The fallacy of one-dimensional theory of planned behaviour structure in predicting health behaviour

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Abstract: Most research on exercise is dominated in the West. Drawing on a socio-cognitive theory, this research aims at addressing methodological issues in an Eastern culture where recent developments of the theory of planned behaviour (TPB) applications have been limited. To answer the call for reinterpretation of the TPB measurement, we propose and test a more complex factor structure of TPB predictors. Cross-sectional data was collected from a quota sample of 512 adults in Malaysia. This study provides an empirical validation that the multidimensional, first-order model has achieved measurement validity and possesses better fit compared to the global, second-order TPB structure. Our investigation of the specific effects of social cognitive components on exercise intention and behaviour also improves the understanding of this theoretical relationship.

Keywords: exercise; health promotion; theory of planned behaviour; TPB; social cognition; health behaviour.
The fallacy of one-dimensional theory of planned behaviour structure


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1 Introduction

Substantial research has clearly supported the role of exercise in promoting psychological health, physical health and social well-being (Hastings, 2002). Beyond individual health benefits results from regular exercise, corporate and eventually the community as a whole benefited as well. Corporations start to implement different form of wellness programme to promote physical fitness and health among employees. These wellness programmes not only lower health insurance costs, but also help to increase employee morale, job satisfaction, and productivity in the long run (Pate and Blair, 1983). At community level, regular exercise leads to an overall decreased in medical and health care costs. However, persuading individuals to perform regular exercise and to commit to an exercise regime represents a major challenge for health professionals. Therefore, the development of a sound and comprehensive theoretical model of exercise is essential for successful implementation of intervention strategies (Baranowski et al., 1998).

Several behavioural change models such as the health belief model (HBM), protection motivation theory (PMT), theory of reasoned action (TRA) and theory of planned behaviour (TPB), self-efficacy theory, self-determination theory, transtheoretical model (TTM) have been popularly examined. In comparing TPB with TTM, Courneya and Bobick (2000) argue that the TPB is a more comprehensive model for explaining health behaviours. In a thorough review of the theories of exercise behaviour, Biddle and
Nigg (2000) conclude that the application of the HBM model has yielded little success in predicting exercise behaviour. While the use of PMT in exercise context is relatively few (Biddle and Nigg, 2000), PMT is limited in explaining an individual’s actual behaviour (Floyd et al., 2000). Notably, Ajzen’s TPB represents one of the leading theoretical models that have offered the basis for successful health behavioural change campaign (Armitage and Christian, 2003). In agreement with this argument, Rhodes et al. (2002) assert that the TPB is the most validated social cognitive framework for explaining exercise behaviour.

We acknowledge the potential for employing social cognitive models to ground research in the area of health. As noted earlier, an influential social cognitive model frequently used to explain health behaviour is the TPB (Ajzen, 1991). While the TPB has been extensively studied in the exercise domain, several methodological issues deserve of concerted research efforts. Indeed, recent research has called for reinterpretation of the TPB measurement (Courneya et al., 2006). The central focus of our study is to propose and test a more complex factor structure of TPB predictors. Ultimately, we hope to determine an effective framework that can potentially aid health professional, government, and other policy agencies to persuade consumers to engage in exercise.

2 Literature review

The TPB stems from the TRA with the addition of perceived behavioural control (PBC) which aimed to improve the predictive capabilities of TRA, particularly for explaining behaviours that are not under one’s volitional control (Fishbein and Ajzen, 1975). The TPB model posits that behavioural intention is the immediate antecedent of actual behaviour (Ajzen, 1991). Intention is determined by three conceptually independent TPB predictors (also term as social cognitive factors) labelled as attitude, subjective norms and PBC (Ajzen, 1991). That is, individuals are more likely to perform a given behaviour if:

a they believe that the behaviour will lead to beneficial or desirable outcomes
b the important others in one’s social environment whose views they value think they should behave in a certain way
c they perceive that they possess the necessary resources and opportunities to perform the behaviour (Ajzen, 2002).

The next section reviews the conceptual development of each TPB predictor.

- **Attitude:** As a core construct in the TPB studies, the theory will be rejected if attitude does not predict intention (Ajzen, 1991). Hence, the conceptualisation of attitude construct becomes an important issue in TPB research. Attitude is traditionally measured as a single concept (Ajzen, 2001). The guideline developed by Ajzen for eliciting the behavioural beliefs which involves questions pertaining to the advantages and disadvantages of performing a given behaviour focuses on the instrumental rather than affective aspect of attitude (Lawton et al., 2007).

However, there is an emerging consensus that the attitude construct should consist of affective (e.g., the enjoyment or pleasure associated with exercising) and instrumental (e.g., the perceived benefits resulting from exercising) components (Hagger and Chatzisarantis, 2005). For instance, Trafimow and Sheeran (1998)
found that instrumental and affective attitude have differential effect in the prediction of smoking behaviour. More recently, in their studies of driving above speed limit and smoking, Lawton et al. (2007) found that affective beliefs has greater contribution to the prediction of behavioural intentions as compared to instrumental. However, as these studies focus on risky health behaviour, the relative importance of these attitude components may differ when more positive health behaviour such as regular exercise is examined.

Most past studies that investigate the conceptual distinction of the attitude components have relied on factor analyses and experimental studies (Rhodes and Courneya, 2003b). In addition, there have been fewer attempts in comparing the predictive ability of these two attitude components on exercise intention and behaviour (Rhodes et al., 2006). Furthermore, Kraft et al. (2005) argue that the perceived difficulty measures (which captured in Ajzen’s original operational definition of PBC) overlapped substantially with the affective attitude measures. Grandon et al. (2011) advocate that future research regarding measurement issues should focus on determining the factor structure of the attitude components of the TPB.

- **Subjective norm**: In the case of exercise engagement, subjective norm reflects individual perceptions of whether participating in exercise are approved, encouraged, and implemented by one’s circle of influence. The original conceptualisation of subjective norm which captures merely the injunctive norm component (e.g., the perception of whether people in one’s social network want them to exercise) has been weak in predicting behaviour, and has received criticism due to its narrow conceptualisation (Terry and Hogg, 1996). For instance, in their meta-analysis, Armitage and Conner (2001) report that correlation for the subjective norm-intention link is significantly weaker compared to the paths between attitude, PBC and intention. Particularly, Hausenblas et al. (1997) found a mean correlation of only .27 between subjective norm and intention in their meta-analysis of 30 studies on exercise behaviour.

In response to these research outcomes, Ajzen (2001) suggests the addition of descriptive norm (e.g., whether one’s social network engage in regular exercise) in view of the relatively weak predictive ability and potential high social desirability of the original conceptualisation of the subjective norm construct. In the exercise domain, Rhodes et al. (2006) found that both injunctive norm and descriptive norm did not predict exercise intention significantly while Courneya et al. (2006) report that descriptive norm has a more salient role in predicting exercise behaviour compared to injunctive norm. It is worth noting that these studies gathered data from undergraduate students, the finding may have been different if a different sample is employed. Although there are growing empirical supports for the addition of descriptive norm, these studies have focused on the measurement distinction between injunctive and descriptive norm (Hagger and Chatzisarantis, 2005). Our study takes one step further to investigate the relative predictive efficacy of these two subjective norm components on exercise intention and behaviour using a different sampling.

- **PBC**: PBC is regarded as the most controversial TPB predictor due to the inconsistent empirical findings and disagreement regarding PBC’s conceptualisation.
Some early TPB studies have identified low reliability problem associated with the one-dimensional PBC construct which reflects a person’s beliefs as to how easy or difficult performance of the behaviour is likely to be (Conner and Armitage, 1998). According to Ajzen and Madden (1986), PBC is the beliefs about the presence of internal (e.g., skills, abilities, power of will) and external factors (e.g., time, opportunity) that may facilitate or inhibit the performance of a behaviour.

However, some scholars argue that PBC should reflect only the external control factors that constrain the engagement of a given behaviour, and that “the notions of self-efficacy and PBC should be incorporated into the theory of planned behaviour as separate variables” [Terry and O’Leary, (1995), p.216]. Terry and colleagues based their arguments on the empirical findings that Bandura’s (1977) notion of self-efficacy (but not PBC measures) predicted behavioural intention in the context of exercise (Terry and O’Leary, 1995) and condom use (White et al., 1994). More recently, Trafimow et al. (2002) identify PBC to comprise of both personal control over behaviour and perceived difficulty using exploratory factor analysis (EFA).

Although the aforementioned studies illuminate the multidimensional view that PBC may comprise of perceived control (e.g., subject’ means and resources to exert control over exercising) and self-efficacy (e.g., subjects’ capability and self confidence in exercising), the conceptual distinctions between self-efficacy and perceived control remain unclear. Despite that Ajzen (2002) has since named the PBC components as self-efficacy and controllability, and yet he argues that these components have no differential impact upon intention and actual behaviour. Indeed, both self-efficacy and perceived control have been labelled with different terms by different authors. For instance, while Kraft et al. (2005) found PBC to compose of three components (i.e., perceived difficulty, perceived confidence, and perceived control), Tarkiainen and Sundqvist (2005) model PBC as importance of price and perception of availability in the organic food purchase context.

Other synonymous terms that reflect the concept of self-efficacy has also been suggested by health scholars such as ‘ease/difficulty’ or ‘perceived difficulty’ (Sparks et al., 1997) and ‘internal control’ (Armitage and Conner, 1999a). Similarly, the control factor has been referred to as ‘controllability’ (Rhodes and Courneya, 2003a), ‘perceived control’ (Sparks et al., 1997), ‘external control’ (Armitage and Conner, 1999a), and ‘locus of control’ (Armitage and Conner, 1999b). In summary, PBC deserves attention especially the controversies concerning the dimensionality and how PBC components relate to exercise intention and behaviour. To date, there have been relatively few attempts that examine the measurement distinctions for the complete TPB model. We provide a more comprehensive view with regards to the dimensional structure of the three main TPB predictors by employing a more robust statistical technique.

2.1 Multidimensional, first-order versus global, second-order TPB structure

Despite acknowledging that each TPB predictor consists of two conceptually distinct sub-components, Ajzen aggregates them to form a second-order TPB structure. However, Rhodes et al. (2006) argue that this second-order structure may overlook the variation in the predictive ability of these differentiated TPB components on the behaviour
investigated, and hence it defeats the purpose of differentiating them in the first place. Furthermore, global estimates of TPB components at second-order do not allow much precision in showing the relative impact of specific components on behavioural intention.

Most of the research addressing TPB measurement issues has been focusing on demonstrating the measurement distinctiveness of the differentiated TPB components. However, prior work overlooks the examination of, for instance, whether a second-order attitude construct operationally characterises attitude better or should it be modelled as two distinct components of instrumental and affective attitude at first-order. Among the limited studies testing the dimensional structure of the TPB, mixed findings were found. For instance, Rhodes and Blanchard (2006) support the first-order, multidimensional TPB structure, whilst Hagger and Chatzisarantis (2005) found no substantial differences in the fit indices across the first and second-order of the TPB model. Clearly, further research to provide more solid empirical evidence regarding the optimal TPB measurement is warranted.

Although the TPB has demonstrated impactful utility in health behavioural research, but several considerations appear noteworthy. The first research issue concerns the mixed findings relating to the measurement of multidimensional, first-order in comparison to global, second-order TPB structure. The second issue relates to the predictive efficacy of alternative TPB structure. Although the multidimensional TPB structure has somehow achieved confirmatory support (Hagger and Chatzisarantis, 2005; Rhodes and Blanchard, 2006); however, the relative predictive ability of these distinctive TPB sub-components on exercise intention and behaviour is relatively unknown.

Thirdly, the methods that earlier TPB studies adopted have weaknesses for their reliance on convenience and homogeneous groups such as patients (Rhodes and Courneya, 2003b), adult women (Goodwin and Hill, 1999), children (Oliver et al., 2011) and mainly student-based samples (Hoyt et al., 2009). Lastly, most of the previous studies that address TPB measurement issue have utilised the traditional approach for data analysis such as factor analysis. A more superior analytical tool like structural equation modelling (SEM) should be employed as it allows for model comparisons and structural estimation that is free of measurement errors.

Past TPB studies in the health literature have their focus on the direct relationships between these social cognitive constructs (e.g., Hong et al., 2010; Lee et al., 2010). There has also been overemphasis on socio-demographic factors in the TPB research (Park et al., 2009). In this study, we take a different approach by addressing methodological issues in an Eastern culture where recent developments of the TPB applications have been limited. Particularly, we aim to examine the measurement validity and predictive efficacy of the global, second-order in comparison to the multidimensional, first-order of the augmented version of TPB structure.

Based on Rhodes and Blanchard’s (2006) work, it is hypothesised that:

1. the multidimensional, first-order extended TPB structure will achieve both convergent and discriminant validity

2. a measurement model comprising multidimensional, first-order inter-correlated latent constructs of TPB (i.e., instrumental attitude, affective attitude, injunctive norm, descriptive norm, perceived control, self-efficacy, behavioural intention, and behaviour) will achieve a better model fit compared with the global, second-order structure
the multidimensional, first-order structural model will achieve better model fit when compared with the global, second-order TPB structure (see Figure 1)

each of the TPB sub-components has a positive effect on exercise intention, and perceived control and self-efficacy influence exercise behaviour positively.

Figure 1  Multidimensional, first-order versus global, second-order TPB structure

3  Methods

This section provides a description of the research instrument design, sampling plan, data collection technique, and analysis procedures. The study was carried out by using survey approach.

3.1  Research instrument

The questionnaire was translated from English into the Malay and Chinese language using back-to-back translation method. All items were adapted from previously published work with proven psychometric quality and were assessed on a 7-point Likert-type scale. Items measuring attitude and PBC components were adapted from Hagger and Chatzisarantis (2005) and Rhodes and Courneya (2003b) whereas items measuring subjective norm components were taken from Hagger and Chatzisarantis (2005). The measure of exercise behaviour was based on previous validated research instrument – the Godin leisure time exercise questionnaire (GLTEQ) (Godin and Shephard, 1985), a simple, self-administered, validated, and reliable measure. The questionnaires were
pre-tested using a sample size of 30 general adults (i.e., faculty members, undergraduate and post-graduate students). Participants were asked to complete the GLTEQ which composed of three self-report items assessing the weekly frequency of strenuous, moderate, and mild levels of exercise during leisure time for periods of 15 minutes on an open scale. Based on predefined metabolic units (METs), a composite score was computed to measure exercise behaviour (Godin and Shephard, 1985). The questionnaires were pre-tested using a sample size of 30 general adults (i.e., faculty members, undergraduate and post-graduate students). Several corrections and modifications were made in terms of the wording, presentation and structure of the questionnaire. Respondents who had participated in the pre-tests were not included in the main study.

3.2 Subjects and sampling procedure

Participants for the present study were adults aged above 18 recruited by student helpers. Subjects were considered qualified if they reported performing exercise activities at least once a week during leisure time for at least 15 minutes in duration each time for the last 3 months. To provide an adequate level of confidence in this study, a sample size of 600 respondents was targeted. Quota sampling (based on gender and ethnicity) was employed to ensure proportionate inclusion of various subgroups in the sample. Based on the composition of the total population of Malaysia, the study set a 50–50 quota for gender, 50–30–20 quota for ethnic groups (Malay, Chinese, and Indian). The Indian group was set higher at 20% compared to the national census of 10% in order to capture an adequate number of Indian respondents. Quota sampling is deemed appropriate since this study aims at deriving theoretical generalisability of the integrated model as opposed to population generalisability (Calder et al., 1982).

3.3 Data collection method

Data were collected from the subjects using personally administered questionnaires. A total of 120 student helpers were employed from several colleges and universities to assist in the data collection process. The student helpers were trained to collect data from various sources of respondents such as peers, neighbours, and relatives recruited through their informal contact. Each student helper was given 10 sets of questionnaires and they were instructed to collect data from various sources of respondents such as peers, neighbours, and relatives recruited through informal contact. A briefing on the research purposes, objectives, and procedures was provided to student helpers prior to data collection. The present researcher also appointed one lecturer from each college or university to facilitate the data collection process. As a token of appreciation for their assistance, a small gift was given to each student helper.

3.4 Common method variance

This study obtained the measures of both exogenous and endogenous constructs from the same source using a cross-sectional design. Since attitude, behavioural intention and behaviour tend to be highly correlated when measured in the same survey, we acknowledge the possibility of common method bias, which may have inflated the
relationships observed between the pair of constructs. Several precautions were taken to verify common method variance, for example, the measurement items were carefully selected to ensure ease of comprehension and the length of the questionnaire was limited to 15–20 minutes to avoid fatigue; respondents were assured of anonymity and encouraged to provide honest answers. Furthermore, the order of questions posed in the instrument was counterbalanced in order to control for priming effects and other potential response bias (Podsakoff et al., 2003).

However, these procedural remedies could not completely eliminate common method bias. Therefore, common method variance was tested using Harman’s single-factor test (Podsakoff et al., 2003). A principal components factor analysis with varimax rotation on all self-report items revealed a nine-factor structure for the extended TPB model. Each factor accounting for less than 50% of the covariation for the model, indicating that no general factor was observed. As a result of this test, we conclude that bias due to common method variance does not pose a serious threat to the findings of this study.

### 3.5 Model specification and analysis procedures

All research questions were investigated using SEM. A two-step approach suggested by Anderson and Gerbing (1988) was adopted using a maximum likelihood estimation procedure, analysis of moment structures (AMOS) version 18.0. Confirmatory factor analysis (CFA) was performed to validate the measurement scales rather than the EFA since established measurement scales were adopted (Kelloway, 1995). Although multiple indicators are more desirable, construct with single indicator is still allowed in the use of SEM by fixing a priori error estimates on single indicator and place theoretical constraint within the model (Hair et al., 2010). Following previous practices in the exercise domain, the exercise behaviour indicator was given a fixed measurement error estimate of 40% (Courneya et al., 1997).

Four main approaches were adopted to examine the research objectives posed in this study. First, a series of CFA model comparisons was performed to determine whether attitude, subjective norm, and PBC are best represented as two-component structure or it should be retained as the traditional single concept measure. Second, the construct validity for the hypothesised multidimensional, first-order TPB structure was tested. Third, the multidimensional, first-order model was compared with global, second-order structure at both measurement and structural level. Lastly, upon determining the structural model fit, the significance, direction, and size of each structural parameter for the hypothesised model were estimated.

### 4 Results

Of the 1,200 questionnaires distributed, 594 responses were returned for a response rate of 49.5%. Of these returns, 512 useable responses made up the final sample size. 82 questionnaires were discarded due to:

1. incomplete response (e.g., part of the questionnaire left unanswered)
2. responses with little variance (e.g., neutral response)
patterns of responses showed the respondent did not understand the content and/or instructions.

4 outliers (Mahalanobis distance was used to detect outliers).

The Chi-square analyses showed no significant demographic differences between the usable and unusable responses.

4.1 Alternative model testing: single-concept versus two-component TPB structure

Alternative model assessments were based on the differences in incremental indices along with differences in chi-square goodness-of-fit (GOF) values (Hair et al., 2010). The χ² GOF values for the two-component CFA models of attitude, subjective norm, and PBC were consistently lower compared to the single-concept measure (see Table 1). In addition, the incremental fit indices for the two-component CFA models have shown practical improvement, suggesting discriminant validity is established (Hayduk, 1996). Preliminary findings suggest superior measurement when the three TPB predictors are modelled as multidimensional as opposed to one-dimensional constructs.

Table 1 Alternative model testing results

<table>
<thead>
<tr>
<th>Model</th>
<th>χ²</th>
<th>df</th>
<th>P</th>
<th>Normed χ²</th>
<th>GFI</th>
<th>TLI</th>
<th>CFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single concept</td>
<td>352.97</td>
<td>35</td>
<td>.0001</td>
<td>10.085</td>
<td>.845</td>
<td>.836</td>
<td>.872</td>
<td>.133</td>
</tr>
<tr>
<td>Two-component</td>
<td>97.10</td>
<td>34</td>
<td>.0001</td>
<td>2.856</td>
<td>.962</td>
<td>.966</td>
<td>.975</td>
<td>.060</td>
</tr>
<tr>
<td>Subjective norm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single concept</td>
<td>478.21</td>
<td>20</td>
<td>.0001</td>
<td>23.910</td>
<td>.765</td>
<td>.697</td>
<td>.784</td>
<td>.212</td>
</tr>
<tr>
<td>Two-component</td>
<td>57.89</td>
<td>19</td>
<td>.0001</td>
<td>3.047</td>
<td>.972</td>
<td>.973</td>
<td>.982</td>
<td>.063</td>
</tr>
<tr>
<td>PBC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single concept</td>
<td>298.57</td>
<td>20</td>
<td>.0001</td>
<td>14.928</td>
<td>.844</td>
<td>.816</td>
<td>.868</td>
<td>.165</td>
</tr>
<tr>
<td>Two-component</td>
<td>33.23</td>
<td>19</td>
<td>.023</td>
<td>1.749</td>
<td>.984</td>
<td>.990</td>
<td>.993</td>
<td>.038</td>
</tr>
</tbody>
</table>

Notes: Chi-square (χ²); degree of freedom (df); goodness-of-fit index (GFI); comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA).

4.2 Construct validity for the hypothesised multidimensional, first-order TPB structure

Based upon Anderson and Gerbing (1982), an analysis of the hypothesised multidimensional, first-order extended TPB measurement model resulted in good model fit (χ² = 909.98, χ²/df = 1.944, GFI = 0.901, TLI = 0.950, CFI = 0.956, RMSEA = 0.043) after several modifications based on standardised residuals, modification indices and the standardised loading estimates (Hair et al., 2010). An acceptable ratio for χ²/df value (i.e., less than 3.0) was achieved; the fit indices for GFI, TLI and CFI were greater than .90 thresholds for satisfactory model fit (Hu and Bentler, 1999). Further, the indicators of residuals were also found to be low (RMSEA = 0.043).
Satisfactory evidence of convergent validity demonstrated – each factor loading of the reflective indicators was significant at 0.001 level with loading greater than 0.50 (Anderson and Gerbing, 1982) (see Table 2). All the individual scales met the acceptable composite reliability values of 0.60 (Bagozzi and Yi, 1988) as well as exceeded the cut-off value of 0.50 for the average variance extracted (AVE) (Fornell and Larcker, 1981).

Table 2  CFA for convergent validity

<table>
<thead>
<tr>
<th>Construct</th>
<th>No. of items</th>
<th>Item loadings</th>
<th>Construct reliability</th>
<th>Average variance extracted (AVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrumental attitude</td>
<td>5</td>
<td>0.557–0.802**</td>
<td>0.840</td>
<td>0.519</td>
</tr>
<tr>
<td>Affective attitude</td>
<td>5</td>
<td>0.516–0.838**</td>
<td>0.861</td>
<td>0.571</td>
</tr>
<tr>
<td>Injunctive norm</td>
<td>4</td>
<td>0.658–0.772**</td>
<td>0.798</td>
<td>0.506</td>
</tr>
<tr>
<td>Descriptive norm</td>
<td>4</td>
<td>0.772–0.918**</td>
<td>0.907</td>
<td>0.715</td>
</tr>
<tr>
<td>Perceived control</td>
<td>4</td>
<td>0.623–0.905**</td>
<td>0.855</td>
<td>0.613</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>4</td>
<td>0.642–0.865**</td>
<td>0.831</td>
<td>0.573</td>
</tr>
<tr>
<td>Exercise intention</td>
<td>6</td>
<td>0.731–0.814**</td>
<td>0.899</td>
<td>0.601</td>
</tr>
</tbody>
</table>

Notes: Final measurement model: $\chi^2 = 909.98$, $\chi^2$/df = 1.944, GFI = 0.901, TLI = 0.950, CFI = 0.956, RMSEA = 0.043. AVE and construct reliability could not be computed for exercise behaviour as it was measured on a single item scale.

Further, satisfactory discriminant validity was achieved as all the scales had reliabilities in excess of the correlations between them (Gaski and Nevin, 1985). A second approach was adopted to assess discriminant validity by comparing the chi-square difference between two models: the unconstrained model and the constrained model (Bagozzi and Phillips, 1982). In the unconstrained model, the covariance between particular two constructs was freely correlated. The covariance of a certain two construct was fixed to 1.0 in the constrained model. A series of chi-square difference tests indicated that the differences in chi-square between the fixed and free solutions were significant (i.e., the minimum $\Delta\chi^2 = 14.0$, $p < 0.05$, df = 1). These $\chi^2$ differences were larger than the 3.84 threshold, indicating that each pair of constructs was indeed distinct. Taken together, these findings support that the hypothesised multidimensional, first-order TPB structure has achieved both convergent and discriminant validity. Hence, Hypothesis 1 was supported.

4.3 Measurement model: multidimensional, first-order versus global, second-order structure

Although the CFA results demonstrated adequate model fit for the multidimensional, first-order TPB structure, one could not disconfirm the second-order, global TPB structure without testing its validity. To examine Hypothesis 2, a CFA model comprising first-order inter-correlated latent constructs of instrumental attitude, affective attitude, injunctive norm, descriptive norm, perceived control, self-efficacy, behavioural intention, and behaviour was tested against the global, second-order CFA model. The results (Table 3) showed that the global, second-order TPB structure (Model 2: $\chi^2 = 2022.62$, $\chi^2$/df = 4.162, GFI = 0.764, TLI = 0.834, CFI = 0.847, PNFI = 0.745, RMSEA = 0.079)
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did not yield sufficient model fit while the multidimensional, first-order model (Model 1: \( \chi^2 = 909.10, \chi^2/df = 1.944, \text{GFI} = 0.901, \text{TLI} = 0.950, \text{CFI} = 0.956, \text{PNFI} = 0.810, \text{RMSEA} = 0.043 \)) achieved an acceptable ratio for \( \chi^2/df \) value as well as satisfactory fit indices. The PNFI index suggested that the hypothesised multidimensional, first-order TPB structure to be a more parsimony model compared to the alternative model. Therefore, Hypothesis 2 was supported.

Table 3  GOF statistics for CFA and full structural models

<table>
<thead>
<tr>
<th>Model</th>
<th>( \chi^2 )</th>
<th>df</th>
<th>Normed ( \chi^2 )</th>
<th>GFI</th>
<th>TLI</th>
<th>CFI</th>
<th>PNFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>909.10</td>
<td>468</td>
<td>1.944</td>
<td>.901</td>
<td>.950</td>
<td>.956</td>
<td>.810</td>
<td>.043</td>
</tr>
<tr>
<td>Model 2</td>
<td>2022.62</td>
<td>486</td>
<td>4.162</td>
<td>.764</td>
<td>.834</td>
<td>.847</td>
<td>.745</td>
<td>.079</td>
</tr>
<tr>
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<td>920.50</td>
<td>472</td>
<td>1.950</td>
<td>.900</td>
<td>.950</td>
<td>.955</td>
<td>.816</td>
<td>.043</td>
</tr>
<tr>
<td>Model 4</td>
<td>2027.1</td>
<td>488</td>
<td>4.154</td>
<td>.763</td>
<td>.834</td>
<td>.847</td>
<td>.747</td>
<td>.079</td>
</tr>
</tbody>
</table>

Notes: Model 1 = multidimensional, first-order CFA model; Model 2 = global, second-order CFA model; Model 3 = full structural model (with first-order, differentiated components); Model 4 = full structural model (with second-order, hierarchical constructs).

4.4 Structural model: multidimensional, first-order versus global, second-order TPB structure

Next, the hypothesised multidimensional, first-order structural paths (Model 3) are postulated based on the tenet of TPB, that is, exercise intention was set to be the proximal predictor of the exercise behaviour construct, and a direct path from perceived control and self-efficacy to exercise behaviour was set free (Ajzen, 1991) [see Figure 1(a)]. To examine Hypothesis 3, Model 3 was tested against the global, second-order structure (Model 4) using competing model strategy. Model 4 postulated that the effects of second-order latent factors of attitude and subjective norm on exercise behaviour are completely mediated through exercise intention whilst the second-order PBC was set to influence exercise behaviour directly and indirectly through exercise intention [see Figure 1(b)]. Table 3 shows that while Model 3 (\( \chi^2 = 920.5, \chi^2/df = 1.95, \text{GFI} = 0.900, \text{TLI} = 0.950, \text{CFI} = 0.955, \text{RMSEA} = 0.043 \)) have achieved satisfactory fit with the observed data, Model 4 did not yield acceptable model fit. The PNFI index revealed that the hypothesised Model 3 was a more parsimony model compared to the second-order model (Model 4). Hence, Hypothesis 3 was supported.

4.5 The effects of social cognition on exercise intention and behaviour

As Model 4 did not achieve acceptable model fit, it would be meaningless to compare the discriminant predictive validity upon exercise intention and behaviour between Model 3 and Model 4. Therefore, only the path estimates and factor correlations for the hypothesised structural model of multidimensional, first-order TPB structure (Model 3) are presented (see Figure 2). The specified structural model explained a total variance of 84.6% and 35.9% in exercise intention and behaviour, respectively. Overall, the results showed that these TPB sub-components were differentially related to exercise intention and behaviour. Particularly, instrumental attitude (\( \beta = .314, p < .001 \)), affective attitude (\( \beta = .400, p < .001 \)), and self-efficacy (\( \beta = .289, p < .001 \)) were significant predictors of
exercise intention with affective attitude having the largest effect on exercise intention. Exercise intention ($\beta = .439, p < .001$) was a strong predictor of exercise behaviour. Lastly, there is an indirect effect of self-efficacy on exercise behaviour through exercise intention.

**Figure 2** Parameter estimates for the multidimensional, first-order TPB structure

![Diagram of TPB structure with parameter estimates](image)

Note: ** denotes $p < .001$.

### 5 Discussion and conclusions

One of the main functions of social cognition theories such as the TPB is to guide behavioural interventions (Armitage and Conner, 1999b). However, effective health intervention strategies could not be achieved without a clear understanding of the theoretical mechanism of the TPB. Our core contribution lies in an important advancement of the social cognitive theory, demonstrating the validity of the multidimensional, first-order augmented version of the TPB structure by applying a robust statistical technique, which can be used as a promising framework to examine other healthy lifestyle behaviour such as weight control, tobacco use, healthy eating, and stress management. Our study also adds to the literature by providing greater clarity of which specific TPB components (e.g., instrumental or affective attitude) have direct effect on exercise intention.

The present empirical results provide support for the superior predictive validity of our hypothesised TPB structure based on the analysis of explained variance in exercise intention and the relative saliency of the TPB sub-components in predicting behavioural
outcome. Particularly, our specified model explained close to 85% of the variance in exercise intention (with both attitude components and self-efficacy being significant predictors), which is higher than the 40% of the variance in intentions reported by Armitage and Conner (2001) in their meta-analytic review. Given strong support for the augmented TPB’s application to exercise behaviour provided by our study, it seems feasible that desirable changes in attitude beliefs and perception of self-efficacy might lead to corresponding changes in behavioural intention. Although the present results are measurement-based, this study identifies pragmatically important issue that interventions aimed at changing one’s cognition may be effective. Particularly, the significant findings regarding the structural relations between the social cognitive components, exercise intention and behaviour are useful for health professionals in their planning and implementation of health promotion efforts.

While our results that the hypothesised multidimensional, first-order extended TPB model is a more parsimony model (both measurement and structural level) compared to the global, second-order model is congruent with Rhodes and Blanchard (2006), it is inconsistent with the study of Hagger and Chatzisarantis (2005). Such finding illuminates important issues at the theoretical level. That is, although the differentiated TPB components can be subsumed by global, second-order factor structure while demonstrating the measurement distinction at the subordinate level (Ajzen, 2002); the identification of the specific TPB components that account for the prediction of behavioural intention and behaviour may be important for researchers whose main objective is to examine the effects of these differentiated sub-components on a particular behaviour. It is evident in the present first-order model that the differentiated TPB sub-components have a different pattern of effect on exercise intention.

PBC is the most controversial TPB predictor due to the inconsistent findings regarding its conceptual and measurement structure (Notani, 1998). The present study adds to the health literature by demonstrating that perceived control and self-efficacy have achieved discriminant validity; these PBC sub-components are better modelled as two-factor, first-order structure. Further, the present finding also provided empirical evidence to support the discriminant validity in the measurement domain of attitude and control factor. This disconfirms the claim of Kraft et al. (2005) that perceived control overlapped substantially with the affective attitude measures conceptually.

We found that self-efficacy has a significant impact on exercise intention but perceived control did not predict exercise intention significantly. While this finding is congruent with several past studies (i.e., Sparks et al., 1997; Terry and O’Leary, 1995; White et al., 1994), an exception is the study conducted by McCaul et al. (1993) which found measures that capture the control-related factor to be a better predictor of behaviour intention. Although there is a reasonably consistent body of literature suggesting that self-efficacy is a superior predictor of behavioural intentions compared to other control-related factors; however, conclusion should be drawn with caution. Rhodes and Courneya (2003a) argue that the more important role of self-efficacy as reported in the literature may be due to measurement redundancy between self-efficacy and the motivation element of behaviour intention rather than the meaningful causal effect. In terms of the effects on exercise behaviour, both self-efficacy and perceived control did not contribute to the prediction significantly. This is somewhat inconsistent with Terry and O’Leary’s (1995) study that report perceived control measures to be an independent predictor of behaviour.
One possible explanation for the relatively more salient role of self-efficacy could be attributable to the conceptual basis of self-efficacy as “people’s beliefs about their capabilities to produce performances that influence events affecting their lives” [Bandura, (1995), p.434]. That is, individuals who have higher self-efficacy tend to be more task focus, and therefore, may be more committed to exercise regime. An alternative explanation for the non-significant relationship between perceived control and exercise intention (behaviour) has to do with the nature of exercise behaviour. That is, some exercise activities may become routine as they are repetitively performed; consequently, the role of perceived control become less salient as it no longer require control from specific intentions (Ouellette and Wood, 1998). In addition, the type of person performing a given behaviour may also influence the importance they attach to control factor, which may ultimately affect the strength of relationship between perceived control and intention (Sheeran et al., 2002).

We found a lack of support for effect of both injunctive and descriptive norms on exercise intention. This lack of significance is congruent with Armitage and Conner’s (2001) meta-analysis that found subjective norm to have less utility in the TPB. Nevertheless, our finding does not disconfirm the TPB model because the theory does not state that all social cognitive predictors will each make a significant contribution to the prediction of behavioural intention (Ajzen, 1991). We explain this finding by noting that social norm may be more influential for exercise activities that require group interaction which reflect the perceptions of pressure or normative expectations arising from significant others in the person’s social environment. This line of research suggests that one should not dismiss the value of social norms in predicting health behaviour since social norms tend to vary with the situation and behaviour under consideration, and are highly dependent on the saliency of the reference groups (Ryan and Bonfield, 1975).

In agreement with Lawton et al. (2007), the present finding indicates that affective component of attitude plays a more important role in predicting exercise participation compared to instrumental attitudes.Traditionally, most of the health interventions have been focused heavily on persuading individuals about the benefits of adopting healthy lifestyle, a technique that focuses primarily on instrumental aspect of attitude. The finding that affective attitude plays a greater role in influencing exercise intention than instrumental has important implication. The assumption that one will exercise just because he or she becomes aware of the health benefits may not be sufficient to promote behavioural change. It might be more effective to adopt the affective-based interventions that involve creating positive experiences (e.g., excitement and enjoyment) associated with exercise rather than merely focusing on persuasion through factual information (e.g., benefits of exercise) in health promotion campaigns.

The generalisability of our findings may be restricted by the study’s limitations, and therefore, should be considered when interpreting the present results. A cross-sectional design can magnify the effect size of findings due to consistency biases since all measures are completed at the same time (Armitage and Conner, 1999b). Nevertheless, most of the TPB research utilise cross-sectional study designs (see Godin and Kok, 1996). Although subjects were assured of anonymity and confidentiality, potential social desirability may have artificially inflated the observed relationship when self-report measures are adopted. We have addressed this issue partially by demonstrating that common method bias does not pose a problem in our study. Indeed, most TPB studies rely largely on self-report data, and the potential of such biases to invalidate the model seems to be overstated (Ajzen and Fishbein, 2004). Lastly, as the participation in the
study was voluntary, subjects may be more health conscious and tend to be better educated and knowledgeable. Although careful consideration has been given in the quota set, the generalisability of the findings to a wider population should be done with caution.

Future research should replicate the results in other behavioural domains using a longitudinal approach to cross validate the modified TPB model and compare it with other specified theories. More objective measures such as fitness class attendance or activity monitoring should be considered. Our findings regarding the conceptual differences between the set of TPB sub-components suggest that further work on the antecedents of these social cognitive components is warranted. Lastly, the attempt to investigate other healthy lifestyle behaviours such as healthy eating, substance use, health preventive practices, and weight control is needed to explore a more comprehensive aspect of healthy lifestyle.

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References


The fallacy of one-dimensional theory of planned behaviour structure


