the uncertainty in their responses (pre M = 23.19%, SD = 18.05; post M = 1.16%, SD = 1.99; $p < .001$, d = 1.28), (2) relative frequency of externally focusing to total focus of attention statements created on the skill assessment (pre M = 18.23%, SD = 13.17; post M = 67.95%, SD = 25.13; $p < .001$, d = 2.11), (3) self-reported attitudes towards learning and practice of external focus promotion (pre M = 88.25, SD = 11.00; post M = 92.83, SD = 6.59; p = .024, d = 0.56) and self-efficacy (pre M = 59.50, SD = 22.36; post M = 85.72, SD = 7.95, $p < .001$, r = 0.86). Using descriptive statistics, physiotherapists reported that participating in the workshop allowed them to increase their encouragement of external focus adoption (M = 79.00, SD = 15.14). Thirteen of the physiotherapists reported that they believed that their use of externally focusing statements led to improvements in their clients' rehabilitation outcomes (n = 13; M = 68.08, SD = 22.13), while

the other two physiotherapists noticed no difference. Finally, those 13 physiotherapists also reported a high intention to continue to provide external focus statements in their practice (M = 87.31, SD = 15.09). In the context of social cognitive theory, these findings suggest that the workshop was successful in strengthening the physiotherapists' behavioral capabilities, self-efficacy, and outcome expectations, suggesting that the behavior change self-reported by the physiotherapists (i.e., more external focus promotion) could extend beyond the short-term assessment period used here. The whole of this doctoral research acts as a powerful step on the pathway to translate focus of attention research into Canadian physiotherapy, and also provides a useful framework for future studies aiming to translate motor learning research into the field - in Canada or globally.

Statement of Contribution

I, Julia Hussien, was the primary contributor for all the studies presented in the research program within this dissertation. I designed the three studies, collected and analyzed the data, interpreted the results, and then wrote and submitted the articles as a research series to the *Journal of Motor Learning and Development*. My supervisor, Dr. Diane Ste-Marie, was involved in the conception, preparation (e.g., pilot testing), data collection/analysis/interpretation, and preparation/editing of the manuscripts related to all three studies in the research program; as such, her name is included as a co-author on all current and future work associated with this research.

My thesis advisory committee was composed of Dr. Jennifer Brunet, Dr. Rose Martini and Dr. Nancy McNevin, who not only contributed conceptually to the research program at its early stages, but continuously throughout my journey during committee update meetings. Additionally, throughout the research program, Dr. Brad McKay served as a data analysis consultant to advise on the planned data analysis procedures.

I was also assisted throughout my doctoral work by the work of eight undergraduate students. In Study 1, Maryesthershalom Okorosobo (Undergraduate Research Opportunities Program: UROP) and Lauren Roberts (4th year Honor's Project) contributed to the preparation, and face validation procedure, of the Therapists' Perceptions of Motor Learning Principles Questionnaire (TPMLPQ). These two students, as well as a third student, Mariam Gerguis (4th year Honor's Project), contributed to the recruitment of physiotherapists to complete the TPMLPQ. Mariam Gerguis also presented preliminary research findings on my behalf at the SCAPPS 2019 conference.

For Study 2, the pilot testing was aided by Lauren Shearer (4th year Honor's Project), who, when done her undergraduate studies continued as a volunteer research assistant. Lauren Gignac then joined the team (UROP) after acting as a participant in the second pilot test and, along with Lauren Shearer, was involved in recruitment of physiotherapists and the analysis of the interview data, including undergoing coding training, coding the pilot transcripts, and coding specific questions of the actual participant data. Additionally, Lauren Shearer and Lauren Gignac contributed to editing the references and supplementary material, respectively, for what became the second article in the series.

As I transitioned into the third study, Lauren Gignac (now Directed research study) and a new student Tessa Roberts (UROP), contributed at multiple levels to the design of the focus of attention educational workshop including aiding in (1) the focus of attention researcher group session, (2) designing the website modules (including the creation of article reviews, testing of at home-experiments, and pilot testing website features), (3) testing the SurveyMonkey assessments, and (4) organizing and attending pilot tests for the full workshop. In addition, Lauren Gignac and Tessa Roberts contributed to recruiting physiotherapists for the workshop, and Lauren Gignac took on additional responsibilities such as designing a recruitment tracking tool, a workshop certificate template, and additional website elements such as a logo and page formatting. Joining later in ***Study 3,*** Liza Khodko and Cooper MacDonald (both volunteer research assistants) contributed to participant recruitment, acting as a pseudo-patient in select workshops (when only 2 physiotherapists formed a group) and coding of the skill assessment data, including undergoing coding training of pilot test data.

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I have always been someone with big dreams and I know the root of all my confidence is the incredible support system I have been born into, and have built around me. There are truly no words that could capture the full extent of my appreciation and admiration for the people who have helped me get where I am today, but I will try.

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My journey was made even better by my lab mates who have made the last few years as fun as they were challenging. Zachary Yantha my lab little brother, our classes and conferences would not be the same without your insight and humor. Brad McKay, you've completely changed the way I look at research, and I find myself asking "what would Brad do/think" at least a few times a week. Not to mention, you originally planted the ear worm to convince Diane to take me on as a student, even when she was so close to retirement, so thank you again! Thank you as well to the countless students who worked on my doctoral projects Maryesthershalom Okorosobo, Lauren Roberts, Mariam Gerguis, Lauren Shearer, Lauren Gignac, Tessa Roberts, Liza Khodko and Cooper MacDonald; you all brought such joy and excitement to the lab, and often went beyond your duties to see these projects through to the end. Watching you all take the next steps to your dream careers has made me so proud to have had the opportunity to teach, and learn from you.

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committee, and Dr. Nancy McNevin who has been on my committee from my Master's into my doctoral studies. It was with great sorrow that I learned of Dr. McNevin's passing in late 2022, and it is my honor to dedicate this thesis to her. Nancy's research has had a huge impact on the field of motor control and learning and her legacy will not soon be forgotten. She has advocated for the translation of the focus of attention research into physiotherapy for over two decades, so having her insight on my doctoral work was an incredible privilege. Alongside Dr. McNevin, my committee members have always been supportive, flexible and challenged me to think about my research on a deeper level. Jennifer, thank you as well for trusting me with so much of your research outside of my doctoral studies. You allowed me to learn from you, but also to learn through experience and I am forever grateful for the opportunities you presented me.

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"If I have seen further, it is by standing on the shoulder of giants"

Table of Contents

List of Figures

List of Tables

List of Abbreviations and Acronyms

Abbreviation or Acronym	Meaning
a.i.	artificial intelligence
ACL	anterior cruciate ligament
ALT	adult learning theory
BCT	behavior change technique
CNS	central nervous system
CPA	Canadian Physiotherapy Association
EFOA	external focus of attention
EMG	Electromyography
fMRI	functional magnetic resonance imaging
FOA	focus of attention
IFOA	internal focus of attention
KP1	Kirkpatrick Level 1: Reaction
KP2	Kirkpatrick Level 2: Learning
KP3	Kirkpatrick Level 3: Behaviors
KP4	Kirkpatrick Level 4: Results
MLRS	motor learning researcher session
MS	multiple sclerosis
MSK	Musculoskeletal
N.R.	no response
n_P	number of physiotherapists who responded to a prompt
n_{SG}	number of physiotherapists who self-generated a code
OPA	Ontario Physiotherapy Association
PI	physiotherapist interviews
RF_{ext}	relative frequency of external focus of attention statements
$RF\text{-}T_{ext}$	total relative frequency of external focus of attention statements
ROM	range of motion
SCAPPS	Canadian Society for Psychomotor Learning and Sport Psychology
SCT	social cognitive theory
TMS	transcranial magnetic stimulation
TPMLPQ	Therapists' Perceptions of Motor Learning Principles Questionnaire
UK	United Kingdom
UROP	Undergraduate Research Opportunities Program

Chapter 1

Introduction

Working within almost all sectors of the Canadian health care system, physiotherapists assist with the learning or relearning of motor skills in order to enhance motor functioning after injury or disease diagnosis (Canadian Institute for Health Information, 2022). The number of citizens who have consulted a physiotherapist in their lifetime has increased in Canada from roughly 2.2 million in 2001 to 3.5 million in 2014 (Sutherland, 2017). In 2014, there were approximately 20,100 physiotherapists employed in Canada (Sutherland, 2017), and this number has risen to over 27,000 in 2021 (Canadian Institute for Health Information, 2022). Given such widespread use of these health care professionals, it could be considered essential that physiotherapists implement informed clinical decision making to ensure that their patients experience efficacious motor (re)learning and recovery. While there are a myriad of ways that practitioners can facilitate motor (re)learning, such as manipulating practice structure, controlling feedback content or frequency, and introducing action observation (Magill & Anderson, 2020), the motor learning principle of research interest here is in relation to how therapists direct their patients' focus of attention prior to, during, or after a movement.

Within the field of motor learning, focus of attention is often viewed from the standpoint of the direction that an individual focuses their concentration (either externally or internally) and does not equate to their visual focus (Wulf, 2013). Specifically, an external focus of attention (herein referred to as external focus) is defined as a mental focus on the effects of one's movements on the environment or the movement outcome, whereas an internal focus of attention (herein referred to as an internal focus) refers to a focus on the elements of the movement to be executed by the body, i.e., the kinematics or muscles/joints involved in the movement (Wulf et

al., 2001). For example, a recent study by Nadzalan and colleagues (2020) manipulated focus of attention instructions on how to perform a weighted barbell squat. The authors encouraged the adoption of an internal focus by stating "Focus on moving and exerting force with your legs" and an external focus by stating "Focus on moving and exerting force through and against the barbell".

Highlighted in Wulf's (2013) review of 15 years of focus of attention research, a consistent finding has been that promoting an external focus enhances motor performance and learning in healthy young and older adults. This robust finding is relevant to the field of rehabilitation given that physiotherapists can guide a client's focus of attention through verbal provision of instructions and feedback. Due to the inherent anatomical nature of the physiotherapy profession, it may be impractical to avoid the use of internally focusing statements altogether; that being said, recent research segmenting movement phases has found that an internal focus during the preparation phase, followed by an external focus during the execution phase, led to significantly enhanced outcomes compared to an internal focus across both phases (Aiken & Becker, 2022). Consequently, the use of externally focusing instructions/feedback, and the timing of their delivery, are both important concepts.

Unfortunately, although motor learning principles are highly relevant for effective rehabilitation, it has been shown that physiotherapists' motor learning-based treatment is often guided by intuition rather than formal knowledge of motor learning principles (Atun-Einy & Kafri, 2021). Specific to Canada, interviews with representatives from seven physical therapy programs revealed that motor learning principles were taught (a) primarily in neurological curriculums, (b) through didactic lectures, and (c) only within approximately the last decade (Bramley et al., 2018). Although we cannot speak to the inclusion of motor learning content in

physiotherapy curriculums across Canada, the evidence suggests it is likely that Canadian physiotherapists may lack the knowledge concerning external focus benefits, or the skill and self-efficacy in applying this knowledge across rehabilitation populations; consequently, they may not provide verbal instruction and feedback that maximizes motor learning effectiveness.

Evidence for this assertion comes from Zachariah (2013) who reported that Ontario-based rehabilitation specialists, of which the majority were physiotherapists (12/15), were almost four times more likely to provide internal focus statements rather than external focus statements in their practice. Such findings warrant further investigation with physiotherapists and their focus of attention use. Markedly, physiotherapists recognize that motor learning is integral to the physiotherapy profession but identify a lack of knowledge as the greatest barrier to implementation of motor learning principles in their practice (Atun-Einy & Kafri, 2019, 2021). Research on physiotherapists' implementation of evidence-based practice, as a whole, further identifies other practitioner-based barriers (e.g., attitudes and self-efficacy), as well as organizational barriers (e.g., physiotherapists' perceptions of access to resources and support) (Salbach et al., 2007; Schreiber et al., 2013; Scurlock-Evans et al., 2014); as such, research exploring these barriers is also warranted.

Overall, I argue that a gap exists between the evidence produced by motor learning researchers regarding effective motor learning principles and its application in rehabilitation settings. Addressing the motor learning subtopic of focus of attention, the main goal of my doctoral work was to integrate the findings of an external focus benefit into Canadian physiotherapy practice through the design, implementation and assessment of an educational workshop on focus of attention. The workshop was delivered to practicing physiotherapists, working with musculoskeletal rehabilitation clients, with the intention of increasing their

external focus promotion. As a primary step, we sought to explore whether such a workshop was warranted by assessing whether a larger sample of Canadian physiotherapists, working with a broader range of clinical populations, self-reported low external focus provision to their clients. Importantly, although currently these is no quantifiable amount of external focus adoption that is deemed ideal, previous studies observing physiotherapists have mainly reported greater use of internally focusing relative to externally focusing statements (Durham et al., 2009; Johnson et al., 2013; Kal et al., 2018; Zachariah, 2013) and this has prompted discussions on the necessity to translate focus of attention research into physiotherapy. While these studies employed physical observation of physiotherapists' focus of attention use, our research instead relied on physiotherapists' self-report. This methodology was selected, despite my knowledge of research cautioning that potential discrepancies exist between 'what we do' and 'what we say we do' (Neil-Sztramko et al., 2017) for two main reasons: (1) it allowed for data acquisition on the focus of attention use for a larger sample of physiotherapists and (2) previous research has shown that physiotherapists tend to over-estimate, not under-estimate, their external focus promotion (Zachariah, 2013).

In line with Hunt et al.'s (2017) assertions that using external focus could maximize the overall success of clients' rehabilitation, my proposition is that an educational workshop on focus of attention use could increase the frequency by which physiotherapists provide externally focusing statements and thus, potentially, save the clients', therapists', and rehabilitation institutions' time and resources by ameliorating motor (re)learning. Admittedly, the laborious process of designing such a workshop, and assessing its impact on practicing physiotherapists, would require the dedication of much time and resources; however, it is my opinion that if a workshop was deemed effective at enhancing physiotherapists' provision of effective attentional

focusing statements in practice, then its delivery to future physiotherapists would require minimal human and financial resources; thus, such a small change may have an important impact with limited cost. While I would contend that future research should explore the integration of motor learning concepts into Canadian physiotherapy curricula, navigating the stakeholder landscape required to enact curriculum changes was considered unfeasible for the time constraints of a doctoral thesis. Consequently, my focus was on the more immediate solution of a workshop with practicing physiotherapists.

As a basis for the research that follows, the succeeding focus of attention literature review will elaborate upon (1) the pioneer research, (2) the constrained action hypothesis and specific evidence supporting it, (3) research with sport-specific skills, (4) research with rehabilitation outcomes, (5) research with clinical populations, (6) observational studies in rehabilitation and (7) an overview of the concepts of evidence-based practice and continuing education in physiotherapy.

1.1 **Literature Review**

1.1.1 Pioneer Research

Although not defined by the authors as such, Singer and colleagues (1993) could be considered the first researchers to show the benefits of an external focus. In their research, they examined the learning effects of instructions that directed learners' attention to their felt body movements (internal focus) versus to cues in the environment (external focus). The participants in their research were tasked with learning to throw a ball to a target and the experiment consisted of four groups: (1) the awareness group were told to focus on how they threw the ball based on how the movement felt (internal focus), (2) the non-awareness group were instructed to preplan their movement and then focus on situational cues rather than movement endpoints

(external focus-situational), (3) the five-step approach group were provided with information on how to execute the task in five steps while also focusing on cues relevant to the environment (external focus-five cue), and (4) the control group were not provided with any advanced instructions. Results showed that both the external focus-situational and external focus-five cue groups outperformed the other two groups and thus, this experiment became the first to suggest the benefits of an external focus over an internal focus or no focus of attention provision at all.

The first research conducted in which the focus of attention construct of the internal and external focus dichotomy was used was a two-experiment paper by Wulf et al. (1998). In their first experiment, they used a ski-simulator and participants were either informed to focus on their feet while exerting force on the platform of the ski-simulator (internal focus) or on the pressure exerted on the wheels of the platform (external focus). In experiment two, participants balanced on a stabilometer and were either informed to keep their feet horizontal (internal focus) or to keep markers placed on the stabilometer horizontal (external focus). In both experiments, participants performed two consecutive days of acquisition, followed by a 24-hour delayed retention test. The results showed that when participants were directed towards an external focus, superior motor learning occurred, relative to internal focus and control groups, as evidenced by greater movement amplitudes (Experiment 1) and reduced displacements from the horizontal (Experiment 2) on the retention tests.

Soon after, Shea and Wulf (1999) examined whether external focus benefits extended to augmented feedback instructions. An internal focus group was told that the augmented feedback presented to them on a screen provided information concerning the movements of their feet during a stabilometer task, whereas an external focus group was informed that it represented the movement of the platform. The researchers found that those informed that the augmented

feedback was about the platform's movements learned the task better, as measured by reduced deviation of the platform from the horizontal, as compared to the internal focus group. This experiment was the first to combine the motor learning principles of focus of attention and the delivery of feedback, and suggested that both instructional statements and augmented feedback information should orient the learner toward an external focus. Soon after the emergence of these findings, Wulf et al. (2001) published the constrained action hypothesis which currently, over two decades later, is still widely used to explain external focus benefits.

1.1.2 Constrained Action Hypothesis

Within their description of the constrained action hypothesis, Wulf and colleagues (2001) suggested that an internal focus of attention leads to conscious control of one's movement, which then constrains the motor system such that it interferes with automatic control processes that would typically regulate movement. On the other hand, adopting an external focus allows for self-organization of the motor systems' interactions among the individual, the task and the environment. This more automatic control of movement is then purported to subsequently result in enhanced performance and more effective motor learning. Consequently, moving forward the focus will be on the research assessing neuromuscular outcomes that provided support for the constrained action hypothesis.

Neuromuscular Evidence Supporting the Constrained Action Hypothesis. Through the use of different technologies, varied evidence has been reported to support the constrained action hypothesis. For example, utilizing surface electromyography (EMG), Zachry and colleagues (2005) observed the activity of key muscles during a basketball free throw under both internal and external focus conditions. The researchers found that an external focus was associated with a reduction in EMG activity which they argued reflected improved movement

economy. In a similar fashion, reduced EMG activity under external focus conditions has been observed for the execution of bicep curls (Vance et al., 2004), isokinetic elbow flexions (Marchant et al., 2008), a vertical jump-and-reach task (Wulf et al., 2010) and a repetitive sit-up exercise (Neumann & Brown, 2013). Moreover, Lohse, et al. (2011) reported that the benefit of an external focus could be attributed to improved efficiency of motor unit recruitment through the prevention of co-contraction of agonist and antagonist muscles. Contrastingly, Kal et al. (2013) found no differences in EMG activity during a leg extension-flexion task under different focus of attention conditions; however, their results still supported elements of the constrained action hypothesis as an external focus led to reduced cognitive dual-task cost and increased movement fluency. Likewise, Vidal et al.'s (2018) findings also partially supported the constrained action hypothesis in that an external focus led to further jump distance and enhanced knee and ankle coordination patterns, but no differences in ankle-knee coordination variability, for a standing long jump.

It is important to note that although reducing EMG activity through externally focused instructions has been highlighted as a benefit, there are instances where the task goal would actually require an increase in motor fiber recruitment (e.g., hypertrophy; Schoenfeld et al., 2018). With this in mind, McNevin et al. (2000) suggested that an internal focus of attention may actually be beneficial during early stages of rehabilitation, when the treatment goal is to strengthen specific muscles or movement components. The authors highlighted that during this time, individuals are acquiring new skills that will be coordinated and incorporated into existing motor patterns at later stages of rehabilitation. Notably, however, to my knowledge, there has yet to be any research directly testing this hypothesis.

In addition to improved muscular efficiencies, advanced techniques, such as functional magnetic resonance imaging (fMRI) and transcranial magnetic stimulation (TMS), have revealed that adopting an external focus leads to differences in neural activity, as compared to an internal focus. For example, using fMRI, Zentgraf, et al. (2009) determined that an external focus led to increased activation within primary somatosensory and motor cortices during a finger pressing sequence as compared to an internal focus. The authors suggested that an external focus increased the processing of task-relevant cues, whereas an internal focus impeded on the efficiency of the flow of neural signals between the sensory and motor brain areas. Similar evidence has been found using the TMS procedure during isometric finger abduction (Kuhn et al., 2017) and flexion tasks (Kuhn et al., 2018). This research also showed that, under external focus conditions, compared to internal focus ones, individuals showed improved inhibition ability within the primary motor cortex, which likely contributed to enhanced movement efficiency. Having now detailed the mechanistic underpinnings of focus of attention instructions/feedback, the next section addresses the research observing the impact of an external focus on healthy adults performing sport-specific skills.

1.1.3 Focus of Attention and Sport Specific Skills

In addition to continued research with laboratory-based tasks, such as the stabilometer, the early 2000s marked a shift in the focus of attention research through the introduction of more sport specific tasks, such as the golf pitch shot (Perkins-Ceccato et al., 2003; Wulf & Su, 2007), soccer kick (Wulf et al., 2002 Exp. 2), basketball free throw (Zachry et al., 2005) and dart throwing (Emanuel et al., 2008; Lohse et al., 2010; Schorer et al., 2012), to name a few. Importantly, the benefits of adopting an external focus persisted and was shown for a number of movement outcomes, such as improved movement accuracy during golf putting (Granados,

2010), a faster speed during sprinting (Porter et al., 2015), increased maximum vertical jump height during a jump and reach task (Wulf & Dufek, 2009), reduced error scores on a dart throwing task (Becker & Fairbrother, 2019), and improved batting performance and step-length for cricket batting (Bull et al., 2022).

In addition to these sport-specific movement outcomes, research interested in choking under pressure also gives evidence for changes in kinematic variables as a consequence of focus of attention. It has been argued, for example, that in high-pressure scenarios, elite athletes shift from an automatic control to a more conscious control of the movement, causing a disruption in their bodies automatic processes (DeCaro et al., 2011; Gray, 2011). This idea of reduced performance due to the return to conscious control of a movement, as opposed to automatic control, is similar to that put forth in the constrained action hypothesis. Evidence for changes in kinematics of the movement as a result of high-pressure, versus low pressure, conditions include (a) lower movement variability (Gray, 2004), (b) greater freezing of degrees of freedom (Pijpers et al., 2003), (c) increases in muscular activity along with a resulting decrease in movement economy (Coombes et al., 2009), and (d) a shift to more novice-style of motor control strategies (Delay et al., 1997).

1.1.4 Focus of Attention and Rehabilitation Outcomes

While there is strong support for the benefits of an external focus in sport skills, it is also important to consider evidence for activities more likely to be used in a rehabilitation environment, such as resistance, neuromuscular and balance training. For example, the research on focus of attention and resistance training has revealed significant benefits for an external focus on both muscular endurance and strength (see Grgic et al., 2021 and Grgic & Mikulic, 2021 for recent meta-analyses). Although most of the studies on focus of attention and sport-

specific skills have utilized a single practice session, research has also observed the impact of longer-term training using an external focus on muscular strength and endurance. For example, Nadzalan et al. (2019) found that six weeks of resistance training under external focus conditions led to greater improvements in muscular strength compared to six weeks of identical training under internal focus and no focus instruction conditions. Turning to neuromuscular training, working with athletes to prevent anterior cruciate ligament injury, Ghanati et al. (2022) found that athletes who completed an eight-week program under external focus conditions experienced enhanced hip strength, single-leg landing mechanics, and hop performance more so than athletes who completed the same program under an internal focus condition.

In considering balance control as a common rehabilitation outcome, the research on postural stability is also relevant. Postural stability is often measured by the trajectories (displacement and/or frequency of responding) of an individual's center of pressure and center of gravity recorded while they stand on force platforms (Paillard & Noé, 2015); while these traditional measures capture the magnitude of movement variability, more recently, focus of attention research has begun assessing sample entropy as a measure of the structure of movement variability (i.e., its predictability) (Becker & Hung, 2020; Rhea et al., 2019). Experimental manipulations have included the typical difference in instructions to participants promoting either an internal or an external focus (Becker & Hung, 2020; Ducharme & Wu, 2015; Rhea et al., 2019), but have also used the addition of secondary cognitive tasks (i.e., dual task paradigm; Nafati & Vuillerme, 2011; Polskaia & Lajoie, 2016; Richer et al., 2017). This dual-task paradigm aligns with the constrained action hypothesis in the sense that drawing an individual's attention away from the postural task itself can be argued to allow for more automatic control of the necessary postural adjustments to maintain stability.

Observing the impact of focus of attention on a dynamic balance task, Ducharme and Wu (2015) had participants walk in a straight line onto an uneven surface, while either focusing on the surface they were walking on (external) or on keeping their body on top of their feet (internal). While adopting an external focus, participants experienced significantly reduced lateral displacement (i.e., from the intended walking line), after stepping onto the uneven surface, when compared to when they adopted an internal focus. Although there was no difference between EMG data for the internal and external focus conditions, the results still suggested than adopting an external focus led to enhanced adaptation to an unexpected balance perturbation. Also using a complex balance task, Becker and Hung (2020) had participants stand on a stabilometer and perform trials under different focus of attention instruction conditions; participants were told to focus on keeping their feet (internal) or the platform (external) level (a third, holistic focus, condition was also used but not spoken to here). The external focus condition resulted in higher sample entropy than the internal focus condition, which was taken as evidence for a more automatic and adaptive motor control strategy being used to maintain balance on the stability platform.

Turning to examples of dual-task experiments, Nafati and Vuillerme (2011) had participants maintain standing balance in a control condition in which that was their sole focus and compared it to a dual task condition in which participants concurrently engaged in a digit-span memory test. Their results showed that balance performance was better under the dual-task condition than the control and argued that it was due to the shift in focus away from the balance task. Further research has shown that increasing cognitive difficulty of the task under the dual-task demands can impact even more greatly on postural stability (Polskaia & Lajoie, 2016). Combining both manipulations of focus of attention instructions and secondary tasks, Richer, et

al. (2017) had participants stand on a force platform under five conditions, (1) baseline, (2) internal focus, (3) external focus, (4) single number counting dual-task and (5) double number counting dual-task, and they recorded EMG data in lower leg muscles. Results showed a decrease in postural sway for the external focus and the two dual-task conditions, with no significant differences between EMG activity under these different conditions. The results of this experiment indicated that the benefit in adopting an external focus of attention was not due simply to an ankle stiffening strategy but instead a result of the automaticity of the postural control processes, thus, empirically supporting the constrained action hypothesis.

Overall, the postural control literature is well-situated within the focus of attention research and reinforces the beneficial effects of adopting an external focus and dual-task conditions. The research discussed thus far has been conducted with mainly university-aged, healthy populations, however, physiotherapists often interact with older adults as well as clinical populations. As a consequence, it is also relevant to present literature on the benefit of adopting an external focus for these varied populations.

1.1.5 Focus of Attention and Research with Clinical Populations

Currently, the population of 'healthy' adults pursuing rehabilitation, following injury or surgery, has not been researched extensively as it relates to focus of attention and motor learning. The research that has been done, however, is in strong accordance with the general body of focus of attention literature. For example, an external focus was found to be beneficial, over an internal focus, for balance tasks after lateral ankle sprains (Laufer et al., 2007; Rotem-Lehrer & Laufer, 2007) and after anterior cruciate ligament reconstruction (Gokeler et al., 2015). Researchers have also detailed recommendations on how to incorporate external focus instruction into rehabilitation programs following anterior cruciate ligament injury (Faltus et al., 2020),

specifying that it would be most beneficial at the stage of transitioning the athlete back into sport, thus aligning with recommendations by McNevin et al. (2000) for external focus to be the emphasis in later stages of rehabilitation.

More literature on the topic of focus of attention use as it relates to older adults and clinical populations is available than that of 'healthy' adults seeking rehabilitation. Notably, the unique physical and cognitive capabilities of these different populations have led to mixed findings. Specifically, although some studies have found an external focus benefit (Chiviacowsky et al., 2010; McNevin et al., 2013; Mückel & Mehrholz, 2014; Rochester et al., 2005), others have found no difference between internal and external focus conditions (de Bruin et al., 2009; Shafizadeh et al., 2013) and still others have found an internal focus of attention to be beneficial for specific outcomes (Beck & Almeida, 2017; Kal et al., 2015). For example, when working with older adults engaging in balancing tasks, Chiviacowsky, et al. (2010) and McNevin et al. (2013) observed external focus benefits. In contrast, De Bruin, et al. (2009) found no significant differences in balance outcomes between older adults who completed five weeks of functional balance training under either an external or an internal focus on attention.

Another area of focus of attention research that has shown mixed findings are those with populations with neurological dysfunction. Some studies on populations with neurological dysfunction do not support the benefit. For instance, Shafizadeh, et al. (2013) found mixed results for the benefit of an external focus when working with patients suffering from multiple sclerosis (MS) who were tasked with walking on a treadmill; while an external focus improved certain aspects of gait, it had no effect on other gait features. Additionally, no differences in joint independence in the upper extremity, were seen between groups of stroke patients receiving either internally or externally focused instructions during arm training on a robotic device (Kim

et al., 2017). Finally, Beck and Almedia (2017) found that when performing a postural task, idiopathic Parkinson's disease patients, who were not on Dopamine replacement medication, experienced increased anterior-posterior postural sway as a result of adopting an external focus, compared to an internal one. Although there has been research with patients with stroke and Parkinson's disease that have clearly shown the external focus benefit (Mückel & Mehrholz, 2014; Rochester et al., 2005 respectively), the conflicting findings suggest that we need to understand that cognitive, and motor disorders may affect an individual's ability to benefit from external focus statements.

Supporting this assertion, a recent review done by Piccoli and colleagues (2018) is relevant. In their review, they determined that while the external focus benefits have been found to extend to individuals with musculoskeletal dysfunction, the findings are still inconclusive for those recovering from neurological disorders (e.g., stroke, Parkinson's disease etc.). Research summarized in this review highlighted the potential impacts of reduced cognitive capabilities, increased sensory impairments and absence of dopaminergic medication on the inconclusive findings of an external focus benefit. As a result of this review paper, the current doctoral work of designing, delivering and assessing an educational workshop on focus of attention was limited to physiotherapists working with musculoskeletal rehabilitation clients.

Overall, the research within healthy adult populations, and certain clinical populations (e.g., musculoskeletal dysfunction, but perhaps not those with neurological dysfunction) has shown a benefit for adopting an external focus for a variety of tasks and outcome measures. These benefits have been shown for both the use of instruction (statements given prior to performance of the movement) and augmented feedback (statements given after the performance

of the movement). Despite such benefits being described in the research, it still leaves open the question as to whether physiotherapists apply external focus statements in their practice.

1.1.6 The Use of Focus of Attention in Rehabilitation Settings

To my knowledge, four studies have been conducted to observe physiotherapists' use of focus of attention statements. Two of these studies were conducted in the United Kingdom (UK; Durham et al., 2009; Johnson et al., 2013), one occurred in the Netherlands (Kal et al., 2018), and more specific to the population of interest here, one was performed in Canada (Zachariah, 2013). The first three observational studies mentioned, all observed physiotherapists working with patients recovering from stroke and were all conducted prior to the publication of Piccoli and colleagues (2018) review. Further, while seemingly aware of the limited and/or inconclusive findings of an external focus benefit with neurological populations, the authors all spoke to the *potential* benefit of an external focus for these populations.

The observational studies performed by Durham and colleagues (2009) and Johnson and colleagues (2013), with UK physiotherapists, found that post-stroke patients received feedback and instructions that were almost exclusively internally focusing. Kal and colleagues (2018), however, found mixed results. Similar to the other researchers, they reported that physiotherapists' feedback statements were more internally than externally focusing; however, for the instructional statements, externally focusing statements were now used more than internally focusing ones. Two factors highlighted for influencing the type of focus of attention statements provided were the patients' phase of rehabilitation and their self-reported preferences for statement type (as determined by the Movement-Specific Reinvestment Scale). Specifically, the physiotherapists in Kal, et al.'s (2018) research provided more externally focusing statements to patients who were in later stages of rehabilitation (aligning with suggestions by McNevin et

al., 2000) and to those with internal focus preferences (likely in an attempt to discourage this type of focus).

Although the methodology for all three studies was similar, Kal and colleagues (2018) attributed the differences in results, from those in the UK, mainly to four factors: (1) the five years that had passed since the previous research, which may have allowed the findings associated with focus of attention to be more known by physiotherapists through their continuing education training, (2) the physiotherapists in the Netherland's study were more experienced (average years of experience were roughly 13 vs roughly 7 years for the UK studies), (3) more physiotherapists in the Netherland's study self-reported a preference to provide externally focusing statements (14/19 vs 2/8 therapists in the study by Durham and colleagues (2009), and (4) the different educational approaches to physiotherapy emphasized in the Netherlands versus the UK; that is the Bobath approach practice widely used in the UK likely encourages more internal focus of attention promotion as compared to the educational emphasis in the Netherlands to direct learning towards the functional aspects of the skill (which could lead to more external focus promotion). Another important distinction between the studies was sample size; the study within the Netherlands was conducted with 19 therapists whereas, the UK studies had lower sample sizes of eight therapists.

Within Canada, Zachariah (2013) observed 12 physiotherapists, two kinesiologists and one physiotherapy assistant who practiced in Windsor, Ontario. Unlike the previous three studies, the physiotherapists observed as part of this study were working with a variety of clinical populations with varying rehabilitation task goals (e.g., strength versus functional goals); thus, the findings were of greater interest for the purpose of this research. Zachariah observed the therapists for a total of forty-three appointments, audio-recorded the verbalizations made by the

therapists, and later coded for the frequency of internally and externally focusing statements, both for instructions and feedback. Additionally, following the appointments, each therapist completed a therapist perception questionnaire that addressed their subjective opinion of their use of focus of attention statements; as well as their awareness of the focus of attention literature. Results showed that (1) therapists were 3.75 times more likely to provide internally focused statements in their practice, (2) therapists underestimated their use of internally focusing statements and overestimated their use of externally focusing statements and (3) just over 50% of therapists had no awareness of the focus of attention literature or understanding of it within a clinical setting. Thus, within this limited Ontario sample, it has been identified that therapists provided more statements that promoted an internal focus, rather than external focus and that many therapists were unaware of the focus of attention literature.

No researchers to date, to my knowledge, have attempted to determine whether an educational workshop on focus of attention would serve to increase physiotherapists' promotion of an external focus in their practice. Indeed, physiotherapists Hunt et al. (2017) stated that physiotherapists would likely benefit from using externally focusing statements in their practice and that more research needs to be done in order to facilitate the integration of such instructional techniques into the physiotherapy practice. The current research heeds this recommendation and serves to address the noted gaps.

1.1.7 Evidence-Based Practice and Continuing Education in Physiotherapy

Within most of the first world countries, health care makes up a great portion of the expenditure by both governments and their populations (Sackett et al., 2000); thus, in an effort to improve the efficiency of these systems, research has emphasized the need to shift from mainly intuitive or traditional clinical decision making, to what has been termed evidence-based practice

(Sackett et al., 2000). As a whole, evidence-based practice is a multi-step process that requires practitioners to ask relevant clinical questions, to then access, interpret and apply the best-scientific evidence into their clinical decision making (Sackett et al., 2000). Evidence-based practice tools, such as databases that provide access to systematic reviews and randomized controlled trials (e.g., PEDro; Moseley et al., 2020) and physiotherapy clinical guidelines (van der Wees et al., 2008), are available to physiotherapists to assist with learning evidence-based practices. Unfortunately, however, research has shown that the application of evidence-based practice in physiotherapy is limited (Scurlock-Evans et al., 2014). Scurlock-Evans and colleagues argued that the lack of uptake was likely attributable to physiotherapists' perceived barriers to evidence-based practice implementation, such as time and workload pressures, limited access and skills to interpret research, and a mistrust of published research and its applicability to real-life patients.

As a consequence of the limited application of evidence-based practice in physiotherapy, continued education workshops and courses serve as an important strategy to keep physiotherapists informed on clinically relevant research and treatment techniques (Schreiber et al., 2013). Although there is a plethora of research related to physiotherapist intervention and assessing patient outcomes, there is significantly less research on the assessment of educational interventions in terms of behavioral change by the physiotherapists themselves. One study that has conducted research of this nature is that of Schreiber and colleagues (2013) who had physiotherapists complete three sessions across seven weeks on content related to translating research evidence into clinical practice. In the first two sessions, physiotherapists received information and computer-based practice of evidence-based practice skills, and a lecture on integration of knowledge into clinical decision making, respectively. Seven weeks later, in the

final session, participants discussed their experience with the application of what they learned in the first two sessions. Overall, as a result of their intervention, the authors saw a positive change in the self-reported frequency of knowledge use in practice and an increase in the physiotherapists self-reported confidence in supporting colleagues to do the same. As well, some physiotherapists reported changes to their behaviors related to applying evidence-based practice. Although this study was done using a sample of only eight physiotherapists, of which only five completed all sessions, the researchers provided useful suggestions for the future design and implementation of continued education workshops for physiotherapists. Specifically, the authors recommended the use of (a) activities to identify potential barriers to behavioral change, (b) interactive activities, (c) hands-on practice, (d) discussions to relate the content to the physiotherapists' own practice and (e) strategies to promote physiotherapists' ability to act as knowledge brokers to their patients and colleagues. These recommendations were considered as I moved forward with my research.

Another influencing article on my research was Stander and colleagues' (2018) scoping review of training programs designed to improve physiotherapists' uptake and use of research evidence. The authors assessed elements that led to successful training programs and echoed similar recommendations as Schreiber et al. (2013). Additionally, they also recommended that those developing training programs should (a) ensure the program is multifaceted including didactic sessions, printed resources, active discussions etc., (b) involve physiotherapists in the conceptual design phase, (c) build the program methodology on a strong theoretical foundation and (d) contextualize all components for the specific population of physiotherapists being trained. These additional recommendations featured prominently in the research I undertook and are expanded upon in subsequent chapters of this thesis.

1.2 Organization of the Dissertation

This dissertation is presented as a thesis by articles. Overall, the doctoral work has been assembled into four articles which are all part of a research series titled "The Path to Translating Focus of Attention Research into Canadian Physiotherapy". Figure 1.1 details the breakdown and subsequent assembly of the three doctoral studies, into the four parts of this research series. These four articles, and additional information are presented in the remaining five chapters of the thesis.

Chapter 2 presents an article (Part one; published) which emerged from the first research study. This entails data from a study-specific questionnaire titled the "Therapists' Perceptions of Motor Learning Principles Questionnaire" (TPMLPQ), which was designed to gather information on Canadian physiotherapists' self-reported focus of attention use, and awareness of the motor learning principle.

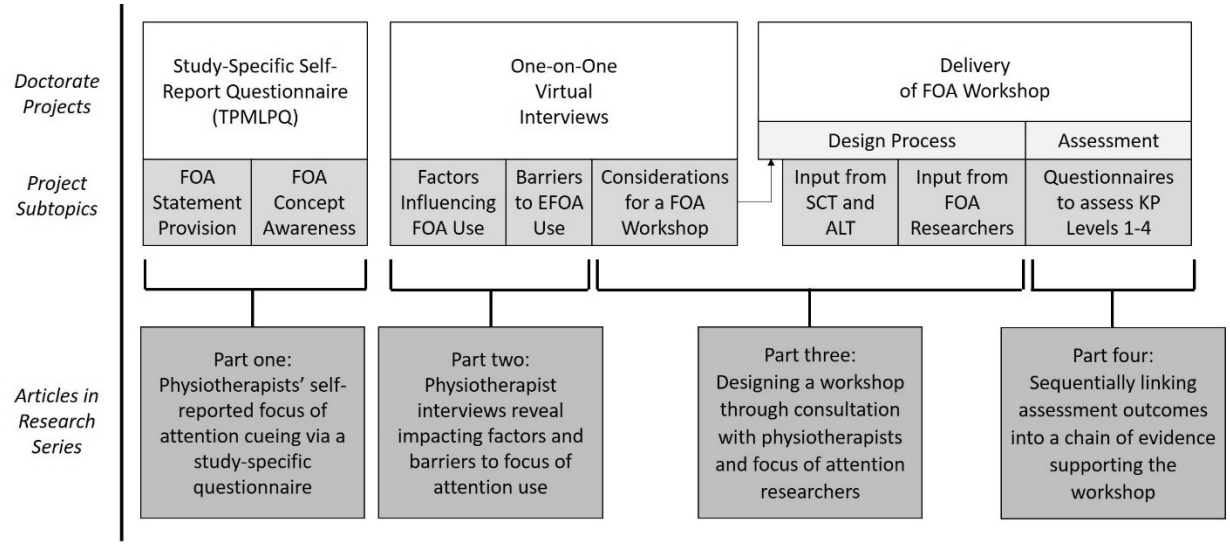
Chapter 3 is divided into two sections. The first section presents an article (Part two; published online ahead of print) from the second research study which consisted of virtual one-on-one interviews with physiotherapists. The interview guide was divided into three parts, of which the first two are relevant to this chapter. The first part included questions to gain information on general factors that influenced focus of attention use by physiotherapists and the second part tapped into barriers to external focus promotion in physiotherapy practice and potential solutions to overcome them. Following publication of the article (Part 2), it was determined that information was missing in order for the reporting to be in accordance with the Consolidated Criteria for Reporting Qualitative Studies (COREQ; Tong et al., 2007) guidelines. Consequently, the second section in this chapter presents missing information on the one-on-one

interviews and details relevant section numbers in the articles deriving from the interviews (Parts 2 and 3) for the 32 items on the COREQ checklist.

Chapter 4 is also divided into two sections. The first section presents an article (Part 3; published online ahead of print) that details the process undertaken to develop the focus of attention workshop to be implemented in the research. This article incorporates data from the last section of the one-on-one interview data, which garnered physiotherapists' perceptions about what activities to include in the workshop and how to get physiotherapists to attend, plus additional information from a group session with focus of attention researchers, which gathered their input to inform workshop content.

Figure 1.1

Breakdown and Assembly of the Three Doctoral Studies into the Four Parts of the Research Series



Note. TPMLPQ = Therapists' Perceptions of Motor Learning Principles Questionnaire, FOA = focus of attention, EFOA = external focus of attention, SCT = social cognitive theory (Bandura, 1986), ALT = adult learning theory (Knowles, 1984) and KP = Kirkpatrick (Kirkpatrick & Kirkpatrick, 2016).

Given the word limits that come with journals, there has not yet been the opportunity to fully frame the workshop design and assessment within a theoretical foundation as recommended by Stander et al. (2018). Consequently, expanding on content presented in article 3, the second section of this chapter expands on these theoretical constructs; i.e., how elements included in the focus of attention workshop fit within constructs of both Bandura's (1986) social cognitive and Knowles' (1984) adult learning theory.

Chapter 5 is divided into two sections. The first section presents an article (Part four; under review following request for modifications after first submission) that highlights the primary outcomes following delivery of the workshop. Next, the second section presents an elaborated discussion on additional questions included in the workshop assessment packages that were not discussed in Article 4, as well as other interpretations of the findings that were not reported on within the article.

Chapter 6 includes a general discussion that summarizes my personal reflections on this research pathway, as well as a summary of the recommendations for future researchers looking to translate motor learning findings into physiotherapy.

Chapter 2

Article 1

Title: The path to translating focus of attention research into Canadian physiotherapy, Part 1: Physiotherapists' self-reported focus of attention use via a study-specific questionnaire

Publication Status: Accepted for publication in the Journal of Motor Learning and Development (JMLD) on November 25th, 2022. First published on the Human Kinetics Journal's website on Jan 28th, 2023. https://doi.org/10.1123/jmld.2022-0052

2.1 Abstract

The focus of attention literature has shown robust findings for the benefits of providing statements that focus on the movement effect or outcome (external focus of attention [EFOA]) as opposed to focusing on the movement kinematics (internal focus of attention). Observational studies, however, have revealed that physiotherapists use fewer EFOA statements than internal focus of attention statements in their practice. Most evidence in this regard has been from non-Canadian physiotherapists working in stroke rehabilitation; consequently, we sought to examine whether Canadian physiotherapists working with various rehabilitation populations also use EFOA statements to a lesser extent than internal focus of attention statements. The "Therapists' Perceptions of Motor Learning Principles Questionnaire (TPMLPQ)" was thus designed and data from 121 Canadian physiotherapists showed low relative frequencies of EFOA use (31.3% ± 14%) averaged across six hypothetical scenarios. A higher EFOA was reported, however, for two of the six scenarios: a functional reaching scenario (55.5% ± 37.0%) and pelvic floor task (65.6% ± 32.9%). This data suggests that the findings of EFOA benefits have not been widely translated into Canadian physiotherapy settings; furthermore, the findings of the scenario-dependency warrant future investigation into factors, such as task characteristics, that may influence physiotherapists' FOA use.

Keywords: attentional focus, motor performance, physical therapy, rehabilitation

2.2 Introduction

Motor learning research has given rise to a number of principles purported to improve both learning and relearning of motor skills. One motor learning principle that has gained substantial support is that of directing a learner's attention to the effect, or outcome, of the movement when trying to learn or perform a motor skill, referred to as an external focus of attention (EFOA; Kim et al., 2017; Neumann, 2019; Wulf, 2013). In particular, an EFOA has been shown to be superior to that of directing a learner's attention to the muscles or body parts to be used to execute the movement (internal focus of attention; IFOA), as well as to the absence of attentional focusing instructions (Kim et al., 2017; Neumann, 2019; Wulf, 2013). Wulf et al. (1998), the pioneers of this line of research, showed that participants who adopted an EFOA showed enhanced motor learning on ski simulator and stabilometer tasks, compared with their counterparts who received either IFOA instructions or no instructions. Since then, research with healthy populations has shown that learners practicing under external, as opposed to internal, focus of attention (FOA) instructions or feedback show better motor learning and performance on a variety of indices, such as outcome accuracy (Lohse et al., 2010; Raisbeck et al., 2020), balance measures (Diekfuss et al., 2019; Wulf & McNevin, 2003), muscular endurance (Lohse & Sherwood, 2011; Marchant et al., 2011), and force production (Halperin et al., 2016; Wulf & Dufek, 2009).

Although fewer studies have been done in clinical settings, it has been shown that an EFOA can benefit key populations that seek rehabilitation. For example, external focus benefits have been shown for balance training in older adults (Chiviacowsky et al., 2010; Richer et al., 2020), postural control for individuals recovering from ankle sprains and ACL reconstruction (Gokeler et al., 2015; Laufer et al., 2007), lateral body weight shift following stroke (Mückel &

Mehrholz, 2014), and postural control for individuals with idiopathic Parkinson's disease (Wulf et al., 2009). More broadly, Piccoli and colleagues (2018) literature review concluded that EFOA benefits were robust in clients with musculoskeletal disorders, yet more evidence was needed for confirmation of the benefits for those with neurological disorders. Findings from the FOA research with clinical populations is particularly important to the field of rehabilitation; in fact, physiotherapists Hunt et al. (2017) have highlighted the importance of translating FOA knowledge into physiotherapy to maximize treatment outcomes.

Despite such recommendations, studies suggest that little attention has been given to these findings. As evidence, the first observational study examining physiotherapists' FOA use was conducted in the United Kingdom and involved video-recording single treatment sessions with eight pairs, consisting of one physiotherapist and one client with stroke (Durham et al., 2009). Following the coding of the verbalizations during the sessions, physiotherapists were shown to provide their clients with low frequencies of EFOA feedback (4%) and instruction (21%) statements. Using the same study design, without the differentiation of instruction versus feedback statements, Johnson et al. (2013) also reported a low percentage of EFOA statements (22%) by eight U.K. physiotherapists. Similarly, a lower percentage (41%) of EFOA feedback statements were used by 20 Dutch physiotherapists relative to IFOA statements, yet more external statements (60%) were used for instruction before the activity (Kal et al., 2018). Kal and colleagues attributed the higher use of EFOA statements by physiotherapists in their study, as compared with the two conducted in the United Kingdom (Durham et al., 2009; Johnson et al., 2013), to factors such as the increased availability of research findings on EFOA benefits, continuing education on the topic of FOA and a different educational approach to neurological rehabilitation in the Netherlands. Also, the different frequencies between instruction

and feedback statements suggest that future research on FOA with physiotherapists should differentiate between these two statement categories.

More specific to Canada, Zachariah (2013) directly observed 15 Ontario-based rehabilitation therapists, which included 12 physiotherapists. They also showed a low percentage of EFOA statements (21% of total FOA statements). Within this study, a questionnaire was included, and it was shown that physiotherapists tended to overestimate their use of EFOA statements and that a majority had no understanding of FOA and its use in clinical settings. Exploring this idea with a much larger sample, Atun-Einy and Kafri (2019) had 289 Israeli physiotherapists complete a self-report questionnaire that asked "To what degree do you plan whether to give instructions using 'external focus of attention' or 'internal focus of attention'?" with response options ranging from 1 = very little to 5 = very much, or simply selecting they were unaware of this motor learning principle. Of their sample, 20.6% selected they were unaware of the motor learning principle, and the remaining respondents selected an average implementation of only 2.3 (*SD* = 1.48). Taken together, these findings suggest that the lack of translation of the FOA motor learning into physiotherapy is a widespread issue.

To date, the studies that included direct observation of physiotherapists (Durham et al., 2009; Johnson et al., 2013; Kal et al., 2018; Zachariah, 2013) have been conducted with small sample sizes. Additionally, with the exception of Zachariah (2013), all the aforementioned studies exploring FOA use in physiotherapy have been performed outside of Canada. Knowing that over 25,000 physiotherapists are employed across Canada (Canadian Institute for Health Information, 2021) in a variety of clinical settings, we argue that it is important to continue to examine the use and awareness of FOA on the part of a larger sample of Canadian physiotherapists. Moreover, the studies that were conducted in other countries were focused

primarily on stroke rehabilitation, and given Piccoli et al.'s (2018) findings, it would be worthwhile to gain more insight from physiotherapists working with broader clinical populations. Finally, the long-term goal of our research program was to see whether we could translate the FOA motor learning principle into Canadian physiotherapy through the use of an educational workshop. As such, the first step of this research was to confirm a need for such translation; thus, the purpose of this study was to determine Canadian physiotherapists' self-reported FOA statement use and awareness of this motor learning principle. To this end, a study-specific questionnaire was designed which included a section specific to FOA. Based on previous research, our primary research hypotheses were that Canadian physiotherapists would self-report both a lower use of EFOA statements, compared with internal ones, and minimal awareness of the motor learning literature on FOA. We also explored whether the differentiation between instruction and feedback statements, which had been noted by Kal et al. (2018), would replicate here.

2.3 Methods

2.3.1 Participants

One hundred and fifty-one physiotherapists participated in the study. Inclusion criteria consisted of being a practicing physiotherapist in Canada who was capable of reading the English language (the study-specific questionnaire was only available in English). Ethical approval was provided by the University of Ottawa's Health Sciences and Science Research Ethics Board.

2.3.2 Materials and Procedure

A questionnaire was created for the purpose of this study and was titled the "Therapists' Perceptions of Motor Learning Principles Questionnaire" (TPMLPQ). This questionnaire is the

first phase of a longer research program for which participants could be included in subsequent phases. For this reason, we wanted the participants to remain naïve to the specific motor learning principle of interest. As such, the questionnaire included sections related to several different motor learning principles, but the specific focus here is on the FOA section, and thus emphasis is placed on its description.

The first section of the TPMLPQ had participants provide their demographic information related to age, gender, education, years of physiotherapy experience, as well as whether they worked in private or public physiotherapy settings. Physiotherapists then reported on all the rehabilitation populations with which they had current or previous experience by selecting from a series of five provided populations and by adding any other relevant populations that were not listed. The second section of the TPMLPQ consisted of six exercise scenarios for which there were two potential statements physiotherapists might provide their client in a hypothetical interaction: One statement promoted the client to adopt an IFOA, whereas the other promoted an EFOA. Three of the scenarios targeted feedback statements that physiotherapists could provide clients, whereas the other three involved instructions that physiotherapists may provide their client before they performed a specific exercise.

To arrive at these six scenarios, and their respective statements, both physiotherapists and motor learning researchers were solicited to provide input to address face validity (see Appendix A for more details). Six physiotherapists provided feedback on whether the scenario, and the statements provided, would typically occur within their practice and suggested any changes to the scenario and/or wording of statements as needed. Additionally, nine motor learning researchers confirmed that the statements used within each scenario accurately reflected an IFOA or EFOA and also provided comments on the scenarios provided. In the end, the three feedback

scenarios included exercises related to tandem balance, shoulder range of motion, and a functional reaching task, while the instruction scenarios involved exercises related to performing a squat, pelvic squeeze, and walking. Knowing the limited time availability of physiotherapists, we restricted this section to six scenarios to ensure the time to complete the entire questionnaire was not excessive.

The manner as to how to respond to each scenario was borrowed from Zachariah's (2013) Therapist Perception Questionnaire such that participants selected the percentage of time they would provide either statement, under the constraint that the two percentages together must equal 100%. For example, if a participant selected 65% for the IFOA statement, then 35% had to be selected for the EFOA statement. Unlike Zachariah's 20% increments between 0% and 100% on the response scale, the TPMLPQ used increments of 5% between 0% – 5% and 95% – 100%, and 10% for the rest of the response scale.[1] An example of a feedback scenario used is provided in Figure 2.1 (see Appendix B for all six scenarios).

Figure 2.1

TPMLPQ Scenario Example

Your client is performing a circular shoulder pendulum exercise, with a small dumbbell in their hand, and you notice they are swinging their arm in a straight line. What feedback statement would you provide? (Percentages should add up to 100%)

1) "Swing your arm in a circle"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

2) "Swing the dumbbell in a circle"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

[1] This was done to allow greater measurement precision while avoiding having an even 50/50 split option.

673 The final section of the TPMLPQ surveyed the physiotherapists' awareness of the topic
674 of FOA. Participants ranked their awareness on a 9-point Likert scale ranging from 1 to 5,
675 including half points (1.5, 2.5, 3.5, and 4.5). The whole number points had text labels of 1 = not
676 at all aware, 2 = slightly aware, 3 = somewhat aware, 4 = moderately aware, and 5 = extremely
677 aware. Furthermore, physiotherapists who selected a score of 3 or higher were asked to indicate
678 where the awareness was gained by selecting among the options of (a) undergraduate education,
679 (b) physiotherapy education, (c) continuing education, and (d) other. If they selected "other",
680 they were asked to specify where the awareness was gained in a space provided on the
681 questionnaire (see Appendix B for the TPMLPQ sections relevant to this manuscript).
682 Varied methods were used to distribute the TPMLPQ which was available in two
683 formats: printed as a hard copy and online via SurveyMonkey. For the hard copy version, in-
684 person drop-offs/pickups of questionnaires at both local clinics and the Canadian Physiotherapy
685 Association's annual conference was used. For the online version, the link to the survey was sent
686 via (a) email communications with managers at varied Canadian clinics, (b) distribution in the
687 Canadian Physiotherapy Association's monthly newsletter, and (c) by an information sheet at the
688 Canadian Physiotherapy Association's annual conference.

689 ***2.3.3 Data Analysis***

690 The relative frequency of EFOA statements (RF_{ext}) for each participant for each scenario,
691 was determined by the percentage they dedicated to the EFOA response option on the scale
692 provided. Next, for each participant, these percentages were averaged across the three feedback
693 scenarios to produce a RF_{ext} feedback statements, and across the three instruction scenarios to
694 produce a RF_{ext} instruction statements. Finally, percentages dedicated to the EFOA statement
695 option across all six scenarios were averaged to produce a total RF_{ext} ($RF\text{-}T_{ext}$). Given the

discrete nature of the response options for the six FOA scenarios and its inability to meet all parametric assumptions (Ahsanullah et al., 2014), data were analyzed using nonparametric tests (Harris et al., 2008).

To test the hypothesis that the frequency of EFOA statement selection would be less than IFOA statements, a one-sample Wilcoxon signed-rank test was performed to compare the group median for the average RF-T_{ext} to a median of 50% (i.e., no difference between internal and external statement selection). Additionally, a Wilcoxon signed-rank test was conducted to explore whether differences in EFOA and IFOA statement provision would arise between feedback versus instruction statements. When needed, Wilcoxon signed-rank tests with Bonferroni adjustments were used to uncover specific differences among the three scenarios. Last, descriptive statistics were calculated for the physiotherapists' awareness of the FOA literature and where that knowledge was obtained.

2.4 Results

2.4.1 Participants

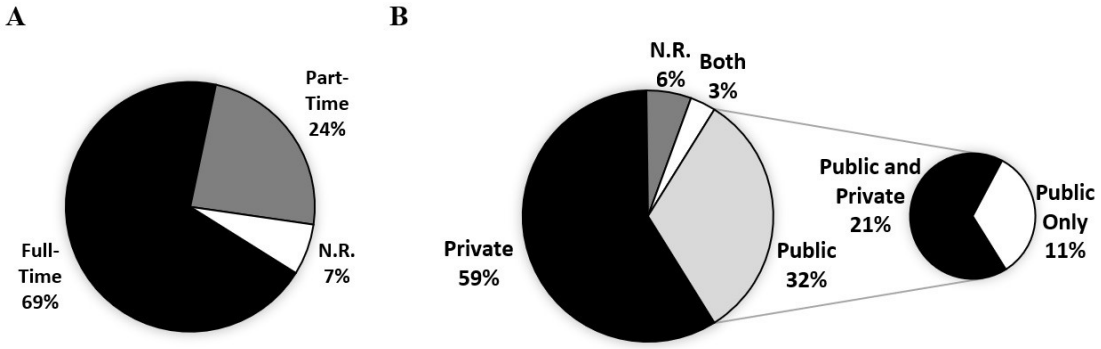
Of the 151 who consented to participate, the data from 30 of the participants were excluded due to incompletion of the relevant sections of the TPMLPQ (n = 28) or improperly following instructions (n = 2). Consequently, analysis was conducted on 121 Canadian physiotherapists (M_{age} = 42.4 years, SD = 12.1; 80 women, 27 men, and 14 not specified) who had 16.9 (SD = 12.3) years of experience with most (60.3%) having a master's degree (includes Master's in Physiotherapy and other fields).[2] Also, 9.1 % of the sample reported other sources of education, including ongoing or completed PhD programs (n = 7) and postgraduate diplomas and

[2] Note, between 2000-2010 most Canadian Universities switched to only Master's entry level Physiotherapy programs (Redenbach & Bainbridge, 2007); before then, only a Bachelor's degree was required to practice as a physiotherapist in Canada. Also, one participant failed to complete this question.

certifications (n = 4). Figure 2.2 summarizes their current employment schedule, as well as their current and previous employment settings. Additionally, the sample reported a median of three different rehabilitation populations with which they worked; the most frequently selected were orthopedic, geriatric, and athletic populations (see Table 2.1 for additional populations).

Figure 2.2

Physiotherapists' Employment Characteristics



Note. N = 121 Canadian physiotherapists. N.R. = no response. **A.** Current employment schedule. **B.** Current employment setting. Percentage of physiotherapists currently employed in a public setting are segmented based on prior employment experience to reflect our population's overall experience in private settings.

Table 2.1

Canadian Physiotherapists' Experience with Rehabilitation Populations

Rehabilitation Populations	*N* (%)
Orthopedic	88.4
Geriatric	81.8
Athletic	62.8
Neurological	47.9
Pediatric	40.5
Other[a]	22.3

Note. Physiotherapists could select multiple population types.

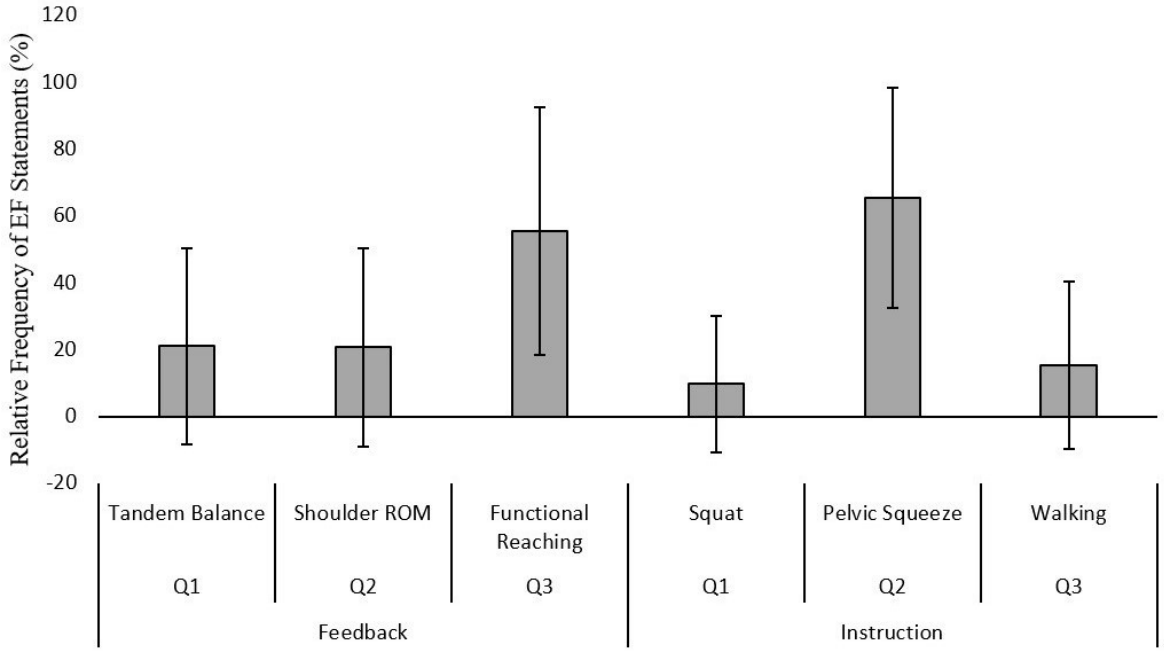
[a] open ended question, responses included: n = 9 women's health, n = 4 respiratory, n = 4 cardiac, n = 3 amputees, n = 3 chronic disease, n = 3 oncology, n = 2 vestibular, n = 2 rural/remote communities, n = 1 lymphedema, n = 1 complex pain, and n = 1 burn rehabilitation.

2.4.2 External Versus Internal Focus of Attentional Use

The one-sample Wilcoxon signed-rank test indicated that the sample median of the average EFOA statements (RF-T_{ext} *Mdn* = 30.8%) was significantly different from 50%, $z = -8.56$, $p < .001$, $r = -.78$. No significant differences were seen across the two section types; overall physiotherapists reported low RF_{ext} for both feedback (*M* of RF_{ext} feedback statements = 32.4%, *SD* = 19.8) and instruction (*M* of RF_{ext} instruction statements = 30.2%, *SD* = 15.4) sections, $T = 2{,}385.50$, $z = -1.27$, $p = .21$, $r = -.082$. Although the overall EFOA statement frequency was lower than the IFOA frequency across the feedback and instruction sections, we did note that the particular scenarios used appeared to have an impact (Figure 2.3). As a consequence of this unanticipated finding, we chose to explore this further and conducted Friedman tests both across the feedback scenarios and across the instructional scenarios.

Figure 2.3

Relative Frequencies of Externally Focused Statements as a Function of TPMLPQ Scenario



Note. ROM = range of motion. Error bars represent ± 1 standard deviation.

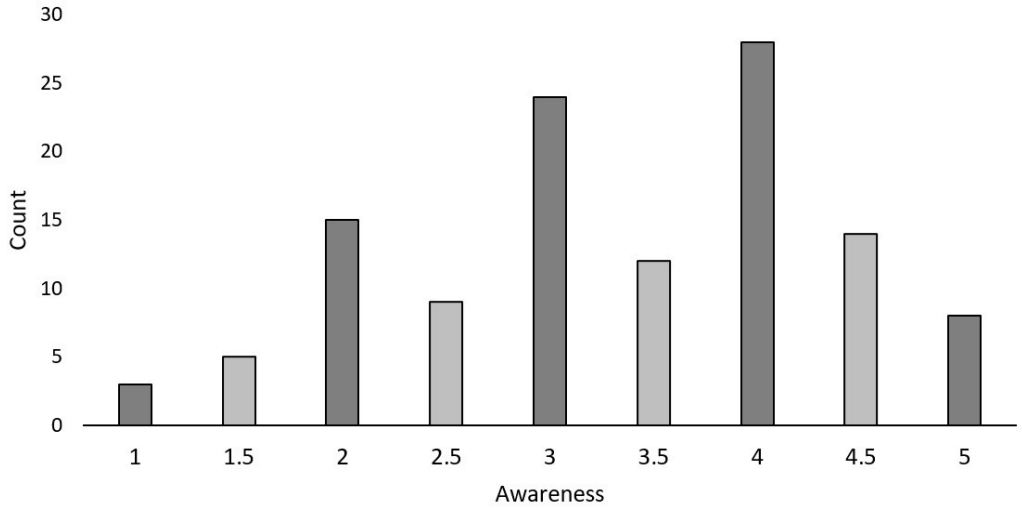
The Friedman analysis of variance for feedback statements revealed a main effect for scenario, $x^2_F(2) = 52.63$, $p \leq .001$. Post hoc testing revealed that the RF_{ext} for Scenario 3 (functional reaching task; $M = 55.5\%$, $SD = 37.0$) was significantly higher than both Scenario 1 (tandem balance task; $M = 21.1\%$, $SD = 29.3$; $T = 566$, $z = -6.45$, $p < .001$, $r = -.41$) and Scenario 2 (shoulder range of motion task; $M = 20.7\%$, $SD = 29.6$; $T = 477.5$, $z = -6.84$, $p < .001$, $r = -.44$), which were not different from each other. Similarly, a main effect for scenario occurred for the Friedman analysis of variance conducted on the instructional statements, $x^2_F(2) = 130.34$, $p < .001$, with post hoc testing showing that the RF_{ext} of feedback statements for Scenario 2 (pelvic squeeze task; $M = 65.6\%$, $SD = 32.9$) was significantly higher than Scenario 3 (walking task; $M = 15.3\%$, $SD = 25.0$; $T = 299$, $z = -8.01$, $p < .001$, $r = -.51$) and Scenario 1 (squat task; $M = 9.8\%$, $SD = 20.3$; $T = 151.0$, $z = -8.62$, $p < .001$, $r = -.55$), and that the RF_{ext} for Scenario 3 was significantly higher than Scenario 1 ($T = 503.5$, $z = -2.89$, $p = .002$, $r = -.19$).

2.4.3 Focus of Attention Awareness

Three participants did not complete this section, and thus data are presented for 118 Canadian physiotherapists. The possible responses on the 9-point range and the associated number of participants for each response are presented in Figure 2.4. The option selected most often by physiotherapists was “moderately aware,” with most of the sample (72.8%) reporting being at least somewhat aware of the motor learning literature on FOA. Of those who self-reported being somewhat aware or higher, the option most selected for where they learned of the concept was physiotherapy education (62.8%), followed by continuing education courses (52.3%), and then undergraduate education (27.9%); note, they could select all options that applied.

Figure 2.4

Physiotherapists' Self-Reported Awareness of the Focus of Attention Literature



Note. The scale included the labels 1 = not at all, 2 = slightly, 3 = somewhat, 4 = moderately and 5 = extremely aware.

2.5 Discussion

The primary aim of this study was to explore whether Canadian physiotherapists provided FOA statements in accordance with the benefits shown in the literature for EFOA. The results aligned with previous observational studies (Durham et al., 2009; Johnson et al., 2013; Kal et al., 2018), showing that, overall, the physiotherapists in our study selected the EFOA statement option less (31.3%) than that of the internal focus option (68.7%). Unlike Kal et al.'s (2018) findings, however, there was no significant difference between physiotherapists' reported FOA statement provision in feedback or instruction scenarios. This may be related to several differences between our studies, including (a) the physiotherapist population, that is, Canadian versus Dutch physiotherapists and the subsequent education differences that may occur through their training; (b) the mode of measurement, that is, self-report questionnaire versus direct observation through video recording; and (c) the client population served by the physiotherapists, that is, various rehabilitation populations versus just clients recovering from stroke.

Perhaps what is more striking is that these findings occurred despite many of the physiotherapists (~71%) reporting being at least somewhat aware of the FOA literature. Notably, this is a marked improvement from the 53% of therapists in Zachariah's (2013) study who reported that they "either had no understanding of focus of attention in a clinical setting or had no knowledge of it at all." Such a finding makes one wonder if those who reported being more aware of the FOA principle also self-selected the EFOA statement more, and this was examined with a Spearman correlation analysis. In effect, there was no correlation between the respondents' self-reported awareness of the FOA principle and percentage dedicated to the EFOA statement across the six scenarios, RF-T_{ext}: $r_s(116) = -.004$, $p = .965$. This lack of correlation and nonconcordant findings between awareness of FOA and lack of application of EFOA statements could be due to the wording of our awareness question. Specifically, we failed to include the terms of internal or external focus of attention, and thus it is possible that the physiotherapists were considering other aspects associated with attention. Additionally, it is possible that the physiotherapists were aware of FOA principles but just not applying their knowledge in real or hypothetical practice. Indeed, a majority of the physiotherapists in Atun Einy and Kafri's (2019) work (79.6%) were aware of the FOA motor learning principle, yet they self-reported little consideration for whether to give instructions using an EFOA or IFOA. This possibility is also reinforced by Bramley et al. (2018) who collected data from instructors representing six Canadian physiotherapy schools. They stated that students likely did not have adequate opportunities to develop the skills of applying motor learning principles in clinical placements. Furthermore, they reported that the teaching of motor learning principles was limited to some content in the neurological curriculum unit and not covered in other units. Although these authors did not report specifically on FOA, it does imply that there is limited education on

motor learning principles across broader rehabilitation populations and a lack of application of the principles in experiential education practices. Thus, it is possible that even if physiotherapists are aware of the concept of FOA, they lack the skill for its application in practice. This could be even more pronounced outside of neurological rehabilitation, and presently, this is the population for which most of the observational studies have taken place.

The main purpose of designing the study-specific questionnaire was to determine if we would replicate the data shown by previous observational studies (Durham et al., 2009; Johnson et al., 2013; Kal et al., 2018; Zachariah, 2013). Certainly, these observational studies have the main advantage of direct observation in the physiotherapists' natural environment (Greenfield et al., 2007); however, limitations such as small sample sizes and restricted populations in the research to date (Durham et al., 2009; Kal et al., 2018; Zachariah, 2013) results in a narrow scope of understanding of the use of FOA statements in physiotherapy. This had us set the goal of tapping into a larger sample size and a broader clinical population base; we believe the sample of 121 physiotherapists and data in Table 2.1 supports that we met these goals.

We recognize, however, that there are limitations with the TPMLPQ that should be considered. First, only six FOA scenarios were included, thus representing a restricted range of rehabilitation exercises. Although including more scenarios could have improved the questionnaire's validity, we sought to keep the topic of interest unknown to the respondents by also including questions on a broader range of motor learning principles. As such, the goals were to include sufficient content to examine FOA statement provision but to keep the length of the questionnaire such that it could be completed in a reasonable timeframe. Regardless of this restricted use of scenarios, we did see variations in the relative frequency of EFOA statements selected across different scenarios, with the functional reaching task and pelvic squeeze

scenarios encouraging greater use of the EFOA option. These frequency variations imply that there are factors influencing the physiotherapists' decision making in regard to the use of FOA with their clients. Characteristics of the task may be an influencing factor. As an example, in the early years of FOA research, McNevin et al. (2000) suggested that an EFOA may be most beneficial in stages of rehabilitation where the focus is on functional retraining; similarly, Zachariah (2013) observed a trend for greater EFOA use by therapists providing instruction/feedback for functional compared with strengthening tasks. Further research which gains a better understanding of these types of factors is warranted.

A second limitation relates to the design of the six scenario questions, specifically the forced choice between a predetermined IFOA and EFOA option. From a practical standpoint, physiotherapists may actually provide different external or internal statements than the ones provided or may provide statements that are not classified as internal or external altogether; for example, mixed focus of attention or motivational non-attentional focusing statements. Despite this, our choice to force a selection between our predetermined options was done in order to maintain consistency across respondents, while also focusing directly on the IFOA to EFOA comparison often presented in the FOA literature. To minimize the above concerns, physiotherapists were included in the face validation of the scenarios and their relevant statement options.

A third limitation of the TPMLPQ relates to the number of response options presented to the participants in each FOA scenario. Specifically, the response design was modified from Zachariah's (2013) 6-point scale (0% – 100% in 20% increments) to a 12-point scale (0% – 100%, in 5% or 10% increments). Importantly, the switch in increments was done intentionally to avoid having a 50% option, and thus decrease the potential for "midpoint endorsement"

(Simms et al., 2019). Further, studies that advise against a large number of response options typically cite concerns with the human inability to form fine-tuned distinctions (Simms et al., 2019); however, the distinction between percentages, as used here, is exact rather than abstract, and thus we argue that the wide response option was likely not problematic. Finally, although we assessed face validity through both physiotherapists' and motor learning researchers' input, another limitation of the TPMLPQ concerns the lack of a deeper psychometric evaluation, such as test–retest reliability and content validity. We have no intent, however, to use the questionnaire as a measure of change in this research and would discourage others to use it as such at this juncture. Should such interest arise, further psychometric testing would be required.

Beyond the limitations specific to the TPMLPQ, there are limitations inherent with questionnaire-based studies in general. One key aspect is that there is evidence that what we say we do, via self-report, and what we actually do, can be discrepant (Neil-Sztramko et al., 2017). This was evidenced in Zachariah's (2013) research that found physiotherapists overestimated their provision of both externally focused feedback (perceived 53.3% vs. observed 10.2%) and instruction (perceived 68.0% vs. observed 26.7%). In light of Zachariah's data, it is possible that the questionnaire data reported here also overestimates the percentage of EFOA statements, further warranting the need for additional research to enable optimal translation of the EFOA benefit into physiotherapy practice. An additional limitation of our designed questionnaire was that the physiotherapists were unable to elaborate on the factors involved in their decision making associated with each scenario. It is clear that the physiotherapists responded differentially based on the scenarios that were being considered within the questionnaire; however, no insight was gained on why this occurred. Finally, although participants were asked to report on where they obtained their physiotherapy education, many respondents did not

provide details pertaining to the university or country; further, we did not ask participants to report on whether they had ever worked as a physiotherapist outside of Canada. As our study is focusing specifically on Canadian physiotherapists, the lack of these details presents a limitation of our findings as they could potentially alter the physiotherapist's responses.

2.6 Conclusion

To conclude, our larger sample of Canadian physiotherapists, which worked with a broader clientele than that used in previous observational studies, selected EFOA statements with lower frequencies than that of internal focus statements. While there are no clear recommendations concerning the relative frequencies that should be used by physiotherapists, and the variables that may impact on these frequencies, we argue that there is sufficient evidence in the motor learning literature (see a recent meta-analysis by Chua et al., 2021) to suggest that physiotherapists should be using a greater proportion of FOA statements with their clients. As such, our findings suggest that the benefits associated with the use of external focus statements has failed to translate into Canadian physiotherapy practice, despite the seeming awareness on the part of the sampled Canadian physiotherapists about the FOA literature. Research which seeks to gain more insight into the extent of physiotherapists' knowledge of the literature and why they preferentially use IFOA statements with their clients is recommended. We presume that there are barriers which impede the easy use of EFOA statements by physiotherapists and that more research is needed to understand these barriers and how to overcome them. In addition, the finding that two of the six scenarios generated greater EFOA use than IFOA suggests that further research is needed to understand the factors associated with the selection of the statements provided. Such lines of research could guide informed decisions for the creation of

911 evidence-based training programs in regard to the effective use of FOA in physiotherapy
912 settings.

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Chapter 3

Section 1: Article 2

Title: The path to translating focus of attention research into Canadian physiotherapy, Part 2: Physiotherapist interviews reveal impacting factors and barriers to focus of attention use

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3.1 Abstract

Although motor learning researchers have highlighted the benefits of adopting an external focus of attention (EFOA) for rehabilitation, studies have consistently revealed a low use of EFOA by physiotherapists. Consequently, the purpose of this research was to explore factors influencing physiotherapists' focus of attention (FOA) use and to gain insight into the barriers, and potential solutions, related to the effective use of EFOA. Eight physiotherapists, working in private practice with musculoskeletal rehabilitation clients, first completed the Therapists' Perceptions of Motor Learning Principles Questionnaire and then participated in virtual one-on-one interviews. The interviews followed a semi-structured interview guide and were analysed using a total quality framework approach to qualitative content analysis. Data showed that physiotherapists' FOA use was influenced by physiotherapist, client and task characteristics/experiences, as well as FOA statement provision strategies. Further, the main barriers discussed related to educational experiences, reinforcement of internal focus of attention statement use and aspects related to research. Solutions presented to these barriers included the incorporation of FOA content into the Canadian physiotherapy curriculum and continued education on FOA. Overall, these results advance our knowledge of factors underlying physiotherapists' FOA use and barriers that must be overcome to successfully translate the FOA research into physiotherapy.

Keywords: attentional focus, motor performance, motor learning, physical therapy, rehabilitation

3.2 Introduction

For over two decades, researchers have explored how manipulating a person's focus of attention (FOA) impacts motor performance and learning (see Wulf, 2013 for a review and Chua et al., 2021 for a recent meta-analysis). The typical research finding with healthy participants is that focusing on the effect of the movement (i.e., an external focus of attention; EFOA) leads to enhanced movement outcomes when compared to focusing on the body kinematics (i.e., an internal focus of attention; IFOA; Chua et al., 2021; Wulf, 2013). Similarly, a review of clinical studies examining FOA concluded that the EFOA benefit is also supported for individuals recovering from musculoskeletal dysfunction, yet more research is needed for other clinical populations, such as those with neurological disorders (Piccoli et al., 2018). Such findings suggest that the findings of the EFOA benefits for motor learning and performance would be, at a minimum, relevant for physiotherapy practice with those with musculoskeltal dysfunction. Indeed, physiotherapists Hunt, Paez and Folmar (2017) made an explicit call to action for the translation of FOA findings into physiotherapy.

Despite this call by Hunt and colleagues (2017), evidence from observational studies of physiotherapists in the United Kingdom (UK; Durham et al., 2009; Johnson et al., 2013) and Canada (Zachariah, 2013) have revealed low usage of EFOA by physiotherapits and minimal awareness of the attentional focus research. Additionally, another observational study of physiotherapists practicing in the Netherlands showed a similar low use of EFOA for feedback statements provided to clients, yet EFOA usage was higher for instructions (Kal et al., 2018). Kal and colleagues (2018) attributed the higher use of EFOA instruction statements by physiotherapists in their study, compared to those in the two UK observation studies, to a variety of factors, such as personal preferences and differences in educational training. No research, to

our knowledge, however, has explored those factors which influence physiotherapists' use of FOA, exposing a gap in the research. Moreover, all the observational studies, to date, consisted of small sample sizes (≤ 20 per study) and, with the exception of the Canadian study (Zachariah, 2013), the physiotherapists' client-base was solely individuals recovering from stroke.

More recently, addressing these small sample size and narrow client-base limitations of the research to date, a study-specific questionnaire (titled the Therapists' Perceptions of Motor Learning Principles Questionnaire; TPMLPQ) was administered to more than 120 Canadian physiotherapists who worked with a variety of client populations (Hussien & Ste-Marie, 2023). The TPMLPQ included a section with six exercise scenarios for which a physiotherapist could select a frequency to reflect their use of a statement which generated an EFOA versus one which generated an IFOA. The results revealed a low relative frequency of EFOA statement provision (*M* RF-T_{ext} = 31.3%, *SD* = 14.8), compared to IFOA, which occurred despite a majority of the sample reporting being at least somewhat aware of the attentional focus literature. Such findings continue to reinforce that researchers need to work towards bridging the gap between FOA research findings and application in relevant settings; a long-term goal of ours. Further, the results showed that the lower use of EFOA statements was scenario dependent as two of the six scenarios, specifically a pelvic squeeze scenario and a functional reaching scenario, garnered higher frequencies of EFOA compared to IFOA statements.

While Hussien and Ste-Marie (2023) addressed some of the limitations of the previous research, a drawback was that no information was garnered to better understand the factors related to the physiotherapists' FOA choices. Such information may help with the research gap already highlighted on why physiotherapists show low usage of EFOA overall and could also provide insight into the scenario-dependency results. Thus, the first aim of this research was to

explore factors influencing physiotherapists' use of FOA by recruiting a smaller group of physiotherapists to not only complete the TPMLPQ, but to also participate in an interview which included questions concerning their thoughts while completing the questionnaire and their perceptions on the results obtained by Hussien and Ste-Marie (2023).

A second aim of the research served to bring us closer to the longer-term goal of designing evidence-based training on FOA for physiotherapists. Stander, Grimmer and Brink (2018) recently published a scoping review of training programs that were designed to increase physiotherapists' use of evidence-based practice and clinical practice guidelines. In this review, they reported that better training outcomes were observed when those who were to undertake the training program were involved from the conceptual design phase. As such, they encouraged direct consultation with those who would undergo the training program, prior to program design, to ascertain context specific barriers and gain insight into strategies to overcome said barriers. With this in mind, the second aim of this research was to explore physiotherapists' perceived barriers to the effective use of FOA in physiotherapy, as well as potential solutions to these barriers. With the EFOA benefit being one of the most robust findings in the motor learning literature within the last 20 years, it is important to explore the factors that guide physiotherapists' use of FOA. Such knowledge could be used to assist in translating FOA findings into Canadian physiotherapy practice.

3.3 Methods

3.3.1 Participants

Eight physiotherapists (M_{age} = 35.6 years, SD = 10.8; $M_{experience}$ = 11.0 years, SD = 9.2; 5 women and 3 men) from the local region participated. Inclusion criteria required participants to be (a) working in a private clinic or institution, (b) working with persons with musculoskeletal

dysfunction and (c) fluent in the English language as the TPMLPQ and interviews were solely in English.[3] Ethical approval was provided by the university's ethics review board.

3.3.2 Materials and Procedure

Multiple recruitment strategies were used and, for each, participants were kept naïve to the fact that our specific research interest was on the topic of FOA. This was to avoid the possibility that the physiotherapists would research the topic prior to completing the first component of the research, that of the Therapists' Perceptions of Motor Learning Principles Questionnaire (TPMLPQ). The TPMLPQ sections of specific relevance here were the demographic (e.g., years of experience, client-base, etc.) and FOA sections (See Appendix B). The FOA section consists of six exercise scenarios in which physiotherapists are provided two statements (one promoting an IFOA and one promoting an EFOA). Respondents circle the percentage of time, using a Likert scale ranging from 0-100%, to represent the frequency they are likely to provide the statement. A constraint imposed is that the frequencies chosen for the two statements must total to 100%. In the awareness section, physiotherapists respond to their level of awareness for the FOA literature on a Likert scale ranging from 1 = not at all to 5 = extremely aware. Further, a response with 3 (i.e., somewhat aware) or higher, prompts the person to report on where they learned of the FOA concept (e.g., undergraduate/ physiotherapy/ continued education). Physiotherapists were provided with a link to the TPMLPQ by email and were asked to complete the questionnaire via SurveyMonkey within the 48 hours before their scheduled interview.

[3] Inclusion criteria for this study was set to have our interviewed physiotherapists represent the future sample of physiotherapists who would undergo our educational workshop. Specifically, for the workshop we are recruiting from private institutions and focusing on physiotherapists working with musculoskeletal rehabilitation clients, as the research has deemed this clinical population would benefit from an EFOA (Piccoli et al., 2018).

A semi-structured interview guide was used during virtual one-on-one interviews. The interview guide was initially developed using three pilot focus-groups. These pilot tests (n = 4-6 in each focus group) were conducted with a mixture of current and recently graduated kinesiology students. As recruitment was gearing up, however, the regulations concerning the COVID-19 pandemic required us to modify our data collection strategy to that of one-on-one interviews. Consequently, the interview guide was modified and a pilot test, using the updated interview guide, was conducted with one physiotherapist.

Interviews were conducted via the Microsoft Teams platform and, before the start of each interview, participants consented to the recording of the interview and the use of Fireflies a.i. transcription assistant. The interview session began with general information concerning FOA (e.g., the definitions of external and internal FOA), but the findings specific to EFOA typically being superior to IFOA was not yet shared. Following this, participants were asked to report on the thoughts they had whilst they were completing the TPMLPQ (Interview question 1). In the transition between questions 1 and 2, the physiotherapists were shown a PowerPoint slide with the overall results of the TPMLPQ from the sample of participants in Hussien and Ste-Marie (2023; Part one of this research) and were then queried as to their thoughts on why physiotherapists tended to select the IFOA statements more than the EFOA statements (Interview question 2). Next, a PowerPoint slide was displayed for the participants that showed the average relative frequencies of externally focused statements for each of the six scenarios from Part one of this research (Hussien & Ste-Marie, 2023); that slide showed that the frequency of EFOA statemets was dependent on the scenario in question, with two scenarios showing greater use of EFOA than IFOA and the other four showing the more typical pattern of a greater use of IFOA versus EFOA. The participants were asked to speculate on why those frequencies varied

(Interview question 3). Following interview question 3, information concerning the benefits of directing clients to an EFOA was shared with the physiotherapists and this transitioned into discussion about how our data showed that more IFOA was used than EFOA. From there, we asked the interviewee about potential barriers that physiotherapists face when trying to provide their clients with statements that promote an EFOA (Interview question 4), and then any potential solutions to address these barriers (Interview question 5).

Probe questions, such as "Can you explain exactly how that acts as a barrier?", were prepared to gain further clarification when necessary. As well, for the first four questions, prompt questions were created to promote discussion should a particular topic not have arisen (M = 1.8; SD = 0.8). The purpose of these prompts was to enrich the discussion given that collaborative insights, that could have arisen in focus group discussion, would not occur within this interview format. For the first two participants, much of the prompt questions were driven by topics reported in the literature (100% for P1; 50% for P2). For all subsequent interviews, excluding one literature derived prompt provided to P5, all prompt questions came from content stated by the previously interviewed physiotherapists. To maintain consistency in prompting across participants, the researcher selected topic prompts from a pre-set list. After each interview question, the researcher would ask, "Do you have anything else to add to this question" and only moved to the next question when participants indicated there was no new information to add.

3.3.3 Data Analysis

Descriptive statistics of the participants' TPMLPQ demographic information were calculated for (a) their personal and employment characteristics, (b) their relative frequency of externally focused statements across the six scenarios in the TPMLPQ, and (c) their awareness of the FOA motor learning research and where they obtained that awareness.

A total quality framework approach to qualitative content analysis was undertaken for the interview data (Roller, 2019; Roller & Lavrakas, 2015). Four researchers, consisting of two upper-level undergraduate students (LG, LS), a doctoral student (JH) and a professor (DSM), were involved in the development of the coding scheme and throughout the analytical process. The first step for the coding scheme was deductive such that code labels were taken from the relevant research on FOA in physiotherapy (Durham et al., 2009; Kal et al., 2018; McNevin et al., 2000; Zachariah, 2013). A codebook was then created that included the code labels, definitions and specific examples that could appear in the transcripts. The coding scheme further evolved through an inductive approach that arose from coding the four pilot test transcripts. This process resulted in new codes being added and a hierarchical structure of parent and child codes being created for existing codes (Forman & Damschroder, 2007); for example, the parent code category of client characteristics' included child codes such as (1) client's occupation, (2) client's athletic experience and (3) client's rehabilitation population. For all coding, the researchers coded the pilot transcripts independently and then met to gain consensus. This iterative process provided an organic environment such that the coding document continued to evolve throughout the coding development and analysis process.

The unit of analysis selected was a single physiotherapist interview. The same four researchers that developed the coding scheme were involved in the coding of each transcript. Consequently, the training of coders could be described as comprehensive as it consisted of (1) reviewing the foundational literature on FOA, (2) involvement in code creation through the pilot testing process, (3) continued study of the coding scheme, and (4) specific practice through coding the final pilot test that met with the conditions of this study. With exception of interview question 5, a coding template was used for all participants such that excerpts could be taken from

the transcript and inserted into the relevant code cell. This template also discriminated between excerpts of the transcript that were self-generated by the participant versus those that were elaborated upon following a prompt. Only excerpts of the transcript in which participants elaborated upon a prompt were used; i.e., a simple yes or no to a prompt was not counted.

For the first two participants interviewed, the transcripts were coded independently by four researchers (JH, LG, LS, DSM) and agreement amongst the coders was consistently strong, both in respect of assigning excerpts of the transcript to existing codes, as well as identifying when a new parent or child code was necessary. For the remaining interviews, two researchers continued to independently code each interview and meet for consensus. A third researcher (DSM) was included in all consensus meetings and served as a tertiary coder in the rare cases where consensus could not be reached by the two coders. Upon data saturation, as indicated by no new codes emerging across the last two interviews, two of the authors (JH, DSM) identified the broad themes of the cumulative data (Roller, 2019; Vaismoradi & Snelgrove, 2019).

Verification of the data was done through three processes. First, at the end of the interview, the researcher did a full summary of the discussion and physiotherapists were given an opportunity to confirm, change or add to any of their points. Second, during the coding process, we sought to identify deviant cases (i.e., statements that did not conform to the observed trend (Roller, 2019). Third, participants were provided with the coding scheme used to code their interview and given the opportunity to comment on whether we appropriately captured their interviews; three out of eight participants responded and verified our coding of the data as apt.

3.4 Results

3.4.1 Participants

The demographic information of the eight physiotherapists are presented in Table 3.1. All physiotherapists were working with more than one population, with the three main populations being orthopedic (100%), athletic (87.5%), and geriatric (75%) clients. On average, they completed the TPMLPQ 19.6 hours (*SD* = 16.3) prior to the interview which lasted between 45 and 90 mins (*M* = 68.8 mins, *SD* = 14.8). The physiotherapists' average relative frequency of EFOA statements across the six TPMLPQ scenarios (RF-T_{ext}) was 34.6% (*SD* = 9.8). Seventy-five percent reported being at least somewhat aware of the FOA literature (≥ 3; see Table 3.1) and these six physiotherapists reported one or more locations in which they gained this awareness: three reported gaining their awareness during their undergraduate degree, four during their physiotherapy Master's program and three during a continued education course. Figure 3.1 shows the average RF_{ext} for each of the six scenarios in the TPMLPQ for the sample tested here, as well as that of Hussien and Ste-Marie (2023; Part one of this research).

Table 3.1

Characteristics and TPMLPQ ata of the Interviewed Physiotherapists

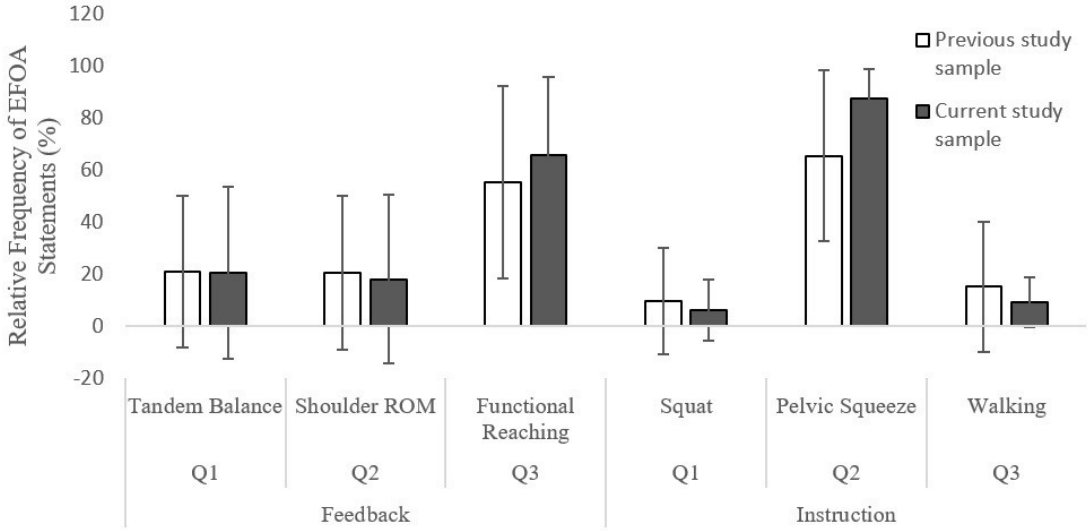
P#	Age	Gender	Years of Experience	Education	Work Schedule	Client Populations	RF-T_{ext} (%)	Awareness of FOA Literature[a]
1	59	F	28	U & MPT	PT	A, G, O	42.5	5
2	30	M	5	U & MPT	FT	A, G, N, O	50.0	3
3	29	M	4.5	U & MPT	FT	O	43.3	4
4	29	M	6	U & MPT	FT	A, G, O	34.2	3
5	27	F	2.5	U & MPT	FT	A, G, N, O	30.8	3.5
6	44	F	22	U	FT	A, G, P, O	29.2	1.5
7	33	F	10	U & MPT	FT	A, G, N, P, O	23.3	2.5
8	34	F	10	U & MPT	FT	A, O	23.3	3

Note. TPMLPQ = Therapists' Perceptions of Motor Learning Principles Questionnaire, P# = participant number, RF-T_{ext} = relative frequency of externally focused statements in total (i.e., across all six TPMLPQ questions), U = undergraduate, MPT = Master's in Physiotherapy, PT = part-time, FT = full-time. A = athletic, G = geriatric, N = neurological, P = paediatric and O = orthopedic.

[a] Awareness measured on 5-point Likert scale: 1 = not at all, 2 = slightly, 3 = somewhat, 4 = moderately and 5 = extremely aware.

Figure 3.1

Relative Frequency of External Focus of Attention (EFOA) Statements, as a Function of TPMLPQ Scenario: A Comparison of Our Current Sample of Physiotherapists to Our Previous Sample in Part 1



Note. TPMLPQ = Therapists' Perceptions of Motor Learning Principles Questionnaire. Previous study sample: $N = 121$; current study sample: $N = 8$. ROM = range of motion. Error bars represent ± 1 standard deviation.

3.4.2 Factors Influencing the Use of FOA

The results are presented in a pooled format across the first three interview questions. Three main themes were first generated by the two leading authors (JH, DSM): (1) characteristics and experiences of the physiotherapist, (2) characteristics and experiences of the rehabilitation client and (3) characteristics of the tasks performed as part of the rehabilitation process. These two authors then independently sorted the codes into the three themes and obtained 100% agreement for code classification. There were two codes, however, that did not fit within the three defined themes, but shared a common foundation and so, a fourth theme was developed: that of strategies related to the use of FOA. For brevity, the results will focus on those codes that were self-generated by two or more physiotherapists in each of the four identified themes (See Table A.1 in Appendix D for all codes, definitions and the associated

participant numbers of those who verbalized content that aligned with the code). A summary of the themes and categories of codes, as well as the number of physiotherapists who self-generated a code (n_{SG}) and the number who responded because of a prompt (n_P), are presented in Table 3.2.

Theme 1: Physiotherapist Characteristics/ Experiences. Educational experiences were spoken to most often within this theme. Contributing educational factors were learning indirectly through clinical practice and instruction and the focus on human anatomy and human movement kinematics within their education. To elaborate, physiotherapists highlighted that their physiotherapy studies focused on anatomical structures and movement kinematics, and that this body-oriented focus resulted in them having an increased use of directing attention internally that continued into their practice. In reference to curriculum, only one physiotherapist mentioned that concepts associated with FOA were explicitly taught in the physiotherapy curriculum, and when it was introduced, it was only within the neurological curriculum. Further, while there was no explicit reference to FOA use in their clinical educational training (e.g., laboratory experiences or placements), they reported that the instructions/feedback used by others was mainly body-oriented. These notions are well captured in a quote by P2 who stated:

> I don't think it was in our curriculum or anything like that. I think it's more from just experience. Maybe even just the experience of watching other physios in our clinical practice and seeing that's just the way, that's the way you ask someone to do something.

Physiotherapists also spoke to their own personal experiences outside of the educational system which led to a greater use of IFOA. Specifically, physiotherapists discussed their (a) personal history with athletics, (b) blending of personality and experiences that developed their use of IFOA, (c) specific experiences working as a physiotherapist, (d) intuition, (e) personal

experiences as a physiotherapy client and (f) preexisting beliefs in regards to FOA. An example of a preexisting belief was presented by P6 who stated:

> I don't know if this is correct, but I made a bit of an assumption somewhere in my practice that by giving an external cue, I'm drawing their attention away from the internal and then they may not then learn what it feels like, because I want them to able to go home and do it properly.

Theme 2: Client Characteristics/ Experiences. A dominant discussion point with regard to the use of FOA statements concerned the clients' characteristics, such as the clients' (a) kinesthetic awareness, (b) learner type, (c) rehabilitation population and (d) cognitive limitations. The relevant experiences mentioned were whether the client had (a) previous physiotherapy sessions, (b) athletic experiences and (c) specific occupational experiences. Here is an example quote from P2 to illustrate some of these factors:

> I think depending on the person's, activity level, their involvement in sport or not, their knowledge of human anatomy and physiology in general, their experience with physiotherapy is another big one. So, is this their first time at physio or first time doing exercise in general?

Overall, physiotherapists favored IFOA instructions/statements for clients who had a strong kinesthetic awareness, often gained through athletic experiences or previous physiotherapy experiences, and who responded well to internal prompting, assumedly because of their learning type.[4] On the other hand, physiotherapists indicated that the use of EFOA was more for clients with less kinesthetic/proprioceptive awareness and those who had cognitive

[4] One physiotherapist, identified as a deviant case, stated they would use EFOA statements with high level athletes performing very sport-specific skills.

limitations, such as older adults or those with neurological disorders. As an example of the kinesthetic awareness, P6 stated:

> If I can tell they're unaccustomed to feeling inside their body, say if they have a lot of pain or there's just some people that don't have a good kinesthetic sense, then I'll talk to them about moving the object versus moving their arm to move the object.

Theme 3: Task Characteristics. The two most common task characteristics mentioned were related to whether an external object was involved in the exercise (object manipulation), and whether the movement pattern was the essence of the task versus an end product of the movement (task goal). P6 provides an example of this, in which she stated that for a task like swimming, in which the individual cannot see the movement pattern, using IFOA instructions/feedback would be considered best to use (no object manipulation and movement pattern is essence of the task). For a task like throwing, however, wherein it may be more important to get the object thrown to a particular target, an EFOA could be used during exercises because an object is being manipulated and the end product (final location of ball as task goal) is a more important aspect of the task. Other task characteristics included the object's function within the task versus it being added as a component to the task (object functionality), the body regions involved in the task, and the extent of localization of the movement. A quote from P5 demonstrates some of these:

> … like if it's an upper body injury, say if we're doing just really isolation exercises first, like just moving one joint one direction, then I focus more on internal, but if we're doing more functional, like say lifting or carrying or something, that's more of like a combined compound task. I tend to kind of

focus on the object rather than, lift this arm here and do this, like kind of just focus on the overall outcome.

Theme 4: FOA Statement Provision Strategies. Two strategies were identified. The first, related to physiotherapists adapting their communication should the client fail to respond in the desired way. P6 shows this through this excerpt "I almost always give internal cues, very rarely are they external. I'll switch to an external if someone doesn't get it sometimes". In fact, this idea that the use of an IFOA was the 'go to' technique was stated by all physiotherapists interviewed. The second key point within this theme concerned their interest in their statements being easily understood and efficient. The pelvic squeeze exercise is a good example of this. In that case, the physiotherapists saw the phrasing 'squeeze the ball' as being an efficient statement that could result in the contraction of the many muscles that needed to be engaged.

3.4.3 Barriers to the Use of EFOA

The responses to the barriers question (Interview question 4) were classified into three themes with 100% agreement by the two lead researchers (JH, DSM). These themes were: (1) educational experiences, (2) reinforcement of IFOA prompting in physiotherapy practice and (3) research aspects. For concision, the results will only focus on codes that were self-generated by two or more physiotherapists (See Table A.2 in Appendix E for all codes, definitions and the associated participant numbers of those who verbalized content that aligned with the code). Table 3.3 presents a summary of themes and the coded categories, as well as the number of physiotherapists who self-generated a code (n_{SG}) and the number who responded to a prompt (n_P).

Table 3.2

Summary of Themes, Subthemes and Codes Related to Factors Influencing FOA Use

Theme		
Subthemes	**Coded Categories**	**Number who discussed code**
Theme 1: Physiotherapist Experiences/Characteristics		
Educational Experiences	Clinical practice/instruction	$n_{SG} = 4$ / $n_P = 1$
	Focus on anatomy/kinematics	$n_{SG} = 3$ / $n_P = 3$
Personal Experiences	Athletic History	$n_{SG} = 4$ / $n_P = 1$
	Developed statement provision style	$n_{SG} = 4$ / $n_P = 0$
	Physiotherapist experience	$n_{SG} = 3$ / $n_P = 0$
	Intuition	$n_{SG} = 2$ / $n_P = 2$
	Physiotherapy client	$n_{SG} = 2$ / $n_P = 0$
	Preexisting beliefs about FOA use	$n_{SG} = 2$ / $n_P = 0$
Theme 2: Client experiences/characteristics		
Client characteristics	Kinesthetic awareness	$n_{SG} = 6$ / $n_P = 0$
	Learner Type	$n_{SG} = 4$ / $n_P = 0$
	Rehabilitation population	$n_{SG} = 3$ / $n_P = 2$
	Cognitive limitations	$n_{SG} = 2$ / $n_P = 2$
Client experiences	Athletic history	$n_{SG} = 6$ / $n_P = 0$
	Occupational experience	$n_{SG} = 2$ / $n_P = 1$
	Previous physiotherapy experiences	$n_{SG} = 2$ / $n_P = 0$
Theme 3: Task characteristics		
	Task goal	$n_{SG} = 5$ / $n_P = 2$
	Object functionality	$n_{SG} = 3$ / $n_P = 1$
	Body regions involved	$n_{SG} = 3$ / $n_P = 0$
	Localization of movement	$n_{SG} = 2$ / $n_P = 2$
Theme 4: FOA statement provision strategies		
	Adapting to clients' successes and failures	$n_{SG} = 7$ / $n_P = 1$
	Statement efficiency	$n_{SG} = 7$ / $n_P = 0$

Note. n_{SG} = number who self-generated code, n_P = number who discussed code in response to a prompt. An n_P of zero does not indicate that no physiotherapists agreed with the ideas presented, rather, it means that the topic was never prompted or never elaborated upon when prompted.

Theme 1: Educational Experiences. The most prominent barrier theme was that of educational experiences, as supported by the fact that all eight physiotherapists self-generated discussion on this topic. Two physiotherapists did comment that they had gained some

knowledge of FOA during their education, yet they described themselves as lacking the skill to apply it in their practice. Most, however, reported little curriculum exposure to motor learning concepts in general, and if this content was introduced, it was in their neurological module; with the topic of FOA not explicitly covered. For example, P3 stated:

> Motor learning, for us at least, was probably more integrated in our neuro units, than it was in our like musculoskeletal units…like you obviously can apply these principles to any population, but I think you start to make those mental associations of like putting this with that.

At a more implicit level, the physiotherapists reported that their educational curriculum inherently promoted the use of an IFOA style: e.g., a strong focus on anatomy/body kinematics during movement. Implicit learning for the use of IFOA was also reinforced during their experiential learning, such as through clinical practice placements by observation of physiotherapists largely using internal prompting with their clients. To illustrate, P2 claimed "When you're on courses being taught by clinicians that you admire and value, when they teach that way [using IFOA], it kind of penetrates the way you instruct someone to do X or Y." As a final point, physiotherapists also commented on the lack of courses related to FOA following graduation.

Theme 2: Reinforcement for Use of IFOA Once in Practice. Perhaps not surprisingly, once physiotherapists begin their practice, they enter into a cycle that reinforces their use of IFOA with clients. For instance, they reported that their clients expected them to provide instructions that are specific to their body parts since they are "anatomy experts" as shown in the following quote by P6 "Because I'm the movement expert; therefore, I must like break down your movement and analyze it and give you [the client] that feedback in a very specific almost

academic anatomical way." Additionally, given their educational experiences, and other lived experiences, physiotherapists reported a natural, unconscious tendency to lean towards using IFOA; one physiotherapist theorized it may be a general human tendency, and another said that physiotherapists "are biased by their focus on anatomy". This natural tendency would become fortified and they reported being 'stuck in their ways' as a result of doing the same thing for so long. This sentiment was captured by P3 who explained "A lot of us, tend to favor external or sorry, internal cueing. And, as a result just don't practice external. It kind of feeds into that cycle, just continuing to use it.". Taken together, this reinforcement to use IFOA with clients after they have started their physiotherapy practice acts as a barrier to the use of EFOA statements.

Theme 3: Research Aspects. Although motor learning research is often published with recommendations for rehabilitation, physiotherapists in our study reported time and effort constraints as a barrier to accessing this research. They commented on the multiple demands in their life, such as their career, family, personal and social responsibilities. and how these competed with time related to keeping current with research. Another important piece that arose during the interviews revolved around physiotherapists' perceptions of the research. In detail, they highlighted their perceptions of a gap between the research and applied practice. Putting it quite bluntly, P7 stated:

> I am sure this isn't new to you, but some, like sometimes the evidence that we get, clinically doesn't show as well…The researchers can say like, yes, this is tested, this is a hundred percent what you need to be doing. It's like, well, in clinic, it doesn't like, it doesn't work that way.

Overall, physiotherapists spoke to the lack of "real world" considerations in research design and potential differences between typical research populations and their own actual clients and how this influenced their decisions on using such evidence to inform their practice.

Table 3.3

Themes, Subthemes and Codes of Barriers to EFOA Use

Theme		
Subthemes	**Coded Categories**	**Number who discussed code**
Theme 1: Educational experiences		
	Lack of knowledge	$n_{SG} = 8$ / $n_P = 0$
	Lack of awareness	$n_{SG} = 6$ / $n_P = 1$
	Lack of skill	$n_{SG} = 2$ / $n_P = 0$
Formal Education	General education	$n_{SG} = 8$ / $n_P = 0$
	Clinical practice/ instruction	$n_{SG} = 2$ / $n_P = 0$
	Lack of post-graduate courses	$n_{SG} = 2$ / $n_P = 0$
Theme 2: Reinforcement of IFOA use		
	Stuck in their ways	$n_{SG} = 4$ / $n_P = 0$
	Natural tendency	$n_{SG} = 3$ / $n_P = 1$
	Client expectations	$n_{SG} = 2$ / $n_P = 1$
Theme 3: Research aspects		
	Research-practice gap	$n_{SG} = 3$ / $n_P = 0$
	Time/Effort constraints	$n_{SG} = 3$ / $n_P = 0$

Note. n_{SG} = number who self-generated code, n_P = number who discussed code in response to a prompt. An n_P of zero does not indicate that no physiotherapists agreed with the ideas presented, rather, it means that the topic was never prompted or never elaborated upon when prompted.

3.4.4 Potential Solutions

When asked about potential solutions to the aforementioned barriers, all the responses shared the common theme of increasing physiotherapists' education on the use of FOA. Some suggestions involved presenting it within the physiotherapy Masters' courses, and beyond just the neurological curriculum. Specifically, P3 highlighted:

> If you had a little more motor learning in MSK [musculoskeletal], in neuro, in cardio- respiratory, I think it would stand to benefit those barriers. Because like again, in any setting you can have a lot of different types of patients and if you're

integrating it in those different areas as you're doing your placements, I think you become a more effective communicator and it makes you probably more likely to use different cues, based on the different scenarios that you're put in.

Similarly, other suggestions involved educating the educators, and clinical practice instructors, so that examples of EFOA instructions/feedback would be passed down to physiotherapy students implicitly. For example, P2 stated:

Maybe it's like from our educators and our clinicians…I think if everyone is aware that's the best strategy, then we can all make that shift and then it's passed down automatically in our implicit education.

All participants presented the idea of sharing the EFOA benefit with practicing physiotherapists through the design of continued education courses. Elaborating on this P1 said:

I think that most physiotherapists are very good students. I think that if you provide a forum of information, of education, of awareness of …research proof or physical proof, that would beneficial for sure. Running a course based on that, those principles.

Coming back to the time constraints barrier, there was encouragement for researchers to synthesize their work more effectively and to make it more practitioner-friendly. P7's statement is a good example of this.

Oftentimes there's a lot more to sift through [the research], than you have time to do. I would love something that's a bit more concise and just spits out all the facts and you can quickly, choose to browse through, areas of interest or areas that apply more to your practice.

3.5 Discussion

Overall, the objectives of the one-on-one interviews were three-fold. A first objective was to gain an understanding of the various factors that may impact the decisions regarding the use of FOA by physiotherapists, including those factors that may have been specific to the two TPMLPQ scenarios that garnered greater use of EFOA instructions/feedback. Second, we were interested in understanding the potential reasons why the larger sample of Canadian physiotherapists in Part 1 greatly favored IFOA statements on the TPMLPQ. The third, and final, objective was to gather physiotherapists' perceptions of barriers to EFOA statement provision and potential solutions to these barriers.

The collective information gathered from the physiotherapists helped address these objectives. Before elaborating, it is important to recognize that the TPMLPQ results were very similar for this smaller sample of eight physiotherapists as that of the larger sample of 121 physiotherapists from Hussien and Ste-Marie (2023; Part one of this research). That is, EFOA statements were selected with a lower frequency overall than IFOA and the same pattern of EFOA frequency variation across the six scenarios in the questionnaire were observed (see Figure 3.1). Consequently, we deemed this group of physiotherapists to be a representative sample from which to gain more insight into the factors that influenced responses on the TPMLPQ in Part 1, and more broadly on the use of FOA within physiotherapy and in responding to why physiotherapists favor directing clients to an IFOA.

In regards to the first objective, all four identified themes contributed information concerning the influencing factors associated with selection of FOA statements. To begin, the clients' characteristics and experiences were an obvious factor that influenced physiotherapists' decisions regarding statement selection in that they considered aspects related to their previous

sport/physiotherapy experiences, as well as clients' learner type and level of kinesthetic awareness. The fact that physiotherapists favored IFOA statements for clients with perceived higher levels kinesthetic awareness and who responded well to IFOA prompting aligns well with Kal and colleagues' (2018) results.

On this topic of client characteristics, physiotherapists stated that rehabilitation population could influence their decision and some reported themselves to be more likely to use EFOA with neurological populations. This finding may have occurred because motor learning principles have been reported to be taught almost exclusively in the neurological component of the Canadian physiotherapy curriculum (Bramley et al., 2018). A problem here, however is that there is insufficient evidence in the current research to recommend EFOA use for those with neurological disorders (Piccoli et al., 2018). Indeed, this has been recognized as one of the limitations related to EFOA benefits and more research is needed on the use of FOA with individuals with central nervous dysfunction .

The factors within task characteristics shed some light on understanding the varied levels of EFOA frequency across the scenarios of the TPMLPQ. As a reminder there were two scenarios which generated greater selection of the EFOA statement. The first scenario involved providing feedback to an individual reaching to put a glass on a table, where the glass itself was a functional element of the task requiring object manipulation: characteristics our sample of physiotherapists reported could lend itself more easily to the use of EFOA statements. Zachariah (2013) also reported on this trend for physiotherapists providing more external statements to clients performing tasks characterized by functional goals compared to strengthening tasks. The second scenario which resulted in more EFOA use, the pelvic squeeze, was also informed by task characteristics in that it was in a body region for which clients do not have much muscular

awareness and control. For this task, physiotherapists selected the phrasing of ‘squeeze the ball’ because they claimed it was a more efficient than saying ‘squeeze your knees together’. We argue that this is an example of how the themes can intersect; the strategy to provide efficient statements impacted on the FOA statement decisions for a task in which much instruction would be needed to describe many muscles to be used to execute the movements.

While these two scenarios led to higher levels of EFOA use, the other scenarios did not. Indeed, all physiotherapists reported a preference to commonly start with internal instructions/feedback and to only switch to using an EFOA if the client was not successful with executing the movement. Notable, however, is that prior to receiving the definitions for internal and external FOA at the start of the interview, our sample did not realize that directing a client’s FOA could have an impact on movement production and outcomes. This leads one to question whether they get to clearly evaluate the strategies they use, given they always start with an IFOA prompt. That is, physiotherapists may stay with using an IFOA technique and not consider trying EFOA, because the IFOA appears to be working. It is possible, however, that even better results could occur via the use of an EFOA orientation. In fact, physiotherapists in our sample specifically discussed this idea of being ‘stuck in their ways’ which simply feeds into the cycle of reinforcing their use of IFOA. Taken together, these findings lead to the recommendation for training that allows physiotherapists to consider alternative strategies of statement provision to that of IFOA, especially for tasks which do not include the manipulation of an object.

In terms of the second objective regarding the propensity for physiotherapists to direct their client’s towards an IFOA, we consider the findings related to the physiotherapists’ experiences to be of most relevance. The influences of their own experiences from sport, previous physiotherapy treatment, and education were pervasive. All of these, both through lack

of explicit content on FOA and implicitly learning from others, led to the increased likelihood that IFOA statements would be selected over the EFOA. Motor learning and performance research findings, however, consistently advocate for the provision of EFOA statement use (e.g., Chua et al., 2021; Wulf, 2013). Thus, we argue that there has been a failure to translate the FOA findings into physiotherapy settings and encourage the integration of information related to FOA as a topic in their education. Understanding the research findings in relevant clinical populations, and the associated limitations of EFOA benefits, will serve to assist physiotherapists in making informed clinical decisions.

These ideas were certainly reinforced when physiotherapists addressed the barriers, and potential solutions, associated with the effective use of FOA by physiotherapists. For example, the physiotherapists highlighted time constraints that interfered with them keeping current with research, and found the current research designs to have limited generalizability given the apparent lack of real-world conditions: both of which are barriers that others have mentioned in regard to practitioners adopting evidence-based practice and training programs. (Chan & Clough, 2010; da Silva et al., 2015; Scurlock-Evans et al., 2014).

While these research barriers existed, the more prominent barrier was related to the physiotherapists' educational experiences; specifically, that they received minimal, if any, instruction on how to effectively utilize FOA within their practice. This directly resulted in a lack of awareness, knowledge and skill in appropriately providing FOA statements. Such findings are reinforced by Bramley and colleagues' (2018) research. They interviewed institution representatives from Canadian physiotherapy programs and reported that curriculum content on motor learning was (1) mainly addressed in neurological units, (2) delivered primarily through didactic lecture formats and lacked practical training, and (3) only introduced within

approximately the last decade. Not unexpectedly, these educational barriers led to the presented solutions of introducing motor learning concepts within the physiotherapy curriculum, an idea in line with recent research in Brazil by Vaz and colleagues (2021), and/or designing and delivering continuing education workshops on key motor learning principles, like FOA.

Although both solutions raised by the physiotherapists would serve to bridge the gap between FOA research and physiotherapy practice, the next steps of this research will focus on a continued education workshop on FOA. The design and development of that workshop will be informed through the results found here. Overall, the workshop could serve to break physiotherapists' cycle of the consistent use of IFOA by (a) addressing knowedge gaps associated with the effective use of FOA, (b) providing research summaries in a format that is conscientious of their time contraints, and (c) providing practice opportunities for creating and delivering EFOA statements. In the context of that workshop, it would be important to highlight that not all situations necessarily yield EFOA benefits. Indeed, having physiotherapists understand its associated limitations is important as there is experimental evidence that suggests that an IFOA may be more beneficial when the task goal is hypertrophy of muscle (e.g., Schoenfeld et al., 2018). Additionally, Lohse and colleagues (2010) showed that an EFOA led to reduced EMG activity, yet a rehabilitation goal may actually be the increase in activation of a specific muscle, and so, an IFOA may be more beneficial in such situations.

3.5.1 Strengths and Limitations

The key strengths of this study are that we provided physiotherapists the opportunity to elaborate on the factors they considered when completing the TPMLPQ and, following recommendations by Stander and colleagues (2018), we sought insight into context-specific barriers from the population of interest (physiotherapists). There are limitations, however, that

should be recognized. The first limitation arises from the seeming contradiction between the high percentage of physiotherapists who reported being at least somewhat aware of the FOA literature on the TPMLPQ (> 70% for both Part 1 and 2) versus the responses in the one-on-one interview, in which only one of the physiotherapists remembered being explicitly taught concepts related to the use of external versus internal FOA statements. This contradiction may be due to the manner in which the awareness question was worded on the TPMLPQ, i.e., "How aware are you of the following principles that can affect motor learning?: How instructions and feedback statements can be used to direct individuals' focus of attention". As a result of not explicitly referring to an internal and external FOA, it is possible that physiotherapists interpreted this statement differently than we intended, resulting in an overestimation of their awareness of the FOA motor learning principle.

Other limitations to consider include the small sample size, the fact that the study participants were from a particular region in Southern-Ontario, and the narrow representation of physiotherapists working with musculoskeletal rehabilitation clients; together these limitations may limit the generalizability of the participants' insights. The final point is particularily relevant because the ease of EFOA use for different populations may be an important factor to consider. For example, it is possible that it is more difficult to provide EFOA statements for persons with musculoskeletal disorders because of the inherent connection to the specific muscles and joints being treated; thus, responses may have been influenced by this factor. Notably, targeting physiotherapists working with musculoskeletal clients was chosen with purpose due to the strong support from the FOA literature for that population. Nevertheless, it means that our findings may not generalize beyond this sub-population of physiotherapists.

3.6 Conclusion

Overall, this research has identified four themes that help to explain the factors that influence the manner in which FOA is used by Canadian physiotherapists. The intersections of the physiotherapist, client, and task work together to influence the frequency with which EFOA statements are used. The data suggested that a combined lack of explicit content in their curriculum concerning FOA, coupled with implicit learning of internal statement use, were the biggest contributing factors to the failed knowledge translation of EFOA benefits. These educational barriers, along with the reinforcement to continue to use IFOA prompting once practicing, and the identified research barriers, led the physiotherapists to propose educational change in the current curriculum and continuing education workshops. Echoing their recommendations, we also advocate for curriculum change at the degree level, however, as already noted, our more immediate interests lie in the latter recommendation provided. Specifically, we aim to begin to bridge the FOA research – physiotherapy practice gap through the design and delivery of an educational workshop for Canadian physiotherapists on the topic of FOA.

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Chapter 3

Section 2: COREQ Summary

Following publication of Part 2 of the research series (Hussien et al., 2023a), it was determined that the reporting of the one-on-one interviews was not in full accordance with the Consolidated Criteria for Reporting Qualitative Studies (COREQ; Tong et al., 2007) guidelines. In an effort to improve the completeness and transparency in the research reporting, the decision was made to summarize the reporting of the interviews relative to the 32 items on the COREQ checklist, and to elaborate on details that were not included in either manuscript Part 2 (former chapter section; Hussien et al., 2023a) or 3 (subsequent chapter; Hussien et al., 2023b). Resultingly, the following table reports the relevant section(s) in the manuscripts when applicable, and provides details for items that were not included in the published manuscripts. Finally, items that do not apply to the current research are marked as N/A.

Table 3.4

Relevant Article Sections, and Additional Details, for the 32-Item COREQ Checklist

No.	Item	Description	Section # or details
Domain 1: Research team and reflexivity			
Personal characteristics			
1.	Interviewer/ facilitator	Which author/s conducted the interview or focus group?	First author Julia Hussien 4.3.1. One-on-One Virtual Interviews – Methods and Procedures
2.	Credentials	What were the researcher's credentials? *E.g., PhD, MD*	Ph.D. candidate
3.	Occupation	What was their occupation at the time of the study?	Doctoral student
4.	Gender	Was the researcher male or female?	Female
5.	Experience and training	What experience or training did the researcher have?	Interviewer training took the form of conducting four pilot tests and receiving feedback

			on their moderation skills from the participants and thesis supervisor
Relationship with participants			
6.	Relationship established	Was a relationship established prior to study commencement?	No relationship was established prior to the interviews for a majority of the participants. However, one of the participants interviewed completed their undergraduate degree with the interviewer
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? *E.g., Personal goals, reasons for doing the research*	Participants were not made aware of the interviewer's goals or reasons for conducting the research prior to the interview. However, upon completing the interviews, personal discussions were held with four of the physiotherapists about the interviewer's career goals.
8.	Interviewer characteristics	What characteristics were reported about the interviewer/ facilitator? *E.g., Bias, assumptions, reasons and interests in the research topic*	Interviewer's long-term interest was to design, deliver and assess a focus of attention workshop. Interview questions related to workshop design (Article 3) were only to be posed to physiotherapists who self-generated the solution of a focus of attention workshop.
Domain 2: Study design			
Theoretical framework			
9.	Methodological orientation and theory	What methodological orientation was stated to underpin the study? *E.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis*	3.3.3 Data Analysis 4.3.1. One-on-One Virtual Interviews – Data Analysis
Participant selection			
10.	Sampling	How were participants selected? *E.g., purposive, convenience, consecutive, snowball*	Purposive sample of Canadian physiotherapists

			working with musculoskeletal rehabilitation clients 3.3.1 Participants 4.3.1. One-on-One Virtual Interviews - Participants
11.	Method of approach	How were participants approached? *E.g., face-to-face, telephone, mail, email*	Potential participants were contacted through email both directly, and indirectly through physiotherapy clinic managers. As well, social media posts (Instagram and Facebook) were made to attract potential interviewees.
12.	Sample size	How many participants were in the study?	3.3.1 Participants 4.3.1. One-on-One Virtual Interviews – Participants
13.	Non-participation	How many people refused to participate or dropped out? What were the reasons for this?	No participants dropped out once they expressed interest in being interviewed.
Setting			
14.	Setting of data collection	Where was the data collected? *E.g., home, clinic, workplace*	3.3.2 Materials and Procedures 4.3.1. One-on-One Virtual Interviews – Materials and Procedures
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	No one else was present in the interviews.
16.	Description of sample	What are the important characteristics of the sample? *E.g., demographic data, date*	The interviews took place between February 2021 and June 2021 3.4.1. Participants
Data collection			
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	3.3.2 Materials and Procedures 4.3.1. One-on-One Virtual Interviews – Materials and Procedures

18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	N/A
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	3.3.2 Materials and Procedures 4.3.1. One-on-One Virtual Interviews – Materials and Procedures
20.	Field notes	Were field notes made during and/or after the interview or focus group?	Throughout each interview, Julia Hussien recorded notes on the topics discussed broken down for each question. These notes were reflected back to the participants in a verbal summary provided by the interviewer at the end of each interview 3.3.3 Data Analysis 4.3.1. One-on-One Virtual Interviews – Materials and Procedures
21.	Duration	What was the duration of the interviews or focus group?	3.4.1. Participants
22.	Data saturation	Was data saturation discussed?	3.3.3 Data Analysis 4.3.1. One-on-One Virtual Interviews – Data Analysis
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	3.3.3 Data Analysis 4.3.1. One-on-One Virtual Interviews – Data Analysis
Domain 3: Analysis and findings			
Data analysis			
24.	Number of data coders	How many data coders coded the data?	3.3.3 Data Analysis 4.3.1. One-on-One Virtual Interviews – Data Analysis
25.	Description of the coding tree	Did authors provide a description of the coding tree?	3.3.3 Data Analysis 4.3.1. One-on-One Virtual Interviews – Data Analysis

26.	Derivation of themes	Were themes identified in advance or derived from the data?	3.3.3 Data Analysis 4.3.1. One-on-One Virtual Interviews – Data Analysis
27.	Software	What software, if applicable, was used to manage the data?	N/A
28.	Participant checking	Did participants provide feedback on the findings?	3.3.3 Data Analysis 4.3.1. One-on-One Virtual Interviews – Data Analysis
Reporting			
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? *E.g., Participant number*	3.4.2. Factors Influencing the Use of FOA 3.4.3. Barriers to the Use of EFOA 3.4.4. Potential Solutions 4.1.1. Interview Results
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	3.4.2. Factors Influencing the Use of FOA 3.4.3. Barriers to the Use of EFOA 3.4.4. Potential Solutions 3.5 Discussion 4.1.1. Interview Results
31.	Clarity of major themes	Were major themes clearly presented in the findings?	3.4.2. Factors Influencing the Use of FOA

			3.4.3. Barriers to the Use of EFOA 3.4.4. Potential Solutions
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	3.3.3 Data Analysis 3.4.2. Factors Influencing the Use of FOA

1641

Chapter 4

Section 1: Article 3

Title: The path to translating focus of attention research into Canadian physiotherapy, Part 3: Designing a workshop through consultation with physiotherapists and focus of attention researchers

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4.1 Abstract

Although researchers have consistently demonstrated the potential benefit of an external focus of attention for rehabilitation, research has shown that this finding has yet to be translated into Canadian physiotherapy. Further, specific barriers to external focus use have been reported by Canadian physiotherapists, and as a solution toward increasing physiotherapists' use of external focus, these same physiotherapists recommended the development of an educational workshop on focus of attention. Considering this, we describe herein the process of developing such a workshop which involved (1) gathering input from physiotherapists concerning content and format via one-on-one interviews and (2) engaging in discussion about content with focus of attention researchers. Analysis of the interview data featured key content for the workshop, the types of activities to include, and a recommended sequencing for the activities: specifically, sharing didactic information on focus of attention research, then providing instruction and demonstration of external focus use, and finally, finishing with opportunities for generating and delivering external focus statements. This input, along with that of the researchers, led to the development of a two-component focus of attention workshop which includes an asynchronous component, featuring seven self-directed learning modules, and a synchronous component which consists of a virtual group session.

Keywords: attentional focus, motor performance, motor learning, physical therapy, rehabilitation

4.2 Introduction

Research involving a broad range of tasks and populations has demonstrated motor learning and performance benefits from instructions/feedback that encourage the adoption of an external focus of attention (external focus to be used herein), which directs the person's focus to the effect of the movement, as opposed to an internal focus of attention (internal focus to be used herein), in which the direction of focus is on body muscles/joints related to execution of the movement (Chua et al., 2021). While much of the research is with healthy populations, external focus benefits have been shown to extend to clinical populations recovering from musculoskeletal dysfunction (Piccoli et al., 2018). These findings have supported recommendations for the use of external focus during rehabilitation (Hunt et al., 2017; McNevin et al., 2000), but, to date, observational studies of physiotherapists' focus of attention use have revealed consistently lower relative frequencies of external focus compared to internal focus statements (Durham et al., 2009; Johnson et al., 2013; Kal et al., 2018; Zachariah, 2013). Kal and colleagues (2018), however, did not show this same pattern for instruction statements; physiotherapists in their study provided more external focus instruction statements than internal focus. This difference in focus of attention use between instruction and feedback statements, however, was not shown in a questionnaire-based study with Canadian physiotherapists (Hussien & Ste-Marie, 2023). In that study, six hypothetical scenarios were presented that included the description of a task that could occur within varied rehabilitation settings (e.g., athletic, neurological, orthopedic), with three being instruction-based scenarios and the others feedback-based. Two statements were provided below each task description; one which promoted an external focus and the other an internal focus. The physiotherapists self-reported the percentage of time they would use the external focus vs the internal focus statement, with the restriction that

the two percentages had to amount to 100. Overall, both types of statement scenarios, i.e., instruction and feedback-based, showed the finding of low external focus use compared to internal focus. An unexpected finding, however, was that physiotherapists favored the external focus option for two out of the six scenarios, suggesting a potential scenario/task dependency in regard to focus of attention use.

Hussien et al. (2022) conducted a follow-up study, which consisted of one-on-one interviews with physiotherapists, to explore this potential task dependency and found that physiotherapists considered a variety of factors when responding to the scenarios used in the questionnaire. For example, external focus statements were more likely to be provided for movements which involved the functional manipulation of an object than those without an object. This same study also showed that physiotherapists identified a lack of information on focus of attention in their physiotherapy curriculum as a barrier that hindered the effective use of focus of attention in their practice. Accordingly, these physiotherapists recommended the development of focus of attention workshop to assist them in using evidence-based learning principles. Consequently, this next component of Hussien and colleagues' research concerns the development of an educational workshop on focus of attention. In moving forward with such a workshop, a review by Piccoli and colleagues (2018) was considered in which they concluded that focus of attention research findings for individuals recovering from neurological disorders (e.g., stroke, Parkinson's disease, etc.) were still inconclusive, yet the external focus benefit extended to individuals recovering from musculoskeletal dysfunction. Consequently, the focus of attention workshop of concern here focused its delivery for physiotherapists working with musculoskeletal rehabilitation clients.

Another key article which influenced the approach adopted for the workshop design was the systematic scoping review done by Stander and colleagues (2018) on training programs designed to improve evidence-based uptake and utilization by physiotherapists. These authors concluded that better outcomes from training programs were observed when a number of conditions were considered and made three recommendations for future studies, all of which we considered in the design of our workshop. First, we were attentive to having the workshop's methodological design guided by a strong foundation in behavioral change theory as well as the respective behavior change techniques, defined as "observable and replicable components of a behavior change intervention" (Michie & Johnston, 2012, p. 3). To this end, the lead and senior authors (JH, DSM) independently selected behavior change techniques that could reasonably be incorporated into the workshop, from Abraham and Michie's (2008) theory-linked behavior change taxonomy. A meeting was held to discuss their selections and through this process, the shared behavior change techniques selected had most aligned with Bandura's (1986) social cognitive theory (e.g., likely use of behavior observation, importance of increasing self-efficacy by increasing task difficulty, use of positive reinforcement etc.) and this was chosen as a guiding theoretical foundation. Additionally, we considered that our participants were adults with higher education, thus, principles of andragogy arising from Knowles' (1984) adult learning theory also served as a guiding foundation for development of the focus of attention workshop. Of note, these two theories have previously been used concurrently by others seeking to improve physiotherapists' use of research evidence to inform their clinical practice (Tilson & Mickan, 2014).

The next two recommendations followed from Stander and colleagues (2018), much in line with the principles of andragogy (Knowles, 1984), involved direct consultation with the

physiotherapists in the conceptual design phase of the training program to (1) gain their insight on key features desired for the workshop and (2) contextualize the workshop components to the population for which it would be delivered. Also considered was Stander and colleagues' (2018) finding that better training outcomes were achieved when varied types of activities were incorporated to ensure a multifaceted and interactive approach. Thus, in addition to the task dependency and barriers/solutions information garnered by Hussien et al. (2022), further questions had been posed in the one-on-one interviews held with those physiotherapists; questions that were used here to guide the development and design of the educational focus of attention workshop. Finally, in addition to the insights from the physiotherapists, we also sought input from focus of attention researchers to help inform the content for the workshop.

4.3 Methods

4.3.1 One-on-One Virtual Interviews

Participants. The data presented here arise from the same one-on-one interviews that were conducted by Hussien and colleagues (2022). Eight English-speaking Southern-Ontario practicing physiotherapists (M_{age} = 35.6 years, SD = 10.8; 5 women and 3 men) who worked with musculoskeletal rehabilitation clients were interviewed.[5] Ethics approval was obtained from the university's ethics review board and written informed consent was obtained from all participants.

Materials and Procedures. Each one-on-one interview was conducted via Microsoft Teams with verbal consent from each participant for the interview to be video recorded, through the Microsoft Teams desktop app (Version 1.5.00.33362), and transcribed using the Fireflies' a.i. transcription assistant (Google Chrome extension Version 2.1.8; Pro plan; https://fireflies.ai/).

[5] Further details of the participant characteristics can be found in Hussien et al., 2022.

The specific interview questions relevant to this manuscript were the last two questions of the interview guide used by Hussien et al. (2022) and immediately followed the questions related to the barriers to, and solutions for, the provision of external focus feedback and instruction. Within this segment of the interview, participants were first asked Question 1: “What would it take for me to get physiotherapists to participate in an educational workshop on the subject of focus of attention?”. Participants first gave their self-generated ideas and then specific prompts were used for any structural design features not mentioned by the physiotherapist. These features related to timing, length, format, reward, location, importance of credibility, scheduling, cost and group size of the workshop. Following this, participants were asked Question 2: “What elements or activities do you think we should do in that workshop, or even after the workshop is complete, knowing that our end goal is for physiotherapists to increase the frequency of using externally focused statements in their practice?”. Physiotherapists shared their own discussion points and then a maximum of three prompts (M = 2.5; SD = .53) were used to further discussion. These prompts came from a set list created in advance of the interview according to the literature on behavior change techniques; 25% of prompts used), and, subsequent to having started the interviews, prompts also came from responses given by previously interviewed physiotherapists (75% of prompts).

Throughout each interview, the lead author (JH) created three PowerPoint slides that summarized the physiotherapist’s input on the workshop design considerations (Slide 1) and the activities to include during (Slide 2) and before/after the workshop (Slide 3). Immediately at the end of their interview, the participant was presented with the slide summaries and asked to select their top three points on each slide. Finally, the lead author went through a verbal summary of

the entire interview and then asked the physiotherapist whether they wanted to add, remove or clarify any of their points.

Data Analysis. Prior to beginning the coding of the interviews, the lead author (JH) compared the AI generated interview transcript (Word document) to the respective participant's interview video recording to ensure its accuracy (minor adjustments were made as needed). For the content arising from Question 1, which asked the physiotherapists to share features that could attract them to a workshop, a coding template was created with rows identifying the structural design features (e.g., location, format, length, etc.). For each participant's data, the lead (JH) and senior (DSM) authors copied excerpts from the interview transcript and pasted them into cells of the coding template respective to the rows of the specific features discussed by the physiotherapist. Following the coding of each interview, the two authors met virtually to discuss the excerpts selected and the codes assigned in order to achieve consensus. Upon completing the coding of all the interviews, the discussion points that arose for each structural design feature were compared across all physiotherapists and considered for the final design of the workshop.

The data analysis of Question 2, which related to the specific activities the physiotherapists had recommended to be used within the workshop, was guided by the total quality framework approach to qualitative content analysis (Roller, 2019; Roller & Lavrakas, 2015). A coding scheme was developed, through both inductive and deductive approaches, to identify codes (i.e., specific elements, activities and/or behavior change techniques that would be used to capture and summarize the interviews). For the deductive component, a multistep process was followed to determine specific behavior change techniques that could be incorporated into workshop activities. First, all four authors completed online training related to the comprehension and coding of behavior change techniques in the behavior change technique

taxonomy version 1 (Michie et al., 2013; https://www.bct-taxonomy.com/). Next, the authors all independently reviewed the 93 hierarchically-clustered techniques in the behavior change technique taxonomy, and selected the behavior change techniques they considered most useful for the focus of attention workshop. A group meeting led to the consensus to include 26 behavior change technique codes. With the codes selected, a codebook was created that included the behavior change technique/code labels, their definitions and an example of how each could present in a transcript.

The inductive component arose from four pilot tests and data collection. The first three pilot tests consisted of focus groups that included four to six, current or recently graduated, kinesiology students. At this point in the process, an increase in restrictions resulting from the COVID-19 pandemic led us to alter our methodology from the planned focus groups to one-on-one interviews; thus, a final pilot test was done with a single physiotherapist. The transcripts of all four pilot tests were reviewed by the lead and senior authors (JH, DSM) to determine whether new codes needed to be included. Using a similar process, new codes were also generated from the interview transcripts of physiotherapists included in the current data collection. These inductive components resulted in the addition of four new codes to the coding scheme (see those marked with an asterisk in Table 4.2) and their respective definitions and examples to the codebook.

A coding template was used to copy excerpts from the transcripts into the relevant code cell that included rows for the individual codes, and one column for self-generated responses and another for those that resulted from a prompt (P). For prompted topics, the passage was only coded if the physiotherapists elaborated on the discussion, rather than simply agreeing. The coding of the transcripts was first conducted independently by the lead author (JH) and third

author (LS). Meetings were held to reach a consensus on the excerpts selected and their assigned codes, and the senior author (DSM) was consulted in the rare cases in which consensus was not achieved. No new codes were identified for either Question 1 or 2 within the final two interviews, and thus data saturation was assumed to be met after eight participants. Subsequent to coding, each participant was emailed their respective coding scheme and asked to comment on the accuracy of the coding; three of the participants replied and all responded the coding was fitting.

4.3.2 Session with Focus of Attention Researchers

To inform the content of the workshop, a virtual (Microsoft Teams) group discussion, led by the lead author (JH) and assisted by the senior author (DSM), was held with four motor learning researchers with focus of attention research experience: two long-standing researchers (>25 years) and two who were earlier in their research career (4-8 years). To ensure a wide breadth of perspective, none of the researchers were currently from the same motor learning research laboratory and each was from a different institution (one of whom overlapped with the authors of this manuscript at the time of the meeting and another who had been at the institution prior), with representation of two universities in the United States and two within Canada. Also of note is that one of the senior researchers had experience teaching in physiotherapy programs. Further, the researchers involved had research interests spanning postural control, complex skill learning, sport expertise, and meta-analytics to name a few; consequently, we believe the four researchers represent a wide array of experiences and knowledge related to focus of attention. In advance of the meeting, the following three questions were provided to the researchers: (1) "What are the seminal articles, and/or quality review articles, related to focus of attention, that physiotherapists should be guided to read?", (2) "What subtopics of focus of attention have been

researched with enough rigor to provide as 'guiding principles' to physiotherapists?" and (3) "What do you believe are the limitations of the external focus benefit?".[6] Following verbal consent, the session , which lasted roughly 90 minutes, was video recorded and notes were taken throughout the meeting by the lead author (JH).

4.4 Results

4.4.1 Interview Results

Workshop Specifications. The physiotherapists' views on the workshop specifications are summarized in Table 4.1.

Pick Top Three Activity. Summed across the participants, the key considerations were to build workshop credibility (n = 5), to be flexible in timing and consider evenings/weekends (n = 4), and to have some of workshop with in-person format and at a low cost (both with n = 3).

Elements to Include in the Workshop. In the interest of brevity, only codes that were self-generated by two or more physiotherapists are presented. Table 4.2 summarizes these codes from most frequent self-generated occurrence to lowest frequency. Beyond these activities, it was noted that a specific sequence was recommended; in particular, it was emphasized that didactic information on the research on focus of attention should be first communicated, followed by activities that provided instruction in a more active manner (e.g., demonstrations), and finishing with opportunities to practice in small groups that involved problem-solving activities or role-play.

[6] Note discussion of a fourth question, "What content do you think is better suited for the online versus in-person learning components?" was excluded from this report as the decision to go entirely virtual was subsequently made.

For example, P2 shared:

> I would assume that a review of the most recent literature would be a factor…That could be a didactic format. Like that can be the researcher sitting down and going through like just abstracts, just a quick review of kind of the latest motor learning research. That would be the first thing. And then secondly, maybe a simulation. So, whether that's the physio or the researchers showing that use in practice, and then like with maybe common physio exercises or common physio tasks. And then a practical component, where you buddy up with someone and your goal is to teach them for a few exercises. I think those three, so instructional and then model and then a practice session.

Table 4.1

Physiotherapists' Considerations for Workshop Specifications

Consideration	Physiotherapist's Discussion Points
Timing	- preference for evenings and weekends - suggestions to avoid summer months
Length	- no consensus - single long days or multiple short days - provide options to accommodate varying preferences
Format	- preference for in-person - openness to combination of both online and in-person components
Reward	- highlighting the value for their practice through marketing of workshop
Location	- no preference as long as there is necessary room, equipment and accessibility
Credibility	- inclusion of physiotherapists in development and delivery of the workshop
Participants	- appeal of having one's colleagues involved - new people for networking opportunities
Cost	- low registration cost - free workshop may not be perceived as credible[a]
Group Size	- sizes ranging from 10-20 participants depending number of instructors - even smaller groups may be beneficial as well

[a] we suggested offering a free workshop under the condition that they sign the consent form which highlights they will participate in all workshop components and assessments.

Pick Top Three Activity. Summed across participants, the most essential activities recommended to include were a review of the literature (n = 6), small group activities (n = 3), and, with a four-way tie for third, the inclusion of experiments, role-play, feedback opportunities, and individual activities (n = 2 for all). The key elements to include before or after the workshop were take home resources (n = 6), follow-up emails (n = 4) and additional resources (n = 4).

Table 4.2

Interview Codes for Elements and Activities to Include in the Workshop

Code Name	Number Who Discussed Code
Information on Focus of Attention	n_{SG} = 8; n_P = 0
Review of the Literature	n_{SG} = 7; n_P = 0
Pre/Post-Workshop Resources	n_{SG} = 7; n_P = 0
Behavioral Practice	n_{SG} = 8; n_P = 0
Role Play	n_{SG} = 5; n_P = 0
Coming Up with Examples	n_{SG} = 3; n_P = 0
*Group Activity Opportunities	n_{SG} = 6; n_P = 2
**To Foster Group Comfort*	n_{SG} = 3; n_P = 0
**To Establish Group Baseline*	n_{SG} = 2; n_P = 0
Instruction on Performing Behavior	n_{SG} = 6; n_P = 0
Pre/Post-Workshop Resources	n_{SG} = 5; n_P = 0
Problem Solving	n_{SG} = 6; n_P = 0
Demonstration of the Behavior	n_{SG} = 5; n_P = 0
*Gathering Data Post-Workshop to Improve Workshop or Assess Outcomes	n_{SG} = 4; n_P = 1
Credible Sources of Information	n_{SG} = 3; n_P = 3
Feedback on Outcomes	n_{SG} = 2; n_P = 2
Post-Workshop Assessments	n_{SG} = 3; n_P = 0
Graded Task Difficulty	n_{SG} = 2; n_P = 2
Practical Social Support from Instructors	n_{SG} = 2; n_P = 1
Feedback on Behaviors	n_{SG} = 2; n_P = 1
*Hitting Different Learning Styles	n_{SG} = 2; n_P = 1
Behavioral Experiments	n_{SG} = 2; n_P = 0
Behavioral Goal Setting	n_{SG} = 2; n_P = 0

Note. n_{SG} = number who self-generated discussion, n_P = number who discussed code following a prompt from instructor. Codes marked with an asterisk were added as a result of pilot testing and data collection rather than originating from the Behavioral Change Techniques (BCT) taxonomy. Italicized code names represent "child codes" (Forman & Damschroder, 2007) that emerged under BCT codes during the interviews.

4.4.2 Session with Focus of Attention Researchers

Discussions on all three questions resulted in much consensus between the researchers. Through this meeting we first determined the recommendations for key seminal and review articles to be included (i.e., Chua et al., 2021; Hunt et al., 2017; Kim et al., 2017; McNevin et al., 2000; Piccoli et al., 2018; Wulf, 2013; Wulf et al., 1998, 2001). Next, the discussion turned to specific topics related to focus of attention to include; specifically, the researchers suggested focusing the workshop discussions on the external focus benefits to the movement outcomes that are most relevant to physiotherapy (e.g., balance and efficiency) and sharing how focus of attention fits into the topics of a constraints led approach based in Newell's (1986) constraints model. As well, the researchers emphasized the importance of clearly differentiating between movement preparation and execution for the physiotherapists in the workshop, and sharing the research findings suggesting an external focus is most essential during the movement execution phase (e.g., Aiken & Becker, 2022). Further discussions during the session revolved around the disclosure of limitations related to the external focus benefits in the workshop. Particularly, the researchers suggested speaking to the inconclusive findings on the external focus benefit with neurological rehabilitation populations (Piccoli et al., 2018) and the idea that task goals in early stages of rehabilitation may actually benefit from an internal focus (e.g., hypertrophy; Schoenfeld et al., 2018), whereas an external focus may be most beneficial for functional movement goals more common in later stages of rehabilitation (McNevin et al., 2000). Additionally, as more general comments, the researchers recommended not to be too rigid in our messaging about beneficial focus of attention statements (i.e., external focus is not 100% effective), and to include messaging related to individual variability as well as the difference between clinical and statistical significance.

4.5 Research Outputs

4.5.1 Workshop Content

The culmination of the three sources of input (i.e., the physiotherapist interviews [PI], the motor learning researcher session [MLRS] and the theoretical foundations of social cognitive theory [SCT] and adult learning theory [ALT]) resulted in a two-component online workshop design with an asynchronous component, consisting of self-directed learning modules, and a synchronous component to be led by the lead researcher via a group Zoom session (desktop app Version: 5.13.3 (11494); Licensed Education account). Heeding the recommendations by Stander and colleagues (2018) to design training programs that are multi-faceted, and incorporate at least five elements, all activities self-generated by two or more physiotherapists during the interviews were incorporated into the workshop, as were the sources of content recommended by the motor learning researchers. The incorporated activities utilized a wide variety of resources (e.g., text summaries, videos and visual aids, hands-on experiments etc.) to adhere to recommendations by both the interviewed physiotherapists and ALT (Knowles, 1984) to hit different learning styles. Also, particular importance was placed on the elements determined to be the most essential through the 'pick your top three' activities.[7]

Asynchronous Content - Website Modules. In alignment with principles of andragogy in Knowles (1984) adult learning theory, the workshop incorporates a self-directed learning component that consists of seven online modules. Following recommendations from the interviewed physiotherapists, these modules will be accessible to participants both before and after the workshop, to act as an ongoing resource. Details about the content of each module, their

[7] Unfortunately, due to uncertainty around COVID-19 and potential restrictions, the suggestion to hold a component of the workshop in-person could not be honored.

purpose for inclusion and the associated influencing input source, that is physiotherapist interviews (PI), motor learning researcher session (MLRS), social cognitive theory (SCT) and/or adult learning theory (ALT), are summarized in Table 4.3. The website design features underwent three rounds of assessment for factors related to ease of navigation, visual appeal, and user-friendliness.

Table 4.3

Asynchronous Workshop Modules: Content, Purpose for Inclusion and Influencing Input Sources

Module Number	Module Content	Purpose(s) and Associated Influencing Input Source(s) (PI, MLRS, SCT, ALT) [a]
1	Operational definitions related to motor learning research and statistical analysis (1a) and differences between statistical and clinical significance (1b).	**PI & MLRS:** To develop a shared system of semantics.
2	10-minute video situating focus of attention in Newell's (1986) constraints model.	**PI & MLRS:** To begin the didactic sharing of focus of attention knowledge.
3	Summaries on five key focus of attention articles, access to the article pdfs and relevant links to related topics, much in the style of Wikipedia. As well as links to three additional articles they could explore.	**PI & MLRS:** To share key research findings in a way conducive to physiotherapists' time constraints.
4	Detailed descriptions of at-home experiments of which the physiotherapists are asked to complete at least two and to record their findings.	**PI & ALT:** To expose physiotherapists to the benefits of external focus through first-hand experiences.
5	Eight videos of varied practitioners in exercise or rehabilitation settings using external focus effectively.	**PI:** To provide instruction and demonstration of effective external focus instruction/feedback provision; **ALT:** to incorporate elements that mimic their real-world scenarios in rehabilitation; **SCT:** to incorporate opportunities for observational learning.

6	Images of common pieces of equipment, or items, that could be found in a physiotherapy setting, as well as two examples of an external focus statement (one instruction and one feedback) for each one.	**PI:** To provide instruction and demonstration of possible external focus instruction/feedback statements utilizing items accessible to physiotherapists; **ALT:** to incorporate elements that mimic their real-world scenarios in rehabilitation. **SCT:** to incorporate opportunities for observational learning.
7	An example of a case study and the subsequent task of creating and submitting one or more case studies to be used during their synchronous workshop.	**ALT:** To tailor the virtual workshop component to their interests as their case studies will be used in a synchronous workshop activity.

[a] PI = physiotherapist interviews, MLRS = motor learning researcher session, SCT = social cognitive theory (Bandura, 1986) and ALT = adult learning theory (Knowles, 1984).

Synchronous Content – Virtual Group Workshop. Three rounds of pilot delivery of the synchronous component of the workshop were conducted with upper-level undergraduate Human Kinetics students ($N = 20$ total), which refined the structure of the workshop. The activities comprising the synchronous component, their purpose for inclusion and the associated influencing input source (i.e., PI, MLRS, SCT and/or ALT) are summarized in Table 4.4.

Table 4.4

Synchronous Workshop Activities: Content, Purpose for Inclusion and Influencing Input Sources

Activity	Purpose(s) and Associated Influencing Input Source(s) (PI, MLRS, SCT, ALT) [a]
Introductions of the research team, followed by details on the background of the instructor.	**PI:** To promote credibility.
A review of the findings of Hussien and colleagues research to date (i.e., Parts one and two in this series) including Canadian physiotherapists' self-reported focus of attention provision, factors impacting their focus of attention provision and barriers to effective focus of attention use.	**PI:** To review the focus of attention concepts learned in the asynchronous component and to build credibility by showing the breadth of population-specific research that went into developing the workshop; **ALT:** To get physiotherapists thinking about factors that may moderate their focus of attention use and barriers they may face.
Interactive activities throughout review including discussions on their statement provision for a hypothetical scenario from the TPMLPQ and factors that influence their focus of attention use.	**PI:** To establish a baseline for the workshop group (and Canadian physiotherapy as a whole); **SCT & ALT:** To encourage self-reflection of their own experiences with focus of attention use.
A discussion on limitations associated with the external focus benefit and the goal of the workshop to increase their use of external focus instruction/feedback when appropriate.	**PI, MLRS & SCT:** To set realistic expectations and goals for focus of attention use; **MLRS:** To clearly differentiate (a) movement preparation and execution, (b) appropriate focus of attention use for early versus late rehabilitation goals and (c) limitations for neurological rehabilitation populations; **MLRS:** To emphasize concept of individual differences and necessity for flexibility in focus of attention use.
A discussion of the physiotherapists' experiences with the at-home experiments.	**PI:** To enable further discussion on the benefits and limitations of external focus and further establish a group baseline; **SCT & ALT:** To encourage self-reflection of their experiences with focus of attention in the experiments.
Participant introductions and work in small groups on external focus statement creation for a single case	**PI, SCT & ALT:** To provide opportunity to (a) foster group comfort, (b) collaborate, practice creating external focus statements, and problem-solve and (c) receive

study (with opportunities to ask instructors questions). Followed by a group discussion on external focus statements created and feedback on the activity.	practical social support and feedback from both peers and instructors; **SCT:** to provide opportunities to (a) receive positive reinforcement of behaviors, by instructors and peers, and (b) experience success and see peers succeed in external focus use, in order to promote self-efficacy.
Small-group role play to highlight physiotherapist-client interactions for three case studies (with opportunities to ask instructors questions). Again, followed by group discussion and feedback.	**PI:** To increase task difficulty by creating and then delivering external focus feedback/instruction; **PI, SCT & ALT:** To provide an opportunity to (a) problem-solve and use creativity to deliver external focus instruction and feedback for common movement errors, (b) receive practical social support and feedback from both peers and instructors; **SCT:** to provide opportunities to (a) receive positive reinforcement of behaviors, by instructors and peers, and (b) experience success and see peers succeed in external focus use, in order to promote self-efficacy.

[a] PI = physiotherapist interviews, MLRS = motor learning researcher session, SCT = social cognitive theory, ALT = adult learning theory and TPMLPQ = Therapists' Perceptions of Motor Learning Principles Questionnaire (Hussien & Ste-Marie, 2023).

4.6 Discussion

The objectives of this research were to gain insight from physiotherapists for the structure and design of an educational workshop on focus of attention, and from motor learning researchers on key aspects to be included in the content delivery of the workshop. In terms of the structure and design, physiotherapists desired credibility of the content and instructor, flexible timing and modes for the delivery of the workshop, and maintaining a low cost. Physiotherapists also suggested multiple forms of activities to be held during the workshop, in a specific sequence that moved from didactic teaching through to problem-solving and integrative role play. Finally, physiotherapists also shared the importance of providing take home and additional resources, and conducting a follow-up. The content recommendations from the focus of attention researchers informed the seminal articles used, the key aspects of focus of attention research to share, and the elements related to the limitations of our understanding of external focus benefits. Through

comparing tenets of different learning theories to behavior change techniques selected for our workshop, both Bandura's social cognitive theory (1986) and Knowles' adult learning theory (1984) were adopted as theoretical foundations for the design of the focus of attention. Consequently, additional elements were incorporated into the workshop design including self-directed learning opportunities, a case study creation task and interactive activities that granted opportunities for self-reflection.

4.6.1 Strengths and Limitations

The design process of the focus of attention workshop features several strengths that lead to confidence in the final product. First, we followed important recommendations generated by Stander and colleagues (2018) and have anchored the focus of attention workshop design within the theoretical foundations of social cognitive theory (Bandura, 1986) and adult learning theory (Knowles, 1984), as well we contextualized the focus of attention workshop to the specific population who would undergo the training, i.e., physiotherapists working with musculoskeletal rehabilitation clients. In addition to these recommendations, we also consulted motor learning researchers, with a wide array of focus of attention research experience, in a group session environment that promoted discussion and collaboration of thought.

There were also limitations associated with the current research. First, restrictions from the pandemic resulted in a switch from our originally planned focus group format with physiotherapists to one-on-one interviews, possibly resulting in less collaborative thought as a result. To mitigate this somewhat, prompts were used to encourage discussion on points that other physiotherapists had raised. An additional limitation concerns the small number of physiotherapists ($N = 8$) that were consulted for input on the workshop design. That being said, we believe that data saturation was achieved with no new information provided in the last two

interviews. Consultation with just four motor learning researchers is also a limitation, however, there was much agreement amongst the researchers for all questions posed.

Despite the limitations, this research has outlined a process to follow when developing a training program for physiotherapists, which includes: (1) assessing the current state of knowledge and implementation of the research by the target population to determine whether the training program is warranted, (2) gaining insight from the population of interest about their experiences with the concept in the real world, barriers to translation of the concept, and potential solutions to those barriers, (3) seeking input from the population of interest during the conceptual design phase of the workshop/training program to generate a number of relevant activities to ensure a multifaceted training program , (4) consulting with researchers to ensure translation of appropriate and relevant research findings into the specific area related to the training program, and (5) framing the workshop design within a theoretical foundation.

4.7 Conclusion and Next Steps

Motor learning researchers have long emphasized that findings from the focus of attention literature should lead rehabilitation therapists to use more external than internal focus statements with their clients (McNevin et al., 2000). Notably, physiotherapists have also advocated for this recommendation, publishing it alongside a review of the focus of attention literature (Hunt et al., 2017). Recent research demonstrates, however, that a higher frequency of external focus statements has not been achieved in physiotherapy practice (Durham et al., 2009; Hussien, & Ste-Marie, 2023; Johnson et al., 2013; Kal et al., 2018; Zachariah, 2013). Importantly, our workshop aim is not to get physiotherapists to deliver external focus statements 100% of the time; we acknowledge that clinical settings give rise to factors that do not necessarily exist within research settings. In fact, our own research has highlighted a variety of

physiotherapist, client and task characteristics that influence physiotherapists' use of focus of attention statements in their practice (Hussien & Ste-Marie, 2023). Nonetheless, the current use of external focus statements is low, and thus, our goal is to increase physiotherapists' awareness, knowledge, skill, and self-efficacy for more effective use of external focus statements. Our belief is that this will better inform them to make evidence-based clinical decisions for instruction and feedback statements; an outcome that we see as advancing the practice of, not only Canadian physiotherapists, but others who also take note of this research. Moreover, should the workshop show such changes, at a broader level, the research will provide a sound methodology for the design of other workshops on motor learning principles that could also serve to inform physiotherapy practice. Subsequently, our next research steps include the delivery and assessment of a focus of attention workshop to Canadian physiotherapists working with musculoskeletal rehabilitation clients.

4.8 References

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Chapter 4

Section 2: Theoretical Foundation for the Workshop Design

In order to meet with journal restrictions, only rudimentary information concerning the theoretical considerations given to the workshop design were provided in the article. Consequently, the purpose of this section is to provide more information on how Knowles' (1984) adult learning theory and Bandura's (1986) social cognitive theory were used to guide workshop design, as well as other considerations. To begin with the other considerations, recommendations by Stander and colleagues (2018) included ensuring that training programs for physiotherapists were multi-faceted in their design; thus, the workshop comprised a number of different activities, such as (1) written summaries of the key focus of attention articles, (2) videos situating focus of attention in Newell's (1986) constraints model and examples of external focus use in rehabilitations settings, (3) images of the at-home experiments, and physiotherapy equipment alongside examples of external statements using them, and (4) both written and verbal instructions for both practice opportunities in the synchronous group session. This diversity in delivery was anticipated to keep the participants interested and engaged with the material.

4.9 Knowles' Adult Learning Theory

Knowing that our target population was highly educated adults, the decision to incorporate suggestions from adult learning theory (Knowles, 1984) was made at the inception of this research. Each of the six core principles of adult learning theory were considered in development of the workshop design and are described next. Interestingly, these core principles overlapped well with the recommendations for training programs for physiotherapists (Schreiber et al., 2013; Stander et al., 2018) and the physiotherapists' input from the interviews conducted in Study 2 of this research series.

4.9.1 Core principle 1: Learner's Need to Know

Adult learning theory (Knowles, 1984) postulates that in order to undertake the learning process, adult learners first need to understand *why* they need to learn the information, *how* they will learn it and *what* they are expected to learn. As such, prior to beginning the asynchronous learning modules, physiotherapists were provided with a brief description of the external focus benefit so they understood why learning this concept could be beneficial. Also, the goals of the workshop were communicated so they understood the learning expectations. Further, to provide information on how they would learn, each of the asynchronous website modules began with a summary detailing what they would be learning and the approximate duration that would be needed to complete the module.

4.9.2 Core Principle 2: Self-Concept of the Learner

Adult learning theory (Knowles, 1984) advances the idea that adults possess a self-concept that makes them feel responsible for their decisions and learning, and thus recommends that occasions for adult learning should include opportunities for self-directed learning. As a result, the asynchronous website modules for the focus of attention workshop have been designed to be entirely self-directed. As mentioned, the expected time to complete each module was provided in order to aid in physiotherapists' decisions about when to progress through them based on their own schedules. In addition, within the practice opportunities introduced in the synchronous virtual group session, physiotherapists were provided with documents listing various case examples, and asked to select the ones they wanted to work on based on their own interests.

4.9.3 Core Principle 3: Prior Experience of the Learner

Another principle of adult learning theory (Knowles, 1984) is built on the premise that different life experiences lead to groups of adult learners that are more heterogenous. As such, learning programs should allow learners to draw from their own experiences in order to gain a better understanding of the material. With this in mind, several opportunities were introduced throughout the workshop to grant physiotherapists time to reflect on their own experiences and to share them with their peers. As an example, within the synchronous workshop component, interactive activities were included so physiotherapists could share, and compare, their general experiences on factors influencing their use of focus of attention statements. In addition, there was opportunity for them to share their own experiences with the at-home experiments they had selected when completing asynchronous Module 4. A final example is that physiotherapists were encouraged to draw on their own experiences and clients when they constructed a case-study during asynchronous Module 7.

4.9.4 Core Principle 4: Readiness to Learn

Knowles (1984) also proposed that adults' readiness to learn is best when the concepts can be immediately applied into their practice. The entire workshop was predicated on this important principle and was a main reason for having physiotherapists submit and work on case examples related to their own practice. Here, the desire was to ensure that physiotherapists were working with examples which applied directly to their practice.

The knowledge of this principle also impacted on the decision regarding the target population for the workshop. That is, I wanted to direct this workshop to those physiotherapists serving clients in which there was the most evidence that they would benefit from the use of external focus. Explicitly, physiotherapists were eligible to participate if they were currently

practicing with musculoskeletal rehabilitation clients, as this population of physiotherapists, and their respective clients, serve to benefit the most from learning about and applying an external focus in their practice (Hunt et al., 2017).

4.9.5 Core Principle 5: Orientation to Learning

Another tenet of adult learning theory (Knowles, 1984) is that adult learners gain motivation to learn through authentic learning experiences, and thus, suggests the use of activities such as case examples and problem-solving activities. Not surprisingly, these types of activities are also those which help learners to gain an understanding of how to apply their knowledge. The inclusion of the aforementioned case study submissions and the group practice activities held during the virtual group session directly fulfil this recommendation.

4.9.6 Core Principle 6: Motivation to Learn

The final core principle to consider is that adult learners are considered to be intrinsically, rather than extrinsically, motivated (Knowles, 1984). With that in mind, elements were incorporated in the workshop to encourage their sense of autonomy, competence and relatedness (Deci & Ryan, 2000). In detail, physiotherapists were granted opportunities for choice (e.g., what case example to work on, whether or not they wanted a break), feedback and positive reinforcement from both peers and instructors, and time to foster group comfort through introductions and sharing of experiences.

4.10 Bandura's Social Cognitive Theory

Social cognitive theory (Bandura, 1986) was identified as a viable theoretical foundation early in the research design by my supervisor and I. Our first step involved examining Abraham and Michie's (2008) taxonomy of behavior change techniques used in interventions, and their overlap with varied theoretical frameworks within the literature. Dr. Ste-Marie and I separately

identified which of the 26 behavior change techniques that were listed in that taxonomy had potential to be used in a workshop component with physiotherapists. Through this activity, social cognitive theory accounted for six of the eight strategies, and thus, we identified it as a viable theoretical framework. This decision was strongly reinforced following the one-on-one interviews with the physiotherapists. More precisely, the elements to include in the design of the workshop, put forward by the interviewed physiotherapists, continued to have considerable overlap with Bandura's (1986) social cognitive theory and thus, it was selected alongside Knowles' (1984) adult learning theory as a foundation for the workshop. The method in which the workshop activities relate to the constructs of social cognitive theory is defined next.

4.10.1 Reciprocal Determinism

Acting as the central tenet of social cognitive theory woven throughout the workshop, reciprocal determinism suggests a dynamic interaction among three factors: (1) individual (personal factors), (2) environment (physical surroundings, including other people) and (3) behavior (actions/words of person) (Bandura, 1986). These three factors are mutually dependent and work together to cause human action and changes in behavior. Within the broad context of the workshop (the environment), the physiotherapist (the individual) will learn about and get to practice providing external focus cues (the behavior). Embedded within the workshop were other factors tied to social cognitive theory that would influence the interrelatedness of these three factors.

4.10.2 Behavioral Capability

Within social cognitive theory, an individual's ability to perform a behavior is dependent on both their underlying knowledge (knowing what to do) and skill (knowing how to do it) (Bandura, 1986). Importantly, the focus of attention workshop was designed to address both of

these. Knowing what to do was addressed through dissemination of information related to focus of attention research findings and other content; i.e., operational definitions, didactic sharing of Newell's (1986) constraints model, and literature reviews in asynchronous Modules 1, 2 and 3, as well as a review of the research series findings and literature within the synchronous component. The 'knowing how' component was mainly addressed via observation of others' use of external focus statements and their own practice opportunities, with reinforcement, to promote the development of the skill of providing external focus instruction/feedback; i.e. videos demonstrating external focus use and examples of external focus statements using physiotherapy equipment in asynchronous Modules 5 and 6, along with the creation of external statements for a case example, and the subsequent role play of additional case examples, in the synchronous workshop component.

4.10.3 Observational Learning

A key construct of social cognitive theory is that individuals are social creatures who can learn through the observation of their peers' behavior, and the resulting consequence of those actions (Bandura, 1986). In accordance with the idea of "modelling" others' behaviors, physiotherapists participating in the workshop were granted opportunities to observe rehabilitation professionals delivering external focus statements successfully. A key consideration in the selection of these videos was that the tasks were being performed in a musculoskeletal rehabilitation environment. As a result, it is likely that participants were seeing successful external focus provision for tasks they perform in their own practice, by physiotherapists who they perceive to be similar to themselves, thus increasing the likelihood that they form an internal representation of the behavior. Additionally, during the synchronous

session, they had opportunity to witness their peers providing external focus statements first-hand.

4.10.4 Reinforcements

Tying into the reciprocal relationship between the behavior and environment, social cognitive theory proclaims that positive reinforcements, deriving from within the individual or externally from the environment, result in an increased likelihood of continuation of the behavior (Bandura, 1986). With this in mind, positive reinforcement was provided to physiotherapists by the instructors, alongside feedback, following their sharing of the external statements created in the practice activities. In addition, physiotherapists were encouraged to provide each other with positive reinforcement as they went through the group activities.

4.10.5 Outcome Expectations

Social cognitive theory identified that individuals perceive the anticipated consequences (outcome expectations) of a behavior, and that this determines whether they are likely to engage in the behavior (Bandura, 1986). In the context of this research, it is argued that the outcome expectation of the physiotherapist would be the perceived benefits to the client's rehabilitation progress as a result of their external focus provision. With this in mind, outcome expectations were considered through the provision of realistic goals for the workshop. Specifically, an external focus was not painted as a be-all-end-all, but instead as a tool for physiotherapists to develop and employ based on their own clinical decision making. Along this line, physiotherapists were also informed of the limitations of the external focus benefit and encouraged to engage in trial-and-error processes to determine which clients would benefit most from an external focus. That being said, outcome expectations were also increased by encouraging physiotherapists to partake in at-home experiments (asynchronous Module 4) in

order to hopefully experience the external focus benefit first hand, and thus be motivated to use it with their clients.

4.10.6 Self-Efficacy

The addition of the concept of self-efficacy differentiates social cognitive theory (Bandura, 1986) from its predecessor social learning theory (Bandura, 1969). Self-efficacy reflects an individual's confidence in their ability to perform a behavior and is influenced by both the individual and the environment, reflecting again the reciprocal determinism between elements. Within the design process of our workshop, physiotherapists were consulted to determine the barriers to external focus use in Canadian physiotherapy. Subsequently, the workshop was designed to specifically overcome several of these barriers. For example, physiotherapists reported a lack of time to access and read research as a barrier, so, Module 3 of the asynchronous component consisted of quick summaries of each of the "key articles" identified by our consulted focus of attention researchers. Further, physiotherapists reported using less external focus statements for exercises that did not include an external object; so, the synchronous workshop included information on the benefits of analogies and imaginary objects, that wouldn't require equipment, as well as examples of external focus statements using equipment on-hand in rehabilitation settings, and activities to practice creating their own. To further develop participants' self-efficacy, the workshop practice activities were designed to begin easier (i.e., working as a group to create external statements for a single case study) and then progress to more difficult (i.e., role play where individuals rotate through the responsibility of independently creating external feedback/instruction).

In sum, adult learning theory (Knowles, 1984) and social cognitive theory (Bandura, 1986) were interwoven to establish a strong theoretical framework for the design and delivery of

the educational workshop on focus of attention. The next chapter is the final part of the research series which involves the delivery and assessment of the workshop to practicing Canadian physiotherapists.

Chapter 5

Section 1: Article 4

Title: The path to translating focus of attention research into Canadian physiotherapy, Part 4: Sequentially linking assessment outcomes into a chain of evidence supporting the workshop

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5.1 Abstract

In previous research, Canadian physiotherapists identified barriers to effective external focus promotion and recommended the delivery of a focus of attention workshop as a solution. Accordingly, the current research entailed the virtual delivery of such a workshop, consisting of asynchronous website modules followed by a synchronous group session, to 15 Canadian physiotherapists working mainly with musculoskeletal rehabilitation clients. Assessment of the workshop outcomes was guided by constructs of social cognitive and adult learning theory, and organized based on the four levels of the Kirkpatrick model (KP1-Reaction, KP2-Learning, KP3-Behavior and KP4-Results). Specifically, participants received links to questionnaire packages at three time points; specifically, 1-week pre-workshop, immediately post-workshop and 1-week post-workshop. Results showed that participants (1) reported high satisfaction, engagement and perceived relevance of the workshop (KP1), (2) experienced significant improvements to their knowledge, skills, attitudes and self-efficacy from pre- to immediately post-workshop (KP2), and (3) self-reported increases to their external focus promotion in the week following the workshop (modified KP3), and perceived improvements to their clients' outcomes as a result of this external focus encouragement (modified KP4). Taken together, these results serve as a chain of evidence supporting the usefulness of the workshop in translating focus of attention findings into Canadian physiotherapy.

Keywords: attentional focus, motor performance, motor learning, physical therapy, rehabilitation

5.2 Introduction

Within the domain of research on motor learning principles, few have garnered as much support as the external focus of attention (external focus used herein) benefit. Namely, research has shown that adopting a focus on the outcome of a movement (external focus) leads to superior motor performance and learning when compared to focusing on the kinematics, or muscles/body parts, of the movement (an internal focus), or adopting no specific focus (Wulf, 2013). Although not all studies have found the external focus benefit, systematic reviews and meta-analyses have confirmed that the external focus benefit applies to a wide range of tasks for healthy and older adults (Chua et al., 2021) and individuals recovering from musculoskeletal dysfunction (Piccoli et al., 2018). Further, although the sample in the majority of the studies were healthy adults, meta-analyses do support the external focus benefit for outcomes essential to rehabilitation, such as balance (Kim et al., 2017), acute and long-term muscular strength (Grgic et al., 2021) and muscular endurance (Grgic & Mikulic, 2021).

Within much of the research highlighting the external focus benefit, suggestions are frequently made for its application in rehabilitation (e.g., McNevin et al., 2000); despite this, observational studies in the United Kingdom (Durham et al., 2009; Johnson et al., 2013), the Netherlands (Kal et al., 2018) and Canada (Zachariah, 2013) have all reported low provision of statements promoting an external focus on the part of clients by physiotherapists. As such, in 2017, Hunt, Paez and Folmar, who are themselves physiotherapists, made a specific call for the translation of the external focus benefit into physiotherapy practice. Consequently, As detailed in the title, the current research is part of a series in which the long-term goal involved translating focus of attention research findings into Canadian physiotherapy practice. As a quick overview of the series (further details can be found in Parts 1-3; Hussien & Ste-Marie, 2023; Hussien et al.,

2023a, 2023b), Part 1 sought to address limitations related to sample size and the narrow scope of the client-base used in the previous observational studies, as well as to expand the literature that examined whether Canadian physiotherapists also used a low frequency of statements encouraging an external focus. Consequently, a questionnaire, titled the Therapists' Perceptions of Motor Learning Principles Questionnaire, was designed and completed by 121 Canadian physiotherapists. Results confirmed a low provision of statements encouraging an external focus and a potential task-dependency on focus of attention use (Hussien & Ste-Marie, 2023).

Having confirmed that Canadian physiotherapists infrequently guide their clients towards an external focus, Part 2 of the series moved to a qualitative methodology that consisted of one-on-one interviews with eight southern-Ontario physiotherapists (Hussien et al., 2023a) to better understand factors influencing focus of attention use. Through those interviews, the physiotherapists stated that insufficient knowledge and awareness of focus of attention concepts, deriving from a general lack of motor learning content within their physiotherapy education, were the main barriers to external focus promotion in their practice. These findings aligned with research in Canadian physiotherapy programs showing that motor learning content was taught almost exclusively in neurological curriculums and only introduced within approximately the last decade (Bramley et al., 2018). Concerning solutions to these barriers, all physiotherapists made the recommendation to deliver a focus of attention workshop to practicing physiotherapists.

In heeding the recommendation forwarded by the physiotherapists, Part 3 of the series detailed the design process of the focus of attention workshop (Hussien et al., 2023b). This process was influenced by recommendations from Stander and colleagues (2018), as well as input from both physiotherapists and focus of attention researchers. Additionally, the workshop design was guided by the theoretical frameworks of social cognitive theory (Bandura, 1986) and

adult learning theory (Knowles, 1984). More specifically, we considered Bandura's propositions that providing opportunities to increase self-efficacy, knowledge and skill of a target behavior through social support, observational learning and reinforcement, should assist with behavior change. Further, in line with Knowles' (1984) adult learning theory, we took into account that the physiotherapists were adult learners who would thus respond well to independent learning opportunities, in which they could draw upon their own experiences, and for which the learning could be directly applied to their practice. The research outcome of Part 3 was a two-component online workshop designed with an asynchronous component, consisting of seven self-directed learning modules, and a synchronous virtual component led by the first author (Hussien). Notably, while the external focus benefit has been found to extend to musculoskeletal rehabilitation populations, the evidence for neurological populations is still inconclusive (for a review see Piccoli et al., 2018). For example, much of the research undertaken with neurological populations has been with persons recovering from stroke and while some research has shown advantages for adopting an external focus (e.g., Mückel & Mehrholz, 2014) others have not (e.g., Jie et al., 2021). Given this, the workshop was targeted for physiotherapists working mainly with musculoskeletal client populations.

The current work concerns delivery of the focus of attention workshop and its assessment, which was guided by the four levels of the Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2016). This multi-level assessment framework was used because it (a) aligned well with the theoretical frameworks adopted in our research, (b) served to set up a chain of evidence to address our varied research questions surrounding the workshop, and (c) has been used successfully by others for evaluation of physiotherapy training programs (Keogh et al., 2018). The first level of the Kirkpatrick model (KP1 Reaction; Kirkpatrick & Kirkpatrick, 2016) was

used to gauge the physiotherapists' reaction to the workshop and served to address the research question: "How do physiotherapists self-report their satisfaction, perceived relevance and engagement in the workshop?". It was assumed that a workshop that was met with satisfaction, and was deemed both relevant and engaging, would be more likely to translate to physiotherapists wanting to better understand and apply the concepts shared.

With that piece of evidence from the first level (KP1 Reaction), the second level (KP2 Learning; Kirkpatrick & Kirkpatrick, 2016) evaluated possible changes to the physiotherapists' learning as a function of the workshop, measured as their knowledge, skills, attitudes and self-efficacy. In this specific context, we asked "Does the workshop lead to increases from pre- to post-workshop on (1) test scores concerning content knowledge of focus of attention concepts (knowledge), (2) physiotherapists' ability to create instruction/feedback statements promoting an external focus (skill), (3) self-reported attitudes towards focus of attention use and (4) physiotherapists' self-efficacy for promoting an external focus despite being faced with various barriers?". Assessing self-efficacy is of particular importance, as studies have shown positive correlations between physiotherapists' self-efficacy and their knowledge (Vaz et al., 2021), and self-reported implementation of motor learning principles (Atun-Einy & Kafri, 2019).

In anticipation that positive changes in the physiotherapists' knowledge, skill, attitudes and self-efficacy would occur, the ensuing research question was to determine whether such outcomes led to behaviour change. For this third level of the Kirkpatrick model (modified KP3 Behaviors), we sought to gain an understanding of physiotherapists' perception of their own behaviour change (Kirkpatrick & Kirkpatrick, 2016) and included a measure to address "To what extent do physiotherapists' self-report an increase in their external focus promotion as a result of their participation in the workshop?". While, the focus of attention research has yet to define any

ideal amount of external focus provision by physiotherapists, previous findings show a fairly low percentage of its use by physiotherapists (Durham et al., 2009; Johnson et al., 2013; Kal et al., 2018; Zachariah, 2013). As such, the goal of the workshop was to simply increase the use of physiotherapists' statements which promoted external focus use by the client. At the final fourth level (modified KP4 Results), there was also interest in understanding the possible impact of this behaviour change on their clients' outcomes, thus, a measure was also included to assess "To what extent do physiotherapists' self-report a positive impact of their focus of attention behaviour change on their clients' rehabilitation outcomes?". In following Kirkpatrick & Kirkpatrick's (2016) model, these four levels of assessment are presented sequentially to allow for the development of a chain of evidence to support the potential effectiveness of the focus of attention workshop for physiotherapists currently practicing in Canada.

5.3 Methods

5.3.1 Participants

Fifteen physiotherapists provided their written informed consent, and then participated in one of five small group focus of attention workshops (2-5 per group). Inclusion criteria required participants to be (a) employed as a physiotherapist in Canada, (b) working with musculoskeletal rehabilitation clients in the week following the synchronous component of the workshop and (c) English-speaking as the workshop, and associated assessments, were only offered in English. Ethics approval was obtained from the university's ethics review board.

5.3.2 Materials and Procedure

A variety of strategies were employed to recruit physiotherapists, such as posting on key social media sites, email/phone communications to physiotherapy clinic managers in Ontario, and provincial/nationwide email distribution by both the Ontario Physiotherapy Association

(OPA) and the Canadian Physiotherapy Association (CPA) to their registered members. To keep participants naïve to the content of the workshop, to ensure adequate baseline measures, the workshop was simply promoted as a "free motor learning principle workshop". Interested participants contacted the lead author via email and all communications in preparation for the workshop were sent by email. SurveyMonkey was used to collect assessment data; to affirm completion of assessments and for data organization. Customized web collector links on SurveyMonkey were created for each participant, for each set of assessments.

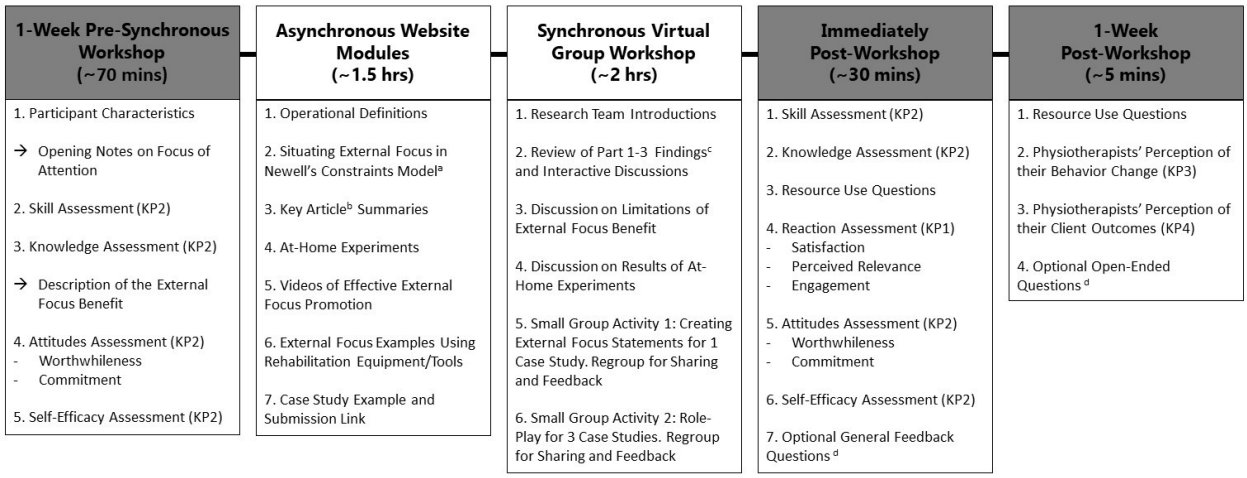
Study Sequence

The basic sequence of the study, elements of the two workshop components, assessments completed at the different timepoints and the respective Kirkpatrick Model levels are presented in Figure 5.1 (for details on the website modules and synchronous virtual group workshop components see Hussien et al., 2023b). Methodological details provided next are intended to supplement Figure 5.1. Further, while this section addresses the overall study sequence, the specifics of each assessment are presented in the next section.

One-Week Pre-Synchronous Workshop (herein referred to as pre-workshop). One week prior to the virtual group session, physiotherapists were sent (1) pre-workshop assessments (refer to Appendix F), (2) a website URL for the asynchronous website modules and (3) an asynchronous content checklist. They were instructed to complete the assessments before they began the website modules, and to have both completed before the synchronous virtual group workshop. Participants were asked not to access any external resources prior to completing the pre-workshop assessments.

Figure 5.1

Assessment Schedule Situated Around Asynchronous and Synchronous Workshop Components



Note. Dark boxes represent assessment delivery times. KP = Kirkpatrick, KP1 = Level 1 Reaction, KP2 = Level 2 Learning, KP3 = Level 3 Behaviour, KP4 = Level 4 Results. [a] (Newell, 1986); [b] (Chua et al., 2021; Hunt et al., 2017; McNevin et al., 2000; Piccoli et al., 2018; Wulf, 2013); [c] (Hussien & Ste-Marie, 2023; Hussien et al., 2023a, 2023b); [d] Secondary research questions not discussed in following chapter section on additional workshop outcomes.

The pre-workshop assessments included a demographic questionnaire in which participants provided information on their age, gender, years of experience in physiotherapy, client base, education, and perceptions of the extent to which their education focused on motor learning and whether their practice was guided by the current motor learning literature. To clearly establish that the upcoming questions on the knowledge and skill assessments were framed within focus of attention, opening notes were provided that situated the focus of attention within Wulf's (2013) dichotomy of internal versus external focus, with the caveat that we did not explicitly define the two categories. Following completion of those assessments, material was provided that included (1) the definitions of an internal and external focus of attention (i.e., a focus on the movement kinematics and a focus on the effects of the movement on the environment respectively), (2) researching findings supporting an external focus benefit, and (3)

limitations of the external focus benefit (e.g., inconclusive evidence with neurological populations) and the objectives of the workshop were outlined. Following this information, participants completed the attitudes and self-efficacy questionnaires. Participants then accessed the asynchronous website modules and used the asynchronous content checklist to record the time spent on each website module. Participants submitted the checklist to the lead author prior to the synchronous workshop component held on Zoom.

Synchronous Virtual Group Workshop. The synchronous component was moderated and timed by the lead author (Hussien). It was held one week after the pre-workshop materials had been sent. During the synchronous session, a PowerPoint presentation was used to guide the discussions and activities. At two different activity points in the session, Zoom breakout rooms were used to divide participants into groups of three.[8] The case studies submitted by participants as part of asynchronous module seven had been organized in two Google docs and shared with participants. For small group activity 1, physiotherapists were provided a single case study to work on together, whereas, for small group activity 2, they selected three case studies from a list provided and rotated through different roles (physiotherapist, patient and evaluator) in a role-play scenario. For both activities, they were instructed to generate as many externally focusing statements as possible and to record these on the relevant Google doc.

Immediately Post-Workshop (herein referred to as post-workshop)**.** The associated assessments for this time point are provided in Appendices G and H. While still in the virtual group session, participants were emailed links to complete the post-workshop assessments. They remained in the virtual session until all assessments were completed. The design of the

[8] When there were not enough participants to complete a group of three, one of the undergraduate research assistants (Khodko or Macdonald) joined the group to serve as a pseudo-patient. This occurred during three of the five workshops (two with $n = 2$, and one with $n = 5$).

knowledge assessment allowed physiotherapists to obtain feedback on their test performance. Physiotherapists were also informed that should they want to discuss any questions the lead author would remain in the video session. Upon completing the assessments, all physiotherapists received a certificate of completion for participation in the workshop.

One-Week Post-Workshop. The associated materials for this time point are provided in Appendix I. Participants were emailed a link to complete the one-week post-workshop assessments and asked to complete them as soon as possible. Follow-up email reminders were sent to participants who had not completed the assessments after 48 hours.

Assessments Used and Data Analysis

Resource Use. While the asynchronous content checklist served as a fidelity measure to determine that self-directed modules were completed, a checklist on additional resources participants may have accessed during the study was included post-workshop and 1-week post-workshop. For these, physiotherapists were asked to report any resources they used to improve their knowledge, skill or implementation of external focus in their practice by selecting all that applied from a list provided (e.g., discussions with coworkers, and YouTube videos or peer-reviewed articles other than those provided in the website modules), or reporting others; the asynchronous website modules were added to the list provided 1-week post-workshop to see whether physiotherapists continued to utilize them. The remaining workshop assessments are presented according to the four levels of the Kirkpatrick model for training program evaluation.

Level 1: Reaction. The study-specific reaction questionnaire was delivered immediately post-workshop and consisted of 27 total questions that assessed (1) their satisfaction with the workshop, (2) its perceived relevance to their practice, and (3) the level of engagement within the workshop. The questions were worded to align with the learner-centered approach

recommended in the Kirkpatrick Model Level 1 (Kirkpatrick & Kirkpatrick, 2016) and required participants to respond on a five-point Likert scale ranging from strongly disagree to strongly agree, with a "neutral" mid-point. As an example, physiotherapists were asked to respond with their agreement to the item "I was satisfied with the duration of the workshop". Physiotherapists were also asked about whether they understood the learning objectives of the workshop. For data analysis, Likert responses within the reaction questionnaire were converted to numeric values where strongly disagree = 1, disagree = 2, neutral = 3, agree = 4 and strongly agree = 5. Means for each subject per category (satisfaction, perceived relevance and engagement) were calculated for the asynchronous website modules, the synchronous virtual workshop, and across both. Results are presented as descriptive statistics.

Level 2: Learning. The concept of learning within the Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2016) incorporates a number of variables; applied here, it captured the participants' (1) knowledge of focus of attention concepts, (2) skill in creating statements to encourage an external focus, (3) attitudes towards learning and applying those concepts and (4) self-efficacy in using externally focusing statements in their practice. Prior to their delivery, the knowledge and skill assessments underwent face validation processes with motor learning researchers and physiotherapists, respectively (details available in Appendix J). All the learning measures were delivered both pre-workshop and post-workshop, and one-tailed paired sample t-tests were run to assess potential improvements between the two time points.

Knowledge Assessment. The knowledge assessment consisted of 23 questions: seven true/false, nine 'identification of the focus' for a given a statement, and seven multiple-choice questions. As an example of an 'identification of the focus' question, physiotherapists were asked to identify whether the statement "Keep a slight bend in your knees when you come up

from the squat" promoted an internal focus, an external focus, or was not a focus of attention statement (labelled as N/A). Notably, following a suggestion from a focus of attention researcher during the workshop design process, an "I don't know" option was presented for all questions; it was hypothesized that physiotherapists certainty in their responses would increase from pre- to post-workshop. The questions on the knowledge assessment were modified slightly from pre-to post-workshop in order to prevent physiotherapists from simply memorizing the answers. Importantly, however, the order and concepts covered in each question remained identical. As an example, in the pre-workshop knowledge assessment, a true or false question was worded as "Motor learning and performance research with healthy populations has shown that adopting an internal focus of attention leads to enhanced movement effectiveness" (false statement). Post-workshop, however, the word internal was switched to external, leading it to be a true statement (compare relevant sections of Appendices F and G for further examples). To prepare the data for hypothesis testing, each participant's number of correct and "I don't know" responses out of 23 were converted to percent correct and percent "I don't know" scores, for both assessment time points (pre- and post-workshop).

Skill Assessment. The online Canva design tool was used to compile eight skill assessment videos capturing either the correct movement form or three common errors, for one of four exercises: bird-dog, squat, plank, and lunge. Four of these videos were presented in the pre-workshop assessment and the other four post-workshop, such that at each assessment time point two of the videos showed exercises executed with correct form (participants' task was to provide instruction statements) and two showed the other exercises' common errors (participants' task was to provide feedback statements to correct error). To avoid practice effects, the exercises used were reversed from pre- to post-workshop, e.g., physiotherapists viewed

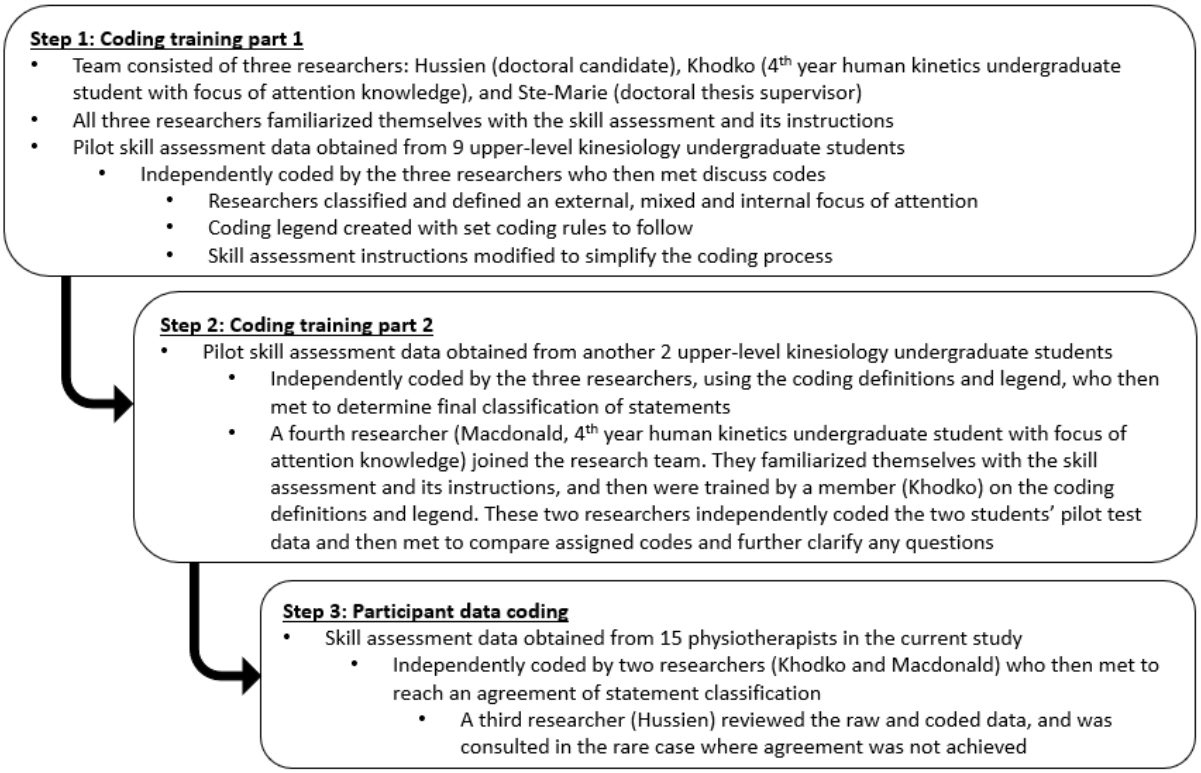
correct squat form pre-workshop and common squat errors post-workshop. Participants were tasked with creating as many externally focusing statements for each video as possible. As well, a photo of equipment/items commonly found in rehabilitation settings (e.g., TheraBand's, athletic tape) was provided during the assessment.

Prior to coding of the skill assessment data for the current study, the research team (Hussien, Khodko, Macdonald and Ste-Marie) participated in training which consisted of coding pilot test data (including both pre- and post-workshop skill assessment data), and then meeting to discuss the classification and rules of coding. The current study data was coded by two of these researchers (Khodko and Macdonald) with a third researcher (Hussien) consulted occasionally. These steps are outlined in further detail in Figure 5.2. The coding was performed using the following classification of statement type: (1) external focus = statements referencing movement outcomes without discussing any body components, (2) mixed focus = statements referencing movement outcomes and body components, and (3) internal focus = statements referencing movement kinematics/muscles/body parts. As well, the final coding legend included coding "rules" explicitly defined; for example, if a statement was repeated within a single video by the same physiotherapist, the second instance was not coded unless its wording caused it to fall into a different focus of attention category than the first occurrence.

For data analysis, the number of external focus, mixed focus, internal focus, and total focus of attention statements were calculated for each participant per video, and then summed across the four videos at the two assessment delivery time points (pre- and post-workshop).

Figure 5.2

Steps Involved in Training of Coders and Subsequent Coding of Skill Assessment Data



Attitudes Assessment. The Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2016) has separate assessments of attitude (perceived worthwhileness) and commitment, however as commitment is often viewed as the behavioral component of attitudes (Vaughan & Hogg, 2010), the scores from both the worthwhileness and commitment questions were combined into one "attitudes" measure. Thus, the attitudes assessment consisted of questions related to the physiotherapists' perceived worthwhileness and commitment related to focus of attention knowledge and its application. Physiotherapists responded on a continuous scale from 0 (not at all worthwhile/committed to) to 100 (extremely worthwhile/committed to) for the degree that they were (1) committed to gaining an understanding of focus of attention, and that it was worthwhile knowledge for their practice and (2) committed to promoting an external focus in

their practice, and that it was worthwhile to do so. For hypothesis testing, participants' responses to the four attitude questions, of which two captured worthwhileness and the other two captured commitment, were averaged to produce one data point per assessment time-point (pre- and post-workshop).

Self-Efficacy Assessment. The self-efficacy measure was developed in consideration of Bandura's social cognitive theory (1986) and his assertions concerning the importance of being able to overcome barriers that hinder desired behaviors. The six barrier items used were based on content gleaned from one-on-one interviews held with physiotherapists (Hussien et al., 2023a), associated with factors that influence focus of attention use in general and barriers specific to external focus promotion in practice. Specifically, the self-efficacy assessment asked physiotherapists to report their level of confidence (using a continuous scale ranging from 0 = not at all confident to 100 = extremely confident) in providing their client with statements to promote an external focus when: (1) the task is highly localized to a specific muscle group or joint, (2) their client doesn't initially appear to understand the external cue, (3) they feel the client expects them to cue internally, (4) their coworkers appear to be cueing their clients internally, (5) the exercise does not make use of an external object and (6) they have limited access to objects that can be used for cues to encourage an external focus. For data analysis, physiotherapists' self-efficacy for promoting an external focus were averaged across the six potential barriers to produce one data point per assessment time-point (pre- and post-workshop).

Modified Levels 3 and 4: Behaviors and Results. The Kirkpatrick Model (Kirkpatrick & Kirkpatrick, 2016) is typically used for training programs in business, which often have specific critical behaviors (e.g., making a certain number of phone calls) which, when done, should lead to specific results (e.g., a goal number of sales). Unlike the context of business, the

translation of focus of attention into physiotherapy is not as easily measured. For example, the appropriate focus of attention could vary from task to task or client to client, and attributing clients' movement outcomes specifically to the physiotherapists' focus of attention promotion would be difficult due to the dynamic nature of rehabilitation. Consequently, instead of attempting to objectively measure behaviour and results, as recommended in the Kirkpatrick model, physiotherapists were asked to self-report their perceptions of their own behavioral change, and its impact on their clients' outcomes one week following the workshop.

In detail, physiotherapists were asked to report, on a continuous scale from 0 (not at all) to 100 (extremely), to what degree they believed participating in the workshop allowed them to increase their use of statements promoting an external focus and, resultingly, to what degree they perceived their use of these statements improved the motor performance/rehabilitation progress of their clients. This latter question taps into the social cognitive theory construct of outcome expectations (Bandura, 1986); i.e., that statements encouraging the adoption of an external focus will be used if physiotherapists perceive better client outcomes arise from them. To assess this, participants who reported improvements to their clients' movement outcomes (i.e., reported a number greater than zero), were also asked to report to what degree (same 0 – 100 scale) they intended to continue to promote an external focus in their practice as a result of their perceptions of their client outcomes. Results for all three questions are presented as descriptive statistics.

5.4 Results

5.4.1 Participants

Individual characteristics of the participants are shown in Table 5.1.

Table 5.1

Individual Physiotherapist Characteristics

P#	Age	Gender (optional)	Years Experience	Client Populations	Highest PT Degree	Non-PT Degrees
1	28	M	2	A, G, O, P	M	B, M
2	32		8	O	M	
3	32		9	O	M	
4	41	F	9	A, G, O, P, N	M	M
5	58	M	35	G, O, N	B	
6	36	F	5	A, G, O, P, N	D	
7	66	F	43	A, G, O, P, N [a]	B	M
8	61		38	A, G, O, P, N	B	
9	36	M	9	A, O [b]	M	B
10	48	F	25	G, N [c]	B	
11	50	F	23	A, G, O, N	B	B, M
12	53	F	28	G, O, N	B	
13	40	M	15	A, G, O	M	
14	45	F	20	A, G, O	B	
15	41		15	G, N	M	

Note. M = male, F = female. A = athletic, G = geriatric, O = orthopedic, P = pediatric, N = neurological. B = Bachelor's, M = Master's, D = Doctorate. MLP = motor learning principles. [a] cardiorespiratory, mental health, and women's health; [b] persistent pain; [c] arthritis diagnosis.

5.4.2 Workshop Metrics

Thirteen of the 15 participants submitted their asynchronous content checklist and on average, they self-reported spending 92 minutes (*SD* = 35; Min = 51, Max = 145) to complete all seven website modules. The average time spent in the synchronous workshop component across the five groups was close to two hours (*M* = 117 mins, *SD* = 18; Min = 85, Max = 135). The physiotherapists received the SurveyMonkey links 1-week pre- and post-synchronous workshop, and completed the assessments roughly 3.7 days (*SD* = 2.5) before and 10.0 days (*SD* = 3.0) after the synchronous group workshop.

5.4.3 Assessments

Resource Use

Prior to the synchronous workshop, physiotherapists reported that they explored resources outside of those provided as part of the study. These included reading peer-reviewed articles (n = 2), discussions with co-workers (n = 2), YouTube videos (n = 1) and reviewing a motor learning and control textbook (n = 1). In the week following the workshop, physiotherapists again reported accessing peer reviewed articles (n = 2), discussing FOA with coworkers (n = 8), and three physiotherapists revisited the asynchronous website modules.

Level 1: Reaction

Participants reported high satisfaction, perceived relevance and engagement in both the asynchronous website modules and synchronous virtual group workshop. The median value, and associated range (*Min – Max*), for each category, are presented individually for the asynchronous and synchronous components, and averaged across the whole workshop (refer to Table 5.2).

Table 5.2

Physiotherapists' Self-Reported Reaction to the Focus of Attention Workshop (Kirkpatrick Level 1)

	Asynchronous Component (*AS*)	Synchronous Component (*S*)	Total Workshop[a]
	Median (Min – Max)		
Satisfaction[a]	4.20 (3.20 – 5.00)	4.70 (3.80 – 5.00)	4.60 (3.60 – 5.00)
Perceived Relevance[b]	4.67 (3.67 – 5.00)	5.00 (4.00 – 5.00)	4.83 (3.83 – 5.00)
Engagement[c]	5.00 (3.00 – 5.00)	5.00 (3.80 – 5.00)	4.83 (3.83 – 5.00)

Note. Physiotherapists' (N = 15) responses to 27 total items converted to strongly disagree = 1, disagree = 2, neutral = 3, agree = 4 and strongly agree = 5.
[a] five items presented for *AS* and 10 for S; [b] three items presented each for *AS* and *S*; [c] one item presented for *AS* and five presented for *S*.

Level 2: Learning

For all four variables of learning objectively measured, the means and standard deviations are presented in Table 5.3. Only the primary hypotheses, however, were analyzed; i.e.,

that physiotherapists would demonstrate improvements to their (1) knowledge assessment score and associated certainty in their responses, (2) ability to create statements promoting an external focus on their skill assessment, (3) attitudes towards learning and applying focus of attention concepts, and (4) self-efficacy in promoting an external focus in light of varying barriers. the test statistics and effect sizes for these analyses are presented in Table 5.3.

Table 5.3

Learning (Kirkpatrick Level 2) Results from 1-Week Pre- to Immediately Post-Synchronous Workshop

	Pre-Workshop	Post-Workshop	*p*-Value	Test Statistic	Effect Size
	Mean (SD)			*t*	*d*
Knowledge Assessment (/23)					
Correct Responses (%)	51.30 (22.30)	84.30 (11.5)	< .001	7.99	2.06
I Don't Know Responses (%)	23.19 (18.05)	1.16 (1.99)	< .001	4.94	1.28
Skill Assessment					
External FOA/Total FOA (%)	18.23 (13.17)	67.95 (25.13)	< .001	8.17	2.11
Mixed FOA/Total FOA (%)	30.29 (23.69)	24.41 (20.68)			
Internal FOA/Total FOA (%)	51.48 (28.60)	7.64 (18.46)			
Attitudes Assessment[a]					
Total	88.25 (11.00)	92.83 (6.59)	.024	2.16	0.56
Worthwhileness	87.33 (13.87)	93.00 (7.08)			
Commitment	89.17 (9.14)	92.67 (7.29)			
	Median (Min–Max)			Z	*r*
Self-Efficacy Assessment[a]					
Total	65.00 (0.00-93.33)	85.00 (66.67-100.00)	< .001	-3.33	0.86

Note. $N = 15$. *p*-values, *t*-statistics, and *d* effect sizes derived from one-way paired sample t-tests. Violation of normality assumption for self-efficacy scores resulted in reporting medians, ranges, *p*-value, *z*-score, and *r* effect size derived from a one-tailed Wilcoxon signed ranks test. FOA = focus of attention.

[a] Responses on a scale from 0 (not at all) to 100 (extremely).

Knowledge Assessment. One-tailed paired sample t-tests revealed that physiotherapists significantly improved their mean percent correct scores and decreased their mean percent "I don't know" scores from pre- to post-workshop (see Table 5.3).

Skill Assessment. It was suspected that physiotherapists may not spend as much time on the post-workshop skill assessment since it was delivered immediately after they spent roughly two hours in the Zoom session. Indeed, this was confirmed as a one-tailed Wilcoxon signed ranks test revealed that a significantly greater number focus of attention statements were generated by physiotherapists across the four videos pre-workshop (*Mdn* = 19; *Min* = 12, *Max* = 43) compared to post-workshop (*Mdn* = 11; *Min* = 7, *Max* = 16); $z = 3.27$, $p < .001$, $r = 0.87$ (nonparametric test used as data violated normality assumption). Consequently, rather than using the absolute number of statements as the dependent variable, a percent value was calculated (number of external focus statements/total number of focus of attention statements) and used to test the primary hypothesis as to whether the physiotherapists learned how to apply externally focusing statements. The pre- and post-workshop percent scores were analyzed with a one-tailed paired sample t-test. As noted in Table 5.3, the findings showed that physiotherapists significantly increased their mean percent of external focus statements from pre-to post-workshop. Simultaneously, the descriptives show that on average a reduced percentage of internal and mixed focus statements were used from pre- workshop to post-workshop.

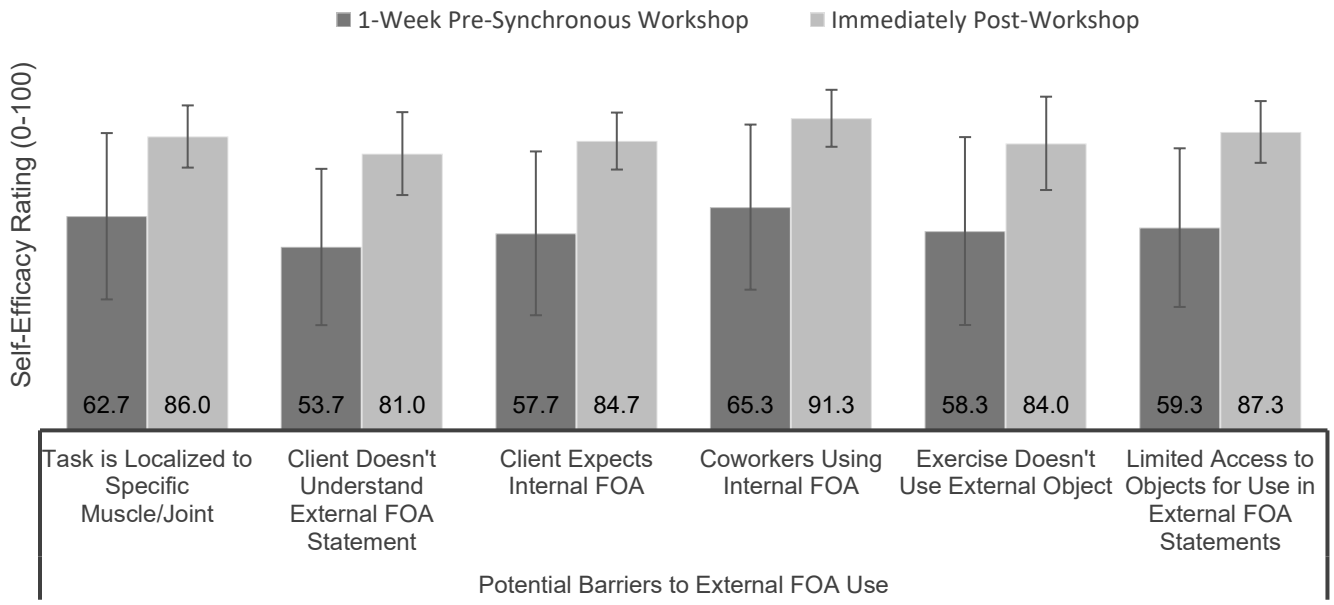
Attitudes Assessment. A one-tailed paired sample t-test revealed that physiotherapists significantly increased their mean attitudes score from pre- to post-workshop (see Table 5.3). Descriptively, both perceived worthwhileness and commitment showed increased scores between the two testing points.

Self-Efficacy Assessment. The data was found to violate the normality assumption so the non-parametric one-tailed Wilcoxon signed ranks test was used. This test revealed that physiotherapists' self-efficacy significantly improved from pre- to post-workshop (see Table

5.3). Physiotherapists' self-efficacy scores, specific to each of the six barriers, is presented for both pre- and post-workshop in Figure 5.3.

Figure 5.3

Physiotherapists' Self-Reported Self-Efficacy from Pre- and Post-Workshop



Note. Error bars represent ± 1 standard deviation. Values represent group means for $N = 15$. FOA = focus of attention. Self-efficacy rating on scale of 0 = not at all confident to 100 = extremely confident.

Modified Levels 3 and 4: Behaviors and Results

When asked to what degree participating in the workshop allowed them to increase their external focus promotion in their practice (scale of 0 = not at all to 100 = extremely), physiotherapists self-reported an average of 79.00 ($SD = 15.14$). When asked to what degree they felt that their promotion of external focus improved the motor performance or rehabilitation progress of their clients, two physiotherapists reported a zero, while the remaining physiotherapists ($n = 13$) self-reported an average of 68.08 ($SD = 22.13$). When asked to what degree they intended to continue to provide externally focusing statements to their clients based

on their current perception of its impact (0 – 100 scale), the thirteen physiotherapists self-reported an average of 87.31 (*SD* = 15.09).

5.5 Discussion

The final step of this research series was to deliver a focus of attention workshop and determine, on a preliminary level, whether it translated into physiotherapy practice, as defined by an increase in physiotherapists' promotion of external focus. Using key recommendations from review papers on past successful training programs for physiotherapists (Schreiber et al., 2013; Stander et al., 2018), the workshop content was informed by input from physiotherapists and motor learning researchers. Information from the physiotherapists' interviews also served to inform the mode of delivery and types of activities used within the workshop, which were grounded in the theoretical frameworks of social cognitive theory (Bandura, 1986) and adult learning theory (Knowles, 1984). Further, the assessment of the workshop was guided by the Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2016) such that a chain of evidence could be followed to determine whether the focus of attention workshop resulted in physiotherapists subsequently using more externally focusing statements in their practice.

Level 1: Reaction

The first step in the chain of evidence concerned the physiotherapists' reaction to the workshop. The findings revealed that the efforts to tailor the workshop to physiotherapists' needs, experiences and time constraints were worthwhile; participants agreed or strongly agreed to 96.8% of items related to satisfaction, perceived relevance and engagement. Additionally, physiotherapists reported that they understood the learning objectives for the workshop, and they thought about how the content could be applied in their practice. From an adult learning theory

perspective (Knowles, 1984), this suggests that their understanding of what they needed to learn and their reflections on their experiences likely both contributed to their engagement.

An additional factor to consider, before moving to learning outcomes of the workshop, is in relation to confirming whether physiotherapists in fact underwent the self-directed training as it had been prescribed. On this, the data from the physiotherapists who submitted their completed asynchronous content checklists strongly supported that they did indeed complete the self-directed modules. Moreover, all physiotherapists submitted case examples as part of the final website module, further reinforcing that all engaged with the asynchronous content. Further, during the synchronous workshop component, all attendees were directly involved throughout all activities, thus reinforcing that the physiotherapists underwent the full training program.

Knowing the positive reaction to the workshop, the next link in the chain was examination of the Level 2 assessments in the Kirkpatrick model's variables of learning (i.e., knowledge, skill, attitudes and self-efficacy; Kirkpatrick & Kirkpatrick, 2016).

Level 2: Learning

At an objective level, the workshop led to a significant improvement to physiotherapists' scores on the knowledge assessment (~51% pre to 84% post). As defined by social cognitive theory (Bandura, 1986), these results support the idea that participating in the workshop allowed physiotherapists to increase the component of their behavioral capability relating to "knowing of" focus of attention concepts. Moreover, there was a reduction in their uncertainty over their content knowledge as the "I don't know" response option was selected less than 2% of the time post-workshop, compared to almost 25% pre-workshop.

Keeping with the constructs of social cognitive theory (Bandura, 1986), and considering the behavioral capability component of "knowing how" to apply this knowledge, we turn to the

data from the skill assessment. Our results demonstrated that the percent of externally focusing statements provided by physiotherapists significantly increased from pre- to post- workshop by almost 50% (~18% pre to 68% post). Given there were three statement types, the reduction in the other two categories (internal vs mixed) may inform which statement type was most impacted. In this regard, it was noted that an approximate 44% reduction occurred for statements promoting an internal focus and only about a 6% reduction in statements promoting a mixed focus. Together this data implies that the significant improvement to external focus promotion derived mainly from a change in their use of statements supporting adoption of an internal focus rather than mixed focus. The use of statements encouraging a mixed focus was observed in previous observational studies of physiotherapists (Durham et al., 2009; Johnson et al., 2013; Kal et al., 2018), yet, to our knowledge, very little research has experimentally assessed the impact of adopting a mixed focus on motor performance or learning. One such experiment has been conducted by Scholl Schell et al. (2020), however methodological concerns with their experimental manipulation prevents an appropriate interpretation of their findings. Future research should thus continue to test the impact of mixed focus statements on motor performance and learning, compared to the typical external and internal focus conditions, to better understand their utility.

Moving to the attitudes measure, despite physiotherapists having reported high scores for their attitudes prior to beginning the asynchronous website modules (~88%), the scores were significantly higher post-workshop (~93%). From an adult learning theory perspective (Knowles, 1984), these findings provide a good indication that physiotherapists began their participation in the workshop with a readiness to learn, and carried that mentality forward during the workshop. In fact, responses to the resource use question showed that in the week following the

synchronous component, a majority of the participants (8/15) accessed resources, which included discussions with their coworkers on focus of attention, the workshop website modules, and/or additional focus of attention research articles. The fact that many shared their focus of attention knowledge with colleagues leads to the exciting possibility that the benefits of the workshop may extend beyond the fifteen participating physiotherapists.

The final measure within Level 2 was the physiotherapists' self-efficacy for being able to provide externally focusing statements to their clients, even when faced with certain barriers. The data showed that not only did physiotherapists significantly increase their average reported confidence from pre- to post-workshop, but this improvement was consistent across all six barriers (see Figure 5.3). Moreover, the fact that mean self-efficacy scores were in the 50-60% range pre-workshop reinforces that the scenarios proposed were perceived as barriers by the physiotherapists, reinforcing the findings of Hussien et al. (2023a). Considering our theoretical foundation in social cognitive theory (Bandura, 1986), the positive impacts of the workshop on the physiotherapists' self-efficacy should lead to increased use of statements encouraging an external focus in their practice. In fact, self-efficacy has been found to be one of the most consistent predictors of behaviors by healthcare professionals (Godin & Shephard, 1985), and has been correlated with greater knowledge (Vaz et al., 2021) and self-reported implementation (Atun-Einy & Kafri, 2019) of motor learning principles.

Overall, with the Level 2 learning variables all showing positive effects, the next part of the sequence was to explore whether there was a behavior change in regard to the physiotherapists' focus of attention promotion.

Modified Levels 3 and 4: Behaviors and Results

The one-week follow up showed that physiotherapists self-reported increasing their promotion of an external focus with their clients. It is recognized, that this one-week delay is not a lengthy time period, and future research would be needed to know if this behavior change would persist. Evidence that it may persist, however, could be taken from the physiotherapists reporting a fairly high degree of intention (87.5/100) to continue to provide statements to promote an external focus in their practice.

This intention to continue to promote external focus is tied to the fourth, and final, level of the Kirkpatrick model (KP4 Results; Kirkpatrick & Kirkpatrick, 2016), which typically details directly observable results produced by the training. For the current research, however, attributing a change in clients' rehabilitation outcomes solely to a change in physiotherapists' promotion of external focus was not viable, and so we assessed the physiotherapists' own perceptions of their clients' rehabilitation outcomes. Most of the physiotherapists (13/15) reported that their promotion of external focus benefited their clients, and to a moderately high degree (68.1/100). This perception of improved client outcomes is important when considering Bandura's (1986) assertions that a behavior will be repeated if reinforcement, from both internal and external factors, occurs. In this light, the perception of improved client outcomes as a result of statements encouraging an external focus could act as reinforcement for their continued use. It is worth noting, one of the two physiotherapists that reported no changes to their clients' outcomes, communicated "I haven't had much chance to apply external focus cueing in my practice yet, but I will strive to continue to try to apply it more frequently", and as such scored the question a 0 as a function of her lack of application of externally focusing statements. The other physiotherapist specified that they had only worked with clients with neurological or

cognitive issues and that no benefits were noted for these clients. It is perhaps not surprising that no benefits were observed for her clients given the conclusions of Piccoli and colleagues (2018), i.e., research findings on the external focus benefit are still inconclusive for these populations.

5.5.1 Strengths and Limitations

As with all research, there are areas of strength and limitations to consider. One key strength, in our opinion, concerned the use of the Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2016) multi-level assessment structure that contributed to creating a chain of evidence to lend credence to the usefulness of the workshop. The fact that the Kirkpatrick model aligned with our guiding theoretical frameworks was also of value. That is, framing the findings within the constructs of social cognitive (Bandura, 1986) and adult learning theory (Knowles, 1984) allowed us to not only provide theoretical underpinnings to the observed results, but also to consider predictions on how the results may extend beyond the short-term. Furthermore, there were specific strengths associated with the varied assessments used throughout. For example, care was taken with the language in all assessments to ensure that participants were responding specifically to changes as a function of the workshop (e.g., to what degree do you feel that participating in the workshop has allowed you to increase your use of an external focus in your practice?). Additionally, for the physiotherapists' reaction (satisfaction, perceived relevance and engagement) and learning (knowledge, skill, attitudes and self-efficacy) measures, multiple items were used to tap into the construct. For example, for the satisfaction section of the reaction measure, rather than asking "were you satisfied with the workshop?", physiotherapists were asked to report on their agreement with five statements for the asynchronous modules and 10 for the synchronous session.

The preparation done prior to delivery of the workshop could also be considered a strength. As one example, the pilot testing of the workshop components allowed us to provide the physiotherapists with accurate timing estimations for the website modules and the virtual group session, and informed the writing of our instructions for the skill assessment to simplify the coding process. Finally, although physiotherapists interviewed in earlier stages of this research specifically recommended in-person delivery of the workshop (Hussien et al., 2023a), the COVID-19 pandemic led to a shift to virtual delivery of the asynchronous and synchronous components. While this likely changed the dynamics of the workshop delivery, it may have been a strength considering that it allowed for easier scheduling of the workshop (no concerns around the commute/parking etc.) and a wider reach as physiotherapists did not have to be local. We recognize, however, that online delivery of the asynchronous content did not allow for monitoring of participants' engagement with the modules.

Notably, there are also limitations of the current research, the largest of which relate to the assessment of levels 3 and 4 of the Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2016). First, we were not able to follow the direct observation technique recommended by the Kirkpatrick model. Despite this, given there is no "ideal" amount of external focus promotion in physiotherapy practice, we believed that using the physiotherapists' perceptions of their behavior, and its impact on their clients, still provided insight on the impact of the workshop. Second, physiotherapists reported on these perceptions, on average, within 10 days following the workshop, thus, we are unable to make conclusions about the longer-term persistence of the current study findings; a question that we think needs continued research. Future research observing the longer-term impact of such a workshop should also consider employing "required drivers", which are "processes and systems that reinforce, monitor, encourage, and reward

performance of critical behaviors on the job" (Kirkpatrick and Kirkpatrick, 2016), to further promote the translation of physiotherapists' intention into behavioral changes. Finally, based on decisions made with the consulting group of motor learning researchers (see Hussien et al., 2023b), the current workshop focused only on the basics of the focus of attention concepts for which there is an evidence base within clinical populations. More research is needed, however, to better understand why external focus yields a benefit for certain populations and/or tasks yet does not (or internal focus is better) for other populations/tasks. With such evidence, motor learning researchers will be better able to work with key stakeholders to translate motor learning knowledge into practice. Indeed, a promising direction may be within Gottwald et al.'s (2023) propositions to conceptualize focus of attention within an ecological dynamics framework.

Further limitations were associated with the study design and sample. To start, the current pre- post-workshop design is quasi-experimental and lacks a control group, limiting interpretations of the impact of the workshop on the outcomes. To minimize this limitation, as mentioned above, wording of the questions were designed to specifically link the outcomes to the workshop. Other limitations relate to potential bias in the sample. Specifically, participants self-selecting themselves into the study may indicate they were highly motivated to advance their knowledge on the topic from the start (Tarquinio et al., 2015). In fact, this was demonstrated by their willingness to complete roughly 5.5 hours of work for the study, and their very high pre-workshop scores for both perceived worthwhileness and commitment to learning and applying focus of attention concepts in their practice. As a result, the current findings may not generalize to physiotherapists who are less motivated to engage in workshop components and assessments. Further research on factors needed to include less-motivated participants is recommended.

As final points of consideration, even though the nature of our topic is not sensitive, our data is still susceptible to social desirability bias if participants believed certain outcomes would be viewed favorably by the researchers (Althubaiti, 2016). This was a concern for the current study as physiotherapists were asked to self-report their perceptions of their behavior change and its impact on their clients' rehabilitation outcome. To offset this limitation, physiotherapists were reassured that there were no right or wrong responses and asked to be honest in their completion of assessments. Another limitation, inherent to using self-report measures, is the potential for discrepancies between 'what we do' and 'what we say we do' (Neil-Sztramko et al., 2017). As such, restraint is needed in regard to the use of physiotherapists' self-perceptions of their promotion of an external focus and the client outcomes. A final limitation is the small sample size of 15 participants, which occurred despite the great efforts taken with dissemination of recruitment material to a vast sample of Canadian physiotherapists (e.g., distribution by the Ontario and Canadian Physiotherapy Associations to all of their members). Although the reasons for low participation interest cannot be confirmed, we suspect that a lack of time/desire to complete numerous assessments was a contributing factor. These combined limitations bring awareness that caution is necessary in the interpretation of these results as they may not generalize to Canadian physiotherapists as a whole.

5.6 Conclusion

Overall, important steps were taken in the lead-up to delivering and assessing the focus of attention workshop presented here. These steps were worthwhile as physiotherapists reported high satisfaction, perceived relevance and engagement in the workshop. We argue that this facilitated learning, as measured by improvements in their knowledge, skills, attitudes and self-efficacy in relation to focus of attention use. Further, this learning translated to behavior change

given that physiotherapists self-reported an increase in their promotion of an external focus and as a corollary, also perceived positive improvements to their clients' rehabilitation outcomes. Finally, physiotherapists reported high intentions to continue to promote external focus in their practice, hopefully extending the workshop benefits beyond just the one-week time frame assessed here. In culmination, these outcomes are interpreted as a positive step on the pathway to translate the focus of attention research findings into Canadian physiotherapy. Accordingly, we strongly recommend that future researchers consider other motor learning principles for translation into physiotherapy practice not only in Canada but globally.

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Chapter 5

Section 2: Elaborated Discussion

While Article 4 included all the primary outcome measures of the workshop, the first section of this chapter is to discuss additional interpretations of the data that were not within the article. Next, additional workshop outcomes that were not presented in Article 4 are also discussed.

5.8 Additional Interpretations of Outcomes in Article 4

Exploring Canadian physiotherapy education, Bramley et al. (2018) interviewed representatives from physiotherapy programs who shared that motor learning concepts were only incorporated into the curricula within approximately the last decade. Based on these findings, one would expect that the dates in which physiotherapists received their education could impact their responses to the questions "To what degree do you feel your education focused on motor learning principles" and "To what degree do you feel your practice is guided by the current literature (~last 5-10 years) on motor learning principles", both scored on a scale of 1 = not at all to 5 = extremely. To this end, I divided our current sample of physiotherapists into two groups, those with 15 years or less of physiotherapy experience (n = 8; M = 9.0 years, SD = 4.4) and those with greater than 15 years experience (n = 7; M = 30.3 years, SD = 8.5). Fifteen years was selected as it represents the sum of a decade plus five years since the Bramley et al. (2018) paper was published. Interestingly, the data showed little difference between these groups for both the question pertaining to their education (less experienced group Mdn = 3 [1-3]; more experienced group Mdn = 3 [2-4]), and to the influence on their practice (less experienced group Mdn = 2 [1-5]; more experienced group Mdn = 3 [3-4]). Together these findings suggest that the motor learning content relating to focus of attention currently taught in Canadian physiotherapy

programs is likely insufficient to enact its conscious use in musculoskeletal physiotherapy practice. Consequently, I argue that the current data supports the importance of continued education on focus of attention for practicing Canadian physiotherapists as a step in bridging the motor learning research – physiotherapy practice gap. Additionally, it is important to highlight that the 2019 National physiotherapy entry-to-practice curriculum guidelines published by the Canadian Council of Physiotherapy University Programs (CCPUP, 2019), specifically lists "Motor control/learning theories, models and principles" within the Sensorimotor Control subtopic of the Movement Science content area. That being said, for a variety of reasons, I expand on in the upcoming General Discussion chapter (e.g., organizational barriers), it would be unrealistic to expect changes in curriculum to immediately translate into changes in physiotherapists' use of motor learning and control strategies.

Moreover, the timing metrics of the workshop showed much variation in the time spent on the asynchronous website modules (*Min* = 51, *Max* = 145) and in the synchronous virtual session (*Min* = 85 mins, *Max* = 135 mins). These timings could be considered a reflection of the participants' engagement with the content; for example, there was a 20-minute difference between the minimum and maximum times spent on both Modules 4 and 7. Specifically, some participants chose to complete just the two required experiments on themselves, while others completed all four experiments on both themselves and other individuals in their homes. Likewise, some participants submitted a singular, simple case study, while others created multiple, extremely detailed case studies. In the same light, although every synchronous workshop followed the same script and prescribed time constraints for the practice activities, we saw great variations in the times between groups. These differences were again in part the result of greater engagement by some groups as participants would (a) share more during the

interactive activities (e.g., discussions on their experiences with the at-home experiments), (b) request additional time to work through the case studies in the practice activities, and (c) ask more questions on how to apply feedback they were getting from instructors during the sharing component following each practice activity. One factor that could have contributed to, or arose from, these differences, that we unfortunately did not measure, was group cohesion. In fact, having conducted a study looking at online group cohesion for students engaged in small group collaborative learning, Altebarmakian and Alterman (2019) suggested that:

> If one participant perceives others in the group as lacking engagement in the collaboration, the potential for collaboration perceived by the first participant is diminished, so she also becomes less engaged. At some point, each group reaches a level of participation that reflects the collective estimates of the potential for productive collaboration. (p 445)

Consequently, future research utilizing group activities within an educational workshop for physiotherapists, should consider how group cohesion may impact engagement. Further interpretations of workshop assessments were also of interest. For example, looking specifically at the reaction questionnaire, all individual reaction items had a median score of 5 (strong agreement with the statements) except for three satisfaction items pertaining to the website modules (*Mdns* = 4). Using this information, if any improvements are made to the workshop, they should be to make the asynchronous website modules more (a) enjoyable, (b) easy to understand and follow, and (c) challenging. An example of how to do so was provided by one physiotherapist who suggested creating a fill in the blank document corresponding to Module 3, such that physiotherapists could fill in the document as they finished reading each article summary.

Shifting to the knowledge assessment, certain questions led to poorer performance than others, as five out of 23 questions were still responded to incorrectly by more than a third of the participants immediately post-workshop (True or false Q5 and 6, and identify the focus Q1,6 and 8; see Package 3). Specifically for the true or false questions, this can likely be attributed to the manner in which this content was delivered in the workshop, as information relating focus of attention instructions to neuromuscular outcomes was mainly emphasized in the article reviews in website Module 3. Notably, the above-mentioned recommendation for the inclusion of a fill-in-the-blank document may encourage more elaborate learning of the constructs presented in the asynchronous literature reviews. Considering the question type of 'identify the focus', all three were general statements and did not direct a client's focus internally or externally. Of the six therapists who got these questions wrong, three did not identify any of the nine statements as non-attentional focusing ("N/A") during the pre- or post-workshop knowledge assessment. Thus, it is possible they were only considering the statements as a dichotomy between internal vs external focus, suggesting incorrect interpretation of the instructions by these participants.

Taking into account the assessment timing, it was noted in Article 4 that in the post-workshop skill assessment, physiotherapists reported almost half as many focus of attention statements as pre-workshop. In the current research, physiotherapists were required to finish assessment packages 2 and 3 in the Zoom workshop, and although we understood this risked obtaining less data for the skill assessment, this decision was made to reduce the risk of participants failing to complete the assessments, or potentially accessing additional resources post-workshop. Future workshops thus, need to consider a balance of risk when scheduling their workshop and assessment components.

5.9 Additional Workshop Outcomes

In addition to the primary outcome measures presented in Article 4, there were additional, exploratory questions included in the workshop assessment packages that were not addressed. More specifically, additional questions included within the attitudes and self-reported behavior assessments, as well as general overview questions are presented.

5.9.1 Attitudes Assessment

Within the attitudes section of the one-week pre- (Package 1) and immediately post-synchronous workshop (Package 3) assessments, two additional questions were included concerning worthwhileness of and/or commitment to (a) gaining an understanding of focus of attention use and (b) applying external focus of attention statements in their practice. Specifically, physiotherapists were instructed that if they selected a value of 70 or less (scale of 0 = not at all to 100 = extremely) for any of the preceding worthwhileness or commitment questions, to select reasons from a list provided as to why they selected that score. The list for potential factors impacting worthwhileness and commitment were different (see Appendix F or H). Notably, there was only one occurrence of this additional question being completed and it was pre-workshop for a physiotherapist who reported a "worthwhileness" score below 70, having selected a score of 50 for the 'gaining understanding' statement and 60 for the 'applying external focus' statement. From the reasons provided, this physiotherapist selected "I am not convinced that the research findings apply directly to my practice" and added their own reasoning by stating "[I am] not sure if the effect of this change will be significant". In particular, these reasons overlap with the third theme of barriers to external focus use identified in Study 2 (Hussien et al., 2022), titled "research aspects". Considering that post-workshop this participants' worthwhileness scores increased to 90 for both gaining an understanding and

applying an external focus, it is suggested that the workshop assisted them in overcoming their perceived barriers. In terms of the other timepoints, one-week pre-synchronous workshop for commitment, and immediately post-synchronous workshop for both worthwhileness and commitment, no physiotherapists reported scores below 70.

5.9.2 Self-Reported Behaviors (Kirkpatrick Level 3) Assessment

Within article 4, changes in knowledge and skill were assessed pre- and immediately post-workshop. While it was objectively observed that knowledge and skill were increased, I also wanted to determine whether the physiotherapists subjectively perceived changes in their knowledge and skill one week following the workshop. As such, in the one-week post-workshop assessment (Package 4), physiotherapists were also asked to share to what degree (scale of 0 = not at all to 100 = extremely) participating in the workshop allowed them to (a) improve their knowledge about the benefits of external cueing and (b) better create externally focused statements for a variety of exercises they use in their practice. Interestingly, their perceptions of their behavioral capabilities improved along with the objective data as physiotherapists self-reported an average of 88.00 (*SD* = 10.82) for knowledge improvement and 85.00 (*SD* = 12.39) for their improved ability to create externally focused statements.

I also was curious about the possibility of factors influencing their use of external focus statements. To explore this, I asked them to select from several options "any personal factors (i.e. related to your thoughts and behaviors) that impacted your provision of externally focused cues to your clients:" (see Appendix I for specific question and response options). A majority of physiotherapists (8/15) reported that no personal factors impacted their external use. The other six physiotherapists did select some of the options; reporting that it was easier to continue cueing internally (*n* = 3), they had difficulty coming up with external focus cues (*n* = 3) and/or that they

had a hard time explaining the external focus cues to neurologically compromised clients (n = 1). Markedly, being stuck in their ways and considering the client's cognitive impairments both arose in discussions during the one-on-one interviews in Study 2 (Hussien et al., 2022), as either a barrier to external focus use or a general factor influencing focus of attention use. Interestingly, while "difficulty coming up with external focus statements" was included in the barrier coding scheme of Study 2 following the pilot tests, it was not identified as a barrier by physiotherapists (even when prompted); thus, it is possible that coming up with external focus statements is not as easy as physiotherapists expect it to be, especially in the absence of an external object.

Another aspect included in the one-week post-synchronous workshop, attempted to tap into whether there were client and task characteristics (derived from the interviews in Study 2; Hussien et al., 2022) that moderated their focus of attention use. As such, a list was provided in which the physiotherapists could score the degree to which they perceived that varied client and task characteristics impacted the external focus benefit experienced by the client. Participants were also provided space to discuss any other client and/or task characteristics or to elaborate on their selections (see Appendix I for questions). Unfortunately, inspection of the data made it clear that this section was not clearly understood and was too difficult to report on. Their written elaborations, however, did reinforce some of the findings from Study 2, as well as topics in the literature (Durham et al., 2009; Kal et al., 2018; McNevin et al., 2000; Zachariah, 2013). For example, speaking only to statements made by more than one physiotherapist, it appears that the external focus may be moderated by the (1) clients' cognition (reduced cognition leads to less likelihood for comprehension of external focus statements or ability to focus all together), (2) stage of rehabilitation (acute stage clients had more difficulty with an external focus due to a focus on their pain), (3) athletic experience or kinesthetic awareness (these clients were better

able to understand and implement the external focus instruction/feedback), and (4) the body region of the exercise (with local movements e.g., abdominal or deep neck flexor exercises, posing greater difficulty for external focus use).

5.9.3 General Overview Questions

In additional to extra questions posed within the levels of the Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2016), more general open-ended questions were also included within the questionnaires delivered immediately post-workshop (Package 3) and one-week post workshop (Package 4). In detail, immediately post-workshop, physiotherapists responded to three general feedback questions worded as follows: Question 1 “What were the three most important things you learned through participation in this workshop?”, Question 2 “What barriers do you anticipate running into when trying to apply what you’ve learned in your practice?” and Question 3 “Do you see any solutions to the barriers you have just listed? Further, as a final question on the 1-week post-workshop package, physiotherapists were asked “Is there anything else about your experience applying external focus cueing in your practice that you would like to share with us?” The data from these questions underwent a process of qualitative content analysis (Roller, 2019). Explicitly, Dr. Ste-Marie and myself independently organized the participants’ responses into categories of codes, then organized those categories into broader themes. Next, we met to discuss those themes to reach consensus.

Overall, the data showed that when asked to list three things they learned in the workshop, physiotherapists spoke to three themes. In keeping with Bandura’s (1986) behavioral capability construct, the first two themes were: (1) ‘knowing of’ focus of attention concepts and (2) ‘knowing how’ to apply external focus in their practice. The ’knowing of’ theme included categories such as (a) knowledge of the literature (e.g., descriptions of the external focus benefit,

the underlying mechanisms, findings with different populations, and findings for movement preparation versus execution stages) and (b) knowledge of the types of focus of attention (e.g., differentiating a mixed focus statement from internal and external focus). The 'knowing how' theme included categories such as (a) how to create external focus statements (e.g., specific examples, the use of real or imagined equipment, and the use of analogies), (b) how to avoid internal and mixed cues (e.g., using dual task paradigms, and avoiding body part references), and (c) strategies of external focus use (e.g., importance of individualizing the instruction/feedback for the client, and getting the client to visualize the task).

The third theme was related to reflections on their past or future use of focus of attention. and included the categories of (a) understanding their own bias (e.g., reflecting on how much they used internal focus in their practice and a need to monitor their vocabulary) and (b) perceptions about applying external focus in their practice (e.g., thinking it will be easy and/or inexpensive versus thinking it will be difficult and take practice). Importantly, the totality of these themes reflects the specific efforts to increase the physiotherapists' behavioral capabilities, in accordance with social cognitive theory (Bandura, 1986), and to provide participants with opportunities to reflect on their own experiences and how they can apply their knowledge in practice, in accordance with adult learning theory (Knowles, 1984).

Moving on, the responses to the barriers question were organized into three themes: (1) the physiotherapist themselves, (2) characteristics of the client and (3) access to resources. At the level of the physiotherapists, presented barriers included (a) limited time to prepare external focus statements before a client session, and resultingly, having to think "on the fly", (b) requiring creativity to create external focus instructions/feedback and (c) getting stuck in old habits of using their typical internal focus statements. Proposed solutions to these barriers

included (a) creating lists of external focus examples for common exercises, (b) brainstorming with coworkers, (c) more time spent preparing before client sessions, (d) reinforcement of behavior, and (e) in general, more practice with external focus provision.

At the level of the clients, barriers addressed a lack of the client's understanding of external focus instructions/feedback as a result of (a) poor exercise knowledge, (b) language barriers, or (c) cognitive or neurological impairments. Solutions offered for these barriers included (a) starting with an internal focus then switching to an external focus, (b) being creative and trying different variations of external focus statements, and (c) simply persisting with external focus statements. Finally, at the level of their resources, physiotherapists reported limited space and equipment in the clinic as barriers. Simply, the solutions raised where to purchase more equipment, and to make use of more analogies and imaginary equipment.

Of interest is that a majority of these barriers were discussed by physiotherapists during the one-on-one interviews (e.g., lack of time, client characteristics and access to equipment; Hussien et al., 2022), however, their proposed solutions revolved around educating physiotherapists on focus of attention concepts. Having completed the workshop, it is interesting to see how physiotherapists turn their perceptions of solutions inwards, to actions they personally could undergo. Future workshops should work collaboratively with physiotherapists to overcome these barriers; for example, a resource could be developed online where researchers and physiotherapists can upload external focus statements they have created for specific exercises, and/or strategies they have used to overcome barriers they have experienced, such as creative ways to use equipment accessible in a physiotherapy clinic.

Twelve physiotherapists responded to the optional open-ended question asking if they wanted to share anything else about their experience applying external focus in their practice. Of

these, many took the opportunity to emphasize that they needed more time to change their old habits and thoroughly experience the outcomes of using an external focus (n = 6), a few just expressed thanks for the opportunity to participate in the workshop (n = 3), and one physiotherapist clarified that they only had a chance to test the external focus on clients with neurological or cognitive impairments. While the current research lacks a long-term assessment of workshop outcomes, these shared points further the idea that physiotherapists intend to continue to use external focus in their practice. As well, suggestions were made for the development of examples of external instruction/feedback for exercises that were more difficult to create external statements for (e.g., exercises for pelvic tilt, scapular retraction etc.; n = 1), and for a potential future avenue of research into how focus of attention interacts with the task goal of developing interoception for clients with chronic pain (n = 1). Overall, the inclusion of these general feedback questions allowed for further insight into (a) what physiotherapists learned in the workshop, (b) their perceptions of potential barriers and exceptional ability to create solutions to them, and finally, (c) the time it takes to really apply the focus of attention knowledge into practice. Together with the results presented in Article 4, this chapter section provided further considerations and specific recommendations for future research.

Chapter 6

General Discussion

This chapter of a thesis typically serves to integrate the research findings presented in the articles; however, I believe that the highly sequential nature of my studies inherently resulted in this integration. Consequently, I have chosen instead to utilize this chapter to share general reflections on the research process, as well as to summarize recommendations for future research looking to translate motor learning findings into physiotherapy through a similar methodology.

6.1 The Intention-Behavior Gap and Required Drivers

In previous sections we have highlighted physiotherapists' high intention to continue to promote an external focus as a potential indication of more long-term benefits of participating in the workshop. Humbly, however, we recognize the importance of a cautious interpretation of our findings as previous research on behavioral change has identified what is termed the intention-behavior gap (Sheeran & Webb, 2016). Specifically, although behavioral intentions are one of the greatest predictors of behavior, the presence of intention does not guarantee behavioral change (Sheeran & Webb, 2016). In the previous chapter, physiotherapists' perceived barriers to use of externally focusing statements were organized into three themes: (1) personal barriers e.g., time to prepare external statements, (2) client characteristics e.g., ability to understand statements, and (3) access to resources e.g., limited access to space and equipment in their clinic. Even beyond these barriers, research has revealed a multitude of cognitive, social and environmental factors that impact the clinical uptake of evidence-based care in physiotherapy (Gleadhill et al., 2022). Notably, these impacting factors include, but are not limited to, (a) patient expectations, (b) colleagues' actions, (c) clinical environment, (d) business demands, (e) research paywalls, (f) lack of financial incentive, (g) lack of professional culture around

evidence-based practice and (h) research relevance (Gleadhill et al., 2022). Consequently, despite an intention to increase their provision of externally focusing statements, physiotherapists may be met with many barriers in regard to the actual clinical uptake and application of focus of attention knowledge. To attenuate these barriers, and encourage the translation of intention into behavior, the Kirkpatrick model highlights the need to leverage required drivers which are "processes and systems that reinforce, monitor, encourage, and reward performance of critical behaviors on the job" (Kirkpatrick and Kirkpatrick, 2016). As an example, researchers could encourage physiotherapists to discuss their focus of attention use with their colleagues to gain reinforcement and to work toward finding solutions to barriers, such as client expectations.

For the purpose of our research, we chose the path of delivering a focus of attention workshop to practicing physiotherapists, however, the solution of changing physiotherapy curriculum was also proposed by physiotherapists (Hussien et al., 2023a). As mentioned in the previous chapter, the Canadian Council of Physiotherapy University Programs has recently published new national physiotherapy entry-to-practice curriculum guidelines (CCPUP, 2019) which include a requirement to teach motor control/learning theories, models and principles. For multiple reasons however, one cannot expect that physiotherapists who complete these updated curriculums will automatically align their practice to the motor control and learning literature. Specific to focus of attention, reasons captured in the one-on-one interviews (Hussien et al., 2023a) include the anatomical focus of the physiotherapy curriculum and the implicit learning that takes place during physiotherapists' clinical placements, both of which the physiotherapists claimed led to the development of an internal cueing style. Consequently, at the current time, incorporating focus of attention knowledge into a small unit within the Canadian physiotherapy curriculum may not lead to rapid clinical uptake as it is likely to be overshadowed by countless

hours spent in anatomical units and clinical placements. Overall, wide-spread translation and clinical uptake of focus of attention knowledge into Canadian physiotherapy may benefit from concerted efforts to educate both new and practicing physiotherapists.

6.2 General Reflections

I wanted to begin by sharing two reflections, with the first arising from a module in the asynchronous component of the workshop. Specifically, I found the at-home experiments to be an extremely beneficial section of the workshop in that they "sold" the external focus benefit to the physiotherapists. Physiotherapists spoke to being shocked at the difference in results obtained when they adopted an external focus as compared to an internal focus, especially for the single leg hop. Importantly, physiotherapists also shared that having these experiments conducted early in the workshop was important, as it increased their interest in learning to apply an external focus in their practice. From a social cognitive theory (Bandura, 1986) standpoint, with the experiments increasing their outcome expectations of external focus use, it may be beneficial to incorporate this activity even earlier in the workshop sequence. Accordingly, future training programs, or research on training programs, should consider having participants experience the motor learning concept first-hand as early as possible in the process, such as immediately post-baseline assessment. While at-home experiments were effective in our workshop, other variations are certainly possible.

Another point of interest was that physiotherapists expressed an excitement to share their knowledge on focus of attention with their coworkers. Indeed, eight physiotherapists reported engaging in focus of attention discussions with their coworkers post-workshop. This suggests that future workshops should consider employing strategies to encourage physiotherapists to act as knowledge brokers. Reflecting on discussions within the Study 2 one-on-one interviews

(Hussien et al., 2022), physiotherapists did share that content delivered by other physiotherapists would be perceived as more credible; consequently, having physiotherapists act as knowledge brokers, whether in their employment settings, or within future workshops, may further the benefits of the workshop. The self-efficacy item that related to this topic also supports this idea of having physiotherapists act as knowledge brokers. That is, physiotherapists self-reported self-efficacy scores for providing external focus statements "when my coworkers appear to be cueing their clients internally", increased from an average of about 65 one-week pre-workshop to 91 immediately post-workshop (scale of 0 = not at all to 100 = extremely). Again, this implies that observing their peers using external focus statements makes them more self-efficacious to use it in their own practice.

Considering the research pathway as a whole, my greatest post factum realizations concerned both the amount of time, and the barriers to overcome, that are associated with applied research. In fact, I had originally proposed about two thirds of this research as a Masters' project in 2017, so it is fair to say my graduate experience has humbled me significantly. Overall, the single greatest barrier to overcome was the challenge of recruiting physiotherapists to participate in the studies. Early on, I believed that physiotherapists were required to complete a set number of continued education credits annually; however, I later learned that the College of Physiotherapists of Ontario had recently altered their requirements to state that physiotherapists should "participate in continuing education and professional development each year, *to the extent needed* to maintain the knowledge, skills and judgment you need to practice". Thus, the intended strategy to recruit by promoting continued education credits for participation was no longer of use.

Another factor considered was that my research, like everything else, was impacted by the effects of the COVID-19 pandemic. While Diane and I were able to quickly transition my research online, physiotherapists expressed that the shift in clinical practice was a massive undertaking and impacted their willingness to participate in my research. In particular, this had greater impact on my second study (one-on-one interviews) than the third (designing and delivering the workshop). Specific to the workshop, I believe the recruitment challenges derived from the time dedication required - about 3.5 hours for the workshop components (1.5 asynchronous and 2 hours synchronous) and another 1.5-2 hours for the completion of assessments. In promoting the workshop, we advertised it as mutually beneficial for both physiotherapists and the researchers, and highlighted that completion of the assessments were in lieu of any payment. Still, many physiotherapists who originally inquired about the workshop, lost interest upon learning of the timing breakdown of its components. Future research should consider collaborating with physiotherapists to create their recruitment posters/scripts in order to determine which elements promote or discourage the physiotherapists' interest in participating. In addition, in the current research, there was a large time spent between when the workshop was finalized (late June 2022) and when the first group participated in the study (early September 2022). Resultingly, to avoid unnecessary delays, future research should also consider beginning the recruitment process concurrently to completing the finals details of the workshop.

Taking a step further, much of my reflection was also based on research decisions that had been taken given the human, financial and time constraints that come with a doctoral dissertation. This reflection process was amplified upon watching Dr. Ian Graham present his keynote talk at the 2022 SCAPPS conference in Montreal, which was on the approaches and practical considerations for knowledge translation. Further, reading Graham and colleagues'

(2018) article titled "*Moving knowledge into action for more effective practice, programmes and policy: Protocol for a research programme on integrated knowledge translation"* led to specific insight into what I may have done differently in my research and suggestions for researchers in motor learning. Certainly, if I was to do my research over again, I would have strived to work in collaboration with key stakeholders, like the Canadian and Ontario Physiotherapy Associations, for the design of the workshop, rather than simply the distribution of recruitment materials. For future researchers aiming to incorporate focus of attention knowledge into physiotherapy curricula, Wideman and colleagues (2018) provide a strong example of which stakeholders to consult in the process.

In addition, if I was to repeat my research, I would have conducted more preliminary research with the anticipated knowledge users, to gain a more elaborate understanding of what the physiotherapists would experience when they returned to practice after the workshop. Technically, this was done through the one-on-one interviews where physiotherapists were asked questions to garner their perceptions on (a) factors influencing focus of attention use, (b) barriers to external focus use, and (c) design considerations for the workshop; in retrospect however, I realize that participants were responding solely on their predictions, rather than concrete experience applying focus of attention knowledge in their practice. Thus, future research should consider incorporating methodology to allow physiotherapists to actively apply the motor learning concept, prior to gathering their insights on its application in practice.

My final reflection is tailored more to our field of research as a whole. Researchers acknowledge that laboratory environments rarely reflect applied settings, yet frequently make conclusions about the impact of their findings for applied fields. In this light, knowledge translation is often viewed solely in the direction of disseminating research into applied practice,

and seldomly in the direction of learning how our research needs to be tailored to the "real-world". A prime example of this is the fact that several studies have revealed mixed focus provision by physiotherapists (e.g., Durham et al., 2009; Johnson et al., 2013; Kal et al., 2018), yet only one published study to date has been done to determine the impact of this focus on motor performance. Taking on an integrated knowledge translation approach (Graham et al., 2018), I recommend that researchers in our field begin to work with physiotherapists to determine the research questions we aim to answer, in order to increase the likelihood of our findings being relevant and applicable in their practice. As an example, arising from discussions with physiotherapists in my research, it became clear that more effort needs to be employed in (a) expanding the focus of attention research with clinical populations and similarly, (b) determining the client and task characteristics that moderate the external focus benefit. Overall, the points discussed above centralize on a single theme which is to view physiotherapists as collaborators, rather than just users, of our research.

6.3 Summary of Recommendations for Future Research

Recommendations for future research have been incorporated throughout the entire thesis (e.g., see Article 3 discussion for an outline of a process to follow when developing a training program for physiotherapists), however, this section serves to summarize recommendations resulting from a reflection on the delivery and assessment of the workshop. While I was excited to see positive outcomes from the workshop, I also recognize there are elements that could have improved the research. In review, future research on training programs should:

1. Balance the risks associated with scheduling of both the workshop components and assessments, to maximize data collected.

2. Consider the addition of an activity, such as a fill-in-the-blank document, to make asynchronous website modules more enjoyable, easy to follow, and challenging. Additionally, this increases the likelihood that constructs presented asynchronously are seen and understood.
3. Evaluate participants' perceptions of group cohesion, considering its potential impact on their engagement in the workshop.
4. Continue to collaborate with physiotherapists' post-workshop to (a) garner their perceptions of potential barriers to their knowledge application and subsequently, (b) create a resource to help overcome these barriers once they return to practice.

Finally, summarizing content from this general discussion chapter, motor learning researchers engaging in applied research should consider:

1. Working to bridge the gap between research and physiotherapy by including physiotherapists (the knowledge users) in the discussions where research questions are determined and working in collaboration for the design of the workshop.
2. Providing physiotherapists opportunities to actively apply the motor learning concept in practice, and then garner their perceptions of impacting factors and barriers.
3. Creating their study recruitment posters/scripts in collaboration with physiotherapists.
4. Starting recruitment in parallel to finalizing all of the workshop details in order to avoid unnecessary delays.
5. Incorporating at-home experiments as an activity within early stages of a workshop.
6. Incorporating strategies, or methodology, promoting physiotherapists to act as knowledge brokers of the workshop content.

7. Make use of required drivers after the workshop to continue to promote the translation of intention to behavior change.

6.4 Concluding Remarks

Through my journey on this doctoral research pathway, it has become quite evident that conducting applied research comes with unique sets of considerations, challenges and required adjustments. With that in mind, faculties should support students within motor control and learning, by working to develop collaborative relationships with applied settings (e.g., hospital, private clinic, and sport rehabilitation settings) in order to take our research findings beyond just our laboratories, conferences and journals. Even with all of the challenges, in my opinion, the knowledge that my research has the potential to improve the motor performance and learning of people who need it most, has made the last six years worth it – and I would do it all over again.

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Appendix A
Therapists' Perceptions of Motor Learning Principles Questionnaire - Face Validity Procedure

The focus of attention section of the Therapists' Perceptions of Motor Learning Principles Questionnaire (TPMLPQ) was designed to include six exercise scenarios that the first author perceived to be common to a physiotherapy environment due to their personal volunteer experience. The first three scenarios were for the feedback category. For each of these, there was first an analysis on the common mistakes that would be performed for the given exercise. Following that, feedback statements were drafted that would serve to address the common mistake. The next three were the instruction scenarios and presented instructions that a physiotherapist may provide their client for a specific exercise.

These six original scenarios then underwent a process of face validation where six physiotherapists confirmed the validity of the exercises and their respective instructions and feedback statements. As a result of their feedback, modifications were made to the wording of certain statements to reflect the language physiotherapists were more likely to provide in the rehabilitation environment. Additionally, the balance exercise was replaced with a scenario that did not require access to specific equipment. Simultaneously, nine motor learning researchers confirmed that the statements accurately facilitated the adoption of either an internal or external focus of attention by placing either an "E" or an "I" beside each of the 12 statements. They also provided recommendations to improve the scenarios and/or the wording of the statements. As a result of their feedback, several changes were made. First, both a functional task and a gait rehabilitation scenario replaced two of the previous scenarios to provide a larger range of exercise types. Second, the order of external focus versus internal focus statements was changed across questions such that the internal statement was not always provided first. Finally, the

wording of some of the externally and internally focused statements were modified such that the pair were more consistent in the length of the wording and the specific movement aspect being addressed. In order to ascertain the changes made were suitable, these two new questions were redistributed to the same researchers and all confirmed no additional changes were required.

Appendix B
Therapists' Perceptions of Motor Learning Principles Questionnaire – Questions Relevant to this Dissertation

The purpose of the following questionnaire is to gather information on how physiotherapists interact with their clients and determine whether their behavior is related to their educational and practical experiences.

1) Physiotherapist Characteristics

Age: _____

Gender (optional): _____

Years of experience working as a physiotherapist: _____

Are you currently working as a part-time or full-time physiotherapist? _____

Are you currently working in a private or a public physiotherapy clinic? _____

- If private, do you have previous experience working in a public clinic (Y/N): ___
- If public, do you have previous experience working in a private clinic (Y/N): ___

What client bases do you currently/have you previously worked with (Check all that apply):

- ☐ Athletic
- ☐ Geriatric
- ☐ Neurological
- ☐ Pediatric
- ☐ Orthopedic
- ☐ Other (please list): _____

Please list your program of study, the university attended and year of graduation for each of the following degrees:

- Undergraduate: _____
- Master's/Professional: _____
- Other (ex. Ph.D.): _____

2) Physiotherapist-Client Interactions

A. Therapist's communication of feedback *

For the following series of questions, please respond with which feedback you are likely to implement in interactions with your client. Note, feedback here is described as information you give your client **after** they have completed a movement.

Listed below are two examples of feedback you might give to your client **after** they have made an error while completing three different exercises. Please rate each statement in terms of the closest percent of the time you would give this kind of feedback to your client after he/she has made an error during performance by circling the percentage value. **Percentages should add up to 100%.** (ex. 1) (25%) and 2) (75%))

Your client is performing a tandem stance balance exercise in a comfortable pair of shoes and you notice the back foot is not positioned directly behind the front foot. What feedback statement would you provide? (Percentages should add up to 100%)

38931) "Focus on keeping your feet touching and in a straight line"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

38942) "Focus on keeping your shoes touching and in a straight line"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

Your client is performing a circular shoulder pendulum exercise, with a small dumbbell in their hand, and you notice they are swinging their arm in a straight line. What feedback statement would you provide? (Percentages should add up to 100%)

38981) "Swing your arm in a circle"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

38992) "Swing the dumbbell in a circle"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

Your client is performing a functional reaching task consisting of bringing a glass they are holding to rest on a table top, and you notice their movements are jerky. What feedback statement would you provide? (Percentages should add up to 100%)

39031) "Focus on keeping the glass moving smoothly through space"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

39042) "Focus on keeping your hand moving smoothly through space"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

B. Therapist's Method of Providing Instruction *

For the following series of questions, please respond with which instruction you are likely to implement in interactions with your client. Note, instruction here is described as information you give your client **before** they have begun a movement.

Listed below are two examples of instructions you might give your client **before** he/she has begun three different exercises. Please rate each statement in terms of the closest percent of the time you would give this kind of instruction to your client by circling the percentage value. **Percentages should add up to 100%.** (ex. 1) (35%) and 2) (65%))

You are instructing your client on how to perform a squat and you have placed markers on the floor to indicate where they should place their heels. What instruction statement would you provide? (Percentages should add up to 100%)

"Make sure to keep your heels on the markers"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

"Make sure to keep your shoe heels on the markers"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

You are instructing your client to perform a pelvic squeeze with a ball between their knees. What instruction statement would you provide? (Percentages should add up to 100%)

"Squeeze the ball"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

"Squeeze your knees together"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

You are instructing your client on how to perform the heel-toe motion required for stepping while wearing shoes. What instruction statement would you provide? (Percentages should add up to 100%)

"Have the heel of your foot make first contact and then move through to the toes of your foot"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

"Have the heel of your shoe make first contact and then move through to the front of your shoe"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

4) Physiotherapists' Awareness of the Literature

For the following questions please circle the number that corresponds to your awareness of the ***current literature (i.e., last 5-10 years)*** in the field of motor learning (please feel free to select full or half numbers ex. 3 or 3.5).

1	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**
Not at all aware		**Slightly aware**		**Somewhat aware**		**Moderately aware**		**Extremely aware**

Furthermore, if you reply with a number of **3 or above** (somewhat aware or more) please also respond to the question regarding where the content was taught to you (select all that apply).

How aware are you of the following principles that can affect motor learning?

A. How instructions and feedback statements can be used to direct individuals' focus of attention: *****

1	1.5	2	2.5	3	3.5	4	4.5	5
Not at all aware		Slightly aware		Somewhat aware		Moderately aware		Extremely aware

- **Where was this content taught to you?**
  - Undergrad
  - Physio education
  - Continued education (Ex. Workshops)
  - Other (Please specify): _____

Appendix C
Study 2 Interview Guide

Moderator: Julia Hussien

Schedule Overview

- As an overview of today's schedule, we are going to start with some questions I have about the questionnaire you completed online. Next, we'll finish the interview with some more questions I have prepared regarding next steps of my research. Finally, I'll give you an opportunity to add any information or clarify any statements before we finish. Before we start, I want you to know there are no right or wrong answers, the goal today is just to share your opinions. Also, you may notice an icon on the bottom of the screen showing a participant called Fireflies. This is actually an a.i. Software that will be transcribing today's session. Additionally, I will be recording today's session. Please note the video recorder is simply being used to confirm the accuracy of the Fireflies transcript and the video will only be viewed by myself, my two research assistants and my supervisor. It is important for you to know that everything you say today is confidential and any results will be reported anonymously. Do you have any questions before we get started?

Intro and Confirmation of Questionnaire Completion

- As you are aware, the premise behind my research is to determine physiotherapists' awareness of motor learning principles and their use within their practice. To start today I'd like to confirm that you had an opportunity to complete the questionnaire that was sent to you via an email link.
- Great! For the first part of the interview, the questions will be related to the questionnaire you completed, and if you need a break at any point just let me know.

Motor Learning Topic Overview and Questions on TPMLPQ

- The questionnaire you completed touch on a number of motor learning concepts but the one of most interest to me is something called attentional focus. This was captured in the first section in which you answered questions related to how you provide instruction and feedback for six different scenarios. As a reminder, here was one of the scenarios:
    - *Note: Show PowerPoint slide.*

Your client is performing a circular shoulder pendulum exercise, with a small dumbbell in their hand, and you notice they are swinging their arm in a straight line. What feedback statement would you provide? (Percentages should add up to 100%)

1) "Swing your arm in a circle"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

2) "Swing the dumbbell in a circle"

0% 5% 15% 25% 35% 45% 55% 65% 75% 85% 95% 100%

- Now I don't want to assume that you are familiar with this particular concept, so I will give a quick overview. Attentional focus can be directed in one of two ways; external or internal. An external focus of attention is achieved when an individual focuses on the effects of their movement on the environment, or the outcome of the task, whereas an internal attention focus is achieved when an individual focuses on the body parts, or muscles, required for the task at hand. Having said this, I ask that you take a moment to think in your head about which of the possible example statements provided for the exercise on the slide promotes an internal attentional focus and which promotes an external attentional focus.
- If you thought that the first statement "Swing your arm in a circle" represents the internal focus statement you are bang on. Directing the learner to focus on their arm represents

the body part needed to do the movements to perform the task. Whereas the second statement "Swing the dumbbell in a circle" represents an external focus statement because the dumbbell movement represents the outcome of the task. This differentiation is essential for the rest of our talk today so if you have any questions about how to differentiate between external and internal focus let's discuss them now.

- Next, what I would like is for you to reflect on your thoughts while you were completing the 6 questions like this on the questionnaire and to share with me whether there were any factors that influenced how you chose to respond. (Q1)
    - Possible probes that could occur if not mentioned: 1) Client's stage of rehab, 2) Client's stage of acquisition of the specific skill, 3) Client's preference, 4) Client's mobility, and 5) Client's cognitive level.
    - *Note: Responses will be written in notebook and Julia will keep track of the exercise dependent ones to add to a slide later on.*

TPMLPQ Results and Questions on Exercises, Barriers and Facilitators

- The same questionnaire you completed was actually completed by over 100 physiotherapists across Canada and I have the results of the attentional focus sections here with us today. Note that these results may not reflect your individual results. but I still feel I can benefit from your insight.
- *Note: Show PowerPoint with results showing the group average relative frequency of internally and externally focused feedback and instruction from the TPMLPQ.*
- Overall, I found that most physiotherapists self-reported a higher frequency of providing their clients with statements that promote an internal focus as opposed to an external

focus. Having just been told this, what explanations might you give as to why there was a higher frequency for the internal focus statements? (Q2)

- Possible probes that could occur if not mentioned: 1) physiotherapy education, and 2) patient preferences.

- *Note: Show PowerPoint showing the group average relative frequency dedicated to the internally and externally focused examples for all 6 scenarios that were used in the TPMLPQ.*
- Also shown through the questionnaire data was that even though physiotherapists did self-report a higher frequency of internal focus overall, there were two scenarios in which external focus statements were used more than internal ones, specifically scenarios 3 and 5.
- *Note: Show PowerPoint showing the two specific scenarios* Do you have any ideas as to why physiotherapists self-reported using more externally focused statements in these two scenarios? (Q3)
  - Possible probes that could occur if not mentioned: 1) Length of the wording, and 2) Client type.
  - Follow-up: Do you think certain exercises in general may favor the use of either internally or externally focused cues?
- You have raised very interesting points as to why you feel PTs may provide internal and external focus cues. Now I would like to share what the motor learning research has shown on this topic. Overall, researchers began testing attentional focus with healthy populations and numerous studies showed that an external focus of attention leads to enhanced motor performance and learning compared to an internal focus. With such a

strong and robust finding, researchers began examining the effect with other populations such as the elderly, and individuals with musculoskeletal dysfunction or CNS dysfunction such as stroke, for example. The experiments with the elderly and with individuals suffering from musculoskeletal dysfunction have also generated clear support for an external focus being superior to an internal focus; however, the research with different CNS dysfunctions has proven to be more discrepant, with some showing the same findings but others not. For this reason, as we move forward today, lets exclude those with CNS dysfunction from the discussion.

- Given that the data I have so far has shown that PTs will often use more internal focus than external focus statements, but the research evidence suggests that external focus statements would be better, I am guessing that there are some barriers in place in relation to PTs use of external focus, which leads me to ask: can you think of some of the potential barriers that physiotherapists face when trying to provide their clients with statements that promote an external attentional focus? (Q4)
    - Possible probes that could occur if not mentioned: 1) Lack of a thorough understanding of the concept, 2) Lack of awareness of the research, 3) Lack of trust in the research, 4) Lack of skill in applying the knowledge, 5) Coming up with externally focused statements, and 6) Remembering to try to provide more externally focused statements
- So, in summary some of the barriers you discussed are…Next, do you think you can identify what, if any, possible solutions could be used to overcome these barriers? (Q5)
    - Once discussion has turned to a workshop design transition into next component.

- Great! I had a very similar train of thought and therefore, for this next part we're going to shift our discussion to the potential creation of an educational workshop for Ottawa-physiotherapists on the topic of attentional focus. The end goal of this workshop would be to get participating physiotherapists to increase the frequency in which they're providing their clients externally focused feedback and instruction cues.
- For starters, I do understand that physiotherapists are very busy people and that time is a precious commodity. Knowing this, I am very curious about what it would take for me to get PTs to participate in an educational workshop on this subject? Do you have some ideas for me on this? (Q6)
    - Possible probes that could occur if not mentioned: 1) would the format impact your decision- e.g., a combination of online/self-paced and in-person sessions, 2) Location, 3) Duration and Timing, 4) Compensation, 5) Method of contacting (email, phone etc.).
- So, let's say we actually got you to participate in our educational workshop. What elements or activities do you think we should do in that workshop, or even after the workshop is complete, knowing that our end goal is for physiotherapists to increase the frequency of using external focus cues in their practice? (Q7)
    - Possible probes that could occur if not mentioned: 1) A review of the literature, 2) Videos of a physiotherapist modeling the behavior in a physio setting, 3) Modeling of the behavior in person, 4) A discussion of the potential barriers to providing externally focused cues, and a discussion of possible solutions, 5) The opportunity to practice on each other through role-play, 6) Activities such as detecting all of the external focus cues on a sheet, 7) Group-based problem-

solving activities such as creating externally focused cues for examples ranging from easy to difficult, 8) The opportunity to choose whether you want to work alone or in a group, and 9) A pamphlet detailing the concept of attentional focus and examples, that you could take home with you.

- Possible probes that could occur if not mentioned: 1) If we provided you with a sign you could place in your office to remind you to try to promote an external focus in your clients and 2) Self-reflection through the use of a diary or scheduled reflection time in the time period when you return to work after the workshop.
- *Note: After working with the responses to this question, a list would be created on a PowerPoint slide and I would ask the PT to pick which 3 they think would be the most effective during the workshop and which 3 would be the most effective after to workshop is complete.*

Summary, Exit Question and Conclusion

- In summary, today we discussed:
  - Factors that could affect how physiotherapists are responding to the survey questions on attentional focus cueing.
  - Why physiotherapists may be providing their clients with high amounts of internally focused statements and why this may be affected by the exercise type.
  - Barriers to physiotherapists providing their clients with externally focused statements, and some solutions to these barriers.
  - Possible solutions, one of which was an educational workshop and so we also talked about how to make this workshop effective.

- Now that you've had a chance to reflect on the whole session, do you have any additional information or clarifications that you would like to make?
- We are all done and I want to reiterate how thankful I am for your participation today and I feel the insight gained will help me very much in the future stages of my research. If you have any questions or concerns, please feel free to contact me at any time via email or phone. Thank you all again.

Appendix D
Code Definitions for Factors Influencing Focus of Attention Statement Use

Interview questions 1-3 were coded using the same definitions and thus, presented results are pooled across the first three interview questions. The definition for each code is described in Table A.1 below, along with the participant number of those who discussed the code in their interview. When the participant number is **bolded**, it indicates that that code was self-generated by the physiotherapists rather than prompted. It is important to note that codes that were neither self-generated or elaborated upon following a prompt, were omitted from the table.

Table A.1

Definitions of Codes Used for Interview Questions 1-3 and Associated Participant Numbers

#	Parent Node Name (Child node sub-points)	Definition	Participant(s) whose interviews included this code
A1	***Client's Stage of Rehabilitation***	Discussion on how focus of attention statement provision changes as a function of whether the client is in early, middle, or late stages of their full rehabilitation process	P1, P2**, P8**
A2	***Client's Stage of Skill Acquisition for Specific Skill***	Discussion on how focus of attention statement provision changes as a function of the client's experience with a specific skill	P2, P6
A4	***Object Manipulation***	Discussion on how focus of attention statement provision changes as a function of whether or not the exercise includes the use and manipulation of a physical object	**P2,** P3, **P4**, **P5, P6, P7, P8**
	A4.1) Object Availability	Discussion on how whether or not an object is available for use affects how they provide focus of attention statements to their client	**P2**
	A4.2) Body Part Used	Discussion on how which body part is manipulating the object affects their use of focus of attention statements	P2
	A4.3) Object Functionality	Discussion on how the functionality, rather than the mere presence, of an object being	**P2, P4, P6,** P7

		manipulated affects the physiotherapists' type of statement provision	
A5	***Consideration of Client's Limitations***	Discussion of an explicit awareness and influence on focus of attention statement provision based on the clients' physical and cognitive limitations	P2, **P6**
	A5.1) Physical	Discussion of clients' physical limitations, such as their proprioceptive awareness, and how they influence the focus of attention statements physiotherapists give them	**P6**
	A5.2) Cognitive	Discussion of clients' cognitive limitations, such as their ability to understand instructions and feedback, and how they influence the focus of attention statements physiotherapists give them	P2, **P6, P7**, P8
A6	***Client Characteristics***	Discussion on how physiotherapists' focus of attention statement provision changes as a function of specific characteristics of the client	**P1, P2,** P3, **P4, P5, P6, P7**
	A6.1) Occupation	Discussion on how the clients' current or previous employment may affect the focus of attention statements given to them	**P1, P2,** P3
	A6.2) Rehabilitation Population/ Age	Discussion regarding the clients' specific rehabilitation population or age, ex orthopedic, stroke survivor, older adults etc., and how this affects the focus of attention statements given to them	**P2,** P3, P5, **P6, P7**
	A6.3) Athletic Experience	Discussion regarding how the clients' current or previous athletic experience affects the focus of attention statements given to them	**P1, P2, P3, P5, P6, P7**
	A6.4) Kinesthetic/ Proprioceptive Awareness	Discussion regarding the clients' "connectedness" to their body, referring to their kinesthetic or proprioceptive sensitivity, and how it affects the focus of attention statements given to them	**P1, P2, P3, P4, P6, P7**
	A6.5) Mental State (Dynamic)	Discussion about how the clients' mental state affects the focus of attention statements they are given. Note, this is not simply referring to a diagnosed mental status, rather it refers to their current mental state at the time of the rehabilitation session i.e., anxious, tired etc.	**P1**

	A6.6) Internal/External Learner	Discussion referring to clients as "someone who learns internally/ externally" in a general sense with no elaboration on why	**P1, P3, P4, P7**
	A6.7) Anatomy Knowledge	Discussion on how client's knowledge of anatomy affects the type of focus of attention statements given to them	**P2**
	A6.8) Previous Physio Experiences	Discussion on how client's previous experiences with a physiotherapist, for the same or different injury, affects the focus of attention statements given to them	**P2, P3**
	A6.9) Rehabilitation Goal	Discussion on how the client's overall rehabilitation goal affects the focus of attention statements given to them	**P3,** P5
	A6.10) Client Communication	Discussion on how the physiotherapist matches the focus (i.e., internal or external) to the way the client communicates their injury	**P6,** P7
A7	***Adapting to Client Success & Failure***	Trial and error where client success led to using the same type of focus of attention statements, and failure leads to switching	**P1, P2,** P3, **P4, P5, P6, P7, P8**
A8	***Physiotherapist's Experiences***	Discussion of how the physiotherapist's personal experiences affect how they provide focus of attention statements	**P1, P2, P3,** P4, **P6,** P7**, P8**
	A8.1) Athletic	Discussion on how the physiotherapist's current or previous athletic experience shapes how they provide their clients with focus of attention statements	**P1, P2, P3,** P4, **P6**
	A8.2) As Patient	Discussion on how the physiotherapist's previous experience as a patient affects their current provision of focus of attention statements	**P1, P3**
	A8.3) Specific PT Experience	Discussion on how specific physiotherapist experiences and job demands affect their provision of focus of attention statements	**P1, P7, P8**
A9	***Education***	Discussion of how the physiotherapist's undergraduate, physiotherapy or clinical education affects how they provide focus of attention statements	P1, P2, **P3, P4, P5, P6,** P7**, P8**
	A9.1 Anatomy Knowledge /Focus	Discussion on how the depth of the physiotherapist's anatomy/ kinematic knowledge affects how they provide focus of attention statements	**P1,** P2, P4, **P5, P6,** P7
	A9.2 Explicit Int/Ext Education	Discussion on whether the physiotherapist was explicitly taught about internal and	**P3**

		external focus as it is defined in the motor learning literature, and how this affects how they provide focus of attention statements	
	A9.3) Clinical Practice / Instruction	Discussion of the physiotherapist's indirect learning of focus of attention during their clinical practice and instruction and how this affects how they provide focus of attention statements	P2, **P3, P4, P6, P8**
	A9.4) Developed Statement Provision Style	Discussion on how the physiotherapist's education led to the development of specifically an internal or external statement provision style/preference	**P4, P5, P6, P8**
A10	***Pre-existing beliefs about focus of attention***	Discussion of a belief that an internal or an external focus of attention leads to a specific result	**P6, P7**
A11	***Task Characteristics***	Discussion of how elements of a task affect whether the physiotherapists are more likely to provide internal or external focus of attention statements for it	**P1, P2, P3,** P4, **P5, P6, P7, P8**
	A11.1) Local versus Global Movement	Discussion on how the movement size, i.e., local involving minimal muscles versus global involving multiple joints/muscles, affects the types of focus of attention statements physiotherapists give to the client	**P3,** P4, **P5,** P6
	A11.2) Degrees of Freedom	Discussion on how the presence of individually moving components (i.e., degrees of freedom) affects the types of focus of attention statements physiotherapists give to a client when the goal is to move a specific joint/muscle in the group	**P1**
	A11.3) Task Goal	Discussion on how the goal of the task, ex. Functional goal vs strengthening goal, affects the types of focus of attention statements physiotherapists give to the client	**P2, P3**, P4**, P5, P6, P7**, P8
	A11.4) Body Region	Discussion on how the specific region of the body involved in the task affects how the physiotherapist provides focus of attention statements	**P3, P4, P8**
A12	***Length of wording***	Discussion of how length of the wording may have affected the physiotherapists decisions when completing the questionnaire	**P4**

A13	***Physiotherapist's Intuition***	Discussion of how aside from knowledge, the physiotherapist utilizes their own intuition for decision making in regards to focus of attention statement provision	**P1, P3,** P7, P8
A14	***Feedback/Instruction Statement Efficiency***	Discussion of how specific focus of attention statements are utilized because they are more efficient in certain scenarios (NOT length of wording, rather it is the length of time for the client to be able to comprehend and use the feedback or instruction effectively)	**P1, P2, P3, P4, P5, P7, P8**

Appendix E
Code Definitions for Barriers to EFOA Statement Use

The definition for each code is described in Table A.2 below, along with the participant number of those who discussed the code in their interview. When the participant number is **bolded**, it indicates that that code was self-generated by the physiotherapists rather than prompted. It is important to note that codes that were neither self-generated or elaborated upon following a prompt, were omitted from the table.

Table A.2

Definitions of Codes Used for Interview Question 4 and Associated Participant Numbers

#	Parent Node Name (Child node sub-points)	Definition	Participant(s) whose interviews included this code
B1	***Lack of Awareness***	Lack of awareness altogether of the concept of focus of attention as described in motor learning research	**P1, P2**, P4, **P5, P6, P7, P8**
B2	***Lack of Knowledge***	Lack of knowledge/understanding of the concept of focus of attention as described in motor learning research	**P1, P2, P3, P4, P5, P6, P7, P8**
B3	***Lack of Skill***	Although they may know of the concept of focus of attention, they describe a lack of knowledge of how to apply it in practice	**P2, P8**
B4	***Education***	Discussion of how their physiotherapy education explicitly or implicitly causes a tendency to provide internally focused statements	**P1, P2, P3, P4, P5, P6, P7, P8**
	B4.1) Clinical Practice/ Instruction	Discussion of how their clinical practice or instruction led them to adopt an internally focused statement provision style	**P2, P4**
	B4.2) Lack of post-grad courses/workshop	Discussion on the lack of adequate post-graduate courses on the topic of focus of attention in physiotherapy	**P4, P6**
B5	***Natural Tendency to Internal Focus***	Discussion of how physiotherapists naturally lean to providing more internally focus statements	**P1, P2, P5,** P6
	B5.1) Anatomy Focus	Discussion on how the anatomy focus of their career causes them to adopt an	**P1**

		internally focused statement provision style	
B6	***Adapting to Patient Success***	Discussion about how the treatment is mainly focused on continuing the provision of statements that leads to clients' success and gearing away from statements that don't	**P4**
B8	***Research Influence***	Discussion about the various ways that accessing, interpreting and transitioning the research into practice, affect how it influences physiotherapists' focus of attention statement provision	**P1,** P2, P4, **P7, P8**
	B8.1) Accessibility	Discussion about how a lack of accessibility of the research is a barrier to teaching physiotherapists about focus of attention statement provision	P2, P4, P7
	B8.3) Research-Practice Gap	Discussion on the gap between research and applied practice as a result of various factors in a real-life setting that may not be captured in the research setting/population	**P1, P4, P7**
B9	***Stuck in their Ways***	Discussion about a difficulty to change the behavior of individuals who are stuck in their ways and may not be willing to try something different	**P1, P3, P6, P8**
B10	***Time / Effort Constraints***	Discussion about how their busy work leads to limited time and/or mental effort that affects their desire to learn/read about/ practice new concepts	**P1, P6, P7**
B11	***Coworkers Behavior***	Discussion about how observation of their coworker's behavior (or verbally sharing experiences) affects the physiotherapists' focus of attention statement provision	P1**, P8**
B12	***Object/Resource Access***	Discussion of how limited or varied access to objects within different physiotherapy settings affects their use of focus of attention statements	**P3,** P5
B13	***Client Expectations***	Discussion on how clients may expect physiotherapists to communicate in a way that is more in line with an internal focus (i.e., specific discussion of muscles/joints)	**P6,** P7**, P8**

4128

Appendix F
Workshop Assessment Package

One-Week Pre-Synchronous Workshop

Participant Characteristics

* 1. Age:

2. Gender (optional):

* 3. Years of experience as a physiotherapist:

* 4. Overall client bases with which you have had experience (select all that apply):

- [ ] Athletic
- [ ] Geriatric
- [ ] Orthopedic
- [ ] Pediatric
- [ ] Neurological
- [ ] Other (please specify)

* 5. Education (select all that apply):

- [ ] Bachelor's degree in Physiotherapy
- [ ] Bachelor's degree in any other field
- [ ] Master's degree in Physiotherapy
- [ ] Master's degree in any other field
- [ ] Ph.D. in Physiotherapy
- [ ] Ph.D. in any other field
- [ ] Other (please specify)

* 6. To what degree do you feel your education focused on motor learning principles:

1 Not at all	2	3	4	5 Extremely
○	○	○	○	○

Feel free to briefly elaborate

* 7. To what degree do you feel your practice is guided by the current literature (~last 5-10 years) on motor learning principles:

1 Not at all	2	3	4	5 Extremely
○	○	○	○	○

Feel free to briefly elaborate

One-Week Pre-Synchronous Workshop

Opening Notes on Focus of Attention

Within the fields of cognitive psychology and motor control/learning, focus of attention has been defined in different ways. For example, focus of attention has been categorized as associative/dissociative, and as a 2x2 matrix that factors in whether it is broad or narrow, and internal or external. For the purpose of our workshop and assessments, we will be adopting the viewpoint on focus of attention brought forward by Wulf and colleagues in which one's focus of attention in relation to movement can be either internal or external.

Note, that I am purposefully not elaborating on the definition of internal and external focus of attention. This is because, for the purposes of my research, it is essential that a true baseline understanding of your knowledge and skill related to this concept is obtained before you engage in the workshop. As such, it is also important that you do not use any external resources for the completion of the assessments and questionnaires that follow.

One-Week Pre-Synchronous Workshop

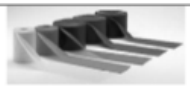
Skill Assessment

Based on our prior work with physiotherapists, we know that some of the concepts presented may be new for you, and we ask that you simply complete the video task described next, to the best of your availability at the present time.

In this task, you will be shown two different videos, each of a different exercise. In each video, you will see an individual performing the exercise with common execution errors. After each error performance, you will be prompted to pause the video and to write as many externally-focused cues you can generate to help that person correct the error. You can assume that the clients are familiar with the exercise.

Below are images of equipment you may have in your physiotherapy clinic. You can choose to use any of these to assist you in generating the external focus cues, but you are not limited to these. Feel free to get as creative as you would like when creating your external focus cues!

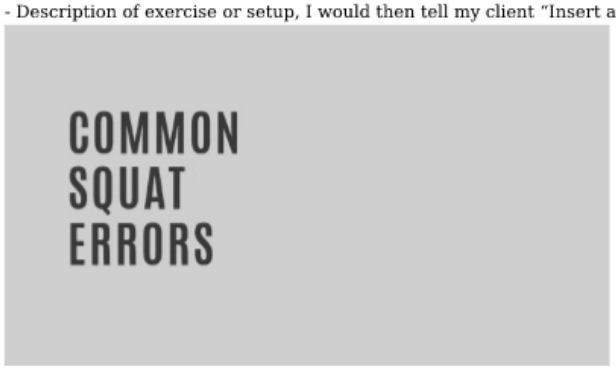
Physiotherapy Equipment/ Tools

 **Resistance Bands**	 **Dumbbells**	 **BOSU Ball**
 **Stickers**	 **Kettlebell**	 **Physio Ball**
 **Pillow**	 **Towel**	 **Athletic Tape**

* 1. Video 1: Correcting Squat Errors

While watching the video titled “Correcting Squat Errors”, generate as many externally focused statements to provide a client who was making those errors. In the box below the video, you can include descriptions leading up to the exercise, but make sure to place the actual instruction or feedback cue in quotation marks. Also, start a new line for each statement.

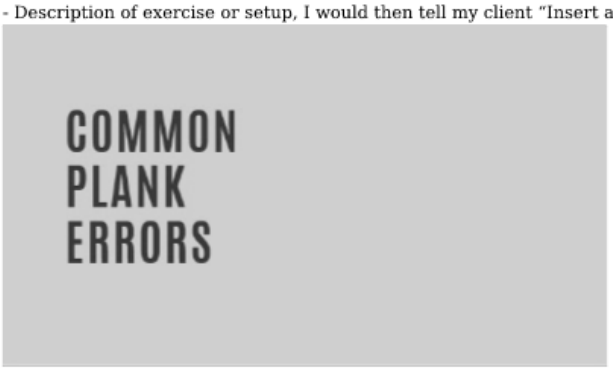
I.e.,
- Description of exercise or setup, I would then tell my client “Insert actual cue”.
- Description of exercise or setup, I would then tell my client “Insert actual cue”.
- Description of exercise or setup, I would then tell my client “Insert actual cue”.



* 2. Video 2: Correcting Plank Errors

While watching the video titled “Correcting Plank Errors”, generate as many externally focused statements to provide a client who was making those errors. In the box below the video, you can include descriptions leading up to the exercise, but make sure to place the actual instruction or feedback cue in quotation marks. Also, start a new line for each statement.

I.e.,
- Description of exercise or setup, I would then tell my client “Insert actual cue”.
- Description of exercise or setup, I would then tell my client “Insert actual cue”.
- Description of exercise or setup, I would then tell my client “Insert actual cue”.



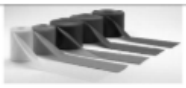
One-Week Pre-Synchronous Workshop

Skill Assessment

For the next two videos, you will see an individual doing an exercise correctly. Knowing the exercise in question, and understanding that your client is familiar with the task, provide a list of externally-focused cues to instruct the actual movements.

You can again choose to use any of the following items to assist you in generating the external focus cues, but you are not limited to these. Feel free to get as creative as you would like when creating your external focus cues!

Physiotherapy Equipment/ Tools

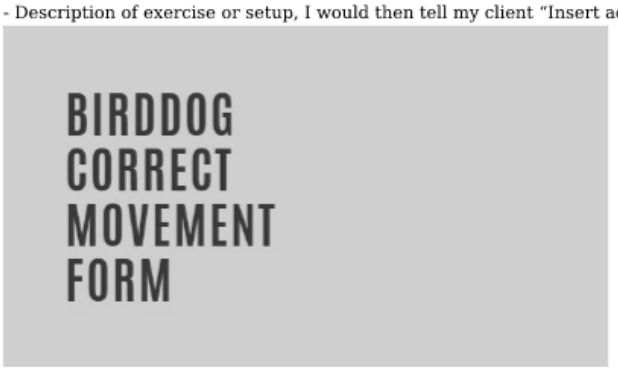
 **Resistance Bands**	 **Dumbbells**	 **BOSU Ball**
 **Stickers**	 **Kettlebell**	 **Physio Ball**
 **Pillow**	 **Towel**	 **Athletic Tape**

4139

* 1. Video 3: Instructing BirdDog

While watching the video titled "Instructing BirdDog", generate as many externally focused statements to provide a client who was making those errors. In the box below the video, you can include descriptions leading up to the exercise, but make sure to place the actual instruction or feedback cue in quotation marks. Also, start a new line for each statement.

I.e.,
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".

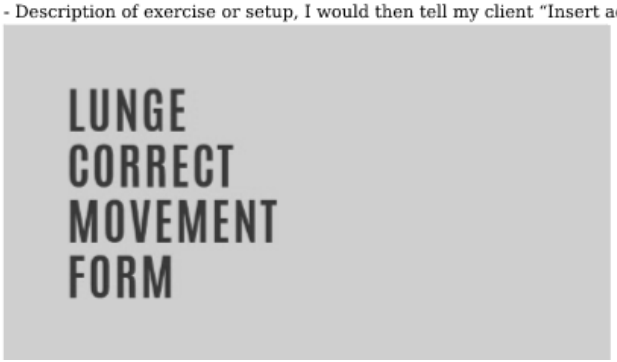


4140

* 2. Video 4: Instructing Lunge

While watching the video titled "Instructing Lunge", generate as many externally focused statements to provide a client who was making those errors. In the box below the video, you can include descriptions leading up to the exercise, but make sure to place the actual instruction or feedback cue in quotation marks. Also, start a new line for each statement.

I.e.,
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".



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4142

One-Week Pre-Synchronous Workshop

Knowledge Assessment

The following questions are designed to gain an understanding of your baseline knowledge of ideas related to attentional focus. We prefer that you not simply 'guess' the answer and encourage you to use the "I don't know" option when you are uncertain of the response.

Please do not use any external resources to aid in answering these questions.

4143

One-Week Pre-Synchronous Workshop

Knowledge Assessment

True or False Questions
1 mark each, 7 total

* 1. Motor learning and performance research with persons that have musculoskeletal injury has shown that adopting an external focus of attention leads to enhanced movement effectiveness in later stages of rehabilitation.

◯ True ◯ False ◯ I don't know

* 2. Motor learning and performance research with healthy populations has shown that adopting an internal focus of attention leads to enhanced movement effectiveness.

◯ True ◯ False ◯ I don't know

* 3. Motor learning and performance research has shown that adopting an internal focus leads to reduced risk of falling in elderly clients.

◯ True ◯ False ◯ I don't know

4144

* 4. Motor learning and performance research has shown that adopting an external focus often leads to reduced muscular activity as measured by EMG.

◯ True ◯ False ◯ I don't know

* 5. Motor learning and performance research has shown that adopting an internal focus often leads to a lesser degree of co-contractions of antagonist muscles.

◯ True ◯ False ◯ I don't know

* 6. Motor learning and performance research has shown that both young and older adults are impacted similarly by attentional focus cueing.

◯ True ◯ False ◯ I don't know

* 7. Researchers have proposed that the external focus benefit may not apply to clients in early stages of rehabilitation and that an internal focus may be more appropriate.

◯ True ◯ False ◯ I don't know

4145

One-Week Pre-Synchronous Workshop

Knowledge Assessment

Identifying the Attentional Focus Questions
1 mark each, 9 total

For each statement below, identify whether it promotes an internal attentional focus, an external attentional focus, or does not promote a specific attentional focus at all (labelled as N/A).

* 1. "You're doing a great job today"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 2. "Reach your arms up as high as you can"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 3. "Keep the mug moving smoothly through space until you rest it on the table"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 4. "Don't lock your knees when you come up from the squat"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 5. "Use your calves to get up on your tippy toes, then lower yourself back down"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 6. "Repeat this exercise three times per day"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 7. "Move the towel against the wall in a circular motion, as though you are washing a window"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 8. "If you feel any pain during the exercise, you should stop"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 9. "Remember to imagine that broomstick helping you to stay in good posture while doing the birddog"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

4146

One-Week Pre-Synchronous Workshop

Knowledge Assessment

Multiple Choice Questions
1 mark each, 7 total

* 1. Attentional focus, as defined by Wulf and colleagues (1998), is described as:

- ◯ Where an individual focuses their eyes during a movement task
- ◯ Where an individual assigns their mental focus during a movement task
- ◯ Whether an individual is focused on, or away, from somatic sensations
- ◯ I don't know

* 2. Which of the following represents an internal focus of attention statement that a physiotherapist could provide to a client who performed an improper squat:

- ◯ Make sure your hips are pushed back when you squat down
- ◯ Slow down the movement as you move the weight up
- ◯ When you lower, pretend like you are going to be sitting on a low chair
- ◯ I don't know

* 3. Which of the following represents an external focus of attention feedback statement that a physiotherapist could provide to a client struggling to maintain their balance while performing a static lunge with one foot on a BOSU ball:

- ◯ Try to center your foot on the BOSU ball
- ◯ Try to reduce the movement of the BOSU ball
- ◯ Try placing your hands on your hips when balancing on the BOSU ball
- ◯ I don't know

4147

* 4. Select the solution that provides the correct word for the 'blank' in the following statement: Learning should be assessed at least 24 hours after practicing a skill in order to allow for _____ processes to occur:

- ◯ Encoding
- ◯ Consolidation
- ◯ Retrieval
- ◯ I don't know

* 5. Research has shown that an external focus of attention:

- ◯ benefits both motor learning and performance
- ◯ benefits motor performance but not motor learning
- ◯ benefits motor learning but not motor performance
- ◯ I don't know

4148

* 6. To date, researchers have stated that evidence is still inconclusive in regard to attentional focus benefits with which of the following populations?:

- ◯ Older adults
- ◯ Individuals recovering from musculoskeletal injuries
- ◯ Individuals with central nervous system dysfunction
- ◯ I don't know

* 7. An external focus of attention leads to enhanced movement effectiveness for:

- ◯ Only simple tasks
- ◯ Only complex tasks
- ◯ Both simple and complex tasks
- ◯ I don't know

4149

4150

One-Week Pre-Synchronous Workshop

Explaining the Benefits of an External Focus of Attention

As an overview, focus of attention refers to the mental focus adopted by an individual performing a movement. Note this does not equate to their visual focus but is instead more about where the client directs their mental concentration when executing the action. An individual adopting an internal focus of attention is focusing on the movement kinematics, for example the joints and muscles involved in the movement. Contrastingly, an individual adopting an external focus of attention is focusing on the effect of their movement on the environment, for example the intended outcome of the movement. Research has shown that people can be directed to adopt a particular focus via verbal instruction or feedback. To illustrate, consider a person who is learning to perform a squat…as their physiotherapist you could cue them internally by saying "make sure to push your hips back as you go down" or externally through an analogy such as "act like you're going to sit on a chair". In both cases, the intended movement should be performed, however only the internal cue is explicitly instructing the individual to focus on their body. To date, research on youth, adult, and older adults, as well as certain clinical populations, such as individuals with musculoskeletal dysfunction or disorder, has shown that adopting an external focus of attention leads to enhanced motor performance and learning. At this time, however, research on populations with central nervous system dysfunction has produced inconclusive results with some findings supporting benefits for an external focus of attention, but others not reporting such benefits.

Despite the robust finding that external focus of attention cues benefits motor learning and performance, evidence from observational studies, and our own questionnaire-based research, suggests that physiotherapists use internally focused statements with their clients more than external ones. Consequently, our goal is to build your awareness, knowledge and skill related to focus of attention cueing and hope that it will increase your use of externally focused cueing. To be clear, the goal of this workshop is not to have you, as a physiotherapist, giving external focus of attention cues 100% of the time, as we acknowledge that clinical settings give rise to factors that do not necessarily exist within research settings. In fact, our own research has highlighted a variety of physiotherapist, client and task characteristics that influence physiotherapists use of focus of attention cueing. Nonetheless, the current use of external focus of attention cues is very low and increased use is recommended.

Prior to beginning this focus of attention workshop, we would like to tap into your attitudes, commitment and confidence related to the use of external focus cueing in your practice. Note that there are no right or wrong answers and that we ask you to simply answer honestly and based on your current perceptions.

4151

4152

One-Week Pre-Synchronous Workshop

Attitudes

Having not completed the workshop yet, please answer the questions that follow based on your current perceptions rather than where you feel they may be after the workshop.

Please respond using the scale below as a guide, by placing your number from 0-100 in the space provided beside the question.

0	10	20	30	40	50	60	70	80	90	100
Not at all worthwhile					Moderately worthwhile					Extremely worthwhile

To what degree do you believe:

* 1. that gaining an understanding of attentional focus cueing will be worthwhile knowledge for your practice?

* 2. that applying external focus of attention cues will be worthwhile in your practice?

If you selected a rating of 70 or less for either of the above two questions, please answer the following question:

3. I am not fully certain that gaining an understanding of or applying more externally focused cues will be worthwhile for my practice because (Select all that apply):

- [ ] I am not convinced it will be an efficient way of cueing my patients
- [ ] I am not convinced that the research findings apply directly to my practice
- [ ] my own experience has shown me that an internal focus is effective
- [ ] I am not convinced that everyone will benefit from the external focus cues
- [ ] Other (please specify)

4153

One-Week Pre-Synchronous Workshop

Attitudes

Having not completed the workshop yet, please answer the questions that follow based on your current perceptions rather than where you feel they may be after the workshop.

Please respond using the scale below as a guide, by placing your number from 0-100 in the space provided beside the question.

0	10	20	30	40	50	60	70	80	90	100
Not at all committed					Moderately committed					Extremely committed

4154

To what degree are you committed to:

* 1. trying to gain an understanding of the concept of attentional focus cueing?

* 2. trying to apply more externally focused attentional focus cues in your practice?

If you selected a rating of 70 or less for either of the above two questions, please answer the following question:

3. My commitment to trying to apply more externally focused cues is impacted by the fact that (Select all that apply):

- [ ] I do not have the necessary skills
- [ ] I am not sure what is expected of me
- [ ] I have other, higher priorities
- [ ] I do not feel I am required to do so
- [ ] no one will care if I actually do or do not
- [ ] there is no incentive for me to do so
- [ ] Other (please specify)

4155

4156

One-Week Pre-Synchronous Workshop

Self-Efficacy

LAST SET OF QUESTIONS!

Having not completed the workshop yet, please answer the questions that follow based on your current perceptions rather than where you feel they may be after the workshop.

A number of barriers are described below that can make it difficult to apply the findings from the attentional focus literature in your practice. In light of each barrier below, please rate in each of the blanks in the column below how certain you are right now (i.e. even before you have begun the workshop) that you can provide effective external focus cues to your clients.

Rate your degree of confidence by recording a number from 0 – 100 beside each statement using the scale given below:

0	10	20	30	40	50	60	70	80	90	100
Not at all confident					Moderately Confident					Extremely Confident

* 1. When the task is highly localized to a specific muscle group or joint

* 2. When my client doesn't initially appear to understand the external cue

4157

* 3. When my client expects me to cue them internally

* 4. When my coworkers appear to be cueing their clients internally

* 5. When the exercise does not make use of an external object

* 6. When I have limited access to objects that can be used for external cues

4158

4159

One-Week Pre-Synchronous Workshop

Thank you so much for your participation! Do not worry if these assessments seemed difficult because you can now begin the online self-directed modules where you will find much of the answers. Feel free to reach out to me at jhuss085@uottawa.ca if you have any questions. Happy learning and see you at our scheduled virtual workshop!

Press DONE to see your knowledge assessment score

4160

Appendix G
Workshop Assessment Package 2

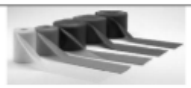
Immediately Post-Synchronous Workshop (Part 1)

Skill Assessment

The following skill assessment is just like the one you had performed at home this week. In this task, you will be shown two different videos, each of a different exercise. In each video, you will see an individual performing the exercise with common execution errors. After each error performance, you will be prompted to pause the video and to write as many externally-focused cues you can generate to help that person correct the error. You can assume that the clients are familiar with the exercise.

Below are images of equipment you may have in your physiotherapy clinic. You can choose to use any of these to assist you in generating the external focus cues, but you are not limited to these. Feel free to get as creative as you would like when creating your external focus cues!

Physiotherapy Equipment/ Tools

 Resistance Bands	 Dumbbells	 BOSU Ball
 Stickers	 Kettlebell	 Physio Ball
 Pillow	 Towel	 Athletic Tape

* 1. Video 1: Correcting BirdDog Errors

While watching the video titled "Correcting BirdDog Errors", generate as many externally focused statements to provide a client who was making those errors. In the box below the video, you can include descriptions leading up to the exercise, but make sure to place the actual instruction or feedback cue in quotation marks. Also, start a new line for each statement.

I.e.,
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".

* 2. Video 2: Correcting Lunge Errors

While watching the video titled “Correcting Lunge Errors”, generate as many externally focused statements to provide a client who was making those errors. In the box below the video, you can include descriptions leading up to the exercise, but make sure to place the actual instruction or feedback cue in quotation marks. Also, start a new line for each statement.

I.e.,
- Description of exercise or setup, I would then tell my client “Insert actual cue”.
- Description of exercise or setup, I would then tell my client “Insert actual cue”.
- Description of exercise or setup, I would then tell my client “Insert actual cue”.

4165

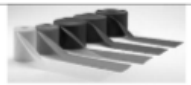
Immediately Post-Synchronous Workshop (Part 1)

Skill Assessment

For the next two videos, you will see an individual doing an exercise correctly. Knowing the exercise in question, and understanding that your client is familiar with the task, provide a list of externally-focused cues to cue for the actual movements.

You can again choose to use any of these items to assist you in generating the external focus cues, but you are not limited to these. Feel free to get as creative as you would like when creating your external focus cues!

Physiotherapy Equipment/ Tools

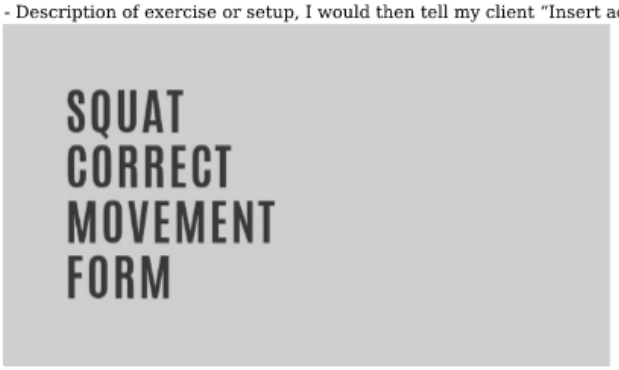
 Resistance Bands	 Dumbbells	 BOSU Ball
 Stickers	 Kettlebell	 Physio Ball
 Pillow	 Towel	 Athletic Tape

4166

* 1. Video 3: Instructing Squat

While watching the video titled "Instructing Squat", generate as many externally focused statements to provide a client who was making those errors. In the box below the video, you can include descriptions leading up to the exercise, but make sure to place the actual instruction or feedback cue in quotation marks. Also, start a new line for each statement.

I.e.,
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".

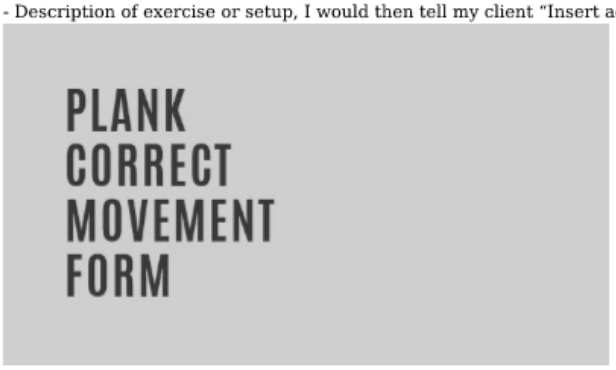


4167

* 2. Video 4: Instructing Plank

While watching the video titled "Instructing Plank", generate as many externally focused statements to provide a client who was making those errors. In the box below the video, you can include descriptions leading up to the exercise, but make sure to place the actual instruction or feedback cue in quotation marks. Also, start a new line for each statement.

I.e.,
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".
- Description of exercise or setup, I would then tell my client "Insert actual cue".



4168

Immediately Post-Synchronous Workshop (Part 1)

Knowledge Assessment

The following questions are designed to gain an understanding of your knowledge of ideas related to attentional focus after participating in the workshop. We prefer that you not simply 'guess' the answer and encourage you to use the "I don't know" option when you are uncertain of the response.

Please do not use any external resources to aid in answering these questions.

Immediately Post-Synchronous Workshop (Part 1)

Knowledge Assessment

True or False Questions
1 mark each, 7 total

* 1. Motor learning and performance research with persons that have musculoskeletal injury has shown that adopting an internal focus of attention leads to enhanced movement effectiveness in later stages of rehabilitation.

◯ True ◯ False ◯ I don't know

* 2. Motor learning and performance research with healthy populations has shown that adopting an external focus of attention leads to enhanced movement effectiveness.

◯ True ◯ False ◯ I don't know

* 3. Motor learning and performance research has shown that adopting an external focus leads to reduced falling risk in elderly clients.

◯ True ◯ False ◯ I don't know

* 4. Motor learning and performance research has shown that adopting an internal focus often leads to reduced muscular activity as measured by EMG.

◯ True ◯ False ◯ I don't know

* 5. Motor learning and performance research has shown that adopting an external focus often leads to a lesser degree of co-contractions of antagonist muscles.

◯ True ◯ False ◯ I don't know

* 6. Motor learning and performance research has shown that young adults, as compared to older adults, are impacted differently by attentional focus cueing.

◯ True ◯ False ◯ I don't know

* 7. Researchers have proposed that the internal focus benefit may not apply to clients in early stages of rehabilitation, thus, promoting an external focus may be more appropriate.

◯ True ◯ False ◯ I don't know

Immediately Post-Synchronous Workshop (Part 1)

Knowledge Assessment

Identifying the Attentional Focus Questions
1 mark each, 9 total

For each statement below, identify whether it promotes an internal attentional focus, an external attentional focus, or does not promote a specific attentional focus at all (labelled as N/A).

* 1. "You're hitting all your targets today"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 2. "Stretch your hands up as high as they go"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 3. "Keep the cup steady as you move it, until you set it to rest on the counter"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 4. "Keep a slight bend in your knees when you come up from the squat"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 5. "Get up on the balls of your feet, then come back down"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 6. "Repeat this exact movement twice a day"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 7. "Hold the ball against the wall and roll it up and down without dropping it"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 8. "If you feel any shoulder pain during the exercise, you should stop"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

* 9. "Imagine you are like a spring and so you lower slowly and then explode on the way up"

◯ Internal Focus ◯ External Focus ◯ N/A ◯ I don't know

4172

Immediately Post-Synchronous Workshop (Part 1)

Knowledge Assessment

Multiple Choice Questions
1 mark each, 7 total

* 1. Attentional focus, as defined by Wulf and colleagues (1998), is described as:

◯ Where an individual focuses their eyes during a movement task
◯ Where an individual assigns their mental focus during a movement task
◯ Whether an individual is focused on, or away, from somatic sensations
◯ I don't know

4173

* 2. Which of the following represents an internal focus of attention statement that a physiotherapist could provide to a client who performed an improper squat:

- ◯ Concentrate on the tape on your shoe not losing contact with the floor
- ◯ Slow down the movement, take your time
- ◯ Try not to lift your heels off the floor as you go down
- ◯ I don't know

* 3. Which of the following represents an external focus of attention feedback statement tha a physiotherapist could provide to a client struggling to maintain their balance while performing a push up with their hands place on a BOSU ball (flipped so their hands are on the platform not the cushion):

- ◯ Try to stabilize the BOSU ball by keeping the platform straight
- ◯ Try inhaling on your way down and exhaling when you come up
- ◯ Try to stabilize your shoulders by keeping your elbows in
- ◯ I don't know

* 4. Select the solution that provides the correct word for the 'blank' in the following statement: Learning should be assessed at least 24 hours after practicing a skill in order to allow for _____ processes to occur:

- ◯ Encoding
- ◯ Consolidation
- ◯ Retrieval
- ◯ I don't know

4174

* 5. Research has shown that an external focus of attention:

- ◯ benefits both motor learning and performance
- ◯ benefits motor performance but not motor learning
- ◯ benefits motor learning but not motor performance
- ◯ I don't know

* 6. To date, researchers have stated that evidence is still inconclusive in regard to attentional focus benefits with which population?:

- ◯ Older adults
- ◯ Individuals recovering from musculoskeletal injuries
- ◯ Individuals with central nervous system dysfunction
- ◯ I don't know

* 7. An external focus of attention leads to enhanced movement effectiveness for:

- ◯ Only simple tasks
- ◯ Only complex tasks
- ◯ Both simple and complex tasks
- ◯ I don't know

4175

Immediately Post-Synchronous Workshop (Part 1)

Thank you so much for your participation! We hope that it has been as beneficial for you, as it has been for us. Please join the main Zoom room to let us know you have completed these assessments, so that we can go over the answers and any questions you may still have together.

Please press DONE below to complete the survey and see your results (as well as the correct responses) for the knowledge assessment questions.

Appendix H
Workshop Assessment Package 3

Immediately Post-Synchronous Workshop (Part 2)

Almost Done!

Thank you so much for your participation in today's workshop on attentional focus cueing in physiotherapy. This will be the final questionnaire we ask you to complete today! Once you are done, please present the completion screen to the instructor. She will then provide you with your certificate of participation in the workshop. For this questionnaire, we want to hear about your experience with the workshop today and the materials made available to you last week. Please be honest in your feedback as we are always looking to improve the quality of our training.

Immediately Post-Synchronous Workshop (Part 2)

Resource Use

* 1. Before todays in person workshop, you were been provided with resources to increase your knowledge, skill or implementation of external attentional focus cueing. It is also possible that you explored resources outside of the ones you were provided as part of the study. Please select any of these additional resources that you utilized in the last week to increase your knowledge, skill or implementation of external attentional focus cueing (select all that apply):

- ☐ YouTube videos (other than the ones we shared)
- ☐ Peer-reviewed articles on attentional focus (other than the ones we summarized for you)
- ☐ Discussions with coworkers
- ☐ Email support from us for questions
- ☐ No additional resources used
- ☐ Other (please specify)

Immediately Post-Synchronous Workshop (Part 2)

Website Modules - Satisfaction, Relevance and Engagement

* 1. For the following questions, please respond in regards to your satisfaction, perceived relevance and engagement related to the **website modules** you completed over the last week.

Please respond on a scale from strongly disagree to strongly agree

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I understood the learning objectives	○	○	○	○	○
I found the modules enjoyable	○	○	○	○	○
I found the content easy to understand and follow	○	○	○	○	○

I was appropriately challenged by the material	○	○	○	○	○
I was satisfied with the duration of the different modules	○	○	○	○	○
The clinical examples presented were relevant to my practice	○	○	○	○	○
I thought about how the material could be applied in my own practice	○	○	○	○	○
I believe applying what I learned today will positively impact my clients	○	○	○	○	○
I felt engaged in the modules	○	○	○	○	○

4185

Immediately Post-Synchronous Workshop (Part 2)

Virtual Workshop - Satisfaction, Relevance and Engagement

* 1. For the following questions, please respond in regards to your satisfaction, perceived relevance and engagement related to the **virtual workshop** you just completed.
Please respond on a scale from strongly disagree to strongly agree

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I understood the learning objectives	○	○	○	○	○
I found the workshop enjoyable	○	○	○	○	○
I found the content easy to understand and follow	○	○	○	○	○
I was appropriately challenged by the material	○	○	○	○	○
My learning was enhanced by the instructor's knowledge and experience	○	○	○	○	○
I was comfortable with the pace of the workshop	○	○	○	○	○
I was satisfied with the duration of the workshop	○	○	○	○	○
I was comfortable with the size of the group	○	○	○	○	○
I was satisfied with the number of instructors	○	○	○	○	○
The instructors effectively answered questions	○	○	○	○	○
The clinical examples presented were relevant to my practice	○	○	○	○	○

4186

I thought about how the material could be applied in my own practice	○	○	○	○	○
I believe applying what I learned today will positively impact my clients	○	○	○	○	○

4187

I felt engaged in the workshop	○	○	○	○	○
I had ample opportunities to practice the material I learned	○	○	○	○	○
I had ample opportunities to ask questions	○	○	○	○	○
I had ample opportunities to share my knowledge	○	○	○	○	○
I had ample opportunities to share my skill	○	○	○	○	○

4188

4189

Immediately Post-Synchronous Workshop (Part 2)

Attitudes

Answer the questions that follow based on your current perceptions and attitudes towards attentional focus cueing.

Please respond using the scale below as a guide, by placing your number from 0-100 in the space provided beside the question.

0	10	20	30	40	50	60	70	80	90	100
Not at all worthwhile					Moderately worthwhile					Extremely worthwhile

To what degree do you believe:

* 1. that gaining an understanding of attentional focus cueing will be worthwhile knowledge for your practice?

* 2. that applying external focus of attention cues will be worthwhile in your practice?

4190

If you selected a rating of 70 or less for either of the above two questions, please answer the following question:

3. I am not fully certain that gaining an understanding of or applying more externally focused cues will be worthwhile for my practice because (Select all that apply):

- [ ] I am not convinced it will be an efficient way of cueing my patients
- [ ] I am not convinced that the research findings apply directly to my practice
- [ ] my own experience has shown me that an internal focus is effective
- [ ] I am not convinced that everyone will benefit from the external focus cues
- [ ] Other (please specify)

4191

Immediately Post-Synchronous Workshop (Part 2)

Attitudes

Answer the questions that follow based on your current perceptions and commitment to providing externally focus cues in your practice.

Please respond using the scale below as a guide, by placing your number from 0-100 in the space provided beside the question.

0	10	20	30	40	50	60	70	80	90	100
Not at all committed					Moderately committed					Extremely committed

To what degree are you committed to:

* 1. trying to gain an understanding of the concept of attentional focus cueing?

* 2. trying to apply more externally focused attentional focus cues in your practice?

If you selected a rating of 70 or less for either of the above two questions, please answer the following question:

3. My commitment to trying to apply more externally focused cues is impacted by the fact that (Select all that apply):

- [ ] I do not have the necessary skills
- [ ] I am not sure what is expected of me
- [ ] I have other, higher priorities
- [ ] I do not feel I am required to do so
- [ ] no one will care if I actually do or do not
- [ ] there is no incentive for me to do so
- [ ] Other (please specify)

4192

4193

Immediately Post-Synchronous Workshop (Part 2)

Self-Efficacy

A number of barriers are described below that can make it difficult to apply the findings from the attentional focus literature in your practice. In light of each barrier below, please rate in each of the blanks in the column below how certain you are right now that you can provide effective external focus cues to your clients.

Rate your degree of confidence by recording a number from 0 – 100 in the space provided beside each statement, using the scale given below:

0	10	20	30	40	50	60	70	80	90	100
Not at all confident					Moderately Confident					Extremely Confident

* 1. When the task is highly localized to a specific muscle group or joint

* 2. When my client doesn't initially appear to understand the external cue

* 3. When my client expects me to cue them internally

* 4. When my coworkers appear to be cueing their clients internally

* 5. When the exercise does not make use of an external object

* 6. When I have limited access to objects that can be used for external cues

4194

4195

Immediately Post-Synchronous Workshop (Part 2)

General Feedback

Last set of questions!

The following questions will provide us with information that will allow us to continue to help you apply what you've learned today into your practice.

* 1. What were the three most important things you learned through participation in this workshop?

4196

* 2. What barriers do you anticipate running into when trying to apply what you've learned today in your practice?

* 3. Do you see any solutions to the barriers you have just listed?

Immediately Post-Synchronous Workshop (Part 2)

All Done!

Thank you so much for completing this feedback questionnaire. We hope that you enjoyed today's workshop and look forward to our continued communications once you have left today.

Please show this page to the instructor in order to receive your certificate.

Appendix I
Workshop Assessment Package 4

One-Week Post-Synchronous Workshop

Welcome Back!

Now that you have had one week to apply the workshop material in your practice, we would like to know how your experience has been. There are three sections to be completed. The first section addresses your use of resources, the second section addresses your perceptions of your outcomes, and the third section addresses your perceptions of your clients' outcomes.

One-Week Post-Synchronous Workshop

Resource Use

* Throughout the study, you have been provided with resources to increase your knowledge, skill or implementation of external attentional focus cueing. Please select any of these additional resources that you utilized **in the last week** to increase your knowledge, skill or implementation of external attentional focus cueing (select all that apply):

- ☐ The website modules provided as part of the study
- ☐ YouTube videos (other than the ones we shared)
- ☐ Peer-reviewed articles on attentional focus (other than the ones we summarized for you)
- ☐ Discussions with coworkers
- ☐ Email support from us for questions
- ☐ No additional resources used
- ☐ Other (please specify)

One-Week Post-Synchronous Workshop

Your Perceptions of Your Outcomes

Answer the questions based on your current perceptions.

For the following questions, please respond on a scale of 0 to 100 using the scale below as a guide.

0	10	20	30	40	50	60	70	80	90	100
Not at all					Moderately					Extremely

To what degree do you feel that, participating in the workshop has allowed you to:

* improve your knowledge about the benefits of external cueing?

* better create externally focused cues for a variety of exercises you have come across in your practice?

* increase your use of external focus of attention cues in your practice?

* more often communicate explicitly the intention of your external cueing to your clients?

* Select any of the following personal factors (i.e. related to your thoughts and behaviors) that impacted your provision of externally focused cues to your clients (select all that apply):

- [ ] It was easier to continue cueing internally
- [ ] I didn't feel confident providing external cues
- [ ] I had difficulty coming up with external cues
- [ ] No personal factors impacted my external cueing
- [ ] Other (please specify)

4207

4208

One-Week Post-Synchronous Workshop

Your Perceptions of Your Clients' Outcomes

Answer the questions based on your current perceptions.

For the following questions, please respond on a scale of 0 to 100 using the scale below as a guide.

0	10	20	30	40	50	60	70	80	90	100
Not at all					Moderately					Extremely

* To what degree do you feel that your use of externally focused cueing improved the motor performance or rehabilitation progress of your clients?

If you **responded with a 0,** then you may skip the questions remaining on this page and move on to the next page.

If you **responded higher than 0**, then please answer the rest of the questions.

4209

Based on your current perception of the impact external focus cueing has on your clients, to what degree do you intend to continue to provide external cues in your practice? (*using same 0-100 scale as above*):

Please respond on a scale of 0 to 100 using the scale below as a guide. Answer the questions based on your **current** perceptions. Feel free to elaborate in your response in the spaces provided. It is also possible that you have not had variability in one or more of the characteristics listed below, if that is the case simply write in N/A.

0	10	20	30	40	50	60	70	80	90	100
Not at all					Moderately					Extremely

To what degree do you feel the benefit of your client adopting an external focus was moderated by the following client characteristics:

Rehabilitation Population:

Response (0-100)

Elaboration

Stage of Rehabilitation:

Response (0-100)

Elaboration

Athletic Experience:

Response (0-100)

Elaboration

Kinesthetic Awareness:

Response (0-100)

Elaboration

Are there any other client characteristics that you feel moderate the external focus of attention benefit?

To what degree do you feel the benefit of your client adopting an external focus was moderated by the following task characteristics:

The functionality of an external object:

Response (0-100)

Elaboration

The goal of the task:

Response (0-100)

Elaboration

The region of the body involved in the movement:

Response (0-100)

Elaboration

Are there any other task characteristics that you feel moderate the external focus of attention benefit?

4212

4213

One-Week Post-Synchronous Workshop

Open-Ended Question

Is there anything else about your experience applying external focus cueing in your practice that you would like to share with us?

Thank you so much for your continued dedication to this study. This was the last assessment required for your involvement! We really hope that you have gotten as much from your participation as we have. If you have any further questions, comments or just want to reach out please feel free to email me at jhuss085@uottawa.ca anytime! Thanks again :)

4214

Appendix J
Face Validation of Workshop Knowledge and Skill Assessments

As the knowledge and skill assessments were created specifically for the purpose of this study, both underwent a process of face validation prior to their implementation in the research. Face validation of the knowledge assessment occurred with six focus of attention researchers who provided their feedback on the clarity and content of the questions associated with the assessment. Following receipt of their feedback, modifications were made to the assessment. These modifications included (1) the removal of questions concerning focus of attention subtopics that were considered to be not yet researched adequately for direct application in rehabilitation (e.g., distance effects and functional variability), (2) changing of wording to improve clarity, and (3) the addition of an "I don't know" option to every question to discourage guessing.

Face validation of the skill assessment was performed by the lead author (Hussien) and involved three physiotherapists. As a first step, four exercises commonly performed in a rehabilitation setting (squat, birddog, plank and lunge) were selected and the common errors associated with each exercise were identified. Next, a personal trainer was video recorded performing the four exercises with correct movement form and these videos were sent to the three physiotherapists along with a word doc summarizing common errors for the exercises. The physiotherapists were asked to complete two tasks. First, they were to confirm that, for each of the four exercises, the movement execution was correct. All physiotherapists agreed that the videos demonstrated correct movement form for all the exercises. Second, based on the common error list provided, they ranked the top three most common errors and were also provided the option to add any errors that were not listed should they consider that it was one of the top three. In terms of errors added, these included: excessive hip hinging and not enough hip flexion for the

squat, and flexing the spine for the birddog. The top three error rankings provided by each physiotherapist were assigned point values and were summed across the three physiotherapists to determine the common execution errors to be used in the skill assessment videos. The top three errors identified for each of the exercises were as follows: (1) squat: not squatting deep enough, lifting heels off the floor and flexing the spine, (2) birddog: rotating hips during extension, not engaging the core and extending the spine, (3) plank: raising the hips too high, dropping hips too low and extending the spine, and (4) lunge: not lunging deep enough, uncontrolled return to neutral and internal knee rotation. With this information, the same individual who performed the movements with correct form was also video-recorded executing the four exercises with each of the identified top three common errors.

Finally, the online Canva design tool was used to compile eight skill assessment videos that were uploaded to YouTube. Four of these videos consisted of the video clips of the individual exercises being performed with correct form and the other four videos consisted of the video clips of the three common errors for each of the individual exercises. These eight videos were used to create the skill assessment for both the pre- and post-workshop measurements. Specifically, for the pre-workshop measure, physiotherapists viewed the common errors for the squat and plank, and the correct form of the birddog and lunge. Contrastingly, post-workshop they viewed the common errors for the birddog and lunge, and the correct form of the squat and plank.

The skill assessment videos were embedded within SurveyMonkey assessments along with written instructions for how to record the external focus statements that read as follows:

> While watching the video titled '*insert video title*', generate as many externally focused statements to provide a client (who was making those errors [error videos] *or* to

encourage execution of the movement [correct form videos]). In the box below the video, you can include descriptions leading up to the exercise, but make sure to place the actual instruction or feedback cue in quotation marks. Also, start a new line for each statement. I.e., *Description of exercise or setup*, I would then tell my client "*Insert actual cue*".

Of note, the instruction to place the external statement in quotation marks was included in order to simplify the process of coding the skill assessments. Further, at the start of the correct form videos, physiotherapists read the following on the screen:

> In this video you will be shown a client performing a '*insert exercise name'* with correct movement form. Your task is to create externally focused instruction statements to provide a client that will perform this exercise. For this task, imagine your client is already familiar with the exercises and you are cueing the actual movement."

During the video, physiotherapists were prompted to pause the video to allow themselves time to write the externally focused statements on the SurveyMonkey form. For an example of the correct performance of the squat instruction video, see https://youtu.be/rGC4LYmIXuE. At the start of the common error videos, physiotherapists received instructions that read:

> In this video you will be shown a client making three common errors while performing a '*insert exercise name'*. Your task is to create externally focused feedback statements to provide this client. Note that each video portraying an error will play twice before moving on to the next error video.

For each exercise, the region of concern was named to orient the physiotherapist to the upcoming error, e.g., "Pelvis position". Physiotherapists were also prompted to pause the video

after each error viewing in order to write their externally focused statements into SurveyMonkey (see https://youtu.be/Td4ooHWlT6k for the correcting squat errors video). Finally, at the end of every video, physiotherapists were informed that they could rewind and repeat the video as many times as they would like.

Appendix K
Ethics Approval for Study 1

05/12/2019

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number	H-05-18-657
Titre du projet / Project Title	Attentional Focus Use In Physiotherapy Settings: An Educational Intervention
Type de projet / Project Type	Projet indépendant d'étudiant / Independent student project
Statut du projet / Project Status	Renouvelé / Renewed
Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)	05/12/2019
Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)	12/11/2020

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Appendix L
Ethics Approval for Study 2

31/05/2021

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number	H-03-20-5566
Titre du projet / Project Title	Attentional Focus Use in Physiotherapy: An Educational Workshop
Type de projet / Project Type	Thèse de doctorat / Doctoral thesis
Statut du projet / Project Status	Renouvelé / Renewed
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Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)	22/04/2022

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Appendix M
Ethics Approval for Study 3

29/09/2022

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number	H-08-21-7219
Titre du projet / Project Title	Attentional Focus Use in Physiotherapy: Delivering the Educational Workshop
Type de projet / Project Type	Thèse de doctorat / Doctoral thesis
Statut du projet / Project Status	Renouvelé / Renewed
Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)	15/09/2021
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