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Transformational Leadership in Higher Education Research Supervision

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Peter J F Tomsett

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Thesis Abstract

This thesis investigated the application of transformational leadership (TL) in the higher education (HE) research supervision context, with a specific focus on mechanisms underpinning leader effectiveness. In Chapter 1, the concept of TL is introduced, and the current research in HE briefly reviewed. The chapter highlights the suitability of the context for study in TL, and the need for research with a focus on mechanisms. In Chapter 2 the issue of contextually valid measurement is addressed. In a two-phase study (N = 389), the measurement properties of the Differentiated Transformational Leadership Inventory were explored using conventional confirmatory factor analyses (CFA) and bi-factor models. Traditional CFA confirmed the eight-factor structure of the scale in the supervision context, while bi-factor models revealed a dominant general TL factor. Consequently, an abbreviated global scale was developed using the factor analyses and confirmed using multi-level CFA. In Chapter 3, two studies examined the role of several variables as mediators of the TL-performance relationship. Mediation analysis in Study 1 (N = 155) showed mixed support for the hypothesis that transformational leadership would positively impact grade performance via its influence on leader-member exchange, needs satisfaction and engagement, sequentially. A second study (N = 139) incorporating a time lag between leadership and LMX showed more positive support for the proposed indirect effects. Findings suggest that LMX, need satisfaction and engagement are important mechanisms underlying the effectiveness of TL. Chapter 4 examined the role of students' implicit theories of ability as an alternative mechanism. A rationale is proposed whereby transformational supervisors may develop incremental beliefs of ability in their students that subsequently enable them to cope more effectively with setbacks. A sample of 421 PhD students completed an online questionnaire measuring TL, their implicit beliefs of ability in their PhD, and their coping styles. Mediation analyses provided some support for the hypotheses, demonstrating an indirect effect of transformational leadership on approach coping via students' entity beliefs. Finally, in Chapter 5 the theoretical and applied implications of the thesis findings are discussed in relation to existing research. Overall, the findings of the thesis emphasise the applicability of transformational leadership to the HE supervision context, having demonstrated its direct and indirect relationship with key student outcomes including grade performance. Furthermore, the results provide insight into the mechanisms of transformational leader effectiveness that may aid practitioners in their own supervision practices. Finally, the thesis presents two new scales for the measurement of transformational leadership in the HE context for use by practitioners and researchers alike.

Chapter 1

General Introduction

General Introduction

It has been more than two decades since researchers first began to acknowledge the applicability of leadership theory to the study of education (Baba & Ace, 1989). Given the immense proliferation of leadership research in this time, and in particular, the dominance of 'new' leadership theories such as transformational-charismatic approaches (e.g. Bass, 1985; Burns, 1978) it is surprising how little is understood about the effects of these leadership styles in educational settings, and especially so in higher education. Indeed, while transformational leadership is a well-developed theory in organisational and business domains, and has been investigated in a wide array of alternative contexts, its influence in higher education research is comparatively small. The breadth of this research attests to the applicability of transformational leadership to the higher education context (see Pounder, 2014).

In this thesis, specific shortcomings of the existing literature are addressed by not only exploring important conceptual issues relevant to this educational context, but also investigating some of the underpinning mechanisms of transformational leader effectiveness, and extending the research into the new sub-domain of research supervision. This introductory chapter will set the foundation for the thesis by firstly providing an overview of transformational leadership theory, describing its conceptualisation and measurement in the wider leadership research, and addressing the issue of global versus differentiated models of transformational leadership. Then, the existing research on transformational leadership in the higher education context is reviewed, and considered in respect to the supervisory context. Finally, an overview of the thesis and study structure is presented.

Transformational Leadership Theory

The study of leadership has fascinated researchers for decades and remains a prominent area of study in the social sciences. As the field has developed definitions and

conceptualisations of leadership have evolved. Whereas leadership was once focused on the study of generals, politicians and men of great standing (Galton, 1869/1979), contemporary leadership research has examined the influence of leadership in the lives of people such as managers, nurses, coaches, parents and teachers. This exemplifies the scope for the application of leadership theory. As such, leadership is viewed as a universal phenomenon in humans (Bass & Stogdill, 1990), although it has been examined from a number of differing perspectives. Indeed, it has been commented upon that, "there are almost as many definitions of leadership as there are persons who have attempted to define the concept" (Stogdill, 1974, p. 259). Early trait theories of leadership attempted to identify the common characteristics that differentiated leaders from non-leaders, but failed to acknowledge the importance of situational and contextual factors. Reactions to the shortcomings of trait theory led to the development of situational contingency (Fielder, 1971) and behavioural approaches to leadership and the acknowledgement of differing leadership styles. This led to a shift in focus from "what" a leader is (e.g., defining characteristics) towards "how" do leaders lead (i.e. behaviour). One such behavioural model of leadership is transformational leadership theory.

Transformational leadership has been a very prominent theory in the study of leadership over the last three decades. Hunt (1999) described the development of transformational leadership in terms of Reichers and Scheider's (1990) work concerning stages of conceptual development, noting that the concept at that time had progressed from the first stage (introduction/elaboration) to the second stage of development (evaluation/augmentation). Subsequently Antonakis, Avolio, and Sivasubramaniam (2003) suggested that the concept straddled the line between the second and third stage (consolidation/augmentation), whereby antecedents, outcomes, underlying mechanisms and moderating conditions have been identified and matter-of-fact reviews on the topic have begun to appear. It is with some conviction that it can be said that, at the time of writing,

transformational leadership sits firmly within this third stage of development. A number of reviews on the topic exist (e.g., Bass, 1999) including several meta analyses (e.g., Judge & Piccolo, 2004; Lowe, Kroeck, & Sivasubramaniam, 1996; Wang, Oh, Courtright, & Colbert, 2011), with recent studies examining its mechanisms (e.g., Kovjanic, Schuh, & Jonas, 2013; Stenling & Tafvelin, 2014), and other factors which moderate its effects such as context (Antonakis et al., 2003) and personality (Arthur, Woodman, Ong, Hardy, & Ntoumanis, 2011).

Bass, (1985) consolidated and extended the work of House (1977), Weber (1947) and (Burns, 1978) to form the basis of transformational leadership theory. Bass' theory emphasised the emotional component of leadership, suggesting that, through emotional appeals, transformational leaders were able to motivate followers to achieve at levels beyond their original expectations (Bass, 1985). Bass and Stogdill (1990) described a transformational leader as one who raises followers' awareness of the importance of designated goals, encourages followers to transcend their own self-interest for the collective good of the team or organisation, and helps to satisfy followers' higher order needs. They achieve this partly through the articulation of a positive vision of the future, which encourages followers to identify with and develop commitment to the organisations goals and values. By contrast, earlier theories of leadership had focused on transactional models of leadership, whereby leaders attained performance from followers through the use of incentives and punishments. While Burns (1978) had theorised that transactional and transformational forms of leadership were conceptual opposites, Bass (1985) suggested that transformational leadership augments the effectiveness of transactional exchanges, encouraging followers to invest extra effort, and exceed minimum expectations.

Bass' (1985) theory represented a significant shift in leadership research, and prompted a rejuvenation of the field and a cascade of related theories of leadership. These

included charismatic approaches to leadership (Kanungo, 1987; Shamir, House, & Arthur, 1993), visionary leadership (Sashkin, 1988), servant leadership (Greenleaf, 1977), and much later, authentic leadership (Luthans & Avolio, 2003). Furthermore, a volume of research can attest to the positive effects of transformational leadership across a wide variety of contexts, from organisational and business settings (Barling, Weber, & Kelloway, 1996) to the military (Dvir, Eden, Avolio, & Shamir, 2002; Hardy et al., 2010), sport (Callow, Smith, Hardy, Arthur, & Hardy, 2009; Rowold, 2006; Vella, Oades, & Crowe, 2013), nursing (Salanova, Lorente, Chambel, & Martínez, 2011), and education (Balwant, 2016; Beauchamp et al., 2010; Leithwood & Jantzi, 2005).

Conceptualisation and Measurement. Whilst there is a general consensus regarding the varied positive individual and organisational outcomes of transformational leadership, there is less agreement surrounding the components of the concept and the behaviours that transformational leaders employ. Since its conception, the theory has been frequently defined in terms of its effects on followers and organisations (see Burns, 1978) rather than in terms of behaviours. As such, a number of operationalized definitions and conceptualisations of the concept exist.

The Multifactor Leadership questionnaire (MLQ). The dominant framework in conceptualisation of transformational leadership has been Bass' (1985) model, and its related measurement tools in the form of the MLQ (and its variant forms). Bass' model initially outlined three components that make up the concept of transformational leadership: charismatic-inspirational leadership, intellectual stimulation and individualised consideration. *Charismatic-inspirational leadership* refers to how leaders act as role models for followers, lead by example, and foster close relationships through positive attitude. *Intellectual stimulation* refers to behaviours that raise awareness of problems and encourage followers to examine them from new perspectives. *Individualised consideration* refers to the support

provided by the leader in providing encouragement and paying attention to individuals' specific needs.

In addition, the MLQ included some transactional components, specifically, contingent reward, passive management by exception and active management by exception. *Contingent reward* refers to clarification of work standards required to obtain rewards and the use of incentives for motivation. *Passive management by exception* refers to the use of corrective action in response to a clear lack of adherence to acceptable performance standards. *Active management by exception* refers to actively seeking mistakes and taking pre-emptive action to avoid mistakes.

The early versions of the MLQ faced criticism pertaining to the scale's factor structure (Bycio, Hackett, & Allen, 1995) and the discriminant validity and ambiguity of the subscales (Yukl, 1999). For instance, Yukl (1999) suggested that individualised consideration consisted of two theoretically distinct constructs, specifically developmental and supportive aspects, with Rafferty and Griffin (2006) providing empirical support to this claim. The original MLQ scale was subject to revisions resulting in a variety of versions of the MLQ. The most recent, developed and widely used form of the MLQ (Form 5X, Bass & Avolio, 1995) consists of nine components measuring transformational, transactional and non-leadership aspects to capture what has been termed the full-range leadership model. The transformational components are: inspirational motivation, idealised influence (attributed), idealised influence (behaviour), individual consideration and intellectual stimulation. The transactional components are: contingent reward, passive management by exception, and active management by exception. Finally laissez faire reflects the non-leadership component or the absence of leadership. Avolio, Bass, and Jung, (1999) presented a case to support a 6-factor structure of a reduced-item MLQ-5X, where idealised influence and inspirational motivation are combined into one factor termed "inspirational-charisma", and including a

"passive-avoidant" factor, combining passive management by exception and laissez faire. The resulting 36-item MLQ-5X (short) remains the most widely used measure of transformational leadership for research purposes.

The wide and continued use of the MLQ in leadership research is a testament to its contribution to the field, and the influence of the underpinning works of Bass and colleagues over the last three decades. However, some authors have continued to raise questions regarding the psychometric properties and validity of the scale (cf. van Knippenberg & Sitkin, 2013). Overall the support for the construct validity of the MLQ has been mixed, and this has prompted researchers to explore alternative factor structures within the MLQ, such as collapsing the transformational dimensions into a single transformational leadership factor (e.g. Dvir et al., 2002) combining dimensions to produce a reduced-factor model (Charbonneau, Barling, & Kelloway, 2001) or further subdividing the existing dimensions (Antonakis et al., 2003). While the MLQ itself fundamentally employs a differentiated conceptualisation of transformational leadership, the majority of studies that employ the MLQ use it with a global measurement approach, frequently combining all of the transformational leadership dimensions into a single factor (e.g. Dvir et al., 2002)

The Transformational Leadership Inventory (TLI). Podsakoff, MacKenzie, Moorman, and Fetter, (1990) developed a 6-factor measure named the Transformational Leadership Inventory (TLI). Despite some support for the construct and predictive validity of the scale, the TLI has seen relatively little use in leadership research. Some criticisms can be brought against the TLI, primarily that it adopts a somewhat narrow conceptualisation of certain behaviours and does not directly measure important aspects, such as the ability of leaders to express belief in their followers. In their conceptualisation of transformational leadership Bass and Avolio (1995) refer specifically to this aspect of transformational leadership and it is not directly measured by the TLI. Nonetheless, the Podsakoff et al. (1990)

conceptualisation of transformational leadership behaviours has been an important influence in the development of subsequent measurement models.

The Rafferty and Griffin Scale. Rafferty and Griffin (2004) developed an alternative model where they outlined a set of more focused and theoretically distinct sub-dimensions of transformational leadership, to address concerns about very high inter-factor correlations between factors in the MLQ (Avolio et al., 1999; Tejeda, Scandura, & Pillai, 2001). The dimensions of their model consisted of vision, intellectual stimulation, inspiration, supportive leadership and recognition. While Rafferty and Griffin demonstrated the adequate psychometric properties of their scale, the sub-dimensions reflect a rather narrow operationalization of the behaviours. As a result, the scale excludes some important behaviours, including role modelling, expressing belief in followers, and high performance expectations.

The Differentiated Transformational Leadership Inventory (DTLI). The DTLI (Hardy et al., 2010) is a fully differentiated model built on the previous models of the MLQ (Bass & Avolio, 1995) and the TLI (Podsakoff et al., 1990) in an attempt to address calls for more differentiated models of transformational leadership (Antonakis et al., 2003). The model was initially developed in the military training context and consists of six transformational leadership dimensions. The transformational dimensions of the scale are inspirational motivation, intellectual stimulation, individual consideration, appropriate role modelling, high performance expectations, and fostering acceptance of group goals. In addition there is one transactional dimension; contingent reward. Hardy and colleagues presented evidence to support the factorial, discriminant and predictive validity of the inventory, and the scale has subsequently been adapted for use in sport (Arthur et al., 2011; Callow et al., 2009) and educational settings (Mawn, 2012).

Global and Differentiated Conceptualisations. There is disagreement in the research literature regarding whether transformational leadership is best operationalised and measured globally or as a set of related dimensions that compose the construct. As discussed, the foundation work of transformational leadership, namely Burns (1978) and Bass (1985) refer to a number of varying aspects of transformational leadership, and in line with this rationale many models have adopted a multi-dimensional approach to conceptualisation of the construct. However, despite the general consensus among authors regarding the multi-dimensional nature of the transformational leadership construct it is commonplace to encounter scales being collapsed to one general transformational leadership dimension, as is frequently practiced with the MLQ. Indeed, some measures have been advanced which adopted a uni-dimensional approach to begin with (Carless, Wearing, & Mann, 2000).

There are several limitations inherent in the adoption of a global perspective. Proponents of differentiated measures describe global measures as "very blunt instruments indeed" (Hardy et al., 2010 p. 31), as they are predicated on the assumption that all transformational leader behaviours will be similarly correlated with outcomes, and that consequently, they have the potential to mask subtle relationships that would be apparent if a differentiated approach were employed. There is no shortage of evidence to suggest that transformational leadership behaviours do indeed differentially predict follower outcomes. For example, Podsakoff et al. (1990) demonstrated that whilst the majority of the leadership behaviours examined in their study demonstrated hypothesised relationships, some crucial differences were evidenced; specifically, that intellectual stimulation was negatively related to trust and satisfaction. A further study by Podsakoff, MacKenzie, and Bommer (1996) revealed that intellectual stimulation and high performance expectations were both positively related to role conflict and high performance expectations was negatively related to general satisfaction. In the same study, high performance expectations were positively related to

courtesy. In another study, Rafferty and Griffin (2004) found that intellectual stimulation was positively related to affective commitment and continuance commitment, but that vision was negatively related to continuance commitment and role breadth self-efficacy. Dumdum, Lowe, and Avolio (2002) reported that the different leader behaviours analysed in their meta-analyses displayed different magnitudes of relationships with the outcome variables included. Furthermore, several authors have noted that global models are of limited utility when the focus of the research is on leadership development. In such circumstances it is preferable to be able to identify specific behaviours in which an individual or group of leaders may be deficient, and describe development of those behaviours in more specific terms, as opposed to general proclamation to "be more transformational". Furthermore, applied research can be used to identify behaviours that are of specific relevance to the context or desired outcomes, enabling more precisely targeted interventions in applied settings.

Whilst there are undoubtedly some valid arguments to support the adoption of differentiated models, it is important to acknowledge that there are valid applications of the global approach. Several authors have adopted global measures in circumstances where the focus of the research is not on specific aspects of transformational leader behaviour (Dvir et al., 2002; Pillai, Schriesheim, & Williams, 1999; Wang, Law, Hackett, Wang, & Chen, 2005) or where they have no a priori expectation that specific behaviours will differentially predict the outcomes under investigation (Avolio, Zhu, Koh, & Bhatia, 2004). Indeed, in one of the few experimental studies on transformational leadership, Barling et al. (1996) showed that training in one aspect of transformational leadership led not only to an increase in ratings of that behaviour, but other behaviours also. This is consistent with the view that transformational leader behaviours are mutually reinforcing (Antonakis et al., 2003) and represent components of one over-arching construct.

The motives for adopting global models of transformational leadership seem to be partly driven by frustrations with the inconsistent factor structure of dominant measures such as the MLQ. Assessing the degree of this inconsistency is complicated by the fact that the varying examinations of the factor structure employ different versions of the scale, differing operationalization of the dimension and are carried out in differing contexts using samples of varying homogeneity. However, factor analytic studies have shown that single-factor models of the MLQ are valid and sometimes provide a better fit to the data than the multi-dimensional factor structure proposed in its development (Tracey & Hinkin, 1998). Similarly, Carless (1998) suggested that the four transformational dimensions of the MLQ best represent a second-order global transformational leadership construct, as opposed to separate transformational leader behaviours. This is a line of reasoning that many researchers have adopted when employing global measures of transformational leadership (e.g. Zhu, Avolio, & Walumbwa, 2009)

Separate from theoretical and empirical arguments regarding dimensionality, there are methodological considerations. As research continues to employ increasingly complex designs and elaborate mediation/moderation models, a simpler, general construct is often much easier to work with. For example, in structural equation modelling, a uni-dimensional factor structure for the main study variable is often advantageous, as it allays the need to use complex measurement structures within the model that can increase the number of parameters to be estimated. For example, estimating a set of simultaneous mediation effects for four to eight specific leader behaviours would quickly lead to very complex models indeed, and this increased complexity comes with an associated requirement for larger sample sizes (Kline, 2011; Wolf, Harrington, Clark, & Miller, 2013). Furthermore, given the high inter-factor correlations between the transformational leadership dimensions, it is highly likely that researchers would frequently encounter problems with multi-collinearity in such models. In

such circumstances a more parsimonious approach would be to adopt a global measurement model. It is important to note that while there are methodological arguments to support the use of global models, these ought to be secondary to the importance of relevant theory and accompanying empirical research.

In summary, there are a number of arguments in favour of both differentiated and global approaches to the conceptualisation and measurement of transformational leadership. While some factor analytic studies attempt to identify the "best representation" of transformational leadership, perhaps it is important to consider that there may be no single optimal way to conceptualise the construct. Moreover, differing approaches will be more or less appropriate depending on the context in which they are employed, the population under investigation, the scope of the research and the position of that research within the existing literature. Where situations allow, it would be prudent to examine both global transformational leadership and the effects of specific leader behaviours as has been performed by some authors (e.g., Bono & Judge, 2004).

Transformational Leadership Correlates. At this stage, there is little dispute that transformational leadership is related to a number of positive individual, and organisational level outcomes. At the individual level, data supports relationships with follower engagement (Tims, Bakker, & Xanthopoulou, 2011; Zhu et al., 2009), creativity (Gong, Huang, & Farh, 2009; Gumusluoglu & Ilsev, 2009), intrinsic motivation (Charbonneau et al., 2001), self efficacy (Pillai & Williams, 2004), basic psychological need satisfaction (Kovjanic et al., 2013), job satisfaction (Braun, Peus, Weisweiler, & Frey, 2013) and performance (Yammarino, Spangler, & Bass, 1993). Group or organisational outcomes include collective efficacy, innovation, organisational citizenship behaviour (Podsakoff et al., 1990) and financial performance (Barling et al., 1996). Although the majority of these studies employ

cross sectional or semi-longitudinal designs, offering limited causal interpretation of findings, the weight of evidence supporting these relationships and others is substantial, and is bolstered by a number of meta-analyses on the topic. Lowe et al. (1996) examined the relationships between ratings of transformational leadership and leader effectiveness from 39 studies, incorporating both published and unpublished works. Their results supported the notion that transformational leadership is associated with work unit effectiveness; across all studies the leader behaviours of charisma, individualised consideration and intellectual stimulation correlated significantly and moderately with measures of effectiveness. In a follow up meta-analysis, Dumdum et al. (2002) reported similar findings for associations with satisfaction with the leader.

The substantial amount of correlational evidence to support the effectiveness of transformational leadership is supported by a limited number of experimental studies. Barling et al. (1996) examined the effects of a field-based intervention on followers' perceptions of their leader's behaviours, organisational commitment and performance. They showed that the intervention increased levels of charisma, intellectual stimulation and individualised consideration, and subsequently it positively impacted on individual's organisational commitment and unit-level financial performance. Other studies have employed interventions in business (Mullen & Kelloway, 2009), military (Dvir et al., 2002; Hardy et al., 2010), educational (Beauchamp & Morton, 2011; Mawn, 2012) and sporting contexts (Vella et al., 2013). While there are only a handful of such intervention studies to draw from, they serve as evidence for the trainability of transformational leadership, as a learnable skill.

Taken together there is support for the notion that transformational leadership is an effective leadership style. However, comparatively less is known about the mechanisms by which transformational leadership exerts its influence in followers, and these mechanisms are a major focus of this thesis.

Motivational Mechanisms of Transformational Leadership. Studies have examined a number of variables that underpin some of the effects of transformational leadership. It is outside the scope of this introduction to describe an exhaustive list of the proposed mechanisms but the roles of leader-member exchange, basic-psychological need satisfaction, engagement and implicit theories are considered as motivational processes that may underlie the positive effects of transformational leadership. Leader member exchange theory (LMX; Graen & Uhl-Bien, 1995) is a relationship-based approach to leadership based on dyadic leader-follower relationships, premised on the notions of social exchange and reciprocity. According to LMX theory, leaders develop an exchange with each of their subordinates and the quality of these leader-member exchanges influences follower outcomes. High quality LMX relationships have been linked to a number of positive individual and group level outcomes including organisational citizenship behaviour (Podsakoff, MacKenzie, & Hui, 1993), organisational commitment (Martin, Thomas, Charles, Epitropaki, & McNamara, 2005), empowerment, job satisfaction and performance (Schriesheim, Castro, & Cogliser, 1999). While there are relatively few studies examining transformational leadership and LMX together, early studies identified positive associations between dimensions of transformational leadership and high-quality LMX (Basu & Green, 1997; Deluga, 1992; Howell & Hall-Merenda, 1999). Furthermore, Wang et al. (2005) argued that transformational leader behaviours nourish high quality LMX relationships, and identified LMX as a mediator of the effect of transformational leadership on organisational citizenship behaviour and performance, suggesting that this is one mechanism underpinning the effectiveness of transformational leadership.

Self-determination theory (Deci & Ryan, 1985) proposes that people have innate needs for three psychological nutriments of autonomy, competence and relatedness. Satisfaction of these needs is necessary in order to maintain personal well-being and facilitate

continued psychological growth. Furthermore, it is associated with a number of positive psychological outcomes such as developing more intrinsic forms of motivation (Ryan & Deci, 2000). Activation of higher order needs has been described as an important tenet of transformational leadership behaviour (Bass & Riggio, 2006; Bass & Stogdill, 1990). Studies have begun to explore the role of basic need satisfaction as an underpinning mechanism of transformational leadership effectiveness (Stenling & Tafvelin, 2014).

Another proposed mechanism employed by transformational leaders is their ability to foster high levels of engagement from their followers. Engagement refers to “a positive, fulfilling, work-related state of mind that is characterized by vigour, dedication, and absorption" (Schaufeli, Martínez, Pinto, Salanova, & Bakker, 2002, p. 74) and is associated with a number of positive individual level outcomes in the work place including work performance (Bakker & Bal, 2010). Studies have identified an association between transformational leadership and follower engagement (Zhu et al., 2009), and support the notion of engagement acting as a mediator of transformational leadership’s positive effects on performance.

One process of transformational leader effectiveness that has not previously been considered is the role that transformational leaders might play in followers’ development of implicit theories. According to Dweck and Leggett's (1988) social cognitive theory of motivation, individuals develop lay theories about the malleability of human characteristics such as intelligence or ability. They contend that individuals tend to adopt either an incremental theory, that human attributes are malleable and can be changed with purposeful effort, or an entity theory, that human attributes are primarily fixed. The nature of these beliefs has important implications for how students approach learning situations, overcome challenges and cope effectively with setbacks (Hong, Chiu, Dweck, Lin, & Wan, 1999). Implicit beliefs have been shown to be somewhat malleable (Leith et al., 2014) and subject to

the influence of authority figures such as parents and teachers through the nature of praise, critical feedback and attributions of success (Dweck, 2007; Molden & Dweck, 2006; Mueller & Dweck, 1998) so it is plausible that leaders help to shape followers' implicit beliefs within a given context. Examination of any association between transformational leadership and implicit theories may be especially worthwhile in educational contexts, such as that explored in this thesis, where studies have demonstrated the beneficial effects of adopting an incremental theory over an entity one.

Transformational Leadership in Higher Education. Not only has research on transformational leadership examined a number of potential outcomes, it has also been conducted in a number of research contexts, including education. Nonetheless, it has only recently begun to attract research attention specifically in the sub-context of higher education (HE). Indeed, a recent meta-analysis by Balwant (2016) shows the proliferation of studies of transformational leadership in HE settings over the last two decades; of the 22 studies in Balwant's review of works from 1997-present (including unpublished works such as doctoral theses) 14 were published in the last five years. This is testament to the suitability of transformational leadership for investigation in the HE context.

To the best of the author's knowledge the earliest published study examining transformational leadership in higher education was Kuchinke (1999), where the MLQ was employed to examine the relationship between transformational leader behaviours and student outcomes of extra effort, instructor effectiveness and satisfaction with the instructor in a group of 326 American graduate students. A positive relationship with all outcomes was reported. In another early study Harvey, Royal, and Stout (2003) showed positive relationships between the three leader behaviours of charisma, individualised considerations and intellectual stimulation, and student ratings of instructor performance and involvement. Several further cross-sectional studies have supported the relationships between

transformational leadership and student ratings of extra effort, effectiveness and satisfaction (Khan, Ahmed, & Nawaz, 2011; Pounder, 2008; Walumbwa, Wu, & Ojode, 2004). A notable limitation of these studies is that they relied almost exclusively on outcomes measured using items of the MLQ measure of full range leadership. These items are supplied within the battery of questionnaires in the MLQ, and they measure known correlates of transformational leadership across an array of contexts. Consequently, these results are likely to be confounded by common method variance, as both the independent and dependent variables were collected from the same source, although Pounder (2008) employed some measures to counteract this. As such, the findings of these studies provide only initial insight into the effectiveness of transformational leadership in HE.

Bolkan and Goodboy (2011) sought to remedy this shortcoming of the research, and their results supported positive relationships between transformational leadership and more typical educational outcomes, including cognitive and affective learning, and instructor credibility. These findings were extended by Bogler, Caspi, and Roccas (2013) who examined a large cohort of undergraduate students participating in distance learning courses conducted via a virtual learning environment. Their results corroborated previous findings suggesting that transformational leadership is positively related with student ratings of satisfaction and leader assistance, although it was not related with participation or grade performance. Furthermore, they demonstrated that the effect of transformational leadership on satisfaction explained variance over and above leader assistance, suggesting that instructors' leadership style was partly independent from assistance behaviour. The Bogler et al. (2013) study is notable for several reasons. First, it represents the first examination of the full 9-factor structure of the full range leadership model (MLQ) in a large sample within the HE setting. Confirmatory factor analyses showed good fit for the 9-factor structure described by Antonakis et al. (2003), suggesting the factor structure was appropriate in the HE context.

Second, while many previous studies had borrowed dependent variables from the organisational psychology literature including the outcome items of the MLQ, Bogler et al. (2013) employed original measures for dependent variables. Third, they demonstrated that transformational leaders are able to exert their positive influence on followers in educational settings even when there is an artificial distance created between leader and follower, via a virtual learning environment. Although, Balwant (2016) showed that these effects are moderated by increased distance between leader and follower such that the effect is weaker for transformational leaders operating in online teaching environments versus face-to-face.

The existing body of literature on transformational leadership in HE has provided some initial insight into the applicability of transformational leadership in this context. However, these works are characterised by a number of shortcomings. Existing studies have relied almost exclusively on correlational designs, often with no measures in place to mitigate the effects of common method bias. There is an overwhelming dependence on adapted version of the MLQ, which, as discussed, has been shown to possess questionable psychometric properties. Furthermore, the continual adaptation of the measure with no standard approach across adapted measures, and sometimes with an incomplete or vague explanation of the adaptations made renders comparison across study results more challenging. In addition, the majority of studies in this context have simply served to identify more and more significant outcomes of transformational leadership, with no consideration for the mechanisms that might underpin these effects. Perhaps most striking is that research has not yet reached the specific sub-context in HE where its influence may be most beneficial; that of research supervision.

Previous research has outlined the important role of the supervisor in students' experience of research supervision at undergraduate (Howitt, Wilson, Wilson, & Roberts, 2010) and postgraduate levels (Golde, 2000). The rate of attrition among postgraduate

research students has been a concern for several decades (Bourke, Holbrook, Lovat, & Farley, 2004), and research has identified the role of the supervisor as important in addressing this situation (Ives & Rowley, 2005). At undergraduate level, the supervisor is instrumental in ensuring that students' first experience of participating in scientific research is enjoyable, and informative. Researchers are in general agreement that the supervisor plays an important role in determining the quality of the student's experience of the research process (Golde, 2000; Halse & Malfroy, 2010; Howitt et al., 2010). Given the promising results of existing research on transformational leadership in HE contexts, and the importance of the role of the supervisor it is worthwhile considering the application and investigation of transformational leadership in supervision contexts, where its influence may be of considerable benefit to students. In this section, the nature of the specific supervision context is considered and the implications of that for the application of transformational leadership theory are discussed.

A number of previous studies on transformational leadership in HE have taken the view that the university classroom or Higher Education Institution (HEI) course can be viewed as a "quasi-organisation" (Pounder, 2008). That is, the classroom is viewed as a small social organisation where the teacher or lecturer is the leader and the students act as followers. Weaver and Qi (2005) assert that "the college classroom, like any other workplace, is a social organization where power is asserted, tasks are assigned and negotiated, and work is accomplished through the interplay of formal and informal social structures" (p. 579). Hence, it is proposed that this structure in educational settings roughly approximates that of more conventional organisational contexts, suggesting that some of the principles and concepts that apply in organisations, such as leadership theory, may be readily transferable to educational settings. This quasi-organisation perspective is largely accepted in the existing research examining the effects of instructor's transformational leadership on students (Pounder, 2014), although it is not without its critics (e.g. Balwant, 2016). While this

approach may be applicable to the HEI lecturing context, there are some specific differences between classroom teaching and the supervision context that have implications for the application of transformational leadership theory.

When considering the nature of the supervision context it is important to differentiate between undergraduate or masters level supervision of research projects and dissertations, and doctoral student supervision. The nature of supervision is likely to differ significantly between levels of study, for example, the contact time between student and supervisor and the length of the relationship. For the purpose of this chapter the focus is primarily on undergraduate supervision, as that is the specific context in which the majority of the studies in this thesis were conducted. Specific differences with doctoral supervision are considered where appropriate.

A number of points supporting the quasi-organisation perspective apply similarly to supervision. Harrison (2011) argued that teachers influence students and shape their future development in the same manner as organisational leaders influence employees, and this is also true of research supervisors and students. Thus, in this setting I can conceive of the supervisor as the leader, and the student as the follower. However, unlike students in the classroom, in many cases of supervision the student will be expected to drive the direction of the research project or dissertation, for example, by choosing the topic for study or proposing a method or research design. In this way the supervisor's role is more one of guidance or mentoring than direction or delivery of information.

Another aspect that is specific to the supervision context is the nature of the supervisor-student relationship. Balwant (2016) argued that when compared with manager-subordinate relationships in organisational settings, instructor-student relationships in the HE classroom setting are inherently more distant due to large class sizes. By contrast, in the supervision context, supervision is likely to take place on a one-to-one basis, or at least in

small groups, which may lead to a closer relationship that is more comparable with that in organisational settings. This may enhance the influence of leader behaviours that rely on closer personal relationships, or more direct supervisor-student contact such as individual consideration. Indeed, in Balwant's (2016) meta-analysis, results showed that transformational leadership was more effective in courses with face-to-face delivery than online delivery, suggesting that distance moderates the effects of some transformational leader behaviours. As such, transformational leadership effects at the supervisor level may be more pronounced than in lecturing situations.

The student supervisor relationship is not just different because it is characterised by greater closeness, but also because it is typically a more long-term relationship than in a typical HEI course. Indeed, Balwant (2016) noted that the short-term and inherently time limited (e.g. one-semester) nature of instructor-student relationships in the HEI course could reduce the influence of leader behaviours that rely on formation of a long-term relationship. Furthermore, behaviours targeted towards follower-development might be less relevant under these circumstances as there is a clear and predetermined end to the relationship, perhaps undermining a long-term investment in followers' development. By contrast, research supervisors typically work with students on final year projects spanning a year or more, and thus have a greater interest in their student's development over that time. While the relationship is still time-limited, supervisors may take into account the skills and knowledge their students need in careers after graduation or in postgraduate study and be more inclined to invest effort in developing those. This is more likely in supervisor than HEI course instructors due to the closer supervisor-student relationship as discussed earlier. In doctoral supervision, relationships are longer still, and the supervisor is likely to be significantly more invested in the student's long-term development, again bolstered by closer relationships.

In summary, there are several aspects of the supervision context that make it a unique setting for the investigation of transformational leadership. While previous authors have acknowledged some similarities between HEI teaching and organisational settings, there are even closer parallels between organisations and research supervision, where relationships are closer, longer in duration and the role of the supervisor is more reflective of a mentor or guide. Results of previous studies in HE support the application of transformational leadership to HE contexts. Given the pivotal role of the supervisor in the quality of the student experience (Golde, 2000) and the arguments above for how transformational leadership may be especially relevant in this context, supervision represents a valid and worthwhile setting for the investigation of transformational leadership effects.

Measurement of Transformational Leadership in HE. While measurement approaches to transformational leadership in organisational contexts are fairly well established this is not so in research in educational settings. A number of measurement approaches have been employed in the existing research on transformational leadership in higher education, mostly relying on adapted version of the MLQ. Here the various measurement approaches are briefly discussed.

Almost all of the existing studies on transformational leadership in higher education have employed adapted versions of the MLQ with minor wording changes to reflect the teaching/instructor context versus work/manager. Researchers have examined three-factor, nine-factor and ten-factor structures of the MLQ, with varying support. Using the original 28-item MLQ measure (Bass, 1985), Bolkan and Goodboy (2009) showed acceptable fit to a three-factor model consisting of charisma (combined factors), individualised consideration and intellectual stimulation. Pounder (2008) examined the factor structure of a translated version of the MLQ-5X (short) in a Chinese sample and results supported a nine-factor model. Although fit indices were not ideal, they were deemed to reflect acceptable fit under

the circumstances. The nine-factor structure was further supported by Bogler et al. (2013), who tested a range of alternative models, although they employed the full 28 item measure (Bass, 1985) and items reflected an online instructor. Finally, Walumbwa et al. (2004) reported acceptable fit for a ten-factor structure of the MLQ 5X-short, although they do not describe the factor structure in detail. While some studies did offer support for a full nine-factor structure, in most cases the differentiated model was not employed in analyses. Moreover, measures were collapsed into two factors measuring transformational and transactional leadership behaviours. By the current author's estimation, no two studies in HE have yet examined the factor structure of the MLQ using the same questionnaire version in the same context, thus making it challenging to examine the replicability of the scale's factor structure. Furthermore, the scale was developed in the organisational setting where employer/employee relationships feature different dynamics to that of instructor/student relationships, as highlighted earlier.

Most other studies have employed measures of their own design produced specifically for the purpose of the study using various approaches (Gill et al., 2010) often with a lack of consideration for underpinning theory. However, there exist two notable examples of measures developed specifically for use in higher education contexts. First, Balwant, Stephan, and Birdi (2014) developed a measure of "Transformational-Instructor Leadership" (TIL) using items of the Experiences of Teaching and Learning Questionnaire (ETLQ; Hounsell & Entwistle, (2001), on the basis that transformational leadership dimensions could emerge from teaching evaluation questionnaires. They built on the contentions of Bolkan and Goodboy (2011) that many behaviours in the classroom that are consistent with effective instruction are also reflective of dimensions of transformational leadership. The resultant Transformational Instructor Leadership Questionnaire consists of three factors labelled consideration ("constructive feedback and support given on assessments, staff support in the

classroom including patience and helping students to think, valuing students views and sharing enthusiasm with students"), path to goals ("exposition of clear learning goals, the teaching of topics in a sensible and organised manner so as to accomplish goals, the use of examples and provision of hand-outs and other materials") and intellectual stimulation ("students being encouraged to (a) think and be aware of varying evidence and issues in the subject matter, (b) apply their learning to the wider world, and (c) challenge their understanding of the subject" (Balwant et al., 2014, p. 4). Correlations supported convergent validity of the dimensions with established measures of transformational leadership, specifically, the MLQ (Avolio & Bass, 2004) and the Rafferty and Griffin scale (2004), and the dimensions were predictive of positive student outcomes common to transformational leadership. However, there was only limited consideration of the underpinning theory of transformational leadership and its dimensions and the development of the scale appears to be empirically driven. Consequently the scale lacks conceptual breadth. Specifically the charismatic aspects of leadership appear to be under-represented, as well as individualised influence or appropriate-role modelling behaviours. While the TILQ represents an attempt to develop a contextually sensitive measure of transformational leadership in HE it is inherently limited in scope as its development was based on a limited pool of items from a pre-existing measure of a different set of variables.

Second, Mawn (2012) developed a contextually relevant measure of transformational leadership for lecturing based on the conceptual structure of the Differentiated Transformational Leadership Inventory (DTLI; Hardy et al., 2010). Focus group interviews were used to explore students' perceptions of transformational leadership specifically in the context of higher education lecturing. Using a dual inductive/deductive approach to examine the qualitative data, themes were coded into categories of transformational leader behaviour (e.g. inspirational motivation) that reflected students' views of transformational lecturing. A

similar process was conducted using semi-structured interviews with lecturing staff identified as "transformational" in the earlier stage. From this two-stage analysis, eight categories emerged as contextually relevant transformational leader behaviours: inspirational motivation, individual consideration, intellectual stimulation, high performance expectations, appropriate role modelling, sense of humour, self-belief and contingent reward. The findings of qualitative analyses were used to generate a pool of items to tap each of the eight categories, which were reduced using a series of confirmatory factor analyses. Item deletion was guided by consideration of relevant theory and students earlier responses in focus groups. The resultant 30-item scale showed acceptable fit to the eight-factor structure and results supported the concurrent validity of the scale with existing measures of transformational leadership (the Transformational Teaching Questionnaire, Beauchamp et al., 2010) and learning climate (Learning Climate Questionnaire, Williams & Deci, 1996). Furthermore, dimensions of the DTLI-HE longitudinally predicted basic psychological needs satisfaction, academic efficacy and satisfaction with university.

In summary, only a few measurement approaches have been employed in transformational leadership research in HE and there is no consensus on the most appropriate approach to measurement in this context. This literature is characterised by injudicious use of the MLQ without proper consideration for the importance of context and the provenance of the MLQ measure. Furthermore, despite the widespread use of the MLQ, it is difficult to assess its suitability to the context due to a lack of consistency in its application across studies and populations. The only available measure that employs a contextually sensitive model of transformational leadership in HE and encompasses the full breadth of the concept is the DTLI-HE (Mawn, 2012), although it has not been widely used because it is not currently published in a peer-reviewed journal. The nature of its development and promising results, supporting the factor structure, and concurrent and predictive validity of the scale, warrant its

further investigation in higher education settings, including sub-settings such as supervision. For these reasons, this scale forms the main measurement approach adopted in this thesis.

Overview of Thesis and Programme of Research. This thesis consists of five chapters; an introduction, three empirical chapters, and a discussion. The present chapter has provided an overview of transformational leadership research, its influence in HE, and reviewed some important issues in the literature; specifically, global versus differentiated conceptualisations of transformational leadership, and the need to examine transformational leadership more closely in higher education contexts, including its mechanisms of action. The subsequent chapters contribute to address these issues. The empirical chapters (Chapters 3-5) are presented as standalone research papers intended for publication, and as such there is some inherent overlap in the content of each chapter.

In Chapter 2 the measurement approach employed in the subsequent empirical chapters is developed. The factor structure of the DTLI-HE is examined (Mawn, 2012) in the context of research supervision. In this chapter a bi-factor measurement model is employed to examine the factor structure in greater detail than has been a possible in the past using conventional confirmatory factor models, helping to address issues regarding the global and differentiated conceptualisations of transformational leadership. This is approach is used confirm the factorial validity of the DTLI in the supervision context and provide support for an abbreviated global scale of transformational leadership for use in that context.

In chapter three the abbreviated scale is employed to examine some of the underlying mechanisms of transformational leadership in this context. Integrating existing work on mechanisms from organisational psychology, a multiple-serial mediation model is developed whereby supervisor transformational leadership behaviour impacts undergraduate students grade performance indirectly via leader-member exchange, satisfaction of basic

psychological needs, and engagement. The model was tested using cross-sectional and longitudinal data. Results provided general support for the proposed mediation model.

Chapter 4 explores an alternative mechanism of transformational leadership effectiveness in PhD students. A large body of research has examined the role of implicit theories of intelligence in students' learning behaviours. A rationale is presented to explain how transformational leaders may be able to develop incremental theories of ability in their followers, and thus equip them to cope better in the face of setbacks. In a cross-sectional study, a mediation model is tested where transformational leadership indirectly affects students coping behaviours via its influence on their implicit theories of ability as a PhD student. Results provided some support for the hypothesised mediations, although some un-hypothesised findings emerged. This study is the first to demonstrate a relationship between transformational leader behaviour and followers implicit theories.

Finally, in Chapter 5, the theoretical and applied implications of the thesis are discussed in relation to existing research, important conceptual and theoretical issues arising from the thesis are explored, and future research possibilities considered.

Data Management.

The dataset used in Chapter 2 was a created by combining the leadership data collected in the two studies of Chapter 3. This was in order to facilitate the complex bi-factor analyses in Chapter 2 that required a large sample of transformational leadership data. These analyses would not have been possible using each sample on their own, and combining them in this way enables maximum utilisation of the available data. Figure 1 provides a graphical representation of the data collected and used in each study.

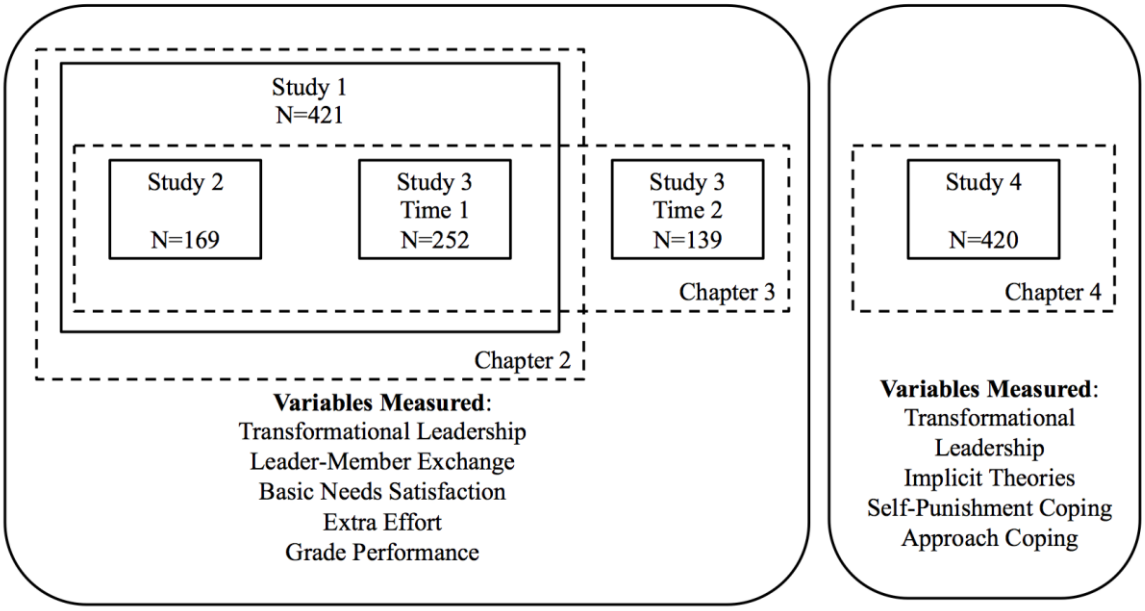

Figure 1. Participant numbers and study variables measured across studies and chapters

Chapter 2

Measurement of Transformational Leadership in the Context of Research Supervision

Abstract

The present study employed bi-factor measurement models to examine the factor structure of the Differentiated Transformational Leadership Inventory for Higher Education in the new sub-context of research supervision and develop an abbreviated global transformational leadership scale. The participants (N=389) completed assessments of transformational leadership and leader inspired extra effort. Conventional CFA confirmed the eight-factor structure of the DTLI-HE. Subsequently, exploratory bi-factor analyses were employed to examine the extent to which the items of the DTLI reflect a general transformational leadership factor versus a set of distinct but related leader behaviours. Results reflected a very dominant general transformational leadership factor; omega coefficients showed that 89% of the variance in the total scale score was accounted for by the general factor versus the specific factors. This evidence provides some support for the adoption of a global measurement approach. Finally, an abbreviated scale was developed from the items of the DTLI-HE using the previous factor analyses. The single factor structure of the resulting seven-item scale was confirmed using multi-level CFA.

Transformational leadership theory continues to receive widespread research attention across a growing number of diverse populations and contexts (Wang et al., 2011). Indeed, the substantial body of research demonstrating positive effects of transformational leadership in business and organisational psychology has led to increased research attention in the theory in alternative contexts such as education. Specifically, researchers have now established the applicability of TL to a broad range of educational settings, from primary school (Leithwood & Jantzi, 2000), through secondary school (Beauchamp et al., 2010) and into higher education (HE: Harvey, Royal, & Stout, 2003). That said, research on the theory in HE is limited compared to the organisational setting, but in a recent meta-analysis Balwant (2016) noted an increase in transformational leadership studies in this context and marked HE for further future growth. As the volume and complexity of this type of research increases, so the need for a flexible, conceptually grounded, and contextually valid measurement tool increases. Given this need, the over-arching aim of the present study was to develop such a tool.

A second overarching aim was to contribute to the wider transformational leadership literature by addressing the debate regarding its conceptualisation. Some authors (e.g., Carless et al., 2000) argue a case for a global conceptualisation of transformational leadership, whereby its dimensions are seen as mutually reinforcing and representative of a global, whole construct, while others (e.g. Hardy et al., 2010) adopt a differentiated conceptualisation, where the dimensions of transformational leadership represent a set of distinct but related sub-domains. The adoption of either perspective has important implications for the measurement of transformational leadership, the interpretation of related findings, and one's conceptual understanding of transformational leadership, such as whether transformational leader behaviours operate independently, or interactively. The present study

employed bi-factor modelling to contribute to this debate and elucidate the factor structure of the differentiated transformational leadership inventory (DTLI: Callow et al., 2009; Hardy et al., 2010; Mawn, 2012) in the context of HE research supervision. In doing so this thesis will extend the scope of transformational leadership research in HE, and provide an essential reference for the wider transformational leadership literature.

Transformational Leadership Research in HE

Given that scholars observed the utility of applying leadership theory to the classroom setting some time ago (Baba & Ace, 1989) it is surprising that it was not until relatively recently that research began to confirm links between transformational leadership and education specific outcomes (e.g. learning) in HE (Bolkan & Goodboy, 2009). HE instructors' transformational leadership has been shown to be related to a number of student outcomes including willingness to exert extra effort, satisfaction, instructor effectiveness (Pounder, 2008), satisfaction with the instructor (Harvey, Royal, & Stout, 2003), cognitive and affective learning (Harrison, 2011), state motivation (Bolkan & Goodboy, 2009), self-reported performance (Balwant, Stephan, & Birdi, 2014) and student satisfaction with the instructor in a virtual learning environment (Bogler et al., 2013). Further, in a meta-analysis of 22 published and unpublished studies, Balwant (2016) examined the strength of relationships between transformational leadership and a number of outcomes. Across those studies, transformational leadership was positively related with students' motivation, perceptions of instructor credibility, affective and cognitive learning, and performance. Overall, these findings confirm the relevance of transformational leadership to the HE context, and support its continued investigation.

While the initial research in this area is promising, the majority of existing studies do not extend beyond cross sectional designs and direct relationships. They are also confined to instructional contexts where there is large ratio of students to instructors (e.g., lecturing, e-

learning modules), necessitating a degree of distance when compared to a supervision context, for example. As such, there is considerable room for growth and development in this area of research. Further, one notable shortcoming is the lack of widely available contextually valid measures of transformational leadership in HE.

Measurement of Transformational Leadership

Within organisational environments there are a number of measures assessing transformational leadership, although a few do dominate the literature. By far the most widely used is Avolio and Bass' (1995) multi-factor leadership questionnaire (MLQ-5X) and various iterations thereof. Other scales designed for use in the organisational setting include the transformational leadership inventory (TLI: Podsakoff, MacKenzie, Moorman, & Fetter, 1990), the transformational leadership scale (Rafferty & Griffin, 2004), and the global transformational leadership scale (Carless et al., 2000). All these scales draw heavily from early conceptualisations of transformational leadership (Bass, 1985) for the construction of their dimensions and items, and to varying degrees, are widely accepted and used in the literature.

In the HE context, the range of available measures is more limited. To date, of the 15 published studies on transformational leadership in HE, all but 4 employed an original or adapted version of the MLQ (cf. Balwant, 2016). Those that did not instead used a self-created scale for the purpose of the study. There are several potential problems with this trend in the research. First, the MLQ has faced criticism regarding its factor structure (Bycio et al., 1995), and the ambiguity of its subscales (Yukl, 1999). Second, the current trend in researchers adapting scales for the purpose of their own research combined with the presence of numerous versions of the MLQ in the literature results in wide variation in the nature of the measurement tools actually applied in research. This lack of consistency makes

comparisons between studies challenging, and the problem is exacerbated by incomplete or vague descriptions of the adaptations made to scales or the exact scale-version used. Finally, the MLQ was developed and designed for use in organisational and business settings, which differ in a number of ways from educational settings in a manner that may influence responses. Ratings of transformational leadership are sensitive to the context in which the data are collected, and the context has the potential to influence the psychometric properties of the scale (Antonakis et al., 2003). Indeed, it has been suggested that the context of leadership may affect the types of behaviours that are effective (Lord, Brown, Harvey, & Hall, 2001). As such, a scale developed for organisational contexts may not address a full range of contextually relevant transformational leader behaviours in educational settings. This issue is addressed in more detail by Mawn (2012).

There is a clear need for more viable measurement options for transformational leadership researchers in this context. Some authors have made useful contributions to that end, for example Pounder (2008) presented some evidence to support the validity of an adapted version of the MLQ, although this was in the context of Hong Kong university students, and is possibly not directly applicable to western populations. It also does not help to expand the range of measures available to researchers and practitioners. Alternatively, Balwant (2014) recognised some key distinctions and characteristics of the educational setting in which the MLQ has been applied, and developed a measure of transformational instructional leadership based on student responses to items of the Experiences of Teaching and Learning questionnaire (ETLQ, Hounsell & Entwistle, 2001). The scale consists of three dimensions; consideration, intellectual stimulation, and path-to-goals. The results of Balwant (2014) supported the convergent validity of the resulting transformational instructional leadership questionnaire (TILQ) measure with established measures of transformational leadership, specifically the MLQ-5X, (Bass & Avolio, 2000) and the Rafferty and Griffin

scale (Rafferty & Griffin, 2004). While the initial empirical support for the scale's validity is encouraging, the source material for the items, and the resulting dimensions are not firmly rooted in classic transformational leadership theory. It is not yet clear how the TILQ will behave in studies examining other outcomes typically associated with transformational leadership.

Mawn (2012) developed a measure of transformational leadership specifically for use in the HE setting, based on the differentiated approach to measurement employed by Hardy et al. (2010). Initially, they employed content analysis of interviews to assess students' and lecturers' perceptions of transformational leadership in lecturing, which supported eight dimensions of transformational leader behaviour. Subsequently, based on the qualitative data collected in the first stage, a large pool of scale items was generated to measure the transformational leader behaviours. The items were reduced in a multi-stage process using independent content validation by the researchers and students, and through confirmatory factor analyses. Mawn (2012) then demonstrated that the eight factors of the scale were predictive of existing measures including the transformational teaching questionnaire (Beauchamp et al., 2010), the learning climate questionnaire (Williams & Deci, 1996) as well as a number of positive student outcomes, including leader inspire extra effort, a well established follower outcome. This is in line with one of the fundamental contentions of transformational leadership, that leaders who are more transformational are able to elicit extra effort from their followers (Bass, 1985). The DTLI-HE measure has a number of notable strengths that set it apart from other scales used to measure transformational leadership in HE. First and foremost, although its factor structure is based on the pre-existing DTLI, the scale was designed from the ground up in the HE context, with methodological input from the intended participants (students). As such, it is the only scale developed to specifically reflect students' perceptions of transformational leadership in HE in its items and dimensions,

including two previously unrecognised transformational leader attributes: sense of humour and self-belief. Finally, the scale adopts a differentiated conceptualisation of transformational leadership, allowing for the exploration of differential relationships between specific leader behaviours and follower outcomes, as well as potentially greater conceptual breadth than other existing measures.

Differentiated vs. Global Conceptualisations of Transformational Leadership

As previously highlighted the conceptualisation of transformational leadership is debated (i.e., global construct, reduced factor structure, or fully differentiated), with the response to mixed support for the discriminant validity and factor structure of the MLQ (Avolio et al., 1999; Bycio et al., 1995; Carless, 1998b) leading some researchers to pursue the development of global measures of transformational leadership (Carless, 2000), while others employed the MLQ as a global scale (e.g. Dvir et al., 2002), which is now commonplace. However, proponents of a differentiated conceptualisation argue that global measures are "blunt instruments" (Hardy et al., 2010, p.31), as they assume that all separate leader behaviours have similar effects on outcomes, and prevent examination of these subtle relationships. In support of a differentiated view, studies have shown that individual aspects of leader behaviour differentially predict outcome variables. For instance, Podsakoff et al. (1990) found that the intellectual stimulation was negatively related to trust and satisfaction, while the majority of transformational leader behaviours measured were positively related. Podsakoff, MacKenzie, and Bommer, (1996) lent further support to this stance, showing that intellectual stimulation and high performance expectations were positively related to role conflict, while other transformational leadership behaviours were negatively related. Other studies adopting a differentiated approach have continued to provide evidence of these kinds of differentiated effects (Callow et al., 2009; Hardy et al., 2010; Rafferty & Griffin, 2006). Furthermore, the ability to focus on specific leadership behaviours is of particular relevance

in settings with an emphasis on leadership development (Antonakis et al., 2003) such as experimental research or training environments, as it facilitates the provision of specific and targeted feedback and instruction, which is of greater value relative to "general" transformational leadership cues (Arthur & Tomsett, 2015).

While there is increasing evidence for the utility of a differentiated conceptualisation, it is important to acknowledge that there are valid applications of the global approach. Antonakis et al. (2003) argues that adoption of simple models of transformational leadership could lead to an over-simplification of the domain, but simple models have their place in the research. Not every question concerns specific leader behaviours, and attempting to employ differentiated models with complex factor structures in increasingly rigorous and complicated research designs presents a challenge for researchers. Further, some authors have argued that very high inter-factor correlations render differentiation largely futile (Carless, 2000), suggesting that the dimensions of transformational leadership are best represented as a single construct, and that they are not conceptually distinct from one another. Application of contemporary data analysis techniques may provide some insight into this debate. For example, Gunnell, and Gaudreau (2015) employed bi-factor analyses to examine the extent to which observed data could be attributed to specific forms of motivation (e.g., intrinsic motivation-amotivation, Ryan & Deci, 2000) as well as the presence of a general motivation factor. In the present study, similar analyses were applied to better understand a leadership scale operationalising specific transformational leadership behaviours, and alternative conceptualisations including a general transformational leadership construct.

Bi-factor Measurement Models

In the development of psychometric tools, researchers often acknowledge the substantive complexity of the construct of interest, and account for the multifaceted nature of the construct in their development process using multiple dimensions (Chen, West, & Sousa,

2006) yet they must simultaneously develop items with the intent to measure one general construct (Reise, Moore, & Haviland, 2010). Thus, in psychological research it is relatively commonplace to observe evidence or theoretical support for a single overarching construct in a set of items at the same time as evidence of multi-dimensionality. Few scales adhere to a strictly one-dimensional structure (see Figure 2, Model A). This precipitates the strong prevalence of first-order factor (Figure 2 Model B) and higher-order factor (Figure 2, Model C) models in the literature that allow for the conceptual justification that a set of highly correlated clusters of items with similar content in fact represent a general construct. This sentiment echoes trends in the transformational leadership literature where authors have moulded a construct that is theoretically multi-dimensional, into a global construct based heavily on high inter-factor correlations, or support for a second-order factor CFA model.

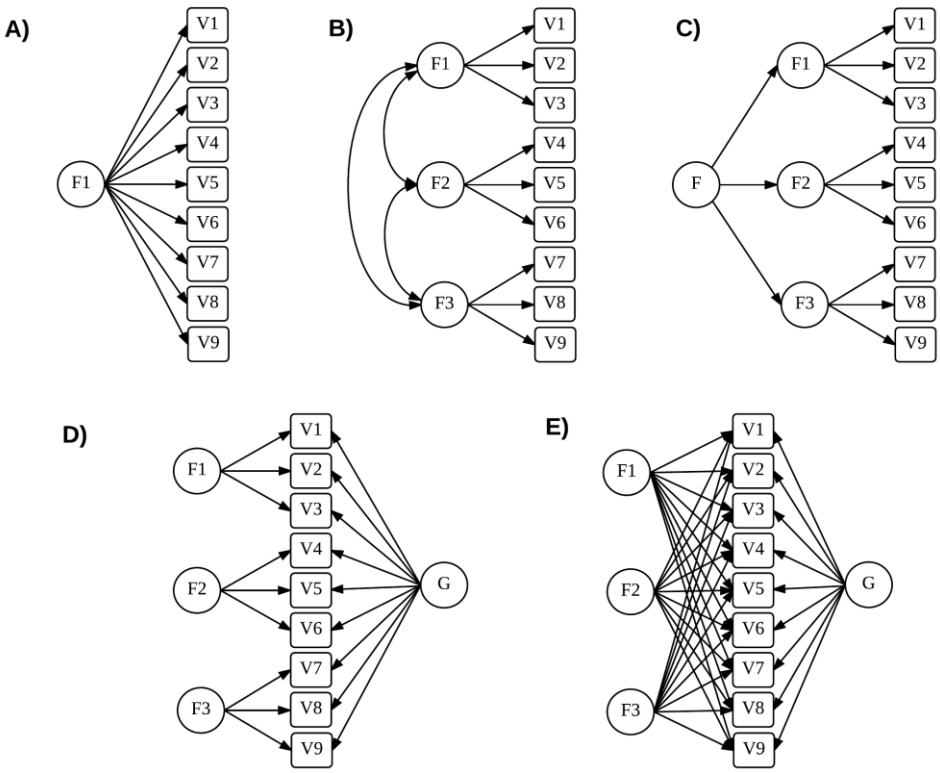

Figure 2. Conceptual similarities between measurement models. A = Single factor CFA model, B = First order factors model, C = Second-order factor model, D = Confirmatory Bi-factor Model, E = Exploratory bi-factor model.

Bi-factor measurement models present an alternative to these widely used measurement models, and account for multidimensionality by allowing each item to load onto both a general factor and a separate "group factor" or sub-domain simultaneously. In this way, bi-factor models can be used to examine the extent to which the variation in item responses is attributable to a specific factor versus a general factor that runs through the entire scale (see Reise, 2012 for a summary of bi-factor modelling). Bi-factor models have several advantages over conventional CFA models that allow researchers to further elucidate a measure's factor structure (Chen et al., 2006). Only in a bi-factor model can the specific and general factors be separated from one another. In the bi-factor model, the strength of the relationship between the specific factors and their associated items is represented by the factor loadings (a direct relationship). In a higher-order model, these relationships cannot be tested, as the specific factors are represented by the disturbances of the first order factors (i.e. the part of the primary factor that is unexplained by the second-order factor)[1]. Note, in Figure 2, Model C shows that there is no direct relationship between the items and the general construct in a higher-order model, but it is instead mediated by the first order factors. As such, the second order factor in Model C represents the commonality among the first order factors, not commonality among the items themselves, as is the case for the general factor in bi-factor models. Reise et al. (2010) explain, "the general and group factors are on equal conceptual footing, and compete for explaining item variance – neither is "higher" or "lower" than the other" (p. 547). Further, due to the capacity to separate general and specific variance, it is possible to examine the extent to which the specific factors predict an external variable over and above that of the general factor (or vice versa).

[1] It is possible to model the effect of the disturbance as a predictor variable in a higher-order CFA, and thus analyse the effect of a specific factor. However, Chen, Hayes, Carver, Laurenceau, and Zhang, (2012)report that this type of non-standard SEM is not easily implementable in conventional SEM software such as Mplus or LISREL.

The Present Study

Bi-factor models can provide a more detailed insight into the dimensionality of a transformational leadership scale than has been available previously from conventional CFA models. In the present study the DTLI-HE is examined, as it is a multi-dimensional scale that has been validated in the context of HE, a setting that is clearly in need of further measurement development. Further, this study is conducted within the context of research supervision, which further extends the reach of transformational leadership research in HE environments. This investigation is separated into two phases. In Phase 1 the results of conventional global and higher order CFA models with a bi-factor model are compared and the unique contribution of the specific factors and the general factor to prediction of leader inspired extra effort is examined. In Phase 2, the results from the first phase are used to help inform and construct an abbreviated global transformational leadership scale for HE. Subsequently, the factorial validity of the resulting shortened measure is tested using multi-level CFA within the same sample. In so doing, the study will provide researchers and practitioners with a conceptually grounded and contextually relevant tool for the measurement of transformational leadership in HE environments, specifically within the context of research supervision, in both long-form and abbreviated formats.

Method

Participants

The total sample consisted of 421 (male = 174, female = 246) final year undergraduate students aged from 20 to 57 years (M_{age} = 21.77 SD = 3.65) from three British Universities, working under the supervision of 93 academic supervisors. Students were studying science-based subjects and were in the process of completing their final year

research project or dissertation. All students had been working with their current supervisor for at least six months.

Measures

Transformational Leadership. Students' perceptions of their supervisor's leader behaviours were measured using the DTLI-HE (Mawn, 2012). Items were adapted to reflect the supervisory context via very minor changes to item wording. Original items referred to leader behaviours "in lectures", and this phrasing was replaced with "in tutorials" in order to be consistent with the present context. The scale comprised 30 items representing eight dimensions of leader behaviour: individual consideration (three items, e.g., "Is considerate towards me"), inspirational motivation (five items, e.g., "Communicates an exciting vision that I can achieve"), intellectual stimulation (three items, e.g., "Asks me questions that make me think"), high-performance expectations (four items, e.g., "Tells me to do my best"), appropriate role modelling (five items, e.g. "Sets an example for me to follow"), sense of humour (four items, e.g., "Uses humour in tutorials"), and self-belief (three items, e.g., "Conducts tutorials in a confident manner"). Participants were asked to indicate how often their supervisor engaged in each of the listed transformational leader behaviours using a 7-point Likert scale from 1 (Never) to 7 (Always). Mawn et al. (2012) found overall support for the eight-factor structure of the measure ($\chi 2(377) = 1054.48$, $p < .001$, RMSEA = 0.07, SRMR = 0.05, NNFI = 0.97, and CFI = 0.98), as well as the discriminant validity of the scale's dimensions. The scale also correlated highly with existing measures of transformational leadership (TTQ, Beauchamp et al., 2010) and the learning climate questionnaire (Williams & Deci, 1996), supporting its predictive validity. In the present study, the DTLI subscale alpha coefficients ranged from .75-.93 (subscale alpha's reported in full in Table 2) demonstrating acceptable internal reliability.

Leader Inspired Extra Effort. Leader inspired extra effort was measured using Arthur et al.'s (2011) 4-item scale, based on Bass and Avolio's (2005) conceptualisation of extra effort as an outcome measure contained within the MLQ-5X. The items were adapted from the sporting context Arthur et al. (2011) to reflect the supervision context (e.g. "My supervisor motivates me to work hard.") for the present study. Item responses were recorded using a five-point likert scale from 1 (*strongly disagree*) to (*strongly agree*). In the present study, data collected using the scale demonstrated strong internal reliability ($\alpha = .95$).

Procedure

Following School ethical approval, data were collected from students using a combination of online and paper-copy questionnaire packs. Paper questionnaires were completed on an opt-out basis during their normal lecture time.

Data Analyses

All analyses were conducted using Mplus 7.0. Data were treated as categorical, using robust weighted least mean square (WLSMV) estimation. Given the nested nature of the data (students within supervisors), ICCs were computed for the general scale and subscale means of the DTLI-HE, as well as the LIEE scale to examine the degree of non-independence in the data. ICC scores for the DTLI-HE ranged from .35 to .46, and LIEE = .44 indicated non-ignorable amounts of non-independence. To account for non-independence an approach which controls for the nested nature of the data was employed by modelling the asymptotic within-groups covariance matrix (Asparouhov & Muthen, 2006) using the "Type = COMPLEX" command in Mplus. Unless specifically stated otherwise these estimation procedures were consistent across all subsequent analyses. Of the original sample of 421 participants, 32 chose not to indicate their supervisor's name when completing the questionnaire, and consequently could not be included in analyses that accounted for nesting within supervisors, resulting in a final sample of 389. To assess the appropriateness of model

fit a range of fit indices were employed. Specifically, the root mean square error of approximation (RMSEA), comparative fit index (CFI) and Tucker-Lewis index (TLI) were used, with respective cut-off values of below .06, and above .95 and .95 (respectively) as indicators of good fit, in accordance with recommendations by Hu and Bentler (1999).

Results

Phase 1A: Initial inspection of the adapted DTLI-HE

In order to glean a preliminary understanding of the proposed eight-factor structure of the DTLI-HE, a series of CFAs were conducted utilising a traditional maximum likelihood approach. First, the DTLI data were subjected to a single factor CFA with all 30 items loading onto one single transformational leadership factor. The single factor model showed an overall poor fit to the data (χ^2= 2401.927, df = 405 RMSEA = .113, CFI = .86, TLI = .85). The scale data were subjected to an eight-factor CFA in accordance with its proposed dimensions. The model demonstrated acceptable fit to the data (χ^2= 957.78, DF = 377, RMSEA = .06, CFI = .96, TLI = .95). Standardized factor loadings varied from .50 to .92 indicating moderate to strong loading of items onto their respective home factors. Inter-factor correlations ranged from .55 to .93 indicating moderate to strong relationships between the leader behaviours. A second-order factor model was also examined, which showed very similar fit (χ^2 = 1026.93, df = 397, RMSEA = .06, CFI = .96, TLI .95) and factor loadings. The leader behaviours each loaded significantly onto the overarching transformational leadership factor (.66 to .97). These results offer some confirmation that the DTLI-HE adapted for the context of research supervision conforms to the eight-factor structure proposed in its design (Mawn, 2012). Further, these findings suggest that the measure is well suited to examination using bi-factor analysis as the scale consists of a number of factors

purporting to reflect variation on one general construct (i.e., scale variance can be seen as attributable to either a general transformational leadership trait running through all the items, or specific leader behaviours).

Table 1. Means and zero-order correlations of variables in Study 1

	Variable	Mean	1	2	3	4	5	6	7	8	9
1.	TLB	4.88	-								
2.	IC	5.28	.86**	-							
3.	IM	4.43	.90**	.69**	-						
4.	IS	5.24	.88**	.80**	.75**	-					
5.	ARM	5.00	.89**	.72**	.77**	.79**	-				
6.	HPE	4.45	.83**	.65**	.73**	.70**	.69**	-			
7.	CR	4.19	.85**	.79**	.72**	.74**	.73**	.69**	-		
8.	SOH	6.00	.72**	.53**	.63**	.50**	.53**	.55**	.50**	-	
9.	SB	5.03	.75**	.70**	.60**	.71**	.69**	.50**	.60**	.43**	-
10.	LIEE	5.32	.80**	.76**	.70**	.75**	.71**	.66**	.72**	.47**	.66**

*p < .05 **p < .001

Table 2. Results of CFAs on DTLI measure

		Factor Loading				Inter-factor Correlations						
		1	2	3	A	IC	IM	IS	ARM	HPE	CR	SOH
	Individual Consideration (IC)			**.94**	*.87*	-						
IC1	Shows me that s/he cares about me	.78	.85	.85								
IC2	Helps me if I have difficulties	.77	.83	.84								
IC3	Is considerate towards me	.79	.85	.85								
	Inspirational Motivation (IM)			**.97**	*.82*	.86	-					
IM1	Shows me how my work relates to the real world	.69	.73	.73								
IM2	Talks enthusiastically about what my future career could be like	.62	.66	.66								
IM3	Explains why seemingly dull work is necessary	.68	.71	.71								
IM4	Tells me inspirational stories	.61	.64	.64								
IM5	Communicates an exciting vision that I can achieve	.82	.86	.86								
	Intellectual Stimulation (IS)			**.97**	*.82*	.94	.93	-				
IS1	Breaks down complex ideas for me	.81	.86	.86								
IS2	Challenges me to come up with new ideas	.73	.78	.78								
IS3	Asks me questions that make me think	.72	.76	.76								
	Appropriate role Modelling (ARM)			**.93**	*.87*	.83	.93	.93	-			
ARM1	Provides examples of people for me to learn from	.61	.66	.65								
ARM2	Sets an example for me to copy by working hard	.77	.83	.82								
ARM3	Gives me an example of somebody that I can learn from	.69	.74	.74								
ARM4	Role models what is possible for me	.80	.86	.86								
ARM5	Sets an example for me to follow	.82	.88	.88								

		Factor Loading				Inter-factor Correlations						
		1	2	3	A	IC	IM	IS	ARM	HPE	CR	SOH
	High Performance Expectations (HPE)			**.92**	*.75*	.85	.90	.87	.83	-		
HPE1	Tells me that they want me to do really well	.75	.83	.83								
HPE2	Tells me to do my best	.77	.86	.86								
HPE3	Tells me I need to improve further	.54	.61	.61								
HPE4	Tells me that s/he expects me to achieve a first	.45	.50	.50								
	Contingent Reward (CR)			**.89**	*.91*	.88	.84	.85	.82	.86	-	
CR1	Gives me recognition when I do good work	.87	.92	.92								
CR2	Gives me praise when I do something well	.87	.92	.93								
CR3	Personally praises me when I do outstanding work	.80	.88	.87								
	Sense of Humour (SOH)			**.66**	*.93*	.61	.73	.58	.58	.65	.55	-
SOH1	Uses humour in tutorials	.81	.92	.92								
SOH2	Makes jokes during tutorials	.78	.88	.88								
SOH3	Integrates humour into tutorials	.84	.95	.95								
SOH4	Tries to make me laugh in tutorials	.77	.88	.88								
	Self-Belief (SB)			**.83**	*.86*	.83	.76	.84	.83	.67	.70	.51
SB1	Acts confidently	.69	.81	.81								
SB2	Conducts tutorials in a confident manner	.79	.92	.92								
SB3	Demonstrates confidence in their subject	.74	.85	.85								

Note: 1 = global CFA model, 2 = first order factors CFA model, 3 = second order factor CFA model. **Bold** values = subscale factor loadings on higher order transformational leadership behaviours factor. *Italic* = subscale alpha coefficients.

Phase 1B: Bi-factor analysis (BFA) of the adapted DTLI

Bi-factor models can be employed within either a confirmatory or exploratory framework. In an exploratory bi-factor analysis, the items are allowed to load onto any number of the specific factors, whereas in the confirmatory approach, they are constrained to load onto only one factor. Exploratory models potentially provide a more detailed insight to a scale's factor structure, as the degree of item cross load onto specific factors other than the items' home factor can be examined. One approach to exploratory bi-factor analysis (EBFA) is to use a target rotation criterion within a bi-factor approach (Browne, 2001).When a researcher has *a priori* knowledge of a scale's factor structure based on empirical analyses or theory a target pattern matrix can be specified in the analysis (Reise, 2012). According to Browne (2001), the target matrix "reflects partial knowledge as to what the factor pattern should be" (p. 124). In accordance with this theorizing, and the scale's pre-existing factor structure, items were specified to load onto their target (home) factor with a pattern loading of .50, and other factors with a pattern loading of .00, consistent with examples by Myers, Martin, Ntoumanis, Celimli, and Bartholomew (2014). Factors were extracted from the data using a target rotation criterion that minimises the differences between the estimated factor pattern and the specified one such that the rotated factor pattern will come as close as possible to the specified values (e.g., IC1 is effectively specified to load as near as possible to .50 on the IC factor, and as near as possible to .00 on the other factors). All items were specified with a pattern loading of .50 on the general factor. Consistent with previous research (Reise, 2012), all group factors (i.e., specific TL behaviours) were specified as orthogonal to one another and the group factor.

EBFA results of the DTLI-HE responses showed excellent fit to the data (χ^2 = 14738, df = 435, RMSEA = .04, CFI = .99, TLI = .98). Rotated factor loadings were generally consistent with the *a priori* eight-factor structure. All items loaded significantly onto their

designated target factor with the exception of IM3. However, significant target factor loadings ranged from .18 to .68 indicating some low loadings for a number of items. Nonetheless, in general target loadings were markedly higher than untargeted loadings, and the factor structure was supported by the relatively low incidence of substantive significant cross-loadings ($\lambda \geq .30$) (see Table 3). All items loaded significantly onto the general factor, and in the overwhelming majority of cases item pattern loadings were markedly higher onto the general factor than onto specified target factors, indicating a factor pattern consistent with a bi-factor structure.

Table 3 Results of exploratory bi-factor analysis on DTLI measure

	Specific Factors																General Factor	
	Individual Consideration		Inspirational Motivation		Intellectual Stimulation		Appropriate Role Modelling		High Performance Expectations		Contingent Reward		Sense of Humour		Self Belief		TLB	
Items	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE
IC1	.36**	.03	.05	.04	.14**	.03	.06*	.03	.17**	.03	.16**	.03	.04	.03	.05	.03	.72**	.03
IC2	.35**	.04	-.02	.04	.11**	.03	-.01	.03	-.01	.03	.15**	.03	-.03	.03	.23**	.03	.73**	.02
IC3	.44**	.04	.04	.03	.02	.03	.06	.03	-.12**	.03	.03	.03	-.01	.04	-.02	.04	.79**	.02
IM1	.12*	.04	.18**	.05	.24**	.05	.13**	.04	.17**	.03	.14**	.04	.00	.03	.15**	.04	.61**	.03
IM2	-.08	.04	.35**	.04	-.09*	.04	.10*	.04	.17**	.05	.23**	.04	.10*	.03	-.09*	.04	.57**	.03
IM3	.10**	.03	.09	.05	.05	.04	.11*	.04	.06	.04	-.11*	.04	.07*	.03	-.02	.04	.69**	.03
IM4	-.13	.04	.35**	.04	.02	.04	.02	.04	.05	.05	-.12**	.03	.17**	.03	.00	.04	.61**	.03
IM5	.06	.03	.33**	.03	.07*	.03	.17**	.02	.05	.03	.05	.03	-.01	.02	.02	.04	.78**	.02
IS1	**.32****	.03	.10*	.04	.22**	.04	.17**	.03	.12**	.03	.15**	.03	.07*	.03	.12**	.03	.72**	.03
IS2	-.11*	.04	.03	.04	.36**	.06	.04	.03	.10*	.04	-.02	.03	-.14**	.03	.01	.03	.77**	.02
IS3	.05*	.04	.16*	.04	.34**	.04	.11*	.04	-.03	.03	.01	.04	-.11*	.04	.12*	.04	.69**	.03
ARM1	.10*	.04	.08	.05	**.22****	.04	.45**	.05	.17**	.05	.07*	.04	.18**	.03	.13*	.04	.47**	.04
ARM2	.08*	.03	-.10*	.04	-.01	.04	.33**	.03	.00	.04	.01	.03	-.16**	.03	.08	.04	.78**	.03
ARM3	-.04	.04	**.21****	.04	.15**	.03	.56**	.05	.06	.03	.11**	.03	.07*	.02	.09*	.03	.57**	.03
ARM4	-.04	.03	**.23****	.04	-.02	.03	.28**	.03	.00	.03	.09**	.02	-.08**	.02	-.04	.03	.78**	.02
ARM5	.00	.03	.11	.04	-.02	.03	.25**	.03	-.04	.04	-.11**	.03	-.11**	.02	.11**	.03	.84**	.02
HPE1	**.21****	.03	-.01	.04	-.02	.04	.01	.04	.55**	.04	.17	.04	.03	.03	.01	.04	.70**	.03
HPE2	.10*	.04	-.08*	.04	-.10*	.03	.08*	.04	.30**	.04	.12*	.04	-.01	.03	.09*	.04	.77**	.03
HPE3	-.10	.04	**.24****	.05	**.26****	.04	.04	.04	.25**	.05	-.14*	.05	.08	.04	-.07	.05	.52**	.04
HPE4	-.17**	.05	**.34****	.04	.05	.05	.07	.05	.27**	.05	.06	.05	.02	.04	**-.23****	.06	.42**	.04
CR1	.17**	.03	.03	.03	.08*	.03	.08*	.03	.06*	.02	.48**	.03	-.02	.03	.05	.03	.76**	.02
CR2	.14**	.02	.03	.03	-.11**	.03	.01	.03	.06	.03	.49**	.03	-.03	.02	.10**	.02	.79**	.02
CR3	.03	.03	.13**	.03	.17**	.03	.08*	.03	.08*	.03	.44**	.03	-.06*	.03	-.18**	.04	.74**	.02

	Individual Consideration		Inspirational Motivation		Intellectual Stimulation		Appropriate Role Modelling		High Performance Expectations		Contingent Reward		Sense of Humour		Self Belief		TLB	
	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE
SOH1	.01	.04	-.05	.04	.03	.03	.04	.03	.05	.03	.03	.03	.66**	.03	.04	.03	.64**	.03
SOH2	-.06*	.03	-.05	.04	-.03	.03	.01	.03	.06*	.02	.01	.02	.69**	.02	-.05	.03	.60**	.03
SOH3	.03	.02	.17**	.02	-.06*	.03	-.05*	.03	-.06	.02	-.05	.03	.63**	.02	-.01	.03	.67**	.03
SOH4	.03	.04	**.28****	.03	-.11**	.03	-.10**	.02	.06*	.03	-.09*	.03	.58**	.02	-.08*	.04	.62**	.03
SB1	.03	.04	.03	.04	.06	.04	.16**	.03	-.01	.04	.03	.03	.08*	.03	.52**	.03	.63**	.03
SB2	.15**	.03	.06	.04	.06	.04	.12**	.03	-.06	.03	.02	.03	-.09*	.03	.51**	.04	.73**	.02
SB3	.08*	.04	-.02	.04	.13*	.04	.09*	.04	-.13**	.04	-.09*	.04	-.09	.05	.44**	.03	.71**	.03
Omega	.92		.90		.89		.93		.86		.95		.95		.91		.98	
OmegaH	.46		.45		.45		.46		.43		.47		.47		.45		.87	
Ratio	.50		.50		.50		.50		.50		.50		.50		.50		.89	

Note. λ = standardized factor loadings, SE = standard error. Shaded cells denote significant loading of item onto their intended home factor. Bold values indicate significant cross loading >.20. * = p<.05. **=p<.001. Ratio = OmegaH/Omega

Table 4. Omega coefficients for specific factors from confirmatory bi-factor analysis (see Appendix A for full results).

	IC	IM	IS	ARM	HPE	CR	SOH	SB
Omega	.89	.85	.88	.90	.80	.93	.95	.89
Omega(H)	.11	.11	.12	.12	.12	.19	.54	.28
Ratio	.12	.13	.13	.14	.15	.21	.56	.31

Supplementary analysis – Coefficient Omega. In order to estimate the degree to which general factor scores reflect a single construct (i.e., the extent to which these scores are confounded by multidimensionality), Omega coefficients were calculated using the results of the initial bi-factor analysis (Brunner & Süβ, 2005; Reise, Bonifay, & Haviland, 2013). Coefficient Omega represents the proportion of total score variance that can be attributed to all common factors (the specific subscales). Omega hierarchical (OmegaH) represents the proportion of total score variance that is attributable to a single factor. Using formulas presented in Reise et al. (2013) omega coefficients were calculated for the specific and general factors (see Table 3). A ratio of OmegaH:Omega was also calculated for the general and specific factors, which yields an index of the proportion of reliable variance that is attributable to a given factor (Reise et al. 2012). For the specific factors this index is constrained to .50 as a result of the target loadings in the model specification. For the general factor the ratio suggests that 88.5% of the reliable variance in DTLI scores is attributable to the general factor (see Table 3) [2]. While there are no agreed upon "cutoff" values for the

[2] Similar calculations in the literature have been performed on confirmatory bi-factor models, although authors state that the equations are equally applicable to exploratory models. For completeness, these analyses were repeated within a confirmatory framework and full results can be found in Appendix A. However, due to problems with model estimation, we were unable to account for the nested nature of the data in those analyses. Results regarding the

magnitude of this index, Reise et al. (2013) report similar values as representing a very dominant general factor.

In addition, a supplementary confirmatory bi-factor analysis was conducted to calculate the omega coefficients for the specific factors as this was not possible in the exploratory model, reported in Table 4. These results can be used to explain both the reliability of the subscales and the degree to which the subscales provide the reliable information that is unique from the general factor. The Omega values reported in Table 4 represent the proportion of reliable subscale variance, or in other words, a measure of subscale reliability. Omega(H) represents the reliable variance that is attributable only to the specific factor (or variance that is unique from the general factor). Therefore the ratio (OmegaH:Omega) represents the percentage of reliable subscale variance that is unique from the general factor. These ratio figures suggest that for the majority of the subscales, only a very small portion of the reliable variance is attributed to the specific factor (i.e. the subscales represent largely general factor variance). Sense of humour is the only subscale where the majority of reliable variance is attributed to the specific factor.

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dimensionality of the general factor were consistent with those presented in the main analysis.

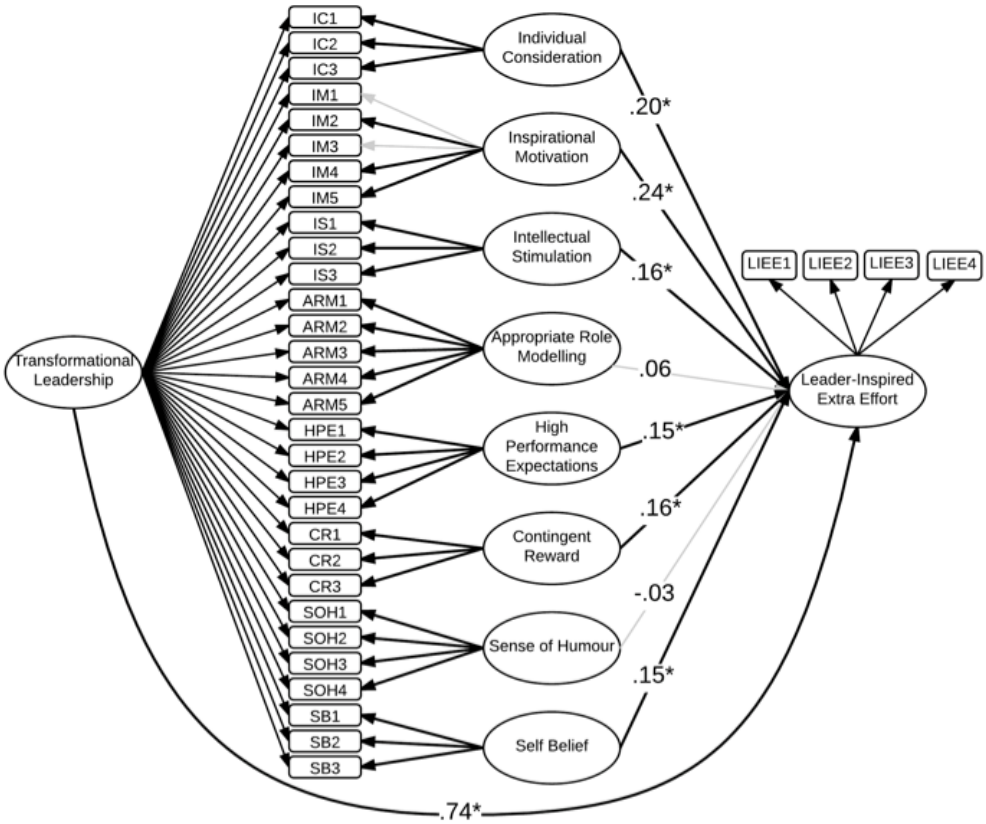

Figure 3 – Results of bi-factor SEM path model. For simplicity, lines denoting cross loadings from specific factors to items are not shown. Bold lines indicate sig. p >.05.

Exploratory bi-factor with External Criterion Variable

Subsequently, the EBFA model was extended in a second analysis, whereby the specific and general factors were used to predict an external criterion variable, in this case leader-inspired extra effort (LIEE). Results of the SEM showed excellent fit to the data (χ^2 = 18741, df = 561, RMSEA = .04, CFI = .99, TLI = .99). Path coefficients from the specific factors to LIEE showed that the leader behaviours of individual consideration, inspirational motivation, intellectual stimulation, high performance expectations, contingent reward and self-belief significantly and positively predicted LIEE, over and above the influence of general transformational leadership, while appropriate role modelling and sense of humour did not (see Figure 3 for coefficients). Additionally, the general transformational leadership factor was a much stronger predictor of LIEE than each of the specific factors. The factor-loading pattern observed in the SEM including the external criterion was largely consistent

with that observed in the initial EBFA. However, IM1 did not load significantly onto its designated home factor, in addition to IM3, as shown in the initial analysis (see Table 5 for factor loadings), suggesting that these items have more in common with the general factor than their specific home factor.

Summary of Phase 1

Results of the EBFA showed that responses to the items of the DTLI conformed to a bi-factor measurement structure, suggesting that while there is evidence of multi-dimensionality the dimensions also share a common theme. In addition, the omega coefficients revealed that the DTLI responses reflected a very dominant general factor (i.e. the items of the DTLI largely reflect variation on one construct), and that the specific factors scores consist mainly of general factor variance, potentially supporting the adoption of a global measurement approach. On the other hand, in the predictive EBFA model, six of the eight specific leader behaviours had significant predictive power over and above that of the general factor when predicting extra effort, although general transformational leadership was a much stronger predictor than each of the subscales. On balance, given that there is general support for the existence of a dominant general factor running through the items of the DTLI, Phase 2 proceeded to develop an abbreviated global form of the DTLI to sit alongside the full 30-item scale.

Table 5. EBFA results of DTLI measure with and external criterion

	Specific Factors								General Factor
	IC	IM	IS	ARM	HPE	CR	SOH	SB	TLB
Items	λ	λ	λ	λ	λ	λ	λ	λ	λ
IC1	.41**	.07	.15**	.06	.20**	.16**	.05	.07*	.71**
IC2	.35**	-.03	.11**	-.01	.00	.15**	-.03	.24**	.74**
IC3	.41**	.01	.01	.06*	-.15**	.03	-.01	-.04	.80**
IM1	.09*	.09	.24**	.16**	.15**	.13**	.01	.11*	.63**
IM2	-.06	.32**	-.07	.13**	.19**	.24**	.12**	-.08	.56**
IM3	.06*	.06	.04	.10*	.02	-.12**	.05	-.06	.71**
IM4	-.12**	.33**	.03	.05	.05	-.11**	.18**	-.01	.60**
IM5	.09**	.35**	.09**	.19**	.07*	.06*	.02	.05	.76**
IS1	**.30****	.02	.20**	.19**	.11**	.13**	.07**	.09**	.74**
IS2	-.12**	.07	.34**	.01	.08	-.03	-.16**	.01	.77**
IS3	.09*	.22**	.37**	.10**	-.01	.02	-.10**	.16**	.67**
ARM1	.06	-.03	.21**	.47**	.15**	.04	.16**	.07	.51**
ARM2	.08*	.01	-.03	.27**	.00	.01	-.18**	.11**	.77**
ARM3	-.06	.15**	.16**	.57**	.04	.10**	.06*	.05	.59**
ARM4	-.01	.29**	-.01	.27**	.02	.10**	-.07**	.00	.76**
ARM5	.03	.21**	-.02	.22**	-.02	-.09*	-.11**	.16**	.81**
HPE1	.20**	-.04	-.03	.02	.52**	.16**	.03	-.01	.71**
HPE2	.06	-.11*	-.13**	.06	.29**	.10*	-.03	.06	.79**
HPE3	-.11*	.20**	.26**	.05	.25**	-.15**	.08*	-.09	.53**
HPE4	-.10	**.44****	.08	.06	.33**	.08	.04	-.17*	.38**
CR1	.17**	.02	.07**	.08**	.06*	.48**	-.02	.05	.76**
CR2	.14**	.03	-.11**	.01	.06	.49**	-.03	.11**	.79**
CR3	.03	.14**	.16**	.07*	.08**	.45**	-.06*	-.18**	.74**
SOH1	.00	-.05	.03	.01	.04	.02	.65**	.05	.65**
SOH2	-.06*	-.01	-.03	-.03	.06*	.01	.68**	-.03	.61**
SOH3	.03	.18**	-.07**	-.06*	-.06*	-.05*	.63**	-.01	.67**
SOH4	.04	.27**	-.11**	-.07*	.07*	-.09**	.59**	-.09*	.61**
SB1	.03	-.01	.07	.18**	-.01	.03	.08*	.51**	.63**
SB2	.13**	.00	.06	.15**	-.07*	.02	-.07*	.48**	.73**
SB3	.10*	.02	.13**	.07	-.13**	-.08*	-.09*	.46**	.71**

Note. λ = standardized factor loadings. Shaded cells denote significant loading of item onto their intended home factor. Bold values indicate significant cross loading >.30. * = p<.05. **=p<.001

Phase 2: Scale Abbreviation

Item Selection. In order to maintain the conceptual breadth of the measure, one item was selected from each of the measure's eight subscales. Factor loadings from the results of CFAs carried out in Phase 1 were used to guide the selection of items in combination with inspection of item wording. The aim was to choose the items which best reflected their respective subscales. Within each subscale, items were narrowed down to the two items with the highest factor loadings across each of the three standard CFAs and the EBFA and then a choice made based on the representativeness of item phrasing. From this process eight items were selected; IC3, IM5, IS3, ARM5, HPE2 CR2, SOH1 and SB2.

Table 6. Abbreviated scale items wordings and inter-item correlations.

			ICC	1	2	3	4	5	6	7
1	IC3	Asks me questions that make me think	.32	-						
2	IM5	Communicates an exciting vision that I can achieve	.32	.62	-					
3	IS3	Asks me questions that make me think	.26	.54	.63	-				
4	ARM5	Sets an example for me to follow	.34	.60	.70	.62	-			
5	HPE2	Tells me to do my best	.30	.58	.56	.49	.58	-		
6	CR2*	Gives me praise when I do something well	.30	.67	.64	.52	.57	.70	-	
7	SOH1	Uses humour in tutorials	.39	.48	.50	.38	.45	.48	.46	-
8	SB2	Conducts tutorials in a confident manner	.33	.62	.57	.61	.65	.54	.59	.41

Note: * denotes item CR2 removed in final model

Multilevel CFA. Due to moderate to high intra-class correlation coefficients for the selected items (see Table 6) the non-independence of observations must be accounted for in the data. Multi-level CFA is a more rigorous approach to accounting for non-independence of observations than modelling of the asymptotic within-groups covariance matrix, which was employed in Phase 1 (Asparhouov & Muthen, 2006). With the current sample, the simple

factor structure and smaller number of items in this model permit a multi-level analysis, which was not practical in earlier analyses. Consequently, the abbreviated scale was subjected to a single factor multi-level CFA.

Table 7. Fit indices and factor loadings for multilevel CFA

						SRMR	
	Chi Sq	df	RMSEA	CFA	TLI	Within	Between
Model 1	162.34	40	.095	.923	.893	.042	.045
Model 2	89.236	28	.080	.952	.928	.035	.044

	Within			
	Model 1		Model 2	
	Factor Loading	SE	Factor Loading	SE
IC3	.73	.05	.70	.05
HPE2	.67	.05	.62	.05
IM5	.73	.05	.74	.05
IS2	.67	.06	.70	.05
SOH3	.54	.05	.53	.06
ARM5	.73	.05	.76	.04
SB2	.65	.05	.64	.05
CR2	.76	.04	-	-
	Between			
	Model 1		Model 2	
	Factor Loading	SE	Factor Loading	SE
IC3	.47	.07	.97	.03
HPE2	.55	.07	.92	.07
IM5	.47	.07	1.0	.02
IS2	.43	.06	.91	.06
SOH3	.55	.08	.76	.13
ARM5	.71	.06	1.0	.03
SB2	.47	.07	.99	.03
CR2	.58	.06	-	-

Note: Model 2 excludes CR2.

Results of the multi-level CFA showed that the proposed eight-item model (Model 1) was a relatively poor fit to the data (see Table 7). Inspection of model modification indices revealed that the item CR2 representing contingent reward was the primary source of misfit. Consequently, item CR2 was removed and the analysis repeated. This is consistent with

existing TL theory, which posits that contingent reward is a transactional leadership behaviour that is distinct from transformational leadership behaviours. The resulting model (Model 2) showed markedly improved fit, and overall acceptable fit to the data. Further, the removal of CR2 resulted in a marked increase in the strength of the between level factor loadings for the remaining items.

Discussion

The aims of Phase 1 were to initially test the proposed factor structure of the DTLI in the new context of HE research supervision, and then subsequently explore the factor structure of the scale in greater detail using bi-factor analyses. Initial Phase 1 results supported the factorial validity of the DTLI scale in the context of HE research supervision, demonstrating acceptable fit to the eight-factor structure and consistent with its development (Mawn, 2012). This finding highlights the adaptability of the scale for subtly differing aspects of the HE environment, including the lecturing context in which it was designed, and research supervision where it is now applied in the present thesis, with only minor changes to item wording to reflect the context.

Results from bi-factor analyses indicated that the items of the DTLI conformed to a bi-factor measurement structure. The relative strength of the item factor loadings onto the general TL factor versus the specific leader behaviours indicated a dominant general transformational leadership factor running through the items. This finding was further supported by the omega coefficients indicating a very dominant general factor in the items. These results suggest that while the measure was conceptually conceived as a multi-dimensional scale, and does not conform to a uni-dimensional structure, the items still heavily reflect variation on a single general transformational leadership construct.

The relationship of general and specific transformational leader behaviours with leader inspired extra effort was also investigated. Consistent with previous studies linking transformational leadership and extra effort (Bass, 1985; Dvir et al., 2002), general transformational leadership was by far the strongest predictor. However, six of the eight specific behaviours also significantly predicted LIEE even while the effect of general transformational leadership was controlled for. This suggests that these behaviours make some unique contribution to extra effort that is separate from "general" transformational leadership. Overall, the results of Phase 1 also support the predictive and discriminant validity of the DTLI-HE scale, consistent with the results of Mawn (2012) that the scale and its dimensions correlated highly with known correlates of transformational leadership such as LIEE.

With regard to the differentiated versus global debate in transformational leadership research, the results of Phase 1 provide some support to both perspectives. First, the finding that the DTLI scale reflects a very dominant general factor lends some support to the notion of global a conceptualisation. From a measurement perspective Reise (2012) has argued that when such a large portion of the reliable variance in a scale is attributable to the general factor, analyses using subscales scores would not be substantively meaningful, as subscales are heavily reflective of the general factor, and therefore a global approach is more appropriate in these circumstances. Indeed, authors have previously suggested that the dimensions of transformational leadership scales are so highly interrelated that the interpretation of subscale effects is not worthwhile (Carless, 1998). The results did generally reflect such high inter-factor correlations, although not across all dimensions, so it would be an oversimplification to collapse the scale purely on this basis. In partial support of the differentiated perspective, the results of the predictive bi-factor model showed that some of the specific behaviours made a unique contribution to the prediction of LIEE. More

poignantly, the effects of the specific behaviours on LIEE varied widely (-.034 - .240). In a global model, these nuanced effects would be obscured. While previous researchers have called for adoption of a differentiated approach due to differential effects of specific behaviours on outcomes (e.g., Hardy et al., 2010), previous examples could not separate the influence of the specific dimensions from general transformational leadership. From a bi-factor measurement perspective, a subscale score is seen as composed partly of general factor variance, partly of specific factor variance, and partly measurement error. The results suggest that such subscale scores calculated from the DTLI dimensions are largely composed of general factor variance, but the portion that is specific factor variance can have differential relationships with a given outcome. While this portion of variance is small, the variation in the relationships with outcomes cannot be dismissed. This author's contention is that it is this portion of specific-factor variance that primarily underlies the findings of differential relationships with a given outcome in previous studies where the bi-factor structure was not accounted for. However, based on the results of the bi-factor models, it is estimated that the influence of the specific-factor variance to be small in relation to the influence of the general factor, and thus, differentiated relationships without accounting for the bi-factor structure would largely reflect variation on the same general transformational leadership construct. Such analyses would also be confounded by multi-collinearity, due to high inter-factor correlations.

Overall, it is concluded that while the use of global scale scores does indeed obscure subtle relationships, to properly interpret these relationships a bi-factor model should be employed. While this is practicable in some situations, increasingly complex research questions may potentially prohibit the use of complicated bi-factor measurement models. In these situations a global approach to measurement of transformational leadership is justifiable, supported by the dominance of the general factor in the results. Leadership

researchers should consider the merits and limitations of both differentiated and global approaches to measurement of both approaches in light of the specific research question under investigation and implications of underpinning theory.

In Phase 2, the factor structure of a reduced-item single factor version of the DTLI-HE was tested in the context of research supervision. Multi-level CFA results revealed that the transactional leader behaviour of contingent reward was incompatible with the remaining seven transformational leadership items in a single factor model. The removal of contingent reward significantly improved the model fit, and resulted in marked improvement in between level item factor loadings. Contingent reward has been viewed as a beneficial form of transactional leadership that is positively associated with and complements transformational leadership behaviour (Bass, 1999). As it is conceptually distinct from transformational leadership it is not surprising that removing the contingent reward item improved model fit. The resulting seven-item scale represents a more focused measure of transformational leadership than those incorporating contingent reward. Notably higher factor loadings at the between-level than the within-level support claims that transformational leadership is best viewed as a group-level construct, and that the hierarchical nature of transformational leadership should be accounted for in analyses when possible.

The abbreviated transformational leadership scale helps to satisfy a need for conceptually grounded and contextually valid measurement tools of transformational leadership in the context of HE. As the scale employs a global approach to measurement it lends itself to complex research questions where the modelling of complex measurement structures is not viable, but limits the scope of questions to examining the effects of global transformational leadership. Further, the short format of the scale means it is well suited to research environments where access to participants is time-limited, or where long questionnaires might lead to biased results or low participation. In situations where a

differentiated approach is warranted, and the research methodology and analysis are sufficiently accommodating, the full 30-item DTLI-HE can be used in place of the abbreviated scale.

One potential limitation of the present study is the reliance on the same data set for both phases of the investigation. By using the same sample to guide the development of the abbreviated measure and confirm its factor structure, there is a risk that the results of Phase 2 represent sample-specific findings. However, the item selection process did not follow a purely empiricist approach, instead relying on a combination of factor-structure information from Phase 1, and careful inspection of the item wordings to form a global scale that was not driven purely by the item factor loadings in the present sample. Future studies with independent samples could seek to further explore the factorial and predictive validity of the scale, as well as its applicability across sub-domains in HE.

Like many questionnaire studies, the current investigation suffers from the potential bias caused by common method variance. This has implications for the results of the predictive bi-factor model in Phase 1, as the relationships between the factors and extra effort could be inflated. However, in the present study, the purpose of examining the effects of the general and specific factors on extra effort was to facilitate comparison of the relative strength of these effects. The absolute size of these effects, while noteworthy, is not the main focus of the investigation. With this in mind, it is estimated that the effects of common method bias would have relatively little bearing on the inferences drawn from the results in Phase 1. However, this rationale assumes that the influence of common method bias is constant across the general and specific factors, which is not possible to estimate.

The differentiated effects of the specific factors and the general factor were examined on only one dependent variable; leader inspired extra effort. Future studies could examine the influence of the specific factors on different types of follower outcomes simultaneously. This

would allow you to examine the relative strength of the influence of the general and specific factors towards the prediction of behavioural versus affective outcomes, for example. Such investigations might have important implications for practitioners in applied contexts, where findings could be used to guide interventions by focusing on specific leader behaviours that emerge as pertinent in their given context, or in relation to their specific desired outcome. One draw back of such an approach is that these findings might be highly context specific and limit the generalizability of any findings to wider applied situations.

Overall, the study results provide three significant contributions to the literature. First, support is provided for the factorial validity and internal reliability of the 30-item DTLI-HE scale in the new sub-domain of HE research supervision. Second, the EBFA results showed that the items of the DTLI strongly reflect variation on a single transformational leadership construct, while specific leader behaviours also make unique contributions to the prediction of leader inspired extra effort once general transformational leadership has been taken into account. These results highlight the importance of considering the merits and limitations of both global and differentiated approaches to the conceptualisation of transformational leadership. They also represent a first attempt to highlight the utility of using bi-factor models for the investigation of transformational leadership effects. Third, initial support is provided for the factorial validity and reliability of a global, short form measure of transformational leadership for use in HE contexts, helping to address the need for contextually valid and conceptually grounded measurement tools in this setting.

Chapter 3

Mechanisms of Transformational Leader Effectiveness: Linking Leader-Member Exchange, Need Satisfaction, Engagement and Grade Performance

Abstract

Two studies were conducted to examine the role of a number of variables that have been individually highlighted as mechanisms of transformational leader effectiveness, specifically, leader-member exchange, basic psychological needs satisfaction, and engagement. A multiple serial mediation model is proposed whereby supervisor's transformational leadership impacts upon student's grade performance via its influence on LMX, needs satisfaction and engagement sequentially. In the first study (N=155), using a cross sectional design, indirect effects were examined using a reliability-adjust manifest variable path model. Results provided general support for the hypothesised indirect effect of transformational leadership upon grade performance via LMX, needs satisfaction and engagement sequentially. The results were replicated in a second study (N=139) using a semi-longitudinal design and a developed engagement measure. The results suggest that LMX, needs satisfaction and engagement are important mechanisms of transformational leader effectiveness in this context, and that these mechanisms are inter-related.

Transformational leadership (Burns, 1978; Bass, 1985) has received wide empirical investigation, and has been shown to predict a number of positive outcomes at the individual and organisational level including intrinsic motivation (Charbonneau et al., 2001), organisational commitment (Avolio et al., 2004), satisfaction (Podsakoff et al., 1990), and performance (Barling et al., 1996; Lowe et al., 1996). While the relationship between transformational leadership and positive outcomes is well established, only relatively recently has research attention shifted towards the investigation of the mechanisms underpinning these relationships. Numerous mechanisms have been proposed such as satisfaction of basic needs (Kovjanic et al., 2013), developing high LMX relationships (Wang et al., 2005), and fostering engagement (Wilson et al., 2012). However, few studies have attempted to explain related mechanisms in one integrative causal model. Indeed, authors have called for more integrative research efforts in the field of transformational leadership (Judge, Woolf, Hurst, & Livingston, 2006). By simply proposing more potential mediators, without considering the interplay between them, we restrict our understanding of what truly underpins the effectiveness of transformational leaders. Through two studies a multiple serial mediator model was developed to test the relationships between a number of mediators, and the mediating role they play in the transformational leadership-performance relationship. Further, the study extends the scope of transformational leadership research into the new context of undergraduate research supervision.

Transformational Leadership and Higher Education

Despite considerable research attention in other domains, most notably in organisational psychology, relatively few studies have examined the effects of transformational leadership in educational settings. This is surprising given the association found between transformational leader behaviours and positive outcomes that are desirable in

this context, such as enhanced commitment (Pillai & Williams, 2004), extra effort (Arthur et al., 2011), intrinsic motivation (Charbonneau et al., 2001), and performance (Lowe et al., 1996). Indeed, Beauchamp et al. (2010) noted that the goals of educators and leaders are closely aligned as they both involve influencing a group of people to achieve a desired set of objectives (Northouse, 2001), so it is appropriate that these fields of research should meet. Early research on transformational leadership in education focused primarily on effects at the principal level of leadership (e.g. Leithwood & Jantzi, 1999, 2005; Marks & Printy, 2003), while more recent studies have examined the transformational behaviours of teachers themselves. These studies have shown that transformational leadership is related to students' self-efficacy (Bourne et al., 2013), satisfaction of basic needs (Wilson et al., 2012), self-determined motivation (Beauchamp, Barling, & Morton, 2011), and behavioural engagement (Beauchamp & Morton, 2011; Wilson et al., 2012). Extending this research into the context of higher education (HE), Mawn (2012) supported some of these findings, suggesting that transformational leadership among lecturers predicted student basic need satisfaction, engagement, and grade performance. The current study further extends this line of research into the context of HE research supervision.

Research supervision poses an appropriate and worthwhile context for the examination of transformational leadership and its mechanisms for at least two primary reasons. First, extensive research has demonstrated an association between transformational leadership and desirable outcomes for the HE context as discussed above. There is a need for more empirical research investigating research-informed approaches to supervision practices. Authors universally accept the paramount importance of the supervisor's role in HE (Golde, 2000; Howitt et al., 2010) recognising it as an influential factor affecting PhD completion rates (Ives & Rowley, 2002) and time to complete (Garcia, Malott, & Brethower, 1988) among postgraduates, and yet there remains a lack of conceptually grounded research

addressing desirable supervisor behaviour. Specifically, much of the research that exists has focused on matching students and supervisors based on personal characteristics such as gender (Vonk, 1996), race, degree level (Worthington & Stern, 1985) and cognitive style (Armstrong, Allinson, & Hayes, 2004), the implications of which often prove impractical as it may not be possible to match supervisors to students on such strata when taking into account students' preferences in topic and research area. Transformational leadership represents a well-grounded and widely researched theory that may provide insight into the effects of leader behaviours on student outcomes, and address some shortcomings of the existing research. Second, when compared with more distant relationships such as in HE lecturing or business the close relationship between student and supervisor may provide the opportunity to elicit enhanced levels of follower identification with the values espoused by the leader, by working in small groups or on a one-to-one basis. Theorists have cited follower identification with collective values and goals as an important process of influence in transformational leaders (Podsakoff, Mackenzie, Moorman, & Fetter, 1990; Bass & Riggio, 2006; Bass, 1999). These potentially more pronounced effects provide a more appropriate environment for investigating the subtleties of underlying mechanisms in leaders.

Potential Mechanisms

Studies have examined the mediating roles of leader member exchange (Wang et al., 2005), basic psychological need satisfaction (Kovjanic, Schuh, Jonas, Quaquebeke, & Dick, 2012), and engagement (Kovjanic et al., 2013) as potential mechanisms underpinning the effectiveness of transformational leaders. However, to date these mechanisms have only been examined in isolation, and most research has not explored the possibility that these mechanisms are themselves related. Thus, the overall aim of this study is to examine the role of these mediating variables in an integrative model explaining the possible effects of transformational leadership on student grade performance, within HE research supervision.

The next section will address the individual processes that comprise the proposed integrative model.

Transformational Leadership, Engagement and Performance

The reported association between transformational leaders and follower performance spans diverse contexts and populations; for example, the military (Bass, Avolio, Jung, & Berson, 2003; Dvir et al., 2002; Hardy et al., 2010), business (Barling et al., 1996; Wang et al., 2011), sport (Charbonneau et al., 2001), and education (Koh, Steers, & Terborg, 1995; Leithwood & Jantzi, 1999). One mechanism that is proposed to underpin this relationship is the manner in which transformational leaders foster follower engagement.

Engagement is most commonly defined as "...a positive, fulfilling, work-related state of mind that is characterized by vigour, dedication, and absorption" (Schaufeli et al., 2002, p. 74). Theorists posit that when an individual's work is characterised by these feelings, they are likely to perform at higher levels. This is borne out in the research where studies have demonstrated an association between engagement and performance in the work place, (Bakker & Bal, 2010; Halbesleben & Wheeler, 2008), and education (Schaufeli et al., 2002). In their study examining the effect of fluctuations in transformational leadership on daily levels of engagement, Tims et al. (2011) concluded that fostering engagement is likely one mechanism of transformational leader effectiveness, given the relationship they observed between transformational leadership and engagement, and the well-established links between engagement and performance. Indeed, subsequent research has supported this notion; Breevaart, Bakker, Demerouti, and Derks, (2015) and Salanova, Lorente, Chambel, and Martinez (2011) both found support for an indirect effect of transformational leadership on job performance via engagement. It is proposed that the link between transformational leadership and engagement is not direct, but rather further mediated by other possible

mechanisms, specifically, the quality of leader-follower relationships, and satisfaction of basic psychological needs.”

Transformational Leadership and Leader-Member Exchange

Leader-member exchange (LMX) is a relationship-based approach to leadership focused upon dyadic leader-follower relationships. LMX proposes that leaders develop individually differentiated relationships with subordinates, as opposed to an average style of leadership (Graen & Uhl-Biehn, 1995). LMX relationships develop through a process described by Graen and Uhl-Biehn (1995) in the leadership-making model. Early in the relationship, known as the "stranger" stage, the exchange is typically impersonal and based on material exchange between partners or that to which they are contractually obliged in performing their role responsibilities. At this stage, exchanges are formal and contractual in nature; leaders provide subordinates only with the minimum resources required to achieve the task, and followers are primarily motivated to achieve a minimum standard of expectation. To progress from this stage one member of the dyad must make an "offer" to raise the level of the exchange beyond that of the contractual obligation (e.g., by providing additional resources for the subordinate to enhance fulfilment of their role responsibilities). Once this occurs, the dyad can progress to the "acquaintance" stage; not all exchanges are purely contractual, and they begin to share greater information and resources, promoting a cycle of increasing exchange quality, whereby dyads can progress to the "mature" stage. At this final stage, leader-member exchanges are high quality; the relationship is characterised by feelings of mutual trust and obligation. The exchange is no longer purely contractual and material, but is now an emotional and social exchange as well. Research has demonstrated high LMX relationships are associated with a number of positive follower outcomes, such as job satisfaction (Graen, Liden, & Hoel, 1982; Turban, Jones, & Rozelle, 1990), organisational commitment (Seers & Graen, 1984), organisational citizenship behaviour (Scandura, Graen,

& Novak, 1986; Yammarino & Dubinsky, 1992), and most relevantly, work engagement (Christian, Garza, & Slaughter, 2011) and performance (Scandura & Graen, 1984). Several authors have called for research integrating the theories of transformational leadership and LMX (e.g. Bass et al., 2003; Gerstner & Day, 1997; Graen & Uhl-Bien, 1995; Howell & Hall-Merenda, 1999) and although related, they represent distinct conceptualisations of leadership. Transformational leadership theory is primarily concerned with leader behaviours directed toward the subordinate, and the effect this has upon the subordinate's behavioural outcomes, while LMX research focuses on dyadic two-way processes of exchange between leader and follower.

The limited literature on transformational leadership and LMX indicates that global transformational leadership is positively correlated with LMX (Basu & Green, 1997; Howell & Hall-Merenda, 1999) as has also outlined the specific predictive roles of individualised consideration and charismatic behaviour (Deluga, 1992). More recently, Wang et al. (2005) drew from the leadership-making model (Graen & Uhl-Biehn, 1995) and LMX theory to hypothesize that LMX mediates the relationship between transformational leadership and follower performance. Results from structural equation modelling offered support for an indirect effect of transformational leadership on performance via LMX. Wang and colleagues concluded, “transformational leadership behaviours are social currency, nourishing high quality LMX” (p. 429). The present chapter extends this argument with reference to the leadership making model; that through the enactment of transformational leadership behaviours, leaders are more likely to engage in the process of offering/acceptance described by Graen and Uhl-Biehn (1995), and extend relationships and role responsibilities beyond the realms of the formal contractual obligation, thus progressing towards higher quality LMX relationships. Consequently, it is posited that transformational leadership and LMX represent the first link of the integrative sequential mediation model and hypothesised that:

Hypothesis 1: Supervisor transformational leader behaviours positively predict student rated LMX relationships

Leadership, LMX, and Need Satisfaction

The second link in the sequential model involves a central feature of Deci and Ryan's (1985) self-determination theory; the concept of basic psychological needs satisfaction. Deci and Ryan propose that individuals have innate psychological needs that must be satisfied in order to maintain personal well-being and facilitate continued psychological growth. Three basic needs support human motivation: first, the need for autonomy refers to individuals' desire to feel volitional and exert control over their own actions; second, the need for competence refers to perceptions of mastery and effectiveness, originating from effective interactions with one's environment; and finally, relatedness refers to perceptions of belonging and connectedness with others. Embedded within self-determination theory is the principle that the social context influences the fulfilment of basic psychological needs (Gagné & Deci, 2005; Ryan & Deci, 2000; Vallerand & Ratelle, 2002). Given that leaders are highly likely to impact upon their followers' social context, it should come as no surprise that need satisfaction has been identified as one of the mechanisms through which transformational leaders positively influence followers (Hetland, Hetland, Andreassen, Pallesen, & Notelaers, 2011). In fact, Shamir, House, and Arthur (1993) described the leader's ability to satisfy their followers' needs as critical to transformational leader effectiveness. In support of this line of reasoning, Kovjanic et al. (2013) found that the influence of transformational leadership on follower job performance was mediated by fulfilment of these needs, followed by work engagement. Further, it is proposed that high-LMX relationships help to foster a work environment that supports the fulfilment of followers' basic psychological needs. Previous

researchers have suggested that LMX facilitates feelings of meaning, positive impact, competence, and choice, which overlap with the needs for autonomy, competence, and relatedness (Chen, Kirkman, Kanfer, Allen, & Rosen, 2007; Liden, Wayne, & Sparrowe, 2000). Furthermore, Graves and Luciano (2013) found that the relationship between LMX and engagement was mediated by the satisfaction of the need for competence, and that satisfaction of all three needs mediated the relationship between LMX and organisational commitment. Therefore, it is hypothesised that:

Hypothesis 2: LMX relationships will positively predict students' satisfaction of basic needs of autonomy, competence and relatedness

Basic Need Satisfaction, Engagement, and performance

There is a plethora of support for the tenet that satisfaction of the psychological needs of autonomy, competence, and relatedness influences individuals' towards more intrinsic motivation (Ryan & Deci, 2000). Extending this line of research, authors have investigated the role of need satisfaction in the prediction of work engagement, as opposed to its effect on autonomous forms of motivation. Specifically, van den Broeck, Vansteenkiste, Witte, and Lens (2008) found that satisfaction of basic needs mediated the relationship between job demands and work engagement, supporting previous research suggesting that satisfaction of needs is an important factor contributing to work engagement (Deci et al., 2001). Additionally, there is a growing body of research supporting the connection between work engagement in terms of dedication, absorption, and vigour, and employee performance (Bakker & Bal, 2010; Halbesleben, Harvey, & Bolino, 2009; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009). Taken together, these findings lead to the proposal that:

Hypothesis 3: Basic needs satisfaction will positively predict students' engagement

Hypothesis 4: Students' engagement will positively predict students' grade performance

Overarching sequential hypothesis

Given the numerous testaments to the importance of research supervision in students' experience of the research process, and its influence on key student outcomes, innovative approaches to teaching and learning in supervision should be considered. Transformational leadership theory represents one such approach. By incorporating the theoretical perspectives of transformational leadership, LMX, need satisfaction, and engagement in an integrative model, the present study addresses calls for more integrative research efforts examining transformational leadership and its mediators (Judge et al., 2006). Through integration of these variables, the study aims to present a more conceptually complete picture of transformational leader effectiveness, as opposed to sporadic, separate findings. Furthermore, by applying transformational leadership theory to research supervision in HE the study will highlight the utility of this paradigm in understanding effective research supervision; helping to address some of the aforementioned limitations of the existing supervision related literature. In accordance with the above theorising, the main multiple-serial mediation hypothesis is presented:

Hypothesis 5: Transformational leadership will have a significant positive indirect effect upon grade performance via LMX, basic need satisfaction and engagement

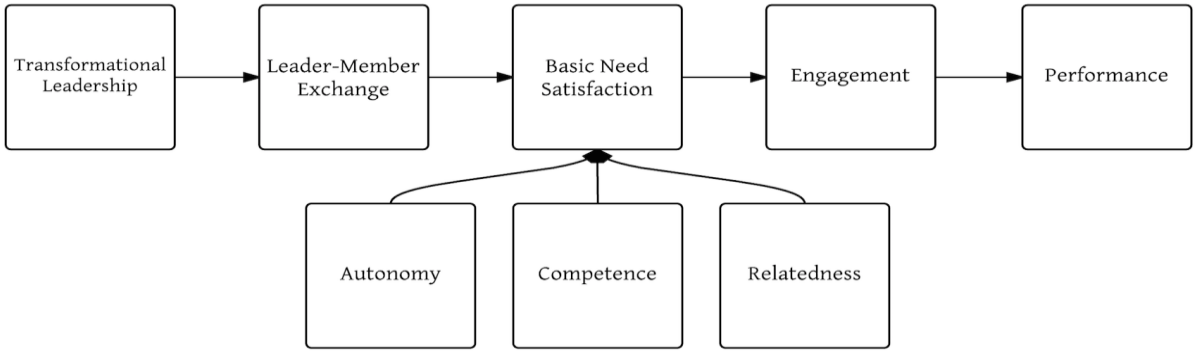

Figure 4. Diagram depicting hypothesised indirect effect of transformational leadership upon grade.

Following the rationale outlined above, it is argued that the sequence of the variables in the model is consistent with the theorised causal chain in leader-follower interactions, starting with leader behaviour, and ending with follower performance.

General Method

In order to test the proposed theoretical model, two studies were conducted. In Study 2, data were collected using a cross sectional design. In Study 3, data were collected with a time lag between the measurement of transformational leadership and the remaining variables. The same measures were employed in both studies with the exception of the engagement scale. Details of developments to the engagement measure are explained in Study 3.

Study 2

Method

Participants. Data were collect from 169 (male = 99, female = 70) final year undergraduate students aged 20 to 56 years (M_{age} = 22.4, SD = 4.59) from three British universities, under the supervision of 53 academic supervisors. Students were studying for

science based degrees, specifically Sport Science and Psychology, and were in the process of completing their undergraduate research project (32%), where the student conducts an independent research project involving the collection of primary data, or an essay style dissertation (45%[3]) involving secondary research. Participants had been working with their current supervisors for an average of 11 months at the time the questionnaires were administered.

Measures.

Transformational Leadership. The abbreviated, uni-dimensional version of the DTLI for HE was used to assess students' perceptions of supervisors' transformational leader behaviour. Participants were asked to indicate how often their supervisor engages in each of the behaviours using a 7-point likert scale from 1 (*Never*) to 7 (*Always*), and the anchor statement "My supervisor…" followed by an item. The seven items of the scale each measure one dimension of transformational leadership as detailed in the original DTLI for HE (Mawn, 2012); individual consideration ("Is considerate towards me"), inspirational motivation ("Communicates an exciting vision that I can achieve"), intellectual stimulation ("Asks me questions that make me think"), high-performance expectations ("Tells me to do my best"), appropriate role modelling ("Sets an example for me to follow"), sense of humour ("Uses humour in tutorials"), and self belief ("Conducts tutorials in a confident manner"). The scale demonstrated good reliability ($\alpha = .88$). Full scale can be found in Appendix C.

Leader-Member Exchange (LMX). Student LMX was measured using Liden and Maslyn's (1998) multi-dimensional measure of LMX (LMX-MDM). The LMX-MDM is composed of 12 items from four subscales; loyalty (e.g., "My supervisor would defend me to others in the organization if I made an honest mistake"), contribution (e.g., "I do not mind

[3] 12% "other", 12% did not specify.

working my hardest for my supervisor"), affect (e.g., "My supervisor is a lot of fun to work with"), and professional respect (e.g., "I respect my supervisors professional skills"). Responses were recorded on a likert scale from 1 (strongly disagree) to 7 (strongly agree). Liden and Maslyn (1998) found support for the construct validity of the LMX-MDM in a study involving 251 business employees, as well as good predictive validity with existing LMX measures. Authors have argued that the LMX-MDM has broader domain coverage (Wang et al., 2005) than its uni-dimensional counterpart, the LMX-7 (Graen & Uhl-Biehn, 1995). Indeed, Liden and Maslyn suggested that a composite measure using all four dimensions could be used in replacement of the LMX-7 when dimensionality is not the focus of investigation. Full scale can be found in Appendix D.

Needs Satisfaction. Student's satisfaction of basic psychological needs of autonomy, competence, and relatedness were measured using an adapted version of the needs satisfaction at work scale (Kasser, Davey, & Ryan, 1992). Previous research has demonstrated acceptable internal reliability for each of the three subscales of autonomy, competence, and relatedness (Deci et al., 2001; $\alpha > .7$) and concurrent validity (Baard, Deci, & Ryan, 2004).

As this measure had not previously been employed in a HE setting the items were adapted to reflect the specific context, for example, the item "I feel like I can make a lot of input in deciding how my job gets done" was changed to "I feel like I can make a lot of input into how my research project/dissertation is done". Participants indicate to what extent each item is true of them using a likert scale from 1 (*not at all true*) to 7 (*very true*). Full scale can be found in Appendix E.

Engagement. To date the engagement literature has been plagued by a lack of conceptual clarity regarding the construct and its definition (Christian, Garza, & Slaughter,

2011) preventing consistent interpretation of research findings. In their review of the topic, Macey and Schneider (2008) discuss the distinction between examining engagement as a psychological state, a form of behaviour, a dispositional trait, or a combination of these. At this quite gross level of distinction there is a trend towards the "state" approach to work engagement with researchers investigating even day-to-day changes in engagement (Tims et al., 2011). In the education context, academic engagement ought to be viewed with a more behavioural interpretation as opposed to the affective or cognitive approach taken by Schaufeli et al. (2002). Indeed, previous studies in schools have employed measures based on a behavioural conceptualisation of academic engagement (e.g. Kindermann, 2007). Further, there is a need to distinguish between engagement with a students' studies and the more general term "student engagement" which encompasses engagement with aspects of the student experience outside the study environment (e.g. social activities, engagement with clubs and societies). For the purposes of this study behavioural forms of engagement are the focus of interest, because that is consistent with the initial theorising of transformational leadership. Leaders are hypothesised to inspire follower to invest extra effort – it is expected this effort to manifest itself in the form of behavioural engagement with the academic task at hand; in this case the dissertation or research project. To the best of the author's knowledge, there was not an existing scale that could be used to measure this type of engagement in the HE setting. Thus, an initial scale was produced for the purpose of this study in accordance with the above conceptualisation.

Engagement was assessed by four questions relating to different aspects of engagement with research project work, specifically focusing on time spent on, or frequency of tasks relating to the research project or dissertation. Items were constructed to encapsulate "time-on-task" (Merwin, 1969; Pace, 1980), an important aspect of student's academic engagement (Kuh, 2009). Questions were framed within a given time period, either, "in the

month prior to assessment submission" or "over the course of your research project". Participants responded indicating: how many hours per week they had spent working on their research project or dissertation from 1 (*2-5 hours*), increasing in five-hour increments to 6 (*25 hours or more*); how many days per week they had worked on their project or dissertation from 1 (*1-2 days*) to 6 (*every day*); how many readings they had completed per week from 1 (*none*) to 4 (*four or more*); how well they had planned their time from 1 (*very poorly*) to 5 (*very well*); and how well they had prepared for tutorials using the same anchors. A mean of the five responses provided the student's engagement score. The full scale can be found in Appendix F.

Grade Performance. Students' final module grades for their research project or dissertation were attained from school administrators with consent from the students and permission from the specific academic school.

Procedure. Following school ethical approval, students were recruited using two methods. First, students were invited to participate electronically via e-mail. Students were contacted by their supervisors with an invitation to participate in the research study via a link to an electronic questionnaire and the accompanying participant information and consent form. Second, using an opportunity sampling approach, students were invited in person by the researcher to complete the paper-copy questionnaire pack during a student conference day event.

Approach to Analyses. The data in the current study consists of two levels; the student (Level 1) nested within supervisors (Level 2), thus the issue of multi-level data must be addressed in measurement analyses and model estimation (Yammarino, 1990). First, to establish empirically whether consideration of multi-level data was necessary the intra-class correlation coefficients (ICC) were calculated for each of the main study variables. The ICCs

for the variables in the current study ranged from .066 (Engagement) to .391 (transformational leadership) indicating relatively high ICCs (above .10) for four of the study variables, calling for consideration of data nesting in these analyses.

Multi-level modelling requires high level-2 sample size in order to be effective. Indeed, Maas and Hox, (2005) showed that level 2 standard errors were biased when level-2 sample size fell substantially below 100. Given the level-2 n of 53 in the current study in accordance with recommendations by Hox and Maas (2001) an approach was adopted that controls for the nested nature of the data by modelling in the asymptotic within-groups covariance matrix (Asparouhov & Muthen, 2006). This method was applied in all subsequent analyses in Mplus 7.0 with the analysis command "TYPE = COMPLEX", as well as maximum likelihood estimation with robust error correction (MLR), to produce estimates that are robust to non-independence and non-normality of data. Of the 169 participants, 14 did not report their supervisor's name. Therefore, these participants could not be included in analyses accounting for nested data resulting in a final sample of 155. Because there was a small amount of data missing completely at random, a full information maximum likelihood approach was used to account for this (Muthen & Muthen, 2010).

The hypothesised mediation model was estimated in Mplus 7.0 using a manifest variable path model whereby each variable is represented by a single indicator using the mean of the scale score. Path models are vulnerable to bias due to measurement error. In such circumstances Cole and Preacher (2014) recommend the employment of an error correction strategy. In line with their recommendation a model-based error correction was employed. In the corrected model each observed variable (scale mean) was represented by a single item latent variable, where the observed variable error variance was fixed to the variance of the scale value multiplied by one minus the composite reliability of the scale (Hayduk, 1987). In order for the model to be identified, the factor loading must also be fixed to a pre-set value,

typically one. In this case the factor loadings were fixed to the standard deviation of the scale multiplied by the square root of the composite reliability (Anderson & Gerbing, 1988; Liang, Lawrence, Bennett, & Whitelaw, 1990). This method makes best use of the information known about the data (i.e. the reliability) in adjusting for error variance, and does not involve ignoring known information (e.g. fixing a factor loading to one when it is known that it is not exactly one). Such error correction strategies reduced the effect of measurement error and inflation and attenuation of parameter estimates (Cole & Preacher, 2014). This approach was adopted over a full latent-variable structural equation model due to the small sample size. [4]

To account for the differentiation of the basic needs of autonomy, competence, and relatedness, needs satisfaction was modelled as a latent construct, composed by the means of each of its subscales, in accordance with the scale's factor structure and theoretical conceptualisation. For each of the subscale means a reliability adjustment was employed in the same manner as described above.

Results

Measurement Analyses. Each of the measures employed in the study was subjected to confirmatory factor analysis to assess the scales' factor structure. In line with recommendations by Cole and Preacher (2014), to examine a range of indices when assessing model fit, the evaluation of the chi-square significance test was supported by several descriptive measures of fit. The selection of these indices for assessment of model fit in the current study is supported by recommendations from Hu and Bentler (1998) and Schermelleh-Engel and Moosbrugger (2003).

[4] Estimated required sample size for Study 1 = 463, based on anticipated effects size of 0.1, power of 0.8, with 25 observed variables loading onto 5 latent variables, at a probability level of .05.

Transformational Leadership. The 7-item abbreviated leadership scale was tested in a single factor CFA, and showed a good fit to the data ($\chi 2 = 24.16$, df =14, RMSEA .069, CFI = .971, TLI .956, SRMR=.036). The scale showed good reliability ($\alpha = .88$)

LMX. The LMX-MDM was first tested in a single factor CFA, which showed poor fit to the data ($\chi 2 = 304.62$, df = 54, RMSEA .174, CFI = .668, TLI .594, SRMR = .108). An alternative four-factor model with a hierarchical structure was tested, with a second order LMX construct composed of the four LMX subscales of loyalty, affect, contribution, and professional respect. This model showed acceptable fit to the data ($\chi 2 = 108.07$, df = 48, RMSEA .090, CFI = .920, TLI .891, SRMR = .065) and a significant improvement over the single-factor model. The scale demonstrated excellent internal reliability ($\alpha = .98$).

Need Satisfaction. The needs satisfaction at work scale was first subject to a single factor CFA, which showed very poor fit to the data ($\chi 2 = 580.62$, df = 149, RMSEA .138, CFI = .593, TLI .533, SRMR = .133). A three factor CFA was conducted specifying the three subscales of autonomy, competence, and relatedness, which, unexpectedly, also showed poor fit to the data. In addition a number of items showed very low factor loadings onto their respective home factors in the three-factor model (< .20). Consequently, an additional exploratory factor analysis (EFA) with three factors was conducted within an exploratory structural equation model (ESEM) framework to further elucidate the factor structure of the measure. An ESEM approach was adopted to enable the closer inspection of significance values for factor loadings, as well as to allow the implementation of the "TYPE = COMPLEX" command, as these options are not available in ordinary EFA in Mplus. The results of the ESEM showed inconsistent factor loadings for reverse-scored items versus non-reverse-scored items. None of the three factors emerged as conceptually consistent with the established three-factor structure of the measure. Cross examination of factor loadings with item wording valence revealed that this may be the cause of misfit in the original three-factor

CFA. This was consistent with modification indices from the original three factor CFA, showing that a substantial majority of high modification indices were attributable to negatively worded items. A second CFA was conducted using only the positively worded items, which substantially improved model fit for the three-factor model, but still produced only marginally acceptable fit ($\chi 2 = 93.90$, df = 41, RMSEA .092, CFI = .910, TLI .879, SRMR = .051). However, this was deemed to be the best fitting conceptually meaningful model that could be ascertained. The resulting 11-item scale showed acceptable internal reliability ($\alpha = .90$). Following these, results the decision was taken to only include the positively worded items in all subsequent analyses.

Engagement. The engagement scale was tested in a one factor CFA model with all four items loading onto one single engagement factor. This model showed extremely good fit to the data across a range of indices ($\chi 2 = .12$, df=2, RMSEA .000, CFI = 1.00, TLI 1.056, SRMR = .007), although factor loadings for two of the items fell below .50 (.432 and .436). The scale showed acceptable internal reliability ($\alpha = .720$).

Hypotheses 1-4.

Correlations. Zero-order correlations of all main variables are presented in Table 8. Transformational leadership positively correlated with all the variables under investigation, including LMX as stated in Hypothesis 1. LMX also correlated positively with other variables measured, including overall needs satisfaction, supporting Hypothesis 2. In turn, overall need satisfaction correlated positively with engagement, in support of Hypothesis 3. Finally, engagement did not significantly correlate with grade performance, contrary to Hypothesis 4. Overall these results provide preliminary support for Hypotheses 1-3, and no initial support for Hypothesis 4.

Table 8. Means, standard deviations, ICC and bivariate correlations of study variables

	Variable	Mean	SD	ICC	1	2	3	4	5	6	7
1.	TLB	5.30	1.06	.39	-						
2.	LMX	5.50	0.85	.25	.75**	-					
3.	Aut	5.39	1.06	.10	.59**	.62**	-				
4.	Comp	5.08	1.03	.09	.60**	.65**	.66**	-			
5.	Rel	5.62	1.00	.12	.66**	.77**	.76**	.70**	-		
6.	Needs	5.39	0.93	.11	.69**	.76**	.91**	.86**	.92**	-	
7.	Eng	3.92	0.92	.07	.22**	.22**	.36**	.37**	.22**	.33**	-
8.	Grade	67.79	12.13	.26	.20*	.21*	.15	.22*	.20*	.21*	.14

*p < .05 **p < .001

Model Fit. To test the sequential/serial mediation model hypothesised, it was estimated in Mplus 7 using a reliability adjusted manifest variable path analysis. Estimation of the full mediation model enabled testing of all the hypothesised relationships simultaneously. The hypothesised model (Figure 4) showed acceptable fit to the data ($\chi 2$ = 27.8, df = 14, RMSEA .080, CFI = .973, TLI .959).

Path Coefficients. Path coefficients provided further support for hypotheses 1-3, with significant paths from transformational leadership to LMX (β = .864, p < .001), LMX to needs satisfaction (β = .883, p < .001) and needs satisfaction to engagement (β = .423, p < .001). In addition, the path from engagement to grade was positive and significant, providing some support for hypothesis 4 (β = .212. p < .05).

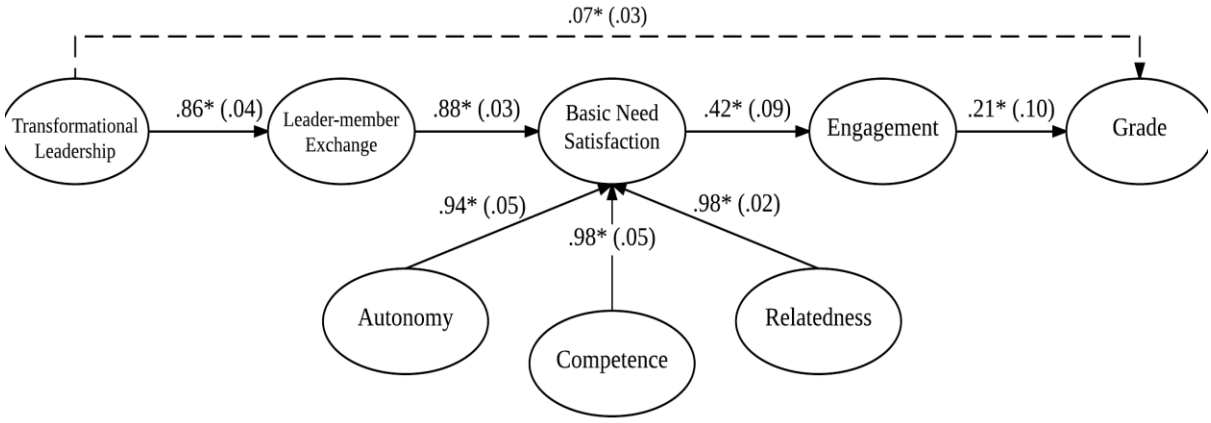

Figure 5. Standardised path coefficients of hypothesised model. *Note.* Coefficients marked with an asterisk (*) are significant to p<.05. Values in parenthesis denote standard errors. The dashed line denotes the indirect effect. N = 155.

Hypothesis 5 – Indirect Effect. In accordance with Hypothesis 5, the indirect effect of transformational leadership on grade performance via LMX, needs satisfaction and engagement was significant ($\beta = .068$ $p < .05$).

Model Comparisons. In order to examine the fit of the hypothesised model in comparison to alternative plausible models, the fit of the hypothesised model was compared against a set of alternative models using the chi-square difference test and the Bayesian information criterion, in an effort to rule out plausible alternative interpretations of the mediating relationships between these variables and strengthen the conclusions regarding the hypothesised model. The alternative models (Figure 6) were derived from the hypothesised model by constraining one or more paths between the mediators to zero and adding an additional path from the independent variable to the mediators, or the mediators to the dependent variable as well as a direct path from transformational leadership to grade. These alternative models were selected in order to examine the potential alternative interpretations of the mediating relationships in the model.

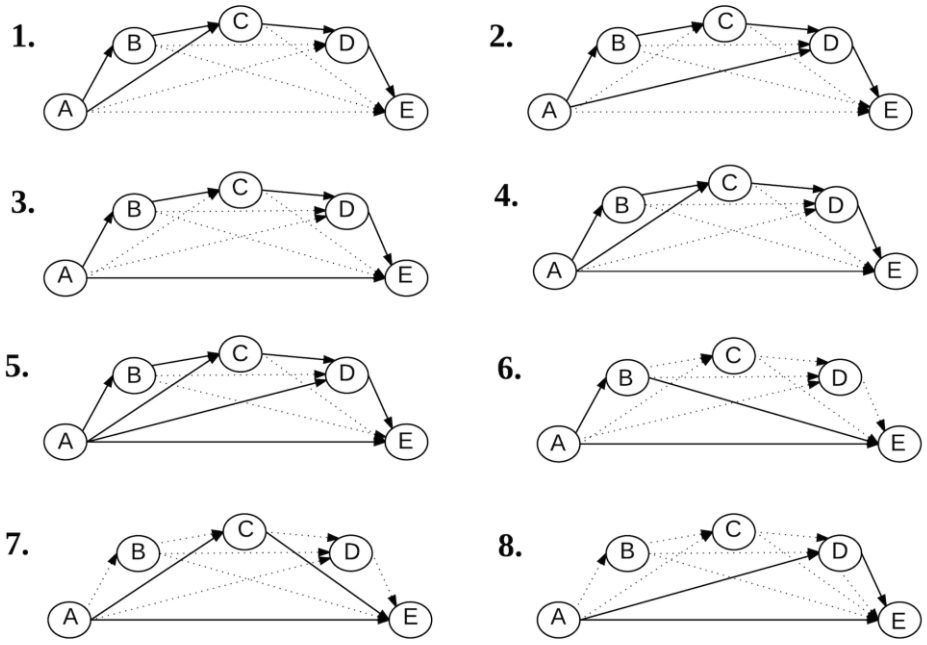

Figure 6. Diagrams of hypothesised and alternative comparison models. A=TLB, B=LMX, C=Needs, D=Engagement, E=Grade. Dashed lines denote paths fixed to zero. Solid lines denote paths estimated in the model.

To account for scaling correction factors employed in MLR estimation of these models, the scaled difference chi-square test was employed[5] (Bryant & Satorra, 2012; Satorra & Bentler, 2000). The test compares the chi-square value of a less restrictive baseline model (m1) with the chi-square of a more restrictive nested comparison model (m0). In the first model comparison, comparing the hypothesised model and model 1, model 1 is the less restrictive baseline model (m1) and the hypothesised model is the more restrictive comparison model (m0). In this case, and for Models 2-5, a significant p-value indicates that the comparison model 1 (m1) is a significant improvement in fit over the baseline model 1 (m0).

[5] Formulas for chi-square difference test calculations obtained from Mplus website: https://www.statmodel.com/chidiff.shtml

Table 9. Fit statistics and results of chi-square difference test results

Model	χ^2	Df	$\chi 2\ \Delta$	$\chi 2\ \Delta$ ρ	df Δ	RMSEA	CFI	TLI	SRMR	BIC
Hyp. Model	27.80	14	-	-	-	.08	.97	.96	.06	3084.23
Model 1	27.60	13	0.26	.61	1	.09	.97	.95	.06	3088.99
Model 2	27.60	13	0.14	.71	1	.09	.97	.95	.06	3089.13
Model 3	23.10	13	**10.10**	**.00**	1	.07	.98	.97	.03	3085.71
Model 4	22.78	12	5.54	.06	2	.08	.98	.96	.03	3090.42
Model 5	22.39	11	5.22	.16	3	.08	.98	.96	.03	3095.22
Model 6†	194.86	15	188.07	.00	1	.28	.65	.50	.30	3244.69
Model 7†	204.07	15	176.27	.00	1	.29	.63	.49	.29	3269.64
Model 8†	308.36	15	280.56	.00	1	.36	.42	.19	.33	3362.06

Note. See figure x for model specifications. Bold highlights significantly improved fit over the hypothesised model. Models marked †are non-nested are not valid for chi-square difference testing. For these models compare BIC for model comparisons - greater BIC indicates poorer fit.

The results of chi-square difference tests revealed that alternative model 3 showed a significant improvement in fit when compared to the hypothesised model. Model 3 was derived from the hypothesised model by adding an additional direct effect path from transformational leadership to grade. All other alternative models did not show a significant improvement in fit relative to the hypothesised model. The model fit statistics and results of chi-square difference tests for all model comparisons are displayed in Table 9.

Discussion

The results of Study 1 showed general support for the hypothesised serial mediation model, whereby transformational leadership influenced student grade performance indirectly via the mediators of LMX, need satisfaction and engagement in a causal sequence. Examination of fit indices revealed acceptable fit for the model, while normal theory tests of indirect effect showed a significant indirect effect of transformational leadership on grade performance.

It was hypothesised that engagement would be positively related to performance. This relationship underpins the final step in the predicted sequential mediation. Bivariate correlations did not support this hypothesis, while model path coefficients did, although the relationship was weak. One explanation for this result is the novel measurement of engagement employed in the current study. Given the relatively narrow scope of the engagement measure employed, which specifically targeted only time spent on task related activity, the non-significant correlation between engagement and grade could be attributed to a lack of conceptual breadth in the engagement measure. As engagement is theorised to be an important predictor of performance, it is argued that this low correlation implies measurement of an incomplete conceptualisation of the engagement construct in this context, which warrants a broadening of the engagement measure in Study 2.

The hypothesised model was compared against a number of competing alternative models in an effort to rule out alternative conceptualisations. Results of chi-square difference tests showed that model 3, in which a direct path was added from transformational leadership to grade, significantly improved fit compared to the hypothesised model. The fact that the specification of a direct path improved fit compared to the hypothesised model brings into question the earlier assertion that transformational leadership and grade performance are too conceptually distant for a direct effect to be present when the variance in performance explained by the mediators is accounted for. However, the presence or non-presence of a direct effect bears no influence on the interpretation of the significant indirect effect in the hypothesised model.

Overall, the results support the contention that the mediators of LMX, needs satisfaction and engagement are important mechanisms of transformational leader effectiveness, and that these mechanisms are linked to some degree in the causal chain of events. This supports and extends previous research that has identified each of these

mediators in isolation (Wang et al., 2005; Kovjanic et al., 2012 Graves & Luciano, 2013), and the rationale explaining how these mediators are linked. However, the limitations of the study design restrict the inferences that can be made regarding this causal chain because the data are cross-sectional in nature with the independent variable and mediators collected from the same source at the same point in time. By separating the variables in time, alternative representations of the causal sequence could be ruled out (i.e., if X comes before M in time, M cannot "cause" X – there can be no reverse causality), and more conclusive inferences can be made regarding this sequence. Thus, having established initial support for the hypothesised mediation in a cross sectional design, a second study was conducted employing a longitudinal design to address this limitation, as well as the limitations surrounding the scope of the engagement measure.

Study 3

Introduction

The purpose of Study 3 was to re-test the hypothesised sequential model (Figure 1) proposed in Study 2, while employing a semi-longitudinal design with a time lag between transformational leadership and LMX. Within the leadership-making model, Graen and Uhl-Biehn (1995) describe the processes of offer and acceptance by which LMX relationships progress from the stranger stage to the acquaintance and mature stages. It is posited that supervisors perceived as more transformational by their students create more opportunities for offer and acceptance to take place and increase the chances of progressing to higher levels of LMX. Given that this process must take place over a significant time period, the design should reflect this delayed effect. Furthermore, according to Podsakoff, MacKenzie, Lee, and Podsakoff (2003), introducing a time lag between the collection of measurements is an effective remedy against common method bias.

Method

Measures. All measures employed in Study 3 were identical to Study 2 with the exception of engagement.

Engagement. To guide the development of new items to provide a broader coverage of the academic engagement construct, the conceptual underpinnings of the National Survey of Student Engagement (NSSE) were investigated. Kuh (2009) writes, "Engagement is the term usually used to represent constructs such as quality of effort and involvement in productive learning activities" (p. 6), and describes the conceptual foundations of engagement supported by works exploring time-on-task (Tyler, 1930) and quality of effort (Pace, 1980). Further, in the Higher Education Academy evidence summary on engagement literature, Trowler and Trowler (2010) report these same empirical foundations as having specific relevance to individual student learning. These concepts were used to guide the wording of items reflecting these dimensions of engagement, namely, time on task, and quality of effort.

In addition to the original items used to measure time on task in an absolute sense (i.e. with specific reference to the amount of time spent), nine items were developed to measure the frequency of task related activities in a relative sense thereby breaking down the measurement of time-on-task into two dimensions. Namely, one measured on a relative scale (e.g. very often-very rarely) and one on an absolute scale (e.g. 0 hours per week – 20 hours per week). Items in the relative dimension were worded to refer specifically to the frequency with which they engaged in different aspects of project work to avoid confusion with engagement in academic work generally, and was thus termed "Task Frequency" to distinguish it from the absolute time-on-task dimension. Using the root question "In the last

month how often do you feel you have done the following". An example item reads "Used feedback from my supervisors or peers to improve my research project work".

To reflect the quality of effort construct, 5 items were developed to measure the contribution that project work has made to learning. Using the root question "How much have your experiences in your research project contributed to your knowledge and development in the following areas", an example item reads "Writing clearly and effectively" or "Thinking critically and analytically". Higher scores on these items are reflective of higher quality efforts in research project work.

The resulting scale now consisted of 18 items from three distinct subscales; four original items measuring absolute time-on-task, nine items measuring task frequency on a relative scale, and five items measuring contribution to learning to reflect quality of effort.

Procedure. An opportunity sample approach was adopted; students were invited to participate in the research during their normal lecture hours. Initial questionnaire packs containing the transformational leadership and engagement scales were distributed to students 10-12 weeks before the culmination of their third year research project or dissertation. The engagement scale was included to allow for psychometric analyses of the engagement measure using the maximum possible sample size. The second questionnaire contained measures of LMX, need satisfaction and engagement and was distributed to students during normal lecture hours, approximately 10 weeks after time 1 data were collected, shortly before the students' research project or dissertation deadline.

Participants. Data were initially collected from 252 undergraduate students from 5 different British Universities, supervised by 73 different supervisors. Of those who completed the questionnaire at the first time point, 140 completed it at the second time retaining 55% of the original sample. Of these 140, one participant did not indicate their supervisor's name,

and could not be included in analyses accounting for nesting. This final sample of 139 was used for analysis and consisted of 82 males and 57 females, (M_{age} = 21.44 SD = 3.88) under the supervision of 53 academic supervisors. Of the sample, 34% were completing research projects, and 44% were completing dissertations (20% indicated "other" projects, and 3% did not specify). Students had been working with their current supervisor for an average of 11.6 months.

Results

Measurement Analyses.

Engagement. The items of the engagement measure were subjected initially to an EFA using the data collected at Time 1, specifying one to five factors to examine the factor structure of the scale. It was expected that the model would conform to a three-factor structure in accordance with its conceptual underpinnings. The three-factor model showed acceptable fit to the data but had significant cross loading of the Task Frequency items in the first factor with the second and third factors. In the four-factor solution, the additional factor showed a clear division of the Task Frequency items between two distinct factors, and minimal cross loading of items in the other factors. Two Task Frequency items were removed for having no clear home factor, because they loaded significantly onto two or more factors, and, upon inspection of the items, were not consistent with the meaning of the other items in either factor. A revised factor structure was developed consisting of four factors; absolute Time-on-Task, Contribution and two Task Frequency dimensions representing more internally focused (Task Frequency - Internal - TFI) and externally focused (Task Frequency External - TFE) aspects of engagement. Subsequently a CFA was conducted using the data collected at the second time point, specifying the four-factor model developed from the EFA. The four-factor model showed acceptable fit to the data ($\chi 2$ = 145.73, df = 84, RMSEA=.073,

CFI =.931, TLI =.914, SRMR=.060), and the overall scale demonstrated good internal reliability (α = .97). See Appendix G for a full breakdown of the items used in the engagement scale.

All other measures were subjected to a CFA in the same manner described in Study 2; the abbreviated DTLI showed good fit in a one dimensional model ($\chi 2$ = 29.12, df =14, RMSEA = .066, CFI = .978, TLI = .967, SRMR = .026), as well as the LMX-MDM in a hierarchical 4-factor structure ($\chi 2$ = 90.05, df = 50, RMSEA = .057, CFI = .979, TLI = .972, SRMR = .047). The reduced item, positively worded needs satisfaction scale showed borderline acceptable fit ($\chi 2$ = 106.722, df = 41, RMSEA = .080, CFI = .929, TLI = .905, SRMR = .053).

Hypotheses 1-4.

Table 10. Means, standard deviations, ICC and bivariate correlations of study variables

	Variable	Mean	SD	ICC	1	2	3	4	5	6	7
1.	TLB	5.14	1.03	.50	-						
2.	LMX	5.40	.99	.25	.61**	-					
3.	Aut	5.68	.90	.19	.54**	.67**	-				
4.	Comp	5.32	.97	.16	.54**	.69**	.62**	-			
5.	Rel	5.56	.97	.24	.54**	.80**	.69**	.65**	-		
6.	Needs	5.52	.83	.23	.61**	.82**	.87**	.87**	.89**	-	
7.	Eng	4.24	.67	.10	.28**	.36**	.40**	.50**	.36**	.48**	-
8.	Grade	64.86	10.18	.18	.28**	.29**	.31**	.33**	.23**	.33**	.38**

*p < .05 **p < .001

Correlations. Zero-order correlations of all main variables are presented in Table 10. As in Study 2, transformational leadership was significantly correlated with all the study variables, providing further support for hypothesis 1. LMX was positively related to overall need satisfaction, and need satisfaction was positively related to engagement, consistent with Hypotheses 2 and 3 respectively, and the results of Study 2. Unlike in Study 2, engagement

was positively correlated with student grade performance, providing some support for Hypothesis 4.

Model Fit. The hypothesised sequential model (Figure 1) showed mediocre fit to the data (RMSEA = .103, CFI = .960, TLI = .940, SRMR .068). The model was compared against a number of alternative competing models in the same manner as Study 2 (see Figure 6 for model specifications, pg. 84).

Table 11. Fit statistics and results of chi-square difference test results

Model	χ^2	df	$\chi 2\ \Delta$	$\chi 2\ \Delta\ \rho$	df Δ	RMSEA	CFI	TLI	SRMR	BIC
Hyp. Model	34.64	14	-	-	-	.10	.96	.94	.07	2816.61
Model 1	31.56	13	3.10	.08	1	.10	.96	.94	.07	2818.71
Model 2	34.46	13	.02	.89	1	.11	.96	.93	.07	2821.52
Model 3	29.10	13	**5.16**	.02	1	.09	.97	.95	.05	2816.01
Model 4	26.08	12	**8.37**	.02	2	.09	.97	.95	.04	2818.16
Model 5	25.78	11	**8.88**	.03	3	.10	.97	.95	.04	2823.05
Model 6†	262.80	15	-	-	1	.35	.52	.33	.32	3017.04
Model 7†	261.10	15	-	-	1	.34	.52	.33	.29	3017.19
Model 8†	321.18	15	-	-	1	.38	.41	.17	.33	3061.97

Note. See figure x for model specifications. Bold highlights significantly improved fit over the hypothesised model. Models marked †are non-nested are not valid for chi-square difference testing. For these models compare BIC for model comparisons - greater BIC indicates poorer fit.

According to chi-square difference test results, three alternative models showed significantly improved fit when compared to the hypothesised model. However, according to the BIC values, the difference in fit is negligible. A BIC difference of 10 or greater represents strong evidence in support of the model with the lower BIC value (Raftery, 1995), while smaller differences represent weaker conclusions.

Path Coefficients. Path coefficients provided further support for hypotheses 1-3, with significant paths from transformational leadership to LMX ($\beta = .658$, $p < .001$), LMX to needs ($\beta = .921$, $p < .001$) and needs to engagement ($\beta = .487$, $p < .001$). In addition, the path

from engagement to grade was positive and significant, providing some support for hypothesis 4 ($\beta = .403$. $p < .05$).

Hypothesis 5.

Indirect Effects. Normal theory tests of indirect effects showed a positive and significant indirect effect of TL on grade performance ($\beta = .117$, $p < .05$), providing general support for Hypothesis 5.

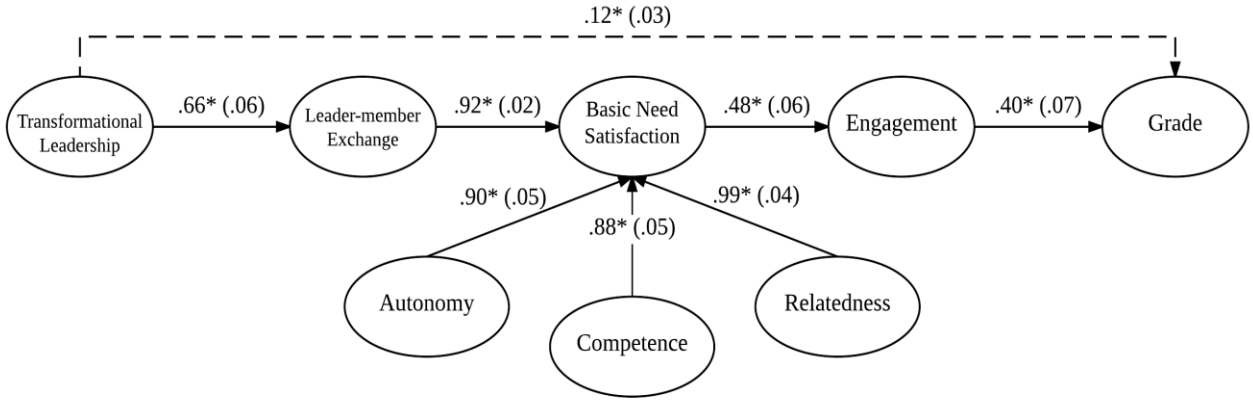

Figure 7. Standardised path coefficients of hypothesised model. *Note.* Coefficients marked with an asterisk (*) are significant to p<.05. Values in parenthesis denote standard errors. The dashed line denotes the indirect effect. N = 155.

Discussion

The results of this study support the initial findings of Study 2, suggesting that LMX, need satisfaction and engagement are indeed important mechanisms of transformational leader effectiveness, and that these mechanisms are related in a sequential fashion. Furthermore, they extend these findings to a time-lagged longitudinal paradigm ruling out possible alternative interpretations of reverse causation between leadership and LMX relationships. The findings provide full support for Hypotheses 4 and 5, which received mixed support in Study 2, suggesting that alterations to the engagement measure have managed to capture aspects of engagement that relate more strongly to performance.

General Discussion

The aims of this study were to integrate concepts of transformational leadership theory, leader-member exchange, basic psychological needs satisfaction, and engagement into one causal model, and to develop transformational leadership research into the new context of HE research supervision. Specifically, it was hypothesised that transformational leadership would positively influence grade performance indirectly via LMX, needs satisfaction, and engagement serially. Findings of the first study provided some initial support for this theorizing, although the main hypothesis was not fully supported. A second empirical study extended these findings into a longitudinal paradigm, providing general support for the hypothesised series of relationships. However, results also supported a direct effect of transformational leadership upon grade, which was not hypothesised. The implications of these findings and how they relate to the transformational leadership literature will be discussed.

As hypothesised, transformational leadership positively predicted student ratings of LMX relationships. This is an important contribution to the existing literature as relatively few studies have examined transformational leadership and LMX together, and the role of LMX in transformational leader effectiveness is not well understood. The findings build upon work by Wang at al. (2005), concluding, "transformational leadership behaviours are social currency, nourishing high-quality LMX" (p. 429). The results are consistent with the notion that transformational leadership may increase the number of opportunities to progress LMX relationships towards higher levels of LMX as described in the leadership-making model (Graen & Uhl-Biehn, 1995), although the study does not measure this specifically. Investigation of the means by which transformational leadership leads to higher quality LMX should be a topic of future research.

More importantly, the finding that LMX is a mediating link between transformational leadership and satisfaction of basic needs extends our understanding of the role of LMX. Indeed, previous studies have demonstrated the importance of basic need satisfaction in the leadership process, and its role in transformational leadership (Kovjanic et al., 2013). The findings are consistent with those of Graves and Luciano (2013) and build upon the relatively small number of studies examining LMX and satisfaction of basic needs by highlighting that LMX is positively related to satisfaction of basic psychological needs.

Further, in line with the hypotheses, students whose basic needs were more fulfilled reported themselves as being more engaged with aspects of their research project work. This highlights the important role of basic need satisfaction as a mediating link between transformational leadership and engagement, or more specifically student engagement. This is of particular interest as engagement is seen as an important driver of performance (Bakker & Bal, 2010).

Regarding the relationship between engagement and performance, across the two studies the results are somewhat inconclusive. In Study 2, engagement did not have a significant effect on grade performance when the direct effect of transformational leadership on grade was accounted for. However, in the originally hypothesised model, where a direct effect was not specified, the effect of engagement on performance was significant. Examining the coefficients more closely, in the revised model from Study 2, the effect of engagement on grade was small and non-significant when the direct effect of transformational leadership was accounted for ($\beta = .139$, $p = .156$). This non-hypothesised finding is attributed to a lack of conceptual breadth in the engagement measure employed in Study 2. This measure specifically aimed to provide an indication of the amount of time that students engaged in task-oriented activities relating to their research project work, in absolute terms. It is interesting to note that a measure pertaining to time-on-task aspects alone did not

correlate significantly with grade performance or produce a significant effect on performance when the direct effect of transformational leadership was accounted for. This suggests that there are other aspects of engagement that are more strongly associated with performance that purely time invested. The results of Study 2 support this notion, as the inclusion of further dimensions of student engagement such as quality of effort in the engagement measure produced a significant effect of engagement upon grade performance.

Finally, the hypothesised sequential mediation model received mixed support. In Study 2, structural equation modelling demonstrated good fit of the hypothesised model to the data, providing initial support. However, model comparisons revealed an alternative better fitting model, incorporating a direct effect of transformational leadership on grade performance. In Study 2, model comparisons again showed that alternative models including a direct path from transformational leadership to grade showed marginally improved fit over the hypothesised model. The model was initially hypothesised without a direct path because it was thought that grade performance was too conceptually removed from transformational leadership in the causal chain, and that the effect of transformational leadership on performance would be almost fully accounted for by the mediators. The results clearly contradict this line of thinking, suggesting that transformational leaders directly influence follower performance, or that performance is mediated by yet further mechanisms. Given that through two studies the direct effect model shows significantly improved fit over the hypothesised model, it is concluded that this model provides the best interpretation of this set of variables.

Overall, the indings extend and integrate the theorising of Wang et al. (2005), and (Kovjanic et al., 2013, 2012) who suggested that LMX, need satisfaction, and engagement are each important mechanisms of transformational leader effectiveness, as well as Graves and Luciano (2013) who demonstrated the connection between LMX and satisfaction of basic

needs. Results of the model in Study 2 support these notions, and the contention that these mechanisms are connected in a potential causal chain of events.

This study represents the first investigation of HE research supervision from a transformational leadership perspective and overall the findings are encouraging. The findings suggest that transformational leadership may provide a useful conceptual framework for further research in research supervision, and to inform supervision practice. Taken together, from an applied perspective the results support the rationale that more transformational supervisors will develop better quality working relationships with their students, and, indirectly, help to satisfy their basic needs, improve their engagement and their grade performance. Indeed, these findings have important implications for supervision practice in higher education. Authors have attested to the importance of research supervision, and student-supervisor relationships for the student's experience of independent research (e.g., Golde, 2000; Howitt et al., 2010). The present study addresses the need to support this literature with theoretically grounded approaches to supervision in HE, which are currently lacking. Specifically, it is the first application of leadership theory to the context of HE research supervision.

Strengths and Limitations

While the results present some compelling evidence for the proposed mediation effects they should be interpreted in the light of several limitations that are common to questionnaire-based studies of this nature. Due to the reliance of these studies on self-report data for the majority of the variables investigated, the possibility of inflated effects as a result of common source bias cannot be ignored. However, there are several points that bolster confidence in the findings. First, the main dependent variable in both studies is student grade

performance, which is externally marked, and the substantive findings of the study concern this outcome. Second, in Study 2, in accordance with recommendations by Podsakoff et al. (2003) to mitigate the effects of common method bias, there is a significant time delay between the collection of transformational leadership and LMX data. Due to high rates of attrition it was not possible to temporally separate each step of the model, but given the conceptual proximity of Transformational Leadership and LMX it was thought that separating these two would be most appropriate. The adoption of a semi-longitudinal design, incorporating a time-lag between Transformational Leadership and LMX, and between engagement and grade is one notable strength of the study.

One proposed solution to problems associated with common source bias is to obtain ratings of the same variables from multiple sources. For most of the variables of interest, to obtain an external rating would be inappropriate. For example, alternative sources are not able to reliably report on an individual's satisfaction of basic psychological needs, or how engaged a student is with their project work. With the specific focus in the study on time-on-task and quality of effort, accurate perceptions of these constructs belong only to the student, as they may be masked to the supervisor or significant others. One potentially valuable external rating to include would be supervisor ratings of LMX.

A second limitation concerns the issue of causation. Although Study 2 extended the design to a semi-longitudinal paradigm by temporally separating the IV from the first mediator, it is still not possible to form firm conclusions about the causative effects of transformational leadership on the other variables from the present data. Studies of mediation are inherently causal in nature, in that they attempt to explain how a third (or fourth, or fifth) variable, m, accounts for or "causes" an association between X and Y. In this case it is the explanation of a process that takes place over time and is therefore casual. To establish such causation in a mediation paradigm is quite the methodological challenge, especially so in a

model with multiple mediators. The rationale presented, supported by the existing empirical literature make a good case for the causal direction and sequence of the variables of interest. Furthermore, incorporating a time-lag in Study 2 has ruled out one alternative causal sequence in the analysis, where LMX or relationship quality might precede transformational leadership in the model.

A key strength of the study is employment of a reliability adjustment in the observed-variable path analysis. Simple path analyses are vulnerable to bias due to measurement error. In the absence of a full SEM approach a reliability adjustment reduces the impact of measurement error (Cole & Preacher, 2014).

Future Directions

The findings raise a number of possible avenues for further research. As an initial exploration of the effects of transformational leadership in HE supervision, the results have demonstrated the applicability of transformational leadership to the context. Further studies might attempt to prove the efficacy of transformational leadership in supervision through intervention studies and experimental designs, with particular focus on its effect upon grade performance. Results generally supported a direct effect of transformational leadership upon grade. Experimental designs could be employed to test whether this is a causative effect.

From an applied perspective, the model proposed is somewhat limiting in that it adopts a global conceptualisation of leadership. Future research might examine the roles of specific leader behaviours and how they are more or less strongly related to specific mediators and outcomes. Findings from such studies could be used to provide more detail to practitioners about what behaviours to employ to maximise effectiveness.

While the proposed model does capture some longitudinal aspects of the causal chain, a deeper explanation of the effect of time in this context would develop our understanding further. For example, how long does it take for transformational leadership to become effective? Is it more important in the early part of the supervision process than the later part? Should supervisors attempt to be especially transformational early on or does the relationship require time to grow before it can be effective? These are not simple questions to address but some consideration of the temporal aspects should be considered in future research to work towards these questions. Specifically you could examine the growth of relationships over time, and subsequently explore the extent to which transformational leadership affects that growth. For example, you might expect students with more transformational supervisors to reach higher levels of LMX, and more quickly, than students with less transformational supervisors.

Conclusions

In summary, the study provides some evidence for the applicability of transformational leadership theory to the context of HE research supervision, and its efficacy in that context. Across two samples, supervisor's transformational leadership predicted student grade performance indirectly via its influence on LMX, need satisfaction and engagement. The results support the use of transformational leadership as a novel approach to enhancing teaching and learning practices in supervision, and to complement the existing resources already available to supervisors. Future research should endeavour to expand these findings to causative paradigms, and explore the role of specific leader behaviours and the effect of time on the development of LMX relationships in supervision.

Chapter 4

Transformational leadership, implicit theories, and coping with setbacks within the doctoral training process

Abstract

The present study examined a mediation model whereby academic supervisors' transformational leadership predicts PhD students' endorsement of specific coping strategies via its influence on students' implicit theories of ability. A sample of 420 PhD students (M_{age} = 31.85, *SD* = 8.14) completed an online survey containing measures of their perception of their supervisors' transformational leadership, implicit theories of ability, and use of approach and self-punishment coping in relation to a simulated failure scenario. A mediation model was hypothesised, predicting a significant indirect effect of transformational leadership upon approach coping via incremental beliefs, and a negative indirect effect upon self-punishment coping. Structural equation modelling revealed the hypothesised model to be a good fit to the data. Results of mediation analyses using bias-corrected bootstrap confidence intervals supported the existence of an indirect effect of transformational leadership on approach coping via incremental beliefs, but did not support the negative indirect effect upon self-punishment via entity beliefs. The theoretical and applied implications of the results are discussed.

The ability to persist in the face of challenges, overcome obstacles and cope effectively with setbacks is vital to success in the majority of life endeavours. One situation that epitomises the need for these abilities is the achievement of a doctoral training qualification (i.e. a PhD). Indeed, the pursuit of the highest level academic degree issued by universities coupled with financial stress (Hyun, Quinn, Madon, & Lustig, 2010), potential intellectual and social isolation (Delamont, Atkinson, & Parry, 2004), a competitive environment (Stubb, Pyhlt, & Lonka, 2011), and the need to repeatedly overcome exposure to obstacles and critical feedback (Wang & Li, 2011) means that postgraduate students face somewhat unique and sustained pressures during their training. Consequently, it is not surprising that supervisors have identified the student's ability to persist in the fact of challenges as a key determinant of PhD completion, and successful transition to independent research (Lovitts, 2008).

A potential consequence of not coping effectively in this context is drop-out. Issues associated with unacceptable rates of doctoral student drop-out have been a concern for decades (e.g. Golde, 2000) and remain a persistent problem (e.g. Jones, 2013). Several studies have implicated the supervisor as being of importance for facilitating the experience of doctoral students (e.g. Ives & Rowley, 2005) in terms of time to degree completion, and drop-out rates (de Valero, 2001). Thus, it is important to explore approaches that supervisors may employ to develop students with the capabilities to cope effectively with the demands of a PhD. One possible approach is transformational leadership.

Transformational Leadership

Transformational leadership theory is a behavioural approach to leadership which posits that leaders inspire followers through emotional appeals, and encourage followers to transcend their own self-interest for the collective good of the team or organisation (Bass &

Riggio, 2006). Although primarily based in business and organisational psychology, research on transformational leadership has also extended to other contexts as diverse as the military (Dvir et al., 2002; Hardy et al., 2010) sport (Callow et al., 2009; Rowold, 2006), nursing (Salanova et al., 2011) and education (Beauchamp et al., 2010; Koh et al., 1995). Indeed, the last decade has seen a marked increase in the number of studies examining transformational leadership in educational contexts, including higher education (Pounder, 2014). Across these contexts, transformational leadership has been found to predict a number of positive organisational and individual level outcomes such as intrinsic motivation (Charbonneau et al., 2001) satisfaction of basic psychological needs (Stenling & Tafvelin, 2014), enhanced engagement (Tims et al., 2011) improved creativity (Gong et al., 2009), and performance (Barling et al., 1996; Dvir et al., 2002; Hardy et al., 2010; Howell & Avolio, 1993).

As the leadership research has developed, its focus has progressed from simply identifying outcomes to examining the mechanisms that explain the effectiveness of transformational leaders. Scholars have placed an emphasis on the motivational foundations of transformational leadership with identified mechanisms reflecting this motivational position (e.g., basic psychological needs satisfaction, [Stenling & Tafvelin, 2014] and engagement [Kovjanic et al., 2012]). In the current context of education, very few studies have examined the underlying mechanisms of transformational leadership. To the best of the current author's knowledge the only such studies are those contained in the earlier chapters of this thesis. Thus, one aim of this study was to address this limitation by examining whether transformational leaders' positive effects can be attributed partly to their ability to shape their followers' implicit beliefs concerning their own ability (i.e. a fundamental component of one's motivation; Elliot & Dweck, 2005).

Implicit Theories

According to Dweck and Leggett's (1988) social cognitive theory of motivation, individuals develop lay-theories about the malleability of human characteristics such as intelligence. These theories are described as implicit because typically they are not explicitly expressed by the individual. Rather they are schema-like knowledge structures that guide the way people infer meaning from events without conscious thought (Ross, 1989). Further, Dweck and Leggett posit that these theories tend to focalise around two perspectives; an incremental and an entity theory. Individuals who adopt an incremental theory tend to believe that human attributes such as intelligence or ability are malleable, and can be changed with purposeful effort, while entity theorists tend to believe that attributes are fixed.

Research on implicit theories in educational contexts has shown that they have important implications for learning (e.g. Blackwell, Trzesniewski, & Dweck, 2007) and are related to a number of self-regulatory processes (Molden & Dweck, 2006). Individuals with a predominantly incremental theory tend to adopt learning goals where the emphasis is on improving skills, and they employ mastery oriented strategies in pursuit of those goals (Robins & Pals, 2002). In contrast, individuals with a predominantly entity theory tend to adopt performance goals, where the emphasis is on performing better than peers and proving their ability to others and themselves. Of particular relevance to the present study is that individuals' implicit theories also have key implications for how they interpret failure and/or negative feedback. Incremental theorists are likely to view such challenges as learning opportunities or as a means to achieve mastery, while entity theorists tend to interpret failure as evidence of their incapability, and will tend to withdraw effort in the face of such

challenge. Research attests to these differences (see Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013, for a review).

While much of the research on implicit theories has focused on beliefs surrounding intelligence, it has been acknowledged that people hold implicit beliefs about other traits such as athletic ability (Biddle, Wang, Chatzisarantis, & Spray, 2003), ability at mathematics (Bonne & Johnston, 2016) and body weight change (Burnette, 2010), and that people can hold different theories across different domains. Furthermore, such theories are at least somewhat subject to change (Leith et al., 2014). While implicit theories have been viewed as a dispositional trait (Dweck, Chiu, & Hong, 1995), and therefore relatively stable over time (Robins & Pals, 2002), several authors have employed implicit theory priming to induce short term changes in laboratory studies (e.g. Spray, Wang, Biddle, Chatzisarantis, & Warburton, 2006; Sue-chan, Wood, & Latham, 2012). Despite these testaments to the malleability of these beliefs by social agents (e.g., experimenters), research has largely failed to examine how significant others might influence people's beliefs through naturally occurring interpersonal behavioural styles such as leadership.

Transformational Leadership and Implicit Theories

To date, no studies have examined how teachers' or supervisors' leadership style might predict followers' implicit beliefs of ability. However, within the workplace Kam, Risavy, Perunovic, and Plant (2012) found that subordinates who believed their manager subscribed to an incremental theory regarding employee performance also perceived their managers as being more transformational. Further, in a follow-up analysis they showed that subordinates' perceptions of their manager's implicit theories mediated the relationship between transformational leadership and employees' motivation to improve their job performance. It is a foundational assertion of transformational leadership theory that leaders

use emotional appeals to motivate followers to invest extra effort in order to improve performance or better achieve organisational aims (Podsakoff et al., 1990). It follows that transformational leaders are likely to hold incremental beliefs regarding subordinates' task performance as this is consistent with the improvements in motivation, effort and performance that transformational leaders are thought to bring about (Yukl, 2010). Alternatively, leaders with an entity belief of employee performance would be less likely to invest effort in their employees' improvement, as they do not believe in their capacity to improve.

While Kam et al. (2012) specifically examined followers' attributions of their manager's implicit theories, in the current study it is proposed that leaders' transformational behaviours are capable of influencing followers' own implicit theories concerning task performance or ability. Indeed, the initial development of children's implicit theories is influenced by authority figures such as parents, teachers and coaches, particularly through the nature of praise, critical feedback, and attributions of success (Dweck, 2007; Molden & Dweck, 2006; Mueller & Dweck, 1998). In the context of the doctoral training process, mentoring and the provision of feedback is a central aspect of supervisors' responsibilities, so it is plausible that their actions influence implicit theories in a similar manner to parents or teachers.

Supervisor transformational leadership may help to foster incremental theories in their doctoral students in at least two ways. First, transformational leaders are more likely to role model behaviours that are consistent with an incremental theory and then followers subsequently identify with this behaviour. Social learning theory (Bandura, 1986) proposes that individuals can learn behaviours through modelling processes such as imitation, observational learning and identification. Appropriate role modelling is a central transformational leader behaviour (Podsakoff et al., 1990), and transformational leaders

facilitate follower identification with the values of the leader through the building of mutual trust and respect (Bass & Riggio, 2006). Given that employees are able to identify incremental theories in their transformational leaders (Kam et al., 2014), it is likely that they will also model these behaviours, in line with social learning theory. Indeed, it is theorised that modelling effectiveness is enhanced when the role model is perceived as an authority figure and possesses legitimacy and credibility (Bandura, 1986). In the present context it is expected that transformational supervisors do possess these characteristics and so serve as enhanced role models for follower identification with an incremental perspective.

Second, challenge behaviours employed by transformational leaders could be seen to present followers with opportunities to overcome obstacles or rise to challenges, and emulate behaviours consistent with an incremental theory. Transformational leaders communicate high performance expectations to followers to demonstrate their demands of excellence and maximum effort, and use intellectual stimulation to challenge followers to re-evaluate situations in new ways. Incremental theorists are proposed to embrace challenges such as these as learning opportunities. It is proposed that that challenge behaviours combined with underlying support behaviours employed by transformational leaders facilitate followers in approaching challenge situations with an incremental theory. If it is acknowledged that implicit theories are subject to change via priming, it is possible that transformational leaders can consistently, but inadvertently, prime their followers to adopt a more incremental theory belief through repeated exposure to challenge and support transformational leader behaviours used in concert.

In support of these arguments, Leith et al. (2014) showed that people strategically shift their implicit beliefs in order to help them support a desired conclusion or opinion. In a series of studies, Leith et al. tested their hypothesis that individuals' beliefs would shift towards the theory that suited a preferred outcome on a test. For example, when presented

with negative feedback on a test, it would be preferable to adopt an incremental theory, as this allows for the possibility that one can improve at the task, while adopting an entity theory perspective would force one to face the reality that they lack the necessary ability for the task. In line with this reasoning, Leith et al. showed that individuals shifted towards an incremental theory when presented with failure feedback on a test of social intelligence, but only under conditions where they perceived that feedback as legitimate and where a positive outcome was pertinent to their goals. It is argued that transformational leaders engage this mechanism through enacting normal transformational leader behaviours. As transformational leaders increase task importance by articulating a positive vision, and encouraging followers to internalise collective goals and organisational values (Bass, 1999) it is likely that this provides impetus to adopt an incremental theory in the face of failure. Together with this, transformational leaders imbue their leader-follower interactions with enhanced legitimacy through developing mutual trust and respect, such that when presented with critical feedback, followers will feel compelled to adopt an incremental theory in preference to an entity one. They are more likely to do this as, in accordance with (Leith et al., 2014) it is in line with their pertinent goals, as emphasised by the leader. Taken together, the above arguments outline how transformational leadership may influence followers' own implicit theories. The initial hypotheses are presented thus:

> Hypothesis 1A – Supervisors' transformational leadership will positively predict students' incremental beliefs

> Hypothesis 1B – Supervisors' transformational leadership will negatively predict students' entity beliefs

Implicit Theories and Coping Behaviours

Ego threat refers to any event that serves to undermine an individual's self-image or self-esteem (Leary, Terry, Allen, & Tate, 2009). Failure feedback represents a potential form of ego threat for both incremental and entity theorists, but the manner in which they respond to such a threat is likely to differ, as will the coping strategies that they employ. While research has noted the ability of incremental theorists to cope more effectively in the face of challenging tasks or setbacks (e.g., Blackwell et al., 2007; Hong, Chiu, Dweck, Lin, & Wan, 1999) the relationship between implicit theories and more general coping styles is less well researched. In one notable exception, Doron, Stephan, Boich, and le Scanff (2009) examined the relationship between students' implicit theories about academic abilities and their pre-examination coping strategies. They found that students who reported a more incremental theory were more likely to adopt adaptive coping strategies such as active coping, planning and support seeking, whereas their entity counterparts adopted more maladaptive coping styles, such as behavioural disengagement. Alternative ego-threatening scenarios are also in need of investigation in this manner, such as how students cope with critical feedback and this is especially relevant in the case of doctoral candidates. Further, while exam stress is relatively infrequent, across the life span, many individuals experience critical feedback on a regular basis, thus the research here has broader reach.

Incremental theorists tend to perceive challenges as opportunities for development, and engage in increased goal pursuit efforts such as planning (Doron et al., 2009), which is a form of approach coping. Approach coping entails a behaviour that is aimed at resolving stress by addressing the source directly. When considering how incremental theorists are likely to respond to ego threat, because they view their ability as malleable, when they receive failure feedback it need not compromise their self-image as they feel they have the capacity to learn, and overcome the challenge. Thus, when faced with an ego-threatening

situation, they are more likely to adopt approach coping strategies then their entity oriented counterparts. Consequently, it is hypothesised that:

> Hypothesis 2A – There will be a significant positive indirect effect of transformational leadership upon approach coping via incremental beliefs

In contrast to the incremental theorist response to the ego-threat, entity theorists infer failure oriented feedback as an enduring indictment of their inadequate ability at the task, as they take the view that their ability is fixed, having negative implications for their self-image. In such circumstances, entity theorists tend to employ avoidant coping strategies (cf. Doron et al., 2009) and are therefore less likely to engage in approach strategies, which entail direct action to address the problem. Therefore:

> Hypothesis 2B – There will be a significant positive indirect effect of transformational leadership upon approach coping via entity (such that the a and b paths will be negative).

Given entity theorists' apparent vulnerability to ego-threats and the implications this has for their self-image, entity theorists are likely to engage in some form of inward focused coping strategy that makes reference to the self. Self-punishment is one form of maladaptive coping characterised by self-blame and self-focused rumination (Zuckerman & Gagne, 2003). Studies have shown that entity theorists tend to make ability-based attributions for failure (Hong et al., 1999) and this further serves to highlight the limits of their ability, with further negative consequences for their self-image. This might predispose entity theorists to inward focused coping strategies such as self-punishment. By contrast, incremental theorists tend to make effort-based attributions of failure (Hong et al., 1999), and while this could also point to the use of inward focused coping strategies, an alternative view is that once again they are guarded by their flexible view of ability; in their case, failure feedback does not negatively

impact upon their sense of self as they can improve in their ability to meet the demands of the challenge. Therefore it is expected that incremental theorists will be averse to adopting self-punishment strategies.

Hypothesis 3A - There will be a significant negative indirect effect of transformational leadership upon self-punishment via incremental

Hypothesis 3B – There will be a significant, negative indirect effect of transformational leadership upon self-punishment via entity beliefs

Transformational Leadership and Coping Behaviours

Despite the considerable volume of existing transformational leadership research, very few studies have examined the relationship between transformational leadership and followers' coping behaviours. In a study on Israeli Kibbutz leaders, Ben-Zur, Yagil, and Oz, (2005) found that transformational leadership was positively related with problem focused coping, which included aspects of approach coping. Alarcon, Lyons, Schlessman, and Barelka, (2012) examined the relationship between transformational leadership of RAF officers and the leaders' own coping behaviours, and found that leaders who were more transformational employed more problem-focused coping, and positive reinterpretation, and also less emotion-focused coping strategies such as self-punishment. These behaviours may also be reflected in the followers. Furthermore, transformational leaders express confidence in their followers' ability to achieve success (Shamir et al., 1993) and this can generate a sense of self-efficacy among followers (Pillai & Williams, 2004) that may empower followers to tackle setbacks directly and employ approach coping behaviours. This is consistent with evidence that self-efficacy positively predicts approach coping and negatively

predicts self-punishment coping (Moneta, Spada, & Rost, 2007). In line this theorising, it is hypothesised that:

Hypothesis 4A: Transformational leadership will have a positive direct effect on approach coping

Hypothesis 4B: Transformational leadership will have a negative direct effect on self-punishment coping.

Figure 8. provides an overview of the hypothesised effects.

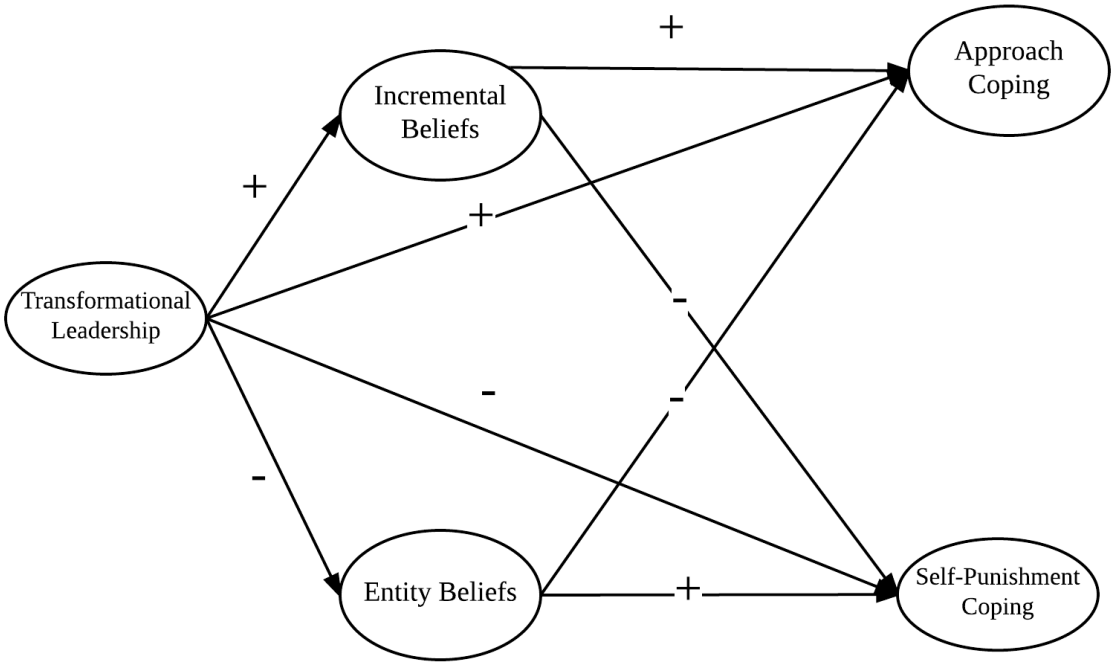

Figure 8. Hypothesised direction of effects

Method

Participants

A total of 751 participants responded to the online questionnaire, 54 of which were not eligible to participate (not currently PhD students) and had mistakenly started the questionnaire. A further 41 withdrew before stating their eligibility, leaving 656 remaining eligible participants. Of these, 236 did not complete the questionnaire, yielding a final sample of 420, with a dropout rate of 36%. The final sample consisted of 107 males and 313 females aged between 21 and 58 years of age (M_{age} = 31.85, *SD* = 8.14) from 180 higher education institutions in 29 countries. The majority originated from the UK (58%), Australia (14%) and United States (10%), and spoke English as their first language (77%). The overwhelming majority of students were studying full time PhDs (82%), while the remainder studied part time (12%), were distance learners (3%), or other modes of study (2%). Participants had been studying for their PhD for an average of 2.74 (*SD* = 1.30) years, and were with their current supervisors for an average of 2.73 (*SD* = 1.36) years. The sample consisted of students working under the supervision of at least 188 supervisors (a number of participants did not report their supervisor's name).

Measures

Transformational leadership. To measure students' perceptions of their supervisors' transformational leader behaviours, the global abbreviated version of the differentiated transformational leadership inventory for higher education (DTLI-HE, see Chapter 2) was used. Participants were asked to indicate how often their supervisor engages in each of the behaviours using a 7-point likert scale from 1 (*Never*) to 7 (*Always*) with the anchor statement, "My supervisor…", preceding the items. The seven items of the scale each measure one dimension of transformational leadership as detailed in the original DTLI-HE

(Mawn, 2012); individual consideration ("Is considerate towards me"), inspirational motivation ("Communicates an exciting vision that I can achieve"), intellectual stimulation ("Asks me questions that make me think"), high-performance expectations ("Tells me to do my best"), appropriate role modelling ("Sets an example for me to follow"), sense of humour ("Uses humour in tutorials"), and self-belief ("Conducts tutorials in a confident manner"). In the present sample the scale demonstrated good fit to the data in its one-factor structure (χ^2 = 35.567, df =14, RMSEA = .06, CFI = .99 TLI = .99), and acceptable internal reliability α = .837). All factor loadings were significant and exceeded .40. To account for situations where students had more than one supervisor, participants were asked to respond to the items of the leadership scale in relation to the supervisor who they had the most contact time with during their studies.

Implicit Theories of Ability. In the present study, the research focus is on effects of transformational leadership upon students' implicit theories within the context of doctoral study. Within the proposed rationale, it is expected that transformational leadership is most likely to predict implicit theories that operate within the sphere of the leader's influence, and that a relationship with general implicit theories of intelligence is more tenuous. To that end, consistent with previous researchers who have re-worked scales for specific aspects of ability, the eight items of Dweck's (2000) scale of implicit theories of intelligence were reworded to reflect the PhD context. For example, the original item "You can always substantially change how intelligent you are" became "You can always substantially change your ability to be a successful PhD student". The reworded items were evaluated by a psychometrics expert to ensure they retained their meaning and properly reflected entity and incremental beliefs. One incremental item (originally "You can change even your basic intelligence level considerably") was deemed an unsatisfactory rephrasing and an alternative rewording could not be found to sufficiently reflect the item's original meaning.

Consequently, the scale consisted of seven items (see Appendix I); three incremental (α = .88) and four entity (α = .91) items that demonstrated good internal reliability.

Coping strategies. The coping strategies of approach and self-punishment coping were each measured using subscales of the revised COPE inventory (COPE-R, Zuckerman & Gagne, 2003) based on the original COPE scale (Carver, Scheier, & Weintraub, 1989). The COPE-R reformulated the original 13 subscales of the measure into 5 overarching factors by introducing seven new subscales and modifying an existing one. The approach-coping subscale employed consisted of eight items representing the original aspects of active coping (four items; e.g., "I do what has to be done, one step at a time"), planning (three items; e.g., "I make a plan of action"), and suppression of competing activities (one item; "I try hard to prevent other things from interfering with my efforts at dealing with this"). The self-punishment subscale consisted of eight items representing self-blame (four items; e.g., "I criticise or lecture myself") and self-focused rumination (four items; e.g., "I brood over my problem non-stop"). In the present study, the items were used to measure participants' coping in simulated recall failure scenario, as opposed to trait-like coping in general situations. Items were re-worded to reflect this more specific context (e.g., In the scenario described above "I would brood over my problem nonstop"). Item responses were recorded on a 4-point likert scale from 1 (*I would not do this at all*) to 4 (*I would do this a lot*) in accordance with the scale's development (Zuckerman & Gagne, 2003).

In the present sample, the measures initially demonstrated only mediocre fit to a two-factor structure ($\chi 2 = 410.39$ df = 203, RMSEA = .08 CFI = .97 TLI = .97. Following examination of factor loadings, modification indices and item wording, item SP2 was identified as the primary source of model miss-fit and removed. The revised two-factor model demonstrated improved and acceptable fit ($\chi 2 = 264.25$, df = 89 RMSEA = .068 CFI =

.980 TLI = .977), and all item factor loadings exceed .45 (mean loading = .78). Approach and self-punishment subscales also demonstrated acceptable reliability ($\alpha = .876$, $\alpha = .894$ respectively).

Procedures

Following institutional ethical approval, an online questionnaire containing the measures outlined above was created using the free online questionnaire platform SocialSci.com. The questionnaire was distributed to PhD students using online social media in order to attract a wide range of students from diverse backgrounds. To reach a range of doctoral students with diverse backgrounds and study areas participants were recruited to complete an online questionnaire using social media.

To ensure respondents were reading the questions carefully and alleviate the effects of block answering, two attention check items were inserted in accordance with recommendations for best practice in online surveys (Smith, 2013) each item read "Select the response 'Neither agree nor disagree' for this question" (referring to the likert scale). Respondents who selected an incorrect answer for these items were excluded from the survey ($n = 15$). In order to alleviate possible priming effects of completing the scales in a particular sequence, custom page ordering was used so that participants were randomly assigned to view the leadership and implicit theories scales in one of two sequences (see Figure 9). The coping scales were not included in sequence counterbalancing as they were immediately preceded by a script depicting a failure scenario with the participants instructed to imagine this scene prior to and during completion of the coping items. It was thought that if presented first, exposure to the failure scenario might bias responses to the other scales. The script asked the participants to imagine themselves as a late-stage PhD student who has worked tirelessly on a journal manuscript and receives a critical rejection letter (see Appendix J for

the full script). Then participants were asked to respond to the items of the coping scale as if they were in the imagined failure scenario. The failure scenario was designed to simulate feelings of failure associated with a contextually relevant setback, as it is in such situations that implicit theories are theorised to come to the fore (Dweck, 2000).

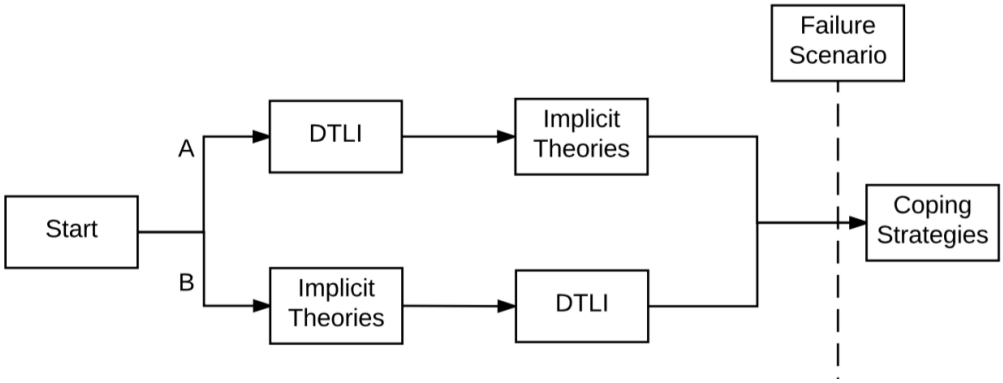

Figure 9. Counterbalancing of questionnaire order

Data Analysis

To test the hypothesised relationships simultaneously, structural equation modelling was employed using Mplus 7. Due to the categorical nature of the data, all analyses were performed using weighted least means square estimation (WLSMV). A latent variable path model was specified with transformational leadership as the independent variable. The two dependent variables of approach coping and self-punishment coping were regressed directly onto transformational leadership, as well as the two mediators of incremental and entity beliefs, which were in turn regressed onto transformational leadership. In accordance with recommendations by Bollen, (1989) a range of fit indices were employed to judge the appropriateness of model fit. The root mean square error of approximation (RMSEA), comparative fit index (CFI) and Tucker-Lewis index (TLI) were used with .06, .95 and .95 used as cut-off values as indicators of good fit, as recommended by Hu and Bentler (1999).

Non-independence of response scores was considered a pertinent issue, given that multiple ratings of transformational leadership for the same supervisor were present in some instances. However, a large proportion of participants chose not to indicate their supervisors' name, and of those who did (40.5% of the final sample) the vast majority were the only respondent to name that supervisor (94%). As a result, it was decided that it was not possible to account for non-independence of data using multi-level modelling or other methods due to the lack of information to do so. Furthermore, as outlined above, any influence of non-independence on parameter estimates was likely to be minimal given the small incidence of nested data.

To test indirect effects 95% bias-corrected bootstrap confidence intervals were computed using 5000 bootstrap samples. This method is more robust to violations of the normal distribution than traditional normal theory tests of indirect effects. In order to better understand any significant indirect effect, it is desirable to interpret he magnitude of the mediation present. However, the issue of how best to report and interpret effect sizes in mediation models is a matter of on-going discussion. Preacher and Kelley (2011) reviewed and critiqued a number of widely used methods of estimating and interpreting effect sizes, demonstrating the functional limitations of many of these approaches. They advanced the adoption of a new statistic for the interpretation of effect sizes in mediation models; Kappa squared (K^2). Nevertheless, this statistic was found to have potentially fatal flaws of its own and is contraindicated in most circumstances (Wen & Fan, 2015). Given the lack of a definitive approach for interpreting effect sizes in mediation models, Wen and Fan recommend reporting a range of statistics. In accordance with these recommendations the total, direct, and indirect effect are reported in both standardized and original scale formats with accompanying confidence intervals, as well as the proportion mediated (PM;

MacKinnon, 2008) where appropriate[6]. The magnitude of the standardized indirect effect can be interpreted using guidelines for Cohen's *d* (Kenny, 2012) so that .01 = small, .09 = moderate, and .25 = large effect.

An alternative comparison model was also estimate, where the direct effect paths from transformational leadership to approach and self-punishment coping were constrained to zero to test whether the hypothesised model provides the best interpretation of the data when compared against an alternative. The models were compared using the DIFFTEST procedure for chi square difference testing with WLSMV estimation in Mplus.

Results

Measurement Model

First, the appropriateness of the overall measurement model fit was tested using confirmatory factor analysis. The confirmatory model consisted of each latent variable as well as their respective indicators, specifically transformational leadership (seven indicators),

Table 12. Chi Square difference test results

	χ^2	df	χ^2 Difference Test	χ^2 Difference Test ρ	df Difference	RMSEA	CFI	TLI
Hypothesised Model	780.20	395	-	-	-	.048	.98	.98
Alternative Model	878.16	397	51.06	.00	2	.054	.97	.97

Hypothesised Model = As figure 8 (above). Alternative model = as figure 1, but with the paths from transformational leadership to approach and self-punishment coping constrained to zero.

[6] PM is not in appropriate in situations where the indirect and direct effect have opposite signs (so called inconsistent models, see MacKinnon, Krull, & Lockwood, 2000), as is the case in a number of the hypothesized effects.

incremental beliefs (three indicators), entity beliefs (four indicators), approach (eight indicators), and self-punishment (eight indicators). According to the previously outlined fit indices, the overall measurement model demonstrated good fit to the data (χ^2 = 780.20, df = 395, RMSEA = .05, CFI = .98 TLI = .98). All item factor loadings were significant and exceeded .40 (mean loading = .774, SD = .14).

Structural Pathway Analysis

The specified latent variable path model was a good fit to the data (χ^2 = 780.20, df = 395, RMSEA = .05, CFI = .98 TLI = .98). Chi square difference test results showed that the hypothesised model was significantly better fitting than the alternative model where direct effects were constrained to zero, although both models provided acceptable fit to the data (see Table 12).

Table 13 Variable means, standard deviations and zero-order correlations

Variable	Mean	SD	1	2	3	4
1. Transformational Leadership	4.88	1.15	-			
2. Incremental	4.30	0.95	.232*	-		
3. Entity	2.71	0.94	-.208*	-.719*	-	
4. Approach	3.12	0.57	.306*	.306*	-.233*	-
5. Self-punishment	2.58	0.84	-.144*	-.225*	.095	-.322*

SD = standard deviation. * = $p < .05$

Hypotheses 1A-1B. Bivariate correlations of the main study variables showed that transformational leadership was significantly positively correlated with incremental beliefs and negatively correlated with entity beliefs, providing initial support for hypotheses 1A and 1B. Structural path coefficients from transformational leadership to implicit theories also

provided further support for hypotheses 1A and 1B (β = .29 and β = -.25 for incremental and entity beliefs respectively. See Figure 10), showing that transformational leadership positively predicted incremental beliefs and negatively predicted entity beliefs.

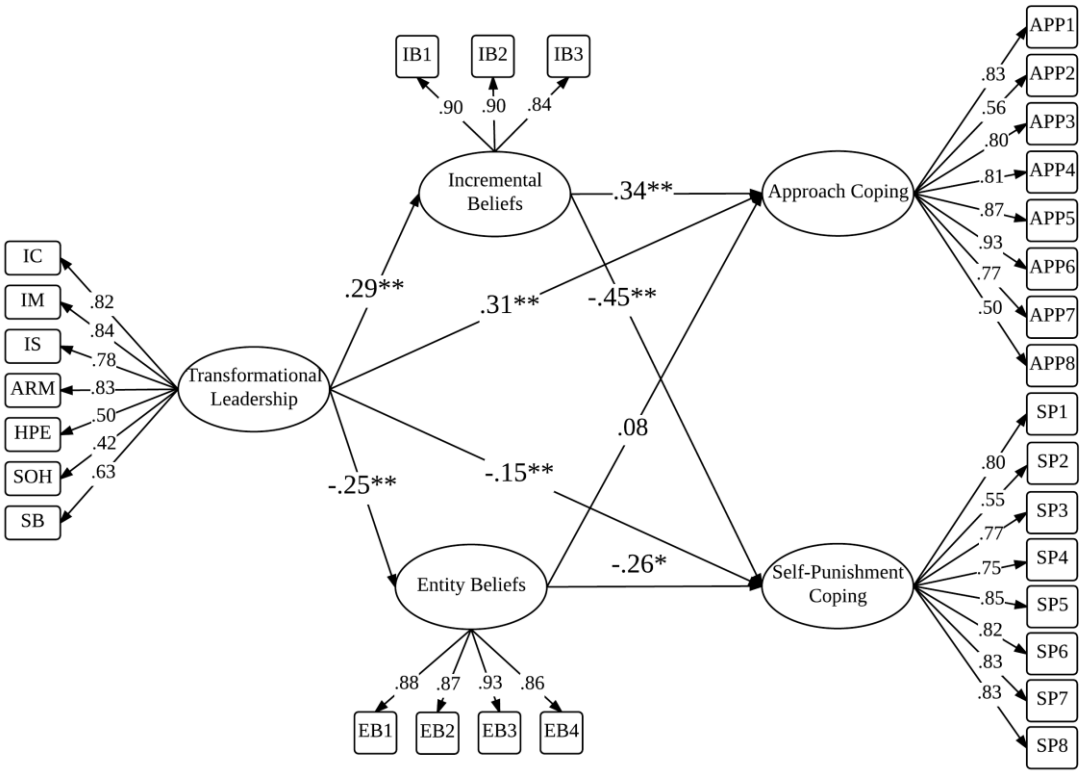

Figure 10. Path diagram of indirect effects of transformational leadership on approach and self-punishment coping. All item loadings are significant to p < .001. * = p < .05 ** = p <.01

Hypotheses 2A and 2B. In accordance with hypothesis 2A, mediation analysis showed that transformational leadership indirectly influenced students' approach coping through its effect on students' incremental theories of ability. As can be seen from Figure 10, students who reported higher levels of transformational leadership reported higher levels of incremental beliefs (β = .29, p<.01), and subsequently higher levels of approach coping (β = .34, p<.01). The bias-corrected bootstrap confidence interval for the indirect effect was entirely above zero (β =.10, Lower CI = .02, Upper CI = .18) indicating a significant and

positive indirect effect of transformational leadership upon approach coping via incremental beliefs. The standardised total effect of transformational leadership on approach coping was β = .39 ($p < .01$), indicating that approach coping was expected to increase by .39 standard deviations for every one-unit of increase in transformational leadership. The ratio of the indirect effect to the total effect (proportion mediated, P_M; Mackinnon et al., 1995) was .25 indicating that incremental beliefs accounted for 25% of the total effect of transformational leadership on approach coping. Taken together these results provide some support for Hypothesis 2A. On the other hand, Hypothesis 2B was not supported. The results showed that transformational leadership was negatively related with entity beliefs, as expected (β = -.253, $p<.01$), but entity theories showed no relationship with approach coping (β = .080, $p>.05$). The indirect effect of transformational leadership on approach coping via entity was not significant (β = .02, Lower CI = -.09, Upper CI = 05).

Table 14. Results of mediation analyses

Dependent Measures			Standardised				Unstandardised			
			Effect of TL via				Effect of TL via			
			Incremental	Entity	Total Effect	Direct Effect	Incremental	Entity	Total Effect	Direct Effect
Approach		β	.10	.02	.39	.31	.19	-.04	.77	.62
		SE	.04	.04	.05	.05	.09	.07	.15	.14
	BC 95% CI	Upper	.18	.05	.48	.41	.42	.08	1.13	.93
	BC 95% CI	Lower	.02	-.09	.29	.21	.06	-.20	.53	.39
		PM	.25	.05			.25	-.05		
Self-Punishment		β	-.14	.07	-.21	-.15	-.26	.13	-.41	-.28
		SE	.04	.04	.06	.06	.09	.08	.13	.12
	BC 95% CI	Upper	-.05	.14	-.10	-.04	-.12	.32	-.18	-.06
	BC 95% CI	Lower	-.25	-.01	-.32	-.26	-.50	.02	-.68	-.54
		PM	.63	-.32			.63	-.32		

Note. TL = Transformational leadership. Bootstrap samples = 5000.PM = The ratio of the indirect effect to the total effect or the percentage of the effect of X on Y mediated by M. Confidence intervals that do not encompass 0 sig p.=.05.

Hypotheses 3A and 3B. Mediation analysis supported hypothesis 3A (full results in Table 14). Students who reported higher levels of transformational leadership in their supervisor reported higher levels of incremental beliefs ($\beta = .29$, $p<.01$) and subsequently reported use of lower levels of self-punishment coping ($\beta = -.47$, $p<.01$). The standardised indirect effect of transformational leadership on self-punishment via incremental beliefs was negative and significant ($\beta = -.14$, Upper CI=-.05, Lower CI = -.25). The standardised total effect of transformational leadership on self-punishment was $\beta = -.19$ ($p<.01$), indicating that for every one-unit increase in transformational leadership self-punishment was expected to decrease by .19 standard deviations. The ratio of the total effect to the indirect effect was .66, implying that incremental beliefs accounted for 66% of the effect of transformational leadership on self-punishment. Overall, these results provide general support for Hypothesis 3A. However, Hypothesis 3B was not supported. It was expected that transformational leadership would be negatively related with entity theories, and entity theories would be positively related with self-punishment, resulting in a negative indirect effect of transformational leadership upon self-punishment via entity theories (see Figure 1). While transformational leadership was negatively related with entity theories as expected ($\beta = -.25$, $p < .01$), entity theories were in fact negatively related with self-punishment coping ($\beta = -.26$, $p < .05$). The resulting indirect effect was small but positive ($\beta = -.25$, Lower CI = -.01, Upper CI = .14), although the 95% bias-corrected bootstrap confidence interval did marginally encompass zero indicating that the indirect effect approached significance at the .05 level, but was opposite to the hypothesised direction.

Hypotheses 4A and 4B. There was a significant positive direct effect of transformational leadership on approach coping, as hypothesised ($\beta = .29$, $p < .01$). Also consistent with hypotheses, the direct effect of transformational leadership on self-punishment coping was significant and negative ($\beta = -.15$, $p < .01$), despite the presence of a

positive indirect effect. This pattern of results is termed inconsistent mediation (MacKinnon, Krull, & Lockwood, 2000).

Discussion

The aim of the present study was to examine the indirect effect of supervisors' transformational leadership on students' coping behaviours via its influence on students' implicit theories of ability. Specifically, it was expected that transformational leadership would be positively related to incremental theories, and that this would subsequently be related to adaptive coping outcomes. Further, a largely inverse set of results was expected for entity; that transformational leadership would be negatively related to entity beliefs, and that this would subsequently be related to maladaptive coping outcomes. Overall, the pattern of results provides mixed support for the hypotheses; while several hypotheses received full support, one relationship was opposite to expectations. The specific findings and their theoretical and applied implications are discussed.

Bivariate correlations and results of the latent variable path model supported hypotheses 1 and 2, that transformational leadership was positively related to incremental beliefs and negatively related to entity beliefs. While the results cannot speak to causation, they are consistent with the rationale that transformational leaders may foster incremental beliefs in their followers. This study is the first to demonstrate a relationship between transformational leadership and follower's implicit theories of ability. However, the results somewhat contradict those of Kam et al. (2012) who found that manager's transformational leadership did not correlate significantly with subordinate's general implicit theory beliefs, only with their *attributions* of their managers' implicit theories regarding ability at work. A key difference between Kam et al. (2012) and the current study is that it was chosen to examine followers' implicit theories of ability with regard to their PhD work, as opposed to

their general implicit theories of intelligence. In the current study the implicit theory measure was aligned with the context in which the leader is most influential to the follower, that is, the PhD. It is this key difference that most likely explains the somewhat contradictory findings of the two studies. It would seem then, that perhaps the influence of transformational leadership is sufficient to affect follower's context-specific implicit theories, but not their general implicit theories of intelligence.

It is interesting to note that while incremental theories mediated the effect of transformational leadership on coping behaviours as expected, entity theories did not. The significant indirect effects of transformational leadership on approach and self-punishment coping via incremental beliefs support previous research suggesting that incremental beliefs have a beneficial impact on individuals' ability to cope effectively with setbacks and challenges (Blackwell et al., 2007; Hong et al., 1999). The results demonstrate that this beneficial effect comes in the form of both promoting the use of adaptive coping strategies such as approach coping, and reducing the use of maladaptive coping strategies such as self-punishment. Conversely, it was expected that entity theories would promote use of maladaptive strategies and reduce use of adaptive ones, and in the current study, the results generally did not reflect this. Moreover, entity beliefs showed no relationship with approach coping, and, unexpectedly, a negative relationship with self-punishment. Whilst not fully consistent with expectations, this pattern of results none-the-less shows that incremental and entity theorists differ in the strategies that they employ when faced with setbacks.

The negative effect of entity beliefs on self-punishment was counter to the proposed rationale. It was proposed that entity theorists' vulnerability to ego threat might predispose them to adopt inward focused coping strategies such as self-punishment. An alternative view that might explain the results observed is that entity theorists tend to adopt an external locus of control (Bodill & Roberts, 2013) and thus are more likely to form external attributions of

failure. Engaging in self-punishment behaviour, characterised by self-focused rumination and self-blame, would entail adopting an internal locus of control, that is, that they would tend to attribute outcomes of events to internal influences (Cooper, Burger, & Good, 1981). This is generally inconsistent with the description of an entity theorist. This could explain why entity theorists seem averse to adopting self-punishment coping strategies; self-punishment entails an internal locus of control that they generally lack. In accordance with this line of thinking, it is likely that some alternative maladaptive strategies correlate positively with entity theories, such as avoidance coping or blaming others for negative outcomes, and these would present good alternative variables for investigation.

One interesting consequence of the unexpected negative relationship between entity and self-punishment is that it results in a net positive indirect effect of transformational leadership on self-punishment, because the product of two negative coefficients is positive. This is counter-intuitive as the direct effect of transformational leadership on self-punishment is negative. This pattern of results has been termed inconsistent mediation (MacKinnon, 2000), which refers to any mediation where the sign of the direct effect is opposite to the indirect effect. Inconsistent mediation is equivalent to a suppression effect, where the inclusion of the mediator as a third variable decreases the magnitude of the total effect of the independent variable upon the dependent variable. In the current analysis, this means that while the total effect of transformational leadership on self-punishment is negative (B = -.21), the proportion of the total effect of transformational leadership that is attributable to the indirect effect actually positively influences self-punishment, or facilitates maladaptive self-punishment coping. With that being said, it is worth noting that the influence of the indirect effect is small relative to the total effect, and that the total effect of transformational leadership on self-punishment is still negative and as such, its influence is beneficial overall, in reducing self-punishment.

Further to the indirect effects, the direct effects of transformational leadership on approach and self-punishment were significantly positive and negative respectively, as hypothesised. Furthermore, the direct effect model represented a significantly improved fit over the alternative model where these direct paths were constrained to zero. This result is consistent with the proposed rationale that while transformational leadership influences coping behaviours indirectly via implicit theories, it also influences them directly or via alternative mechanisms. The result is generally consistent with the limited existing evidence linking transformational leadership and coping behaviours, suggesting that followers of transformational leaders are more likely to employ problem based coping strategies such as approach coping (Ben-Zur et al., 2005) and that leaders themselves are less likely to employ emotion based coping strategies (Alarcon et al., 2012). Future research could consider the role of self-efficacy in the relationship between transformational leadership and effective coping strategies such as approach coping as an alternative mechanism.

The asymmetrical pattern of results through the mediators of entity and incremental beliefs is noteworthy, and reinforces the assertion that it is important and meaningful to analyse effects of entity and incremental beliefs separately. Implicit theories have sometimes been described as at opposite ends of the same continuum (Dweck & Leggett, 1988). As such, some authors have chosen to collapse measurement of this construct into one dimension by reverse scoring items of one of the theories, creating a composite scale where high scores reflect either entity or incremental theories (e.g. Blackwell et al., 2007). This approach suffers from several limitations. First, it tends to assume that the effects of incremental and entity beliefs are equal and opposite, when in fact they are not, as demonstrated by the results and others. While these beliefs are diametrically opposed to one another at a conceptual level, this author takes the view that they are not mutually exclusive and as such, disagreement with a set of entity items does not necessarily imply equal agreement with a set of incremental

items, despite attempts to justify this perspective (Hong et al., 1999). Second, it blurs the effects of the two theories into one, such that combined measures of "implicit theories" lack sensitivity to subtle findings. In circumstances where incremental and entity beliefs share similar relationships with an outcome (as in the present study), these effects would cancel each other out when the subscales are combined (and one subscale reverse coded to reflect the same direction). Finally, it ignores the possibility that the two theories might interact to predict some outcome; the relationship between incremental beliefs and a given outcome may depend partly on entity beliefs held simultaneously. This study is by no means the first to make these and similar observations (Biddle et al., 2003; Dupeyrat & Mariné, 2005; Sarrazin et al., 1996) yet researchers continue to employ composite scores of implicit theories (e.g. Yeager, Trzesniewski, & Dweck, 2012) with no apparent justification. The current study serves as another reminder that incremental and entity theories represent separate yet related constructs and should be measured as such.

The potential for common method variance to bias the results cannot be ruled out. Actions were taken to alleviate the effects of common method bias, including counter balancing questionnaire order, inducing a psychological break between predictor and criterion variables, and employing varied response formats for differing scales, in line with recommendations by Podsakoff et al. (2003). Further, due to the cross-sectional nature of the research design in the present study, inferences regarding the causal nature of the effects observed cannot be made. Rationale to support the causal sequence has been presented, although alternative explanations, including reverse causality, cannot be ruled out entirely. Some authors support the view that implicit theories remain very stable over time (Robins & Pals, 2002), which contradicts the proposed rationale, as it relies on the gradual shifting of beliefs. One alternative explanation of the results that is consistent with this line of thinking is the potential existence of a selection bias by transformational supervisors towards more

incrementally minded students. However, evidence supports the view that implicit beliefs are at least flexible in the short term as demonstrated by use of priming (e.g. (Sue-chan et al., 2012) and are likely subject to long-term change provided there is a stimulus for that shift (Blackwell et al., 2007; Leith et al., 2014). In the context of the PhD, the long-term relationship with a transformational supervisor could represent such a stimulus.

Future studies might employ longitudinal designs to capture a more accurate representation of the causal chain of events proposed in the proposed rationale, and address the limitations regarding reverse causality or selection bias. Furthermore, examining the influence of time with the supervisor might help to elucidate the processes by which transformational leadership influences implicit theories. If transformational leadership were to be positively related with incremental beliefs in the very early stages of the relationship, this would imply that the effect of leadership on implicit theories does not take place over time as proposed in the proposed rationale, and works by some other means. In addition, examinations of exactly which transformational leader behaviours are most influential in predicting implicit theories would be worthwhile, as these would aid in the development of transformational leadership interventions targeted to improve followers implicit theories.

One factor that limits the scope of the study is that only two coping strategies were examined. Students' use of coping strategies has been widely researched in the educational literature, and there are a number of differing aspects of coping that are worthy of further investigation in relation to transformational leadership and implicit theories in the context of PhD students. Examination of alternative coping strategies such as avoidance coping, other blame and behavioural disengagement specifically would complement the current understanding of the strategies employed by entity theorists. Previous research has suggested that entity theories are related to maladaptive coping (Doron et al., 2009) and the results of the present study are somewhat inconsistent with this, as entity was negatively related to self-

punishment. Examining a broader array of coping behaviours would shed light on how this finding compares in relation to other strategies employed by entity theorists.

In summary, the study has shown how transformational leadership in academic research supervisors positively predicted their students' implicit theories of ability in their PhD studies, and this subsequently predicted the coping strategies they employed when faced with a contextually relevant setback. This highlights the utility of transformational leadership as a model for research supervisors to guide supervision practice, and extends the scope of transformational leadership research in higher education to include doctoral supervision. The study findings also demonstrate the importance of employing differentiated measure of implicit theories in research, and consequently it is urged that researchers to consider incremental and entity beliefs as conceptually and empirically distinct constructs.

Chapter 5

General Discussion

General Discussion

Thesis Summary

This thesis investigated the application and measurement of transformational leadership in the previously unexamined context of higher education research supervision, and tested a number of underlying mechanisms by which it exerts its influence on followers. Chapter 1 introduced the foundational assertions of transformational leadership theory, reviewed its measurement and conceptualisation, and briefly examined the existing research on the theory in higher education contexts providing some framing for the work of the subsequent chapters.

In Chapter 2, some of the issues surrounding the measurement of transformational leadership in higher education research supervision were explored using the differentiated transformational leadership inventory for higher education (DTLI-HE, Mawn, 2012). Results of factor analyses supported the factorial validity of the measure attesting to its suitability for the specific context of supervision. The factor structure of the scale was investigated in greater detail using exploratory bi-factor analysis to examine the extent to which the items of the DTLI reflected a general transformational leadership factor as opposed to a set of differentiated but related leader behaviours. The results reflected a very dominant general factor running through the items; calculation of Omega coefficients showed that the general factor represented 89% of variance in the total scale score. This finding provided some support for the adoption of a global measurement approach to transformational leadership. However, when the specific and general factors were used to predict leader inspired extra effort in a subsequent analysis, while general transformational leadership was the strongest predictor, six of the eight specific behaviours predicted variance in extra effort over and above that of the general factor. As a result, specific behaviours accounted for aspects of

transformational leadership that are unique from the general transformational leadership factor. Using the factor analyses, an abbreviated global transformational leadership scale was developed. Data in this chapter are important as they represent the first attempt to apply bi-factor measurement models to extend the current understanding of the measurement and conceptualisation of transformational leadership resulting in a psychometrically sound abbreviated measure of global transformational leadership for higher education settings.

The variables of leader-member exchange, basic psychological needs satisfaction, and engagement have each been proposed in the existent research as mechanisms of transformational leader effectiveness in varying domains. In Chapter 3, these variables were integrated into a multiple-serial mediation model whereby it was expected that supervisors' transformational leadership would impact students' grade performance indirectly via leader-member exchange, basic psychological needs satisfaction and engagement sequentially. Support for the model was initially confirmed using a cross-sectional design and then further supported using a semi-longitudinal design. In both cases mediation analyses generally supported the hypothesised multiple-serial mediation model. The research demonstrates that, within higher education supervision, leader-member exchange, satisfaction of basic needs and engagement are important processes that explain the effectiveness of transformational leadership.

Chapter 4 considered an alternative mechanism of transformational leader effectiveness among PhD students, proposing that transformational supervisors foster incremental beliefs of ability in their students, enabling them to employ more effective coping strategies when faced with setbacks. Using an online questionnaire, data were collected from an international sample of PhD students, measuring their perceptions of their supervisors' leader behaviours, their implicit theories of ability as a PhD student, and their use of approach and self-punishment coping strategies in response to setbacks. Mediation

analyses revealed a positive indirect effect of transformational leadership on students' use of approach coping via incremental beliefs, as well as a negative indirect effect on self-punishment via incremental beliefs. Indirect effects via entity beliefs were not significant. These results provide the first empirical support for the notion that transformational leaders may foster incremental beliefs of ability in their students, and that this subsequently equips them to cope more effectively with setbacks.

Theoretical Implications

Measurement of Transformational Leadership in Higher Education. As discussed in Chapter 1 and briefly in Chapter 2, the existing research on transformational leadership in higher education has relied overwhelmingly on modified versions of the MLQ, an approach that has a number of shortcomings. Specifically, the MLQ itself has displayed questionable psychometric properties in organisational (Bycio et al., 1995) and educational domains (Pounder, 2008), Moreover the scale's multiple versions render comparison across studies a challenge, and the ways in which the scale has been adapted for the purpose of study are potentially varied and often not fully described, further frustrating comparison of results between studies. Existing alternatives to the MLQ such as the transformational instructional leadership questionnaire (TILQ, Balwant, 2014) suffer from their own limitations (see Chapter 1). Furthermore, there are no existing scales designed specifically for the application in supervision settings. As such this is an area in need of measurement development. Confirmatory factor analyses in Chapter 2 provided support for the eight-factor structure of the DTLI-HE (Mawn, 2012), consistent with its development. This lends some support to the DTLI-HE scale and attests to its applicability to the supervision context.

A second aim of Chapter 2 was to generate a short-form global measure of transformational leadership in higher education, to complement the existing 30-item version

of the DTLI-HE (Mawn, 2012) and other measures employed in the educational domain such as the MLQ. Chapter 2 provided some evidence to support the psychometric properties of the 7-item global scale. In addition, the scale showed acceptable fit in Chapter 3, and Chapter 4, where the sampled supervisory context was slightly different (i.e., PhD students). Chapter 2 demonstrates the utility of a short-form global scale of transformational leadership; using a uni-dimensional scale enabled the employment of a reliability-adjusted manifest variable path analysis. When investigating complex research questions where specific transformational leader behaviours are not the main focus of the investigation, short-form global scales may be particularly useful as they are easier to use within analytical frameworks such as structural equation modelling, where it is often preferable for constructs to conform to a uni-dimensional structure. This is especially relevant in under developed areas of research in transformational leadership such as higher education where research questions are likely to increase in complexity as the research area develops. This type of short form measure is also more applicable when used as part of a battery of questionnaires used to survey an organisation, for example as part of a survey of student satisfaction in a university, as it allows you to gain some insight with the addition of only a few items.

The existing measure most readily comparable to the abbreviated DTLI-HE is the Global Transformational Leadership scale (GTL; Carless et al., 2000). The GTL consists of seven items that adhere to a uni-dimensional factor structure. Each item measures a different aspect of transformational leadership, specifically vision, staff development, supportive leadership, empowerment, innovative thinking, lead by example and charisma. Carless et al. (2000) demonstrated the convergent validity of the scale with the MLQ and the Leadership Practices Inventory. The main difference between the GTL and the DTLI-HE (short) is that the latter has been developed specifically for the context of higher education, and in line with its development, it encompasses two leader behaviours that emerged as contextually relevant

transformational leader behaviours in that context; sense of humour and self-belief (Mawn, 2012).

Global and differentiated conceptualisations. Some authors have warned that simplistic conceptualisations of transformational leadership such as global models are the wrong direction for leadership research (Antonakis et al., 2003) as they are an over-simplification of the construct restricting the capacity for theoretical development. Advocates of differentiated approaches have responded to calls by Antonakis et al. (2003) for the development and adoption of more differentiated conceptualisation of transformational leadership (e.g., Hardy et al., 2010). Several compelling arguments exist for the adoption of a differentiated approach over a global one. Differentiation among leadership factors allows better examination of leadership development with reference to specific behaviours, enable more specific feedback on leader behaviour, and examine how specific behaviours differentially predict outcomes. Arguably, differentiated models are also more consistent with the underlying theory of transformational leadership developed by Bass and colleagues (Avolio et al., 1999; Bass, 1985) describing multiple dimensions of leadership. While these arguments are valid, a more measured view is that there is an appropriate application for both differentiated and global conceptualisations of transformational leadership. Furthermore there are circumstances when a global conceptualisation and measurement approach is more prudent. Consistent with this stance some research has questioned the discriminant validity of specific transformational leader behaviours (Carless, 1998a), and indeed the inter-factor correlations between some dimensions of transformational leadership are consistently high across a range of measures (Antonakis et al., 2003; Arthur & Hardy, 2014; Podsakoff, MacKenzie, Moorman, & Fetter, 1990).

Factor analyses in Chapter 2 revealed inter-factor correlations ranging from .55-.94. Despite such evidence, authors have reported support for the discriminant validity of such

measures (Callow et al., 2009; Hardy et al., 2010; Podsakoff et al., 1990). However, the evidence from Chapter 2 extends further than simple inter-factor correlations, using the bi-factor model to demonstrate that, at least in the case of the DTLI, the dimensions of transformational leadership are very strongly reflective of a general transformational leadership factor, more so than they are reflective of their specific dimension. The implications of this are that when analysing subscales of this measure, the majority of the variance in the subscale reflects general transformational leadership (i.e. what is common among all the subscales), and only a small percentage reflects variance that is unique to that subscale. Some psychometricians would argue that under these circumstances, analysis of subscales is not justified as they are so heavily reflective of the same construct (Reise et al., 2010), and therefore a global measurement approach is acceptable.

While the conclusions drawn about the bi-factor structure of the DTLI are limited to that measure, and obviously cannot speak to the dimensionality of other scales, established measures such as the MLQ feature a similar factor structure with a collection of highly correlated dimensions designed to measure transformational leadership. It is likely that such measures would conform to a similar bi-factor structure where the subscales are predominantly reflective of general transformational leadership. While the findings have important implications for measurement and analysis the implications for the conceptualisation of transformational leadership are not so clear. In their critical assessment of transformational leadership research van Knippenberg and Sitkin (2013) stated:

"We avoid the mistake of concluding that the evidence for uni-dimensional measurement indicates that charismatic–transformational leadership is a unitary construct. We argue that we cannot draw this conclusion for multiple reasons. First, problems of conceptual definition should be addressed at the conceptual level and cannot be solved empirically: we need a conceptual answer to the question as to what charismatic-

transformational leadership is and why the three (or more) dimensions together form a unitary construct. If at the level of survey measurement a one-factor solution is favoured, this only indicates that survey items tap into a shared underlying construct. It is not evidence that the construct as defined by theory is singular" (p. 41).

The findings from the bi-factor analyses are more nuanced than the simple conclusion that "a one-factor solution is favoured", a conclusion that could be reached with conventional factor analyses. However, the point above underlines the fact that while the findings of the bi-factor model extend the current understanding of measurement of transformational leadership, they cannot speak to the conceptual nature of the construct itself. Therefore, conclusions drawn from the analyses in Chapter 2 suggest something of a disconnect between measurement and theory. From a purely empirical standpoint, measurement and analysis of transformational leadership might be best conducted using a global approach, but the fact remains that this approach does not adhere to theoretical development to the same degree as a differentiated approach. In light of this, it is recommended that authors in future apply both global and differentiated models with careful consideration for the relative merits and shortcomings of each approach, and employ each in a manner that is most appropriate for the aims of their research. For example, a global approach might be more appropriate for initial explorations of a new context or to facilitate the investigation of a complex hypothesis (as in the present thesis), but should be applied in full acknowledgement that a global approach has some conceptual shortcomings. This research might be complemented in future by studies which examine specific behaviours in more detail using a differentiated approach, but are limited in the complexity of questions they can address due to methodological or analytical restrictions.

Alternative Theories of Leadership

As briefly discussed in Chapter 1, transformational leadership has some degree of conceptual overlap with other existing theories of leadership. Specifically, authentic leadership (Luthans & Avolio, 2003; (Avolio & Gardner, 2005) and servant leadership (Greenleaf, 1973) each refer to elements that are similar to components of transformational leadership. The results of this thesis undoubtedly provide some support for the application and investigation of transformational leadership in higher education contexts, but furthermore, by association with transformational leadership have potential implications for the investigation of other positive leadership theories in this context. Therefore, it is worthwhile briefly considering the conceptual similarities and differences between transformational leadership and such alternative theories and the implications.

Definitions and conceptualisations of authentic leadership vary between theorists but generally they describe authentic leaders as being highly self-aware, particularly regarding personal values, demonstrating openness and clarity about who they are, and consistently behaving in a manner that is in accordance with their values, beliefs and motives (Walumbwa, Avolio, & Gardner, 2008). Acting in a principled manner to do what is right and fair for followers and also consistent with their beliefs allows them to develop mutually trusting relationships that encourage open and honest communication. Research evidence has linked authentic leadership with a number of positive attitudinal and behavioural outcomes such as job satisfaction, satisfaction with the leader, and task and organisational performance (Leroy, Palanski, & Simons, 2012). One primary difference between authentic leadership and transformational leadership is that the latter focuses on developing followers in the pursuit of shared organisational objectives, whereas the former is concerned with developing followers more generally for their own personal benefit. In addition, while transformational leadership theorists refer to the espousal of values and beliefs (Bass & Riggio, 2006; Bass, 1999), there is no requirement that the beliefs espoused for the benefit of the team are consistent with

leader's actual beliefs. This allows for the existence of both authentic and inauthentic transformational leaders (Bass & Steidlmeier, 1999). Furthermore, charisma and vision are not central aspects of authentic leadership, whereas they are pivotal in transformational leadership. While there are some notable differences between the theories, they share many common aspects. Both theories emphasise the importance of positive role modelling, supporting follower autonomy and self-determination and positive leader follower interactions. They are also similar in terms of their posited beneficial effects on follower outcomes. In their meta-analysis examining the potential for empirical redundancy of the authentic leadership construct (due to similarity with transformational leadership), Banks, McCauley, Gardner and Guler (2016) found it correlated very highly with transformational leadership (.72). The results showed that transformational leadership was generally more strongly predictive of individual level and performance outcomes (specifically, task performance, leader effectiveness, job satisfaction and satisfaction with leader), while authentic leadership was more strongly predictive of group level outcomes (group performance and organisational citizenship behaviour). This suggests that maybe the strong focus of transformational leadership on performance drives followers to higher levels of attainment and satisfaction, while authentic leadership's focus on straying true to values may enforce a greater sense of collective responsibility.

Servant leadership represents another alternative theory that has overlap with both authentic leadership and transformational leadership. Greenleaf (1973) first proposed the concept of servant leadership, although it's origins in philosophy date back much earlier (See Harter [2002] for a review of authenticity in psychology). Greenleaf suggested that the primary responsibility of leaders is to serve followers, and empower them to develop to their fullest potential. This dictates a certain altruistic tendency of servant leaders demonstrated by their motivation to place the needs of others ahead of their own. As such, they are not

motivated to lead by the accruement of power and social influence. Servant leadership is relatively under-developed when compared with transformational leadership, and as such there is a lack of conceptual clarity regarding the characteristics and behaviours that make up servant leadership. Van Dierendonck (2011) outlines six characteristics that summarise a number of works conceptualising servant leadership. They consist of, empowering and developing people, humility, authenticity, acceptance of people, directions and stewardship. The growing body of empirical research on the theory suggests that servant leadership is predictive of job satisfaction and work engagement (Van Dierendonck & Nuijten, 2011) trust and team performance (Schaubroeck, Lam, & Peng, 2011) and organisational citizenship behaviour (Walumbwa, Hartnell, & Oke, 2010).

Some characteristics of servant leadership are shared with transformational leadership. For example, they both emphasise the development of followers, specifically though means of empowerment to allow them to maximise their potential. Both theories make specific reference to individual consideration of followers' needs, and the role of the leader in communicating a vision to followers. They are also both proposed to work partly by forming trusting individual relationships with followers, and through the maintaining of respect and integrity. The principle difference between the two styles is the differing focus of the leader; whereas the servant leader's primary focus is to provide for and satisfy their followers' needs, the transformational leader's overriding concern is encouraging followers to engage with and successfully achieve organisational objectives. It could be argued, that for the transformational leader, satisfaction of follower's needs is a means to an end (performance), while for servant leaders, satisfaction of follower's needs is the end itself, and effective performance is merely a by-product. Authors argue that this differing focus is likely to lead to a number of secondary points of differentiation from transformational leadership (Stone, Russell, & Patterson, 2004). For example, Van Dierendonck, Stam, Boersma, de

Windt, and Alkema (2014) found that transformational leadership was more strongly related to perceptions of leader effectiveness than servant leadership, but simultaneously, that servant leadership was more strongly predictive of satisfaction of basic psychological needs. This result is consistent with the differing focus of servant and transformational leaders, and represents differences in the mechanisms by which these styles of leadership operate and the outcomes they predict.

When considered in the context of the educational setting, the performance related focus of transformational leadership has some potential benefit over and above alternative theories such as authentic and servant leadership, in that it may help lift students to higher levels of attainment. In addition, transformational leadership is a more thoroughly developed theory in terms of its conceptualisation and measurement, and therefore lends itself more readily to investigation in a new context. However, it is important not to forget that Higher Education is not simply a performance environment. In the UK, national benchmarking tools such as the National Student Survey (NSS) put universities are under increasing pressure to boost student satisfaction, and growing concerns about student mental health and wellbeing (Hunt & Eisenberg, 2010) might give these issues relatively more weight in relation to outright grade performance. While there is certainly a case for transformational leadership being an effective leadership style in HE environments, styles which are more follower-focused such as authentic and servant leadership might in fact be more conducive to the aims of HE institutions. The results of thesis lay down a small foundation on which to build outward in investigating the relative effectiveness of alternative leadership approaches.

Mechanisms of Transformational Leadership

The development of transformational leadership research can be described in terms of Reicher and Schneider's (1990) model of stages of conceptual development, from introduction/elaboration, through evaluation/augmentation to consolidation/augmentation. In Chapter 1 it was asserted that transformational leadership presently sits in this third and final stage of conceptual development, thanks to the presence of multiple reviews, an understanding of mechanisms and contextual moderators. While this is a fair reflection of the transformational leadership literature as a whole, within specific context such as higher education, the theory is less well understood. Through the examination of multiple inter-related mechanisms of transformational leadership in the higher education context, this thesis has helped to extend the conceptual development of the theory in this context.

Evidence from Chapter 3 demonstrated the roles that leader-member exchange, the satisfaction of basic psychological needs, and the fostering engagement play as mechanisms of transformational leadership. Relatively few studies have examined transformational leadership and LMX together, although the results are consistent with the findings of Basu and Green, (1997), Deluga (1992) and Wang et al. (2005) suggesting that transformational leadership is positively related with LMX relationships. Researchers have acknowledged the importance of supervisor-student relationships in the research supervision contexts (Ives & Rowley, 2005) and LMX represents a way to operationalize the quality of those relationships in a meaningful way.

Consistent with Wang et al. (2005) the mediation model in Chapter 3 proposed that LMX acts as a mediator of transformational leadership. From a conceptual standpoint this suggests the causal chain of events begins with leadership behaviour, and this impacts upon the relationship, which impacts upon subsequent mediators, and ultimately performance. An alternative view could be that LMX or the nature of the relationship acts as a moderator of transformational leadership. In this theorizing, the relationship acts as the “lens” through

which leader behaviour is interpreted by the follower, and thus is likely to moderate the effect of that leadership on follower outcomes. Within the sequential model described in Chapter 2, it could be suggested that LMX might moderate the relationship between leadership and needs satisfaction such that transformational leadership has a greater influence on satisfaction in higher quality relationships. While there may be some merit to this conceptualisation, the existing evidence points more decisively towards the mediation hypothesis (e.g., Wang et al., 2005; Chapter 3). However, these perspectives are not mutually exclusive; it is possible that LMX may act as a mediator and moderator simultaneously. Given the close conceptual nature of leadership and the social relationship (i.e., the relationship), future research might attempt to elucidate the subtleties of the relationship between these variables.

Psychological needs satisfaction has previously been highlighted as a mechanism underpinning the effectiveness of transformational leadership (Kovjanic et al., 2013; Stenling & Tafvelin, 2014). The unique contribution of this thesis is to examine this construct in relation to other inter-related mechanisms of transformational leadership; namely LMX and engagement. The proposed serial mediation model suggests that it is partially via their influence on LMX relationships that transformational leaders are able to satisfy basic psychological needs, and via its influence on engagement that needs satisfaction positively influences performance. This enhances the current understanding of the role of need satisfaction in the effectiveness of transformational leadership providing a more realistic and elucidated depiction of transformational leaders' influence.

Engagement has also previously been examined as one of the mechanisms of transformational leadership (Breevaart et al., 2015). This thesis has extended the current understanding of the role of engagement by positioning it within a sequential model of other inter-related mediating variables. Specifically, according to the proposed mediation model, engagement is the final mediator in the causal chain and is the driver of performance. This is

consistent with previous works linking engagement and performance (e.g., Bakker & Bal, 2010; Halbesleben, Harvey, & Bolino, 2009). From an applied perspective, the results of the multiple-serial mediation analyses in Chapter 3 highlight aspects which leaders (or, more specifically, supervisors) can target to encourage greater levels of engagement from followers (students), specifically emphasising LMX relationships and satisfaction of basic-psychological needs, as these constructs are indirectly related to engagement.

One finding unique to this thesis is that supervisors' transformational leadership positively predicted incremental beliefs of ability in their PhD students, and negatively predicted entity beliefs. Furthermore, mediation analyses in Chapter 4 also showed that this subsequently equips followers of transformational leaders to employ more effective coping strategies when faced with setbacks. The ability of transformational leaders to influence their follower's implicit theories of ability has not previously been considered as a possible mechanism of transformational leader effectiveness. The results of Chapter 4 present some compelling initial evidence to further investigate the relationship between transformational leadership and implicit beliefs. The benefits to the development of incremental theories are well documented; incremental theories are associated with a tendency adopt learning goals, employ mastery strategies in pursuit of those goals, and persist longer in the face of challenges and setbacks (see Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013 for a meta-analytic review of implicit theories research). As such, the ability of leaders to facilitate such an approach in their followers would be a useful skill indeed. Existing research has manipulated or sought to develop incremental beliefs in a number of ways, but most commonly priming beliefs using short descriptions and using workshop interventions. Several studies have employed priming methods for experimental manipulation of implicit theories, using a short description of the determinants of intelligence that stresses the fixed innate determinants to induce entity beliefs, and stresses environmental and developmental

determinants to induce incremental beliefs. These priming manipulations have been shown to be effective, at least in the short term, in a number of studies (e.g. Hong, Chiu, Dweck, Lin, & Wan, 1999; Sue-chan, Wood, Latham, Sue-chan, & Wood, 2012). Intervention studies have also demonstrated more enduring changes, for example Blackwell et al. (2007) developed a series of eight weekly workshops for school children focused on teaching students the scientific basis under which intelligence and ability is malleable and the benefits of an incremental theory. This intervention was shown to have lasting effects on students' motivation and grade performance. In the future, transformational leadership might be seen as an alternative approach to fostering incremental beliefs indirectly, or as an approach which could be employed to supplement an incremental theories workshop. Intervention studies have shown that transformational leadership is a trainable behaviour but what remains unclear is which specific behaviours to train to target the development of incremental theories. Future studies might seek to develop a more fine-grained understanding of how specific behaviours related to implicit theories as this will have important implications for applied practitioners.

In the present thesis, the mediating role of implicit theories was examined specifically under circumstances where the participants are facing an ego-threat in the form of a simulated setback. It is theorised that it is under exactly these such ego-threatening circumstances that the differences between incremental and entity theorists will be most apparent, and there is some evidence to support this (Burnette et al., 2013). It is possible the pattern of results observed in Chapter 4 would have emerged so clearly under more generic circumstances. It is possible that presence or degree of ego-threat might moderate the relationship between transformational leadership and implicit theories, such that transformational leadership has a greater effect on implicit theories under ego-threatening scenarios. Findings speaking to such a question would have important implications for

practitioners as it would highlight opportunities where transformational leadership might be especially effective (e.g. in the face of setbacks). Indeed, forms of transformational leadership have been discussed as having a more important influence in crisis situations (Avolio et al., 2003; Bass 1998).

Applied Implications

Transformational Leadership and Research Supervision. One main finding drawn from this thesis is that supervisors' transformational leadership exerts a number of positive influences on students, both indirectly and directly at undergraduate and postgraduate levels. Therefore, transformational leadership represents a useful framework for the guidance of supervisors' leader behaviour that is likely to enhance students' outcomes both in terms of their well-being (e.g., psychological needs satisfaction), their engagement and their performance. Engagement with study is related to a number of other desirable outcomes for students including lecture attendance (Fowler & Zimitat, 2008), satisfaction (Zhao & Kuh, 2004), and academic success (Fenollar, Román, & Cuestas, 2007). In a landscape where universities are increasingly measured by the satisfaction and success of their students, transformational leadership represents a novel teaching and learning approach that can be used by supervisor's to increase their effectiveness. Furthermore, the results demonstrate the role of engagement as not only an (indirect) outcome of transformational leadership, but also one mechanism by which it exerts its influence on follower performance.

From an applied perspective, a greater understanding of the mechanisms underlying the effectiveness of transformational leadership in a theoretical sense can provide practitioners with more clarity regarding the functions and purpose of transformational leadership. It is posited that this may have two main benefits. First, it may encourage

practitioners to adopt (more) transformational leadership behaviours, perhaps more so than simple testaments to the effectiveness of this leadership style. A clearer understanding of how transformational leadership exerts its influence on follower outcomes presents a more compelling argument for its adoption. Second, it may enhance the effectiveness with which practitioners can employ transformational leadership, at least in terms of its effects on the proposed mediators. A grasp of the underpinning mechanisms may allow supervisors to direct their behaviour more specifically towards the aims of developing high quality relationships, satisfying needs and encouraging engagement. Future research examining the role of specific leader behaviours in predicting individual mediators may provide further elucidation of how supervisor's can tailor their leader behaviours towards them.

Previous research has demonstrated the applicability of transformational leadership to other aspects of higher education teaching such as face-to-face lecturing (Bolkan & Goodboy, 2009; Mawn, 2012) and online degree courses (Bogler et al., 2013). The findings of this thesis extend the existing literature by demonstrating the applicability of transformational leadership specifically to the context of research supervision. The importance of the supervisor in shaping the student experience has been emphasised in a number of works (Golde, 2000; Howitt et al., 2010; Ives & Rowley, 2005). Similarly, the role of the supervisor has been implicated as an important factor in addressing long-standing problems with PhD attrition rates (Golde, 2000). Transformational leadership represents a novel approach to provide guidance to supervisors in the form of research informed recommendations about best practices in research supervision.

There are existing resources available for the guidance of research supervisors. Most universities provide guidelines or a code of conduct that is made available to academic staff with supervision responsibilities that outlines the responsibilities of staff and sometimes students. Training for doctoral supervision might include workshops, mentoring, and

continual professional development and there exist a number of books on the topic (e.g. Wisker, 2012). Chiefly these resources provide guidance on the instrumental functions of the research supervisor. The position of transformational leadership as a framework for supervision is to complement these existing sources of guidance, not replace them. Without a sound basis in the understanding of the instrumental functions and responsibilities of the supervisor, transformational leadership is unlikely to be especially beneficial. In addition, there are existing research-informed models guiding research supervision practice. For example, Lee (2007) developed a conceptual model of supervision based on interviews with supervisors. This model, and others alike, are explanatory in nature, and are useful for extending the current understanding of supervision as researchers and practitioners. Transformational leadership stands apart from such models, as it is a behavioural framework of leadership, and can be employed to provide more direct, actionable feedback or as part of a programme of reflective practice with growing evidence to support its efficacy. A more comparable conceptual model developed by Mainhard, van der Rijst, van Tartwijk, and Wubbels, (2009) was used to describe aspects of supervisor-doctoral student interpersonal style, and is accompanied by a questionnaire for its measurement (questionnaire on supervisor-doctoral student interaction; QSDI). The QSDI and accompanying conceptual model differ from transformational leadership in at least two important ways. First, the substantial body of literature supporting the effects of transformational leadership arguably provides a more compelling foundation for such a model than that of the QSDI. Second, the QSDI is focused towards relationships and interactions, where as transformational leadership captures interactive components to some extent, but also emotional and motivational aspects of leadership. It would be interesting to examine the QSDI in combination with transformational leadership to explore the amount of crossover between these two independently theorised conceptualisation of supervisor behaviour.

Finally, in terms of resources available to supervisors this thesis makes one more contribution in the form of validated long (30-item) and short-form (7-item) scales for the measurement of transformational leadership. Both have potential for useful application in applied settings but might used for different purposes. The abbreviated scale provides a quick, simple measure that can be easily deployed to gain a snapshot measure of a supervisor own general transformational leadership, or could be used in a longitudinal manner to inform long term-professional development. It is better suited to longitudinal use than the long form as it would require students to complete multiple times which can be time consuming and repetitive. Meanwhile, the long form questionnaire would provide a better reflection of ratings on specific leader behaviours using a differentiated approach, which might prove more useful in the development of supervisors' leader behaviour. For example, it can be used to highlight areas of strength and weakness across the range of leader behaviours and provide more targeted feedback for development. Between the two scales a number of practical applications are provided for.

Limitations of the thesis

A major thrust of the thesis was to investigate the effects of transformational leadership in higher education, and as such the reliance on samples taken from student populations is wholly appropriate. However, the generalizability of the findings is limited due to the reliance on student samples. Earlier have noted a number of contextual factors specific to the higher education context that might influence the effectiveness of transformational leadership. For instance, it is acknowledged that the closeness of the working relationship between student and supervisor is likely to be closer than the typical manger-subordinate relationship in the workplace, and that this might result in a stronger effect of transformational leadership. Thus, while the findings have the potential for implications

outside of educational contexts, they must be considered in relation to the specific context and nature of the samples used.

A second potential limitation of the thesis concerns the re-use of data between chapters. Chapter 2 used a data set that combined the samples of Studies 2 and 3 from Chapter 3. Measurement analyses in Chapter 2 were used to guide the development of an abbreviated measure of transformational leadership that was subsequently employed in the mediation analyses of Chapter 3's Studies 2 and 3. As such, the fit statistics for the abbreviated transformational leadership measure reported in Studies 2 and 3 should be judged with a degree of caution, as the possibility of sample specific findings cannot be ruled out. That being said, the abbreviated scale maintained adequate psychometric properties when employed in an independent sample in Chapter 4.

A third consideration relates to adequate sample size and statistical power, with particular reference to studies 2 and 3. In these studies a reliability-adjusted manifest variable path analysis was employed it would have been preferable to employ a full structural equation model encompassing variables latent structures (as was conducted in chapter 4), but inadequate sample size prevented this. Adopting a manifest variable path model approach eases sample size requirements to achieve appropriate statistical power but is vulnerable to problems associated with measurement error. In line with recommendations by Cole and Preacher (2014), an error correction method was employed to ameliorate the effects of measurement error.

The fourth limitation concerns same source bias of the data employed in analyses. All of the studies in the thesis rely on the same source (i.e., the student) for the independent and a number of dependent variables. One method to address this would have been to attain some external ratings of the variables under investigation. However, in many instances, the only

source of the information for that variable is the participant themselves. For instance, an external rating of basic psychological needs satisfaction would not make sense. To avoid such concerns, in Chapter 3, the main dependent variable is an independently scored grade percentage, which is not susceptible so same source bias.

Finally, fifth, the studies in this thesis employed a global measurement approach to transformational leadership, and while this approach is considered appropriate in its application in the present work, some scholars would consider this a limitation. Had a fully differentiated approach been employed it would have greatly increased the complexity of some of the associated research questions. However, it remains that the global approach employed means that it is not possible to make recommendations about the role of specific leader behaviours and this limits the utility of the findings for applied purposes.

Strengths of the Thesis

One strength of the thesis is that it has has presented two new contextually relevant measures of transformational leadership for application in higher education research supervision to complement the existing measures validated for use in higher education but also extend the scope of transformational leadership research to supervision. As discussed in earlier sections, the existing literature on transformational leadership in higher education is in need of further measurement development and this thesis has helped to address this need. The combination of a global abbreviated scale and the full DTLI will be useful in a wide range of research and applied settings. A second strength is that the studies in the thesis have addressed higher-level research questions, both relative to the existing transformational leadership research in general, and that which exists in the higher education context. The investigation of mechanisms of transformational leadership is an on-going topic of research in the wider literature. This thesis has extended this research by integrating a number of

mechanisms under one explanatory model. In the HE literature, the majority of studies do not extend beyond the investigation of simple relationships. This thesis represents a development of this research from identifying correlates of instructor's transformational leadership, towards understanding the underpinning mechanisms of such effects.

A major strength of the thesis is the employment of advanced statistical techniques in addressing the research questions examined. Bi-factor measurement models have recently been rediscovered in the social sciences (Reise, 2012), but are not yet widely used. Nonetheless a bi-factor model was employed to examine the factor structure of the DTLI in more detail than is possible with conventional factor analytic techniques. It also represents the first such analysis conducted on a measure of transformational leadership, the findings of which extend the current understanding of the dimensionality of the construct. In addition the multi-level nature of the data was accounted for wherever possible by analysing the asymptotic within groups variance covariance matrix, in line with recommendations by Asparouhov and Muthen (2006). Although multi-level analysis represents a superior approach to addressing non-independence and was utilized when possible in Chapter 2's multi-level "abbreviated" CFA, it requires a larger group-level N of 100 or more (Hox, Moerbeek, & Schoot, 2010). Given the current smaller group level sample size the approach employed represents the next most favourable approach to addressing this problem; in fact, McNeish and Stapleton (2016) demonstrated that under some circumstances these methods are comparably as accurate as multi-level analysis. All factor analytic and structural equation models employed this approach excepting those in Chapter 4, where there was insufficient data about the groups to model this effectively. Furthermore, a balanced and rigorous approach to examination of model fit was employed throughout the thesis using guideline cut-off recommendations by Hu and Bentler (1999), utilising a range of statistics to judge model fit in line with recommendations by Bollen (1989).

Multiple-serial mediation analyses were employed in Chapter 3, first in a cross-sectional design and then replicated using a semi-longitudinal design to address concerns regarding common method bias (Podsakoff et al., 2003). In these analyses a simple path model was employed. This approach assumes that all variables are measured without measurement error. However, a reliability-adjusted error correction was implemented to minimise the effect of measurement error in these analyses. Finally a full latent structural equation model (SEM) was used in Chapter 4, also using bias-corrected bootstrap confidence intervals to examine indirect effects. While simple path models assume no measurement error, SEM accounts for measurement error by modelling the latent variable structure from the observed indicators. In addition, bootstrapping provides a confidence interval that is more robust to non-independence of observations and non-normality of data (Preacher & Hayes, 2008).

Finally, latent variable SEMs are less vulnerable to bias due to measurement error, and bootstrapping provides a confidence interval that is less biased by non-independence of observations and non-normally distributed data.

Future Research Directions

This section summarises some of the future research possibilities arising from the studies of the thesis.

1. As discussed, the studies of this thesis have largely adopted a global measurement perspective. Future research could employ differentiated approaches to explore some of the relationships highlighted in the thesis in greater depth. Specifically, it is not clear which aspects of transformational leadership may be most influential in

predicting outcomes such as high quality LMX relationships or implicit theories. Furthermore, differentiated approaches might also be used to examine complex questions such as the degree to which behaviours might interact to predict outcomes. Previous research had demonstrated the potential for such interactions in leader behaviours to exist (Vecchio, Justin, & Pearce, 2008). For example, intellectual stimulation might interact with individual consideration to predict engagement such that intellectual stimulation is more effective under conditions of high levels of individual consideration. In this way, the supportive effects of one behaviour might augment the challenging nature of another. Addressing questions such as these might provide more practically useful research implications for applied practitioners.

2. Related to the use of differentiated approaches in future research, the application of bi-factor models may enhance the clarity of the findings drawn from such studies. Ignoring the bi-factor structure of transformational leadership measures is likely to confound results to some degree when analysing subscale scores. In Chapter 2, it was demonstrated that, in the case of the DTLI at least, the subscales of transformational leadership are heavily reflective of general transformational leadership. Only a small portion of the variance in each subscale is reflective of the unique aspects of that subscale. Bi-factor models facilitate the estimation of the effect of a specific behaviour that is unique from general transformational leadership on some dependent variable *and the relative contribution of that unique effect*. This approach could provide a much more accurate reflection of which behaviours are most important in predicting specific outcomes. Chapter 2 examined leader inspired extra effort as a means to demonstrate the differential effects of the specific behaviours when controlling for general transformational leadership. Future studies should examine a

variety of behaviours in this manner, perhaps allowing comparison of the unique effects of behaviours across a range of outcomes.

3. This thesis has primarily conceptualised effects in terms of causative meditational processes, as that appears most consistent with the existing research and rationale presented. An alternative approach is to consider the role of contextual and situational moderators. For example, personality traits are likely to influence the way transformational leadership is interpreted and the subsequent behavioural response to that leadership. In the present context with a key focus on leader-follower relationships, follower attachment style might be an influential moderator. Attachment styles describe stable tendencies in how individuals relate to others that are formed in childhood through parental influences (Bowlby, 1969) and are usually differentiated into three distinct styles; avoidant, anxious and secure (Ainsworth, Blehar, Waters, & Wall, 1978). Attachment style influences the development of interpersonal relationships, and may subsequently influence the manner in which transformation leadership is interpreted by the follower.
4. The causal pathways proposed in the meditational models presented are theorised to take place over some significant period of time. While a longitudinal mediation model was employed in Chapter 3, future studies could make greater use of longitudinal designs to examine the temporal effects of transformational leadership. For example, how long does it take for transformational leaders to develop high quality LMX? Is the length of the relationship important in facilitating an incremental theory? Such research could make use of latent-growth curve modelling techniques in order to model the development of such relationships over time.
5. One primary finding of this thesis is that supervisors' transformational leadership was positively related with a number of student outcomes, either directly or indirectly, and

including grade performance in the dissertation. The impact of these findings is limited by the correlational and semi-longitudinal designs employed. While the findings of this thesis present some promising evidence for the effectiveness of transformational leadership, an experimental intervention study with a control group is required in order to infer causation. Such a study would require the development of a large-scale transformational leadership intervention targeted at contextually relevant transformational leader behaviours. As such, this might represent a somewhat distal future research direction, as it would benefit substantially from a more subtle understanding of the role of specific leader behaviours in this context. Nonetheless, an experimental study would present much more compelling evidence for the effectiveness of transformational leadership in the research supervision context.

6. This thesis puts forward some compelling evidence for the effectiveness of transformational leadership in research supervision, and extends the research that already exists which attests to its applicability in HE contexts. As briefly discussed above, there is also a case for the applicability of alternative, more follower-focused theories such as authentic and servant leadership, which share many components of transformational leadership. Future studies might examine the differential prediction of relevant educational outcomes such as student satisfaction, student well-being, learning and performance by transformational leadership and authentic of servant leadership. Further investigations might explore the differing (or similar) mechanisms of such leadership styles in educational contexts.

Conclusions

In conclusion, the thesis has investigated the measurement and mechanisms of transformational leadership in the context of HE research supervision. The studies contained

within provide some evidence for the applicability of transformational leadership to this new context, and some arguments for why it may be especially suited to it. The thesis has extended the existing research on transformational leadership in HE in a number of ways; by extending the study of leadership specifically to research supervision contexts, providing two contextually relevant measures of transformational leadership, and by presenting the first investigations the mechanisms of transformational leader effectiveness in this context. The findings support the notion that transformational leadership provides a novel approach for supervisors to enhance their effectiveness. Further, the more detailed understanding of mechanisms underpinning transformational leadership provided by this thesis will enable practitioners to employ transformational leadership more effectively.

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Appendices

Appendix A – Bi-factor Confirmatory Factor Analysis Results

Table 15. EBFA results of DTLI-HE measure with orthogonal target rotation

	Specific Factors																General Factor	
	Individual Consideration		Inspirational Motivation		Intellectual Stimulation		Appropriate Role Modelling		High Performance Expectations		Contingent Reward		Sense of Humour		Self Belief		TLB	
Items	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE
IC1	.24**	.05															.80**	.02
IC2	.25**	.05															.80**	.02
IC3	.40**	.07															.80**	.02
IM1			.05	.06													.68**	.03
IM2			.27**	.08													.65**	.03
IM3			.03	.06													.70**	.03
IM4			.22**	.06													.64**	.03
IM5			.28**	.07													.83**	.02
IS1					.08	.05											.85**	.02
IS2					.58**	.24											.74**	.02
IS3					.25**	.09											.73**	.02
ARM1							.36	.05									.59**	.03
ARM2							.15**	.03									.77**	.02
ARM3							.59	.06									.66**	.03
ARM4							.17**	.03									.81**	.02
ARM5							.18**	.03									.82**	.02
HPE1									.27**	.08							.77**	.02
HPE2									.54**	.16							.79**	.02
HPE3									.15*	.06							.53**	.03
HPE4									.11	.07							.45**	.04

CR1											.46**	.03					.82**	.02
CR2											.40**	.03					.83**	.02
CR3											.38**	.03					.78**	.02
	Individual Consideration		Inspirational Motivation		Intellectual Stimulation		Appropriate Role Modelling		High Performance Expectations		Contingent Reward		Sense of Humour		Self Belief		TLB	
	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE	λ	SE
SOH1													.68**	.02			.61**	.03
SOH2													.72**	.02			.56**	.03
SOH3													.69**	.02			.63**	.03
SOH4													.64**	.02			.60**	.03
SB1															.48**	.04	.68**	.03
SB2															.49**	.04	.77**	.02
SB3															.45**	.04	.70**	.03
Omega	.89		.85		.88		.90		.80		.93		.95		.89		.98	
OmegaH	.11		.11		.12		.12		.12		.19		.54		.28		.95	
Ratio	.12		.13		.13		.14		.15		.21		.56		.31		.97	

Note. λ = standardized factor loadings, SE = standard error. * = p<.05. **=p<.001. Ratio = OmegaH/Omega

Appendix B – Participant Information Sheet

Student Information Sheet

Bangor University School of Sport Health and Exercise Science (SSHES)

You are being invited to take part in a research study. Before you agree to take part it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully.

Background of the study:

This research is investigating student-supervisor relationships and how these affect important outcomes for students such as motivation and final grades. The research will help to inform lecturers on how to foster effective working relationships with their research project and dissertation students, which will have knock on benefits for students like you in the form of improved research supervision.

Do I have to take part?

Participation is entirely voluntary. Choosing not to participate will not affect your grades or your standing with your supervisor. You have the right to withdraw from the study at any time without giving a reason.

What will happen to me if I take part?

You will be asked to complete a questionnaire, with questions relating to your supervisor's leader behaviours, your working relationship with your supervisor, and your engagement with your research project work. The questionnaire will take 10-15 minutes to complete. We also request permission to access your module grade for your research project when the module is complete, but you can opt out of this on the consent form if you wish. After completion of your research project, you'll be asked to complete a second questionnaire.

The possible benefits of taking part:

It is very important for students like yourselves to be involved in research like this so we can continue to improve the quality of provision, not only at your University, but also for students on a wider scale. The findings will enable us to better understand the relationships between relationship quality and important student outcomes such as engagement, and how these quality relationships are developed.

Confidentiality

All results are recorded anonymously; names are only used for data collection and collation purposes. Data will not be recorded with any identifiers of the institution from which the data were sourced. Only the PhD researcher will have access to the raw data.

Who has reviewed the study?

The Ethics Committee of Bangor University's School of Sport, Health and Exercise Sciences (SSHES) have reviewed the study.

Any Questions?

Please ask us if you have any questions. You can contact the PhD researcher at p.tomsett@bangor.ac.uk. You should not sign the form consenting to take part in the study if you still have unanswered questions or any doubts.

Appendix C – Differentiated Transformational Leadership Inventory for Higher Education – Full format

Section 1

The questions in this section are about your supervisor's behaviour. Please answer the following questions in relation to the primary supervisor named earlier, indicating how often your supervisor does each of these things using the scale provided.

		Never	Rarely	Occasionally	Sometimes	Fairly Often	Very often	Always
1.	Uses humour in tutorials	1	2	3	4	5	6	7
2.	Acts confidently	1	2	3	4	5	6	7
3.	Provides examples of people for me to learn from	1	2	3	4	5	6	7
4.	Shows me that s/he cares about me	1	2	3	4	5	6	7
5.	Shows me how my work relates to the real world	1	2	3	4	5	6	7
6.	Tells me that they want me to do really well	1	2	3	4	5	6	7
7.	Breaks down complex ideas for me	1	2	3	4	5	6	7
8.	Gives me recognition when I do good work	1	2	3	4	5	6	7
9.	Sets an example for me to copy by working hard	1	2	3	4	5	6	7
10.	Makes jokes during tutorials	1	2	3	4	5	6	7
11.	Helps me if I have difficulties	1	2	3	4	5	6	7

		Never	Rarely	Occasionally	Sometimes	Fairly Often	Very often	Always
12.	Tells me to do my best	1	2	3	4	5	6	7
13.	Gives me praise when I do something well	1	2	3	4	5	6	7
14.	Talks enthusiastically about what my future career could be like	1	2	3	4	5	6	7
15.	Conducts tutorials in a confident manner	1	2	3	4	5	6	7
16.	Gives me an example of somebody that I can learn from	1	2	3	4	5	6	7
17.	Challenges me to come up with new ideas	1	2	3	4	5	6	7
18.	Personally praises me when I do outstanding work	1	2	3	4	5	6	7
19.	Role models what is possible for me	1	2	3	4	5	6	7
20.	Explains why seemingly dull work is necessary	1	2	3	4	5	6	7
21.	Is considerate towards me	1	2	3	4	5	6	7
22.	Integrates humour into tutorials	1	2	3	4	5	6	7
23.	Tells me I need to improve further	1	2	3	4	5	6	7
24.	Demonstrates confidence in their subject	1	2	3	4	5	6	7

		Never	Rarely	Occasionally	Sometimes	Fairly Often	Very often	Always
25.	Tells me inspirational stories	1	2	3	4	5	6	7
26.	Tries to make me laugh in tutorials	1	2	3	4	5	6	7
27.	Sets an example for me to follow	1	2	3	4	5	6	7
28.	Communicates an exciting vision that I can achieve	1	2	3	4	5	6	7
29.	Asks me questions that make me think	1	2	3	4	5	6	7
30.	Tells me that s/he expects me to achieve a first	1	2	3	4	5	6	7

Appendix D – Leader Member Exchange Scale

Section 2

The questions in this section are about your relationship with your supervisor. Please rate the extent to which you agree with the following statements using the scale provided.

		Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
1.	I like my supervisor very much as a person	1	2	3	4	5	6	7
2.	My supervisor is the kind of person one would like to have as a friend	1	2	3	4	5	6	7
3.	My supervisor is a lot of fun to work with	1	2	3	4	5	6	7
4.	My supervisor would defend my work actions to a superior even without complete knowledge of the issue in question	1	2	3	4	5	6	7
5.	My supervisor would come to my defence if I were "attacked" by others	1	2	3	4	5	6	7
6.	My supervisor would defend me to others in the organisation if I made an honest mistake	1	2	3	4	5	6	7

		Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
7.	I do work for my supervisor that goes beyond what is expected	1	2	3	4	5	6	7
8.	I am willing to apply extra efforts, beyond those normally required to meet my supervisors project goals	1	2	3	4	5	6	7
9.	I do not mind working my hardest for my supervisor	1	2	3	4	5	6	7
10.	I am impressed with my supervisors knowledge of his/her research area	1	2	3	4	5	6	7
11.	I respect my supervisor's knowledge and competence in their research area	1	2	3	4	5	6	7
12	I admire my supervisor's professional skills	1	2	3	4	5	6	7

Appendix E – Basic Psychological Needs Satisfaction Scale

These questions relate to how you feel about working on your research project/dissertation. Rate how true each of the following statements is about you, using the scale provided.

		Very Untrue	Untrue	Somewhat True	Neutral	Somewhat True	True	Very True
1.	I feel like I have a lot of input into how my project is completed	1	2	3	4	5	6	7
2.	I really like my supervisor	1	2	3	4	5	6	7
3.	I do not feel very competent when I am working on my project	1	2	3	4	5	6	7
4.	My supervisor tells me I am good at what I do.	1	2	3	4	5	6	7
5.	In my project work I feel forced to do things I do not want to do	1	2	3	4	5	6	7
6.	I get along with my supervisor	1	2	3	4	5	6	7
7.	I pretty much keep to myself when I am working on my project	1	2	3	4	5	6	7
8.	I am free to express my ideas and opinions about my project to my supervisor	1	2	3	4	5	6	7
9.	I consider my supervisor to be my friend	1	2	3	4	5	6	7
10.	I have been able to learn interesting new skills whilst working on my project	1	2	3	4	5	6	7

11.	When I am doing my project/dissertation work I have to do what I am told	1	2	3	4	5	6	7
		Very Untrue	Untrue	Somewhat True	Neutral	Somewhat True	True	Very True
12.	Most days I feel a sense of accomplishment from working on my project	1	2	3	4	5	6	7
13.	In my project work, I feel I am doing what I want to be doing	1	2	3	4	5	6	7
14.	When working on my project I do not get much of a chance to show how capable I am.	1	2	3	4	5	6	7
15.	My supervisor cares about me.	1	2	3	4	5	6	7
16.	There are not many people at work that I am close to.	1	2	3	4	5	6	7
17.	I feel like I can pretty much be myself in tutorials	1	2	3	4	5	6	7
18.	My supervisor does not seem to like me much.	1	2	3	4	5	6	7
19.	When I am working on my project I often do not feel very capable.	1	2	3	4	5	6	7
20.	There is not much opportunity for me to decide for myself how to go about my work.	1	2	3	4	5	6	7
21	My supervisor is friendly towards me	1	2	3	4	5	6	7

Appendix F - Engagement

This final section contains questions relating to your engagement with your research project/dissertation work. Please answer the questions as accurately and truthfully as you can.

	During the last month, how often do you feel have you done the following?					
		Never	Rarely	Sometimes	Often	Very Often
1	Discussed your project ideas with others e.g. peers, family, staff	1	2	3	4	5
2	Explained important concepts to students working on similar projects to me	1	2	3	4	5
3	Actively carried on working longer than originally intended	1	2	3	4	5
4	Thought about project work at times other than while working on it	1	2	3	4	5
5	Prioritised project work at the expense of social commitments or leisure time	1	2	3	4	5
6	Used feedback from my supervisor(s) or peers to improve my research project work	1	2	3	4	5
7	Approached my supervisor for help	1	2	3	4	5
8	Come to tutorials well prepared	1	2	3	4	5
9	Planned your hobbies or leisure time around your project work	1	2	3	4	5

	How much have your experiences in your research project/dissertation **over the last month** contributed to your knowledge and development in the following areas?					
		Not at all	Very little	A moderate amount	Quite a bit	Very Much
10	Writing clearly and effectively	1	2	3	4	5
11	Thinking critically and analytically	1	2	3	4	5
12	Interpreting research findings from studies	1	2	3	4	5
13	Applying literature and theory to drive a research question or hypothesis	1	2	3	4	5
14	Developing an in-depth knowledge of the research area	1	2	3	4	5

18	**In the last month**, how many e-mails have you sent to your supervisor regarding your research project/dissertation?	……
19	**In the last month**, how many meetings have you had with your supervisor?	……..

20	**In the last month**, how well do you feel you have managed your time on your research project/dissertation?	Very Poorly	Poorly	Neither Poorly nor Well	Quite Well	Very Well

22	**In a typical week over the last month**, how many readings did you complete for your research project dissertation.	None	1-2	3-4	4-5	5+

23	**In a typical week over the last month**, how many days per week have you worked on your research project?	0	1 to 2 days	3-4 days	5-6 days	Every day

21	**In a typical week over the last month**, how many hours a week have you worked on your research project?	**0**	**1-10**	**11-20**	**21-30**	**31-40**	**41-50**	**50+**

Appendix G – Items and factor structure of revised engagement measure

Table 3. Items and factor structure of revised engagement measure

	Frequency (Internal)	Frequency (External)	Contribution (quality of effort)	Time-on-Task
Root question	Over the last month how often do you feel you've done the following?		How much have your experiences in your research project **over the last month** contributed to your knowledge and development in the following areas?	In a typical week over the last month…
Items	Actively carried on working longer than originally intended	Used feedback from my supervisor(s) or peers to improve my research project work	Writing clearly and effectively	How many hours a week have you worked on your research project?
	Thought about project work at times other than while working on it	Approached my supervisor for help	Thinking critically and analytically	How many readings did you complete for your research project dissertation.
	Prioritised project work at the expense of social commitments or leisure time	Come to tutorials well prepared	Interpreting research findings from studies	How many days per week have you worked on your research project?
	Planned your hobbies or leisure time around your project work		Applying literature and theory to drive a research question or hypothesis	
			Developing an in-depth knowledge of the research area	

Appendix H – Implicit beliefs scale

This questionnaire has been designed to investigate people's ideas about ability. There are no right or wrong answers. We are interested in your ideas. Using the scale below, please indicate the extent to which you agree or disagree with the following statements by ticking the number that best represents your response. Please read each statement carefully.

		Strongly Agree	Agree	Mostly Agree	Mostly Disagree	Disagree	Strongly Disagree
1	No matter who you are, you can significantly change your ability to be a successful PhD student	1	2	3	4	5	6
2	You can always substantially change your ability to be a successful PhD student	1	2	3	4	5	6
3	To be honest, you can't really change your ability to be a successful PhD student	1	2	3	4	5	6
4	You have a certain level of ability to be a successful PhD student, and you can't really do much to change that level	1	2	3	4	5	6
5	Your ability to be a successful PhD student is something about you that you can't change very much	1	2	3	4	5	6
6	You can learn new things, but you can't change your basic ability to be a successful PhD student	1	2	3	4	5	6
7	No matter what your ability to be a successful PhD student, you can always change it quite a bit	1	2	3	4	5	6

Appendix I – Coping Scale Items

	What follows is a list of behaviours you might engage in following a significant setback, challenge or period of stress. Imagining the scenario you have just read. Indicate how often you would engage in the following behaviours if you were in that scenario, immediately following that event.				
		I would not do this at all			I would do this a lot
1	I would re-live the problem by dwelling on it all the time	1	2	3	4
2	I would brood over my problem nonstop	1	2	3	4
3	I would blame myself	1	2	3	4
4	I would do what has to be done, one step at a time	1	2	3	4
5	I would criticise or lecture myself	1	2	3	4
6	I would take additional action to try and get rid of the problem	1	2	3	4
7	I would see that I am the root of the problem	1	2	3	4
8	I would realise I brought the problem on myself	1	2	3	4
9	I would think hard about what steps to take	1	2	3	4
10	I would try hard to prevent other things from interfering with my efforts at dealing with this	1	2	3	4
11	I would return in my head, again and again to what is troubling me	1	2	3	4
12	I would take direct action to get around the problem	1	2	3	4
13	I would concentrate my efforts on doing something about it	1	2	3	4
14	I would just think about my problem constantly	1	2	3	4
15	I would try to come up with a strategy about what to do	1	2	3	4
16	I would make a plan of action	1	2	3	4

Appendix J – Simulated failure scenario script

Imagine yourself in the situation described below. Please take time to carefully read the description. You will be presented with a series of questions relating to this scenario.

Imagine you are a PhD student approaching the end of the time available for your PhD. You work in a high performing, research driven school where it is common for students to submit a research article to a journal before submitting their thesis. Over the recent months you have been most heavily invested in preparing a research manuscript for submission to a journal. This is the culmination of a long process which has occupied you for the last year or so, from the conception of the associated research question and clarifying the study design, through a long period of data collection, and analysis.

The preparation of the manuscript took many weeks of work, requiring many drafts and redrafts of each section until you had perfectively crafted each and every sentence. You have lived and breathed the contents of this manuscript for the last 12 weeks, working longer hours than normal, sometimes late into the night, in order to meet your own exacting standards. The process of preparing this manuscript has been so long that you almost cannot wait for it to be over. Because of your painstaking efforts, you are confident that the manuscript will be accepted. You are particularly proud of the quality of your scholarly language, and the fact that it represents an original and valuable contribution to the research literature.

Today is the day you receive your feedback from the journal regarding your manuscript submission. You open the e-mail from the editors and your heart sinks as you immediately see that your manuscript has been rejected. You proceed to read the reviewers comments only to discover that the areas in which you were most confident have in fact attracted the greatest criticism. One reviewer

describes your work as "derivative" and "unoriginal", claiming that you have merely replicated existing research findings, while another blasts your "scrappy" written language.

Take a moment to imagine this scenario happening to you as best you can. Imagine the emotions you would feel, and how you would behave following this event. Once you have taken some time to do this, move on to the next section.

Appendix H – Consent Form

1	Title of project	Student Supervisor Relationships and Student Engagement
2	Name and e-mail address(es) of all researcher(s)	Peter Tomsett – peua62@bangor.ac.uk Supervisors: Nichola Callow n.callow@bangor.ac.uk James Hardy j.t.hardy@bangor.ac.uk Calum Arthur calum.arthur@stir.ac.uk

Please tick boxes

- I confirm that I have read and understand the Information Sheet dated ……. for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

- I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason. If I do decide to withdraw I understand that it will have no influence on the marks I receive, the outcome of my period of study, or my standing with my supervisor or with other staff members of the School.

- I understand that I may register any complaint I might have about this experiment with the Head of the School of Sport, Health and Exercise Sciences, and that I will be offered the opportunity of providing feedback on the experiment using the standard report forms.

- I agree to take part in the above study. ☐

Name of Participant …….

Signature ……. Date ……..

Name of Person taking consent…….

Signature ……. Date ……..

Appendix I

PRIFYSGOL BANGOR UNIVERSITY

Information Sheet

Title of project: Supervisor Leader Behaviours and PhD Students' Implicit Beliefs of Ability

You are being invited to take part in a research study. Before you agree to take part it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully.

The research team for this study consists of Prof Nichola Callow, Dr James Hardy, Dr Calum Arthur and Peter Tomsett. If you have any problems completing this survey please contact Peter Tomsett at p.tomsett@bangor.ac.uk.

Background of the study:

This research is investigating how research supervisors may influence students' beliefs about ability and the ways in which students cope with set-backs.

Do I have to take part?

Participation is entirely voluntary. Choosing not to participate will not affect your standing with your institution or with your supervisor. You have the right to withdraw from the study at any time without giving a reason.

What will happen to me if I take part?

You will be presented with a series of questionnaires asking you questions about your supervisor's leader behaviours, your beliefs about ability, your engagement with your PhD work, your feelings of competence in your PhD work, how you cope with setbacks, and your feelings of self-worth after a setback or failure. All the information collected in this study will be strictly confidential; your supervisors will not see your responses.

The possible benefits of taking part:

The findings of the research will help researchers to understand some of the mechanisms underpinning effective forms of research supervision. Research findings will inform best practice for academic research supervisors in the future.

Confidentiality

All results will be recorded anonymously; names are collected in this questionnaire, but they are used for data collection and collation purposes only and will be removed at the earliest viable stage of data analysis. Identifiers of participants institution will also be removed at the earliest opportunity, these data are collected so we can group participants from the same institution, and not to draw comparisons. Only the research team will have access to the study data.

Who has reviewed the study?

The study has been reviewed and by the Ethics Committee of Bangor University's School of Sport, Health and Exercise Sciences (SSHES).

Feedback on Conduct of Research

SSHES is keen to hear the views of research participants about their experience. If you would like to feedback, please ask your researcher to provide you with a Participant Feedback Form. The completed form should be returned to Prof Andrew Lemmey, Chair, SSHES Ethics Committee, SSHES, Bangor University, Bangor, Wales, UK, LL57 2PZ. All information will be treated in a strictly confidential manner.

Any Questions?

If you have any questions, you can contact the PhD researcher at p.tomsett@bangor.ac.uk before you start. You should not sign the form consenting to take part in the study if you still have unanswered questions or any doubts.

This research is conducted as part of a Higher Education Academy funded PhD.

THE END