Predicting Physical Activity Intention and Behavior in School-Age Children

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Two studies were conducted to predict physical activity in school-aged children. Study 1 tested the utility of an integrated model in predicting physical activity (PA) intention and behavior—the theory of planned behavior (TPB) and self-efficacy theory. Six hundred and forty-five New Zealand children (aged 11–13 years) completed measures corresponding to the integrated model and a self-reported measure of PA one week later. Perceived behavioral control (PBC) and subjective norm were the two strongest predictors of intentions. Task efficacy and barrier efficacy were the two strongest predictors of PA. A second study (Study 2) was conducted to determine whether the self-efficacy measures could discriminate objectively measured PA levels. Sixty-seven Canadian children (aged 11–13 years) completed task and barrier self-efficacy measures. The following week, children classified as ‘high’ (n = 11) and ‘lower’ (n = 7) for both task and barrier efficacy wore an Actical® monitor for seven consecutive days to provide activity-related energy expenditure (AEE) data. Results showed that children with high efficacy expended significantly greater AEE than their lower efficacious counterparts. Findings from these two studies provide support for the use of self-efficacy interventions as a potentially useful means of increasing PA levels among school-aged children.

Participation in regular physical activity (PA) is associated with multiple physical (24) and mental health (19) benefits and therefore has become an important public health objective. The global estimate for inactivity (doing no or very little PA at work, at home, for transport or in discretionary time) is 17%, while the global estimate for insufficient levels of activity (< 150 min moderate or < 60 min of vigorous activity per week) is 40% (11). The U.S. Surgeon General’s report (45) and recent review by Warburton, Nicol and Bredin (46) highlighted that substantial health benefits can be gained through PA producing daily energy expenditure of 150 kcal · day⁻¹ or 1000 kcal · week⁻¹. Although the specific amount of energy expenditure needed to obtain health benefits in children (e.g., decrease their risk of cardiovascular disease) is not known, there is evidence that PA is inversely related...
to obesity (27), cardiovascular disease risk factors (18), and various physical and psychological health complaints (26). It is recommended that children participate in at least 60 min of moderate intensity PA most days of the week, preferably daily (17).

Because of the potential of regular PA to improve health, considerable research has focused on understanding the motivation and cognitive processes that underlie the adoption and maintenance of the behavior. From a theoretical perspective, several models cached within social cognitive theory have arisen to explain PA behavior. Of these, the Theory of Planned Behavior (TPB)(1) has been widely used and shown to be successful in predicting PA intentions and behavior in disparate populations including adults, youth and those with heart disease (23). According to the TPB, intention is proposed to be the most immediate determinant of behavior. The constructs attitude, subjective norm, and Perceived Behavioral Control (PBC) are proposed to influence intention. Because many behaviors pose difficulties of execution that may limit volitional control, PBC is also posited to directly influence behavior as shown in Figure 1.

Identifying the determinants of PA behavior in youth and adolescents may be particularly important as the maintenance of regular PA from youth to adulthood could result in the prevention of inactivity-related diseases (31). In youth-related research to date, the TPB has been found to predict significant variance in exercise intentions (14,20,36). Although these findings provide support for the utility of TPB to predict PA intentions, none used a subjective or objective measure of PA behavior. However, in adults, research evidence has generally supported a modest positive relationship between intention and behavior (23).

A core argument for theory integration is that a greater understanding can be gained through the joint use of theory than obtained through the use of a single model approach (10,29). For instance, researchers have incorporated Self-Efficacy Theory into the TPB to study PA intention and behavior in adolescent populations (22). Self-efficacy is defined as “people’s belief about their capabilities to produce performances that influence events affecting their lives” (6). More recently, Bandura (7,8) has refined that definition of self-efficacy to encompass those beliefs regarding individuals’ capabilities to produce performances that will lead to anticipated outcomes. Maddux (30) suggests that this definitional development has led to the distinction between task efficacy (efficacy is assessed relative to capabilities to successfully perform the targeted behavior) and self-regulation efficacy (e.g., barrier efficacy—overcoming impediments or challenges to successful behavioral performance).

By definition there seems to be some degree of overlap between PBC and self-efficacy. Both constructs, for instance, are concerned with control (32). One way to distinguish between these two constructs is to highlight that control comes in two forms: internal, based on factors within the individual, and external, based on factors outside the individual. This argument has been developed by Terry and O’Leary (40) who suggested that PBC is synonymous with external control factors, while self-efficacy is synonymous with internal control factors. Armitage and Conner (5) also present a perspective on this issue that is in line with that adopted by Terry and O’Leary (40). Hence, PBC and self-efficacy are thematically similar constructs, but nevertheless conceptually different.
Although researchers (5,22,40) have argued that Azjen’s (1) PBC construct can be separated into distinguishable internal and external control factors, it is problematic to accept the internal component of PBC as a true measure of self-efficacy because of the manner in which it is assessed. PBC items are general in nature, whereas items representing self-efficacy are more specific and precise. For instance, it has been recommended that the optimal measurement of internal (i.e., task) self-efficacy should include an assessment of both the strength and the magnitude of the efficacious belief (33). An example item is “How confident are you that you can complete ten minutes of physical exercise at a light intensity level, three times next week”. Traditional PBC items posited to measure internal control such as, “I would find it easy to take part in regular physical activity next week” do neither of these things. Furthermore, such an item makes it difficult to ascertain whether the respondent is referring to internal control (i.e., my personal ability makes it easy) or external control (i.e., things in my environment make it easy) factors. Because of these conceptual and measurement differences, incorporating self-efficacy into the TPB as an integrated model has the potential to provide a more comprehensive understanding of PA intention and behavior.

Research in youth incorporating self-efficacy with the TPB has generally found self-efficacy to explain approximately between 18% and 22% additional variance in PA intentions over that of the TPB variables (22). Only a few studies exist that have included a measure of PA (35,43). Of these, Trost et al. (43) found that intention explained 8% of the variance in objectively measured PA, which increased to 10% with the inclusion of PBC and self-efficacy. Another study of adolescent girls found that self-efficacy and PBC had independent effects on change in subjectively measured PA over the course of one year (35). Change in PBC predicted change in levels of vigorous PA, whereas change in self-efficacy did not (35). Unfortunately, all of the abovementioned studies assessed barrier efficacy and not task efficacy. The current study seeks to extend previous research in this area by measuring (a) the strength and magnitude of task efficacious beliefs, (b) both task and barrier efficacious beliefs, and (c) PA behavior.

The aim of Study 1 was to integrate self-efficacy theory within the TPB framework to predict PA intentions and behavior in a large sample of youth (Figure 1). Two hypotheses were generated for Study 1. First, intention would be predicted by attitude, subjective norm, PBC, and also self-efficacy. Second, PA would be predicted by intention, PBC, and the self-efficacy constructs.

**Methods—Study 1**

**Participants**

Participants were 645 intermediate school children (Years 7 and 8) recruited from central Auckland, New Zealand. Participants were required to communicate in English, and obtain parental consent. The sample consisted of both males (n = 348) and females (n = 290) who ranged in age from 10 to 12 years (M = 11.59, SD = .88) and represented various ethnic groups (NZ European 52%; Maori 14%; Pacific 11%; Asian 11%; South African 4%, Indian 4% and other 4%). The average BMI for the sample was 20.26, SD = 5.05.
Measures Corresponding to the Integrated Model

**Attitude.** Attitude toward PA was assessed using the stem item “For me to take part in regular physical activities during the next week is . . . ”. Six bipolar adjective scales were scored from 1 to 5. The scales included both experiential (e.g., enjoyable-not enjoyable, pleasant-unpleasant, fun-boring) and instrumental (e.g., useful-useless, harmful-beneficial) items (3). An alternative phrase or word was used to describe the descriptors that anchored the attitude scale (e.g., another word or phase for “harmful” is “dangerous” or “not good for you”) to assist the children in identifying the most appropriate response. The instructions that preceded the adjectives directed the participant to “Please put a tick on the line for the amount that you agree or disagree with the statement”. To obtain an overall measure of a participant’s attitude, each of the six items were summed. Possible scores for the overall attitude measure could range from 6 to 30. The scale displayed an acceptable degree of internal consistency (\( \alpha = .72 \)).

**Subjective Norm.** Subjective norm was assessed using six questions which were rated on a 5-point Likert scale using the following descriptors: 1 “strongly disagree or completely false”, 2 “disagree or kind of false”, 3 “maybe”, 4 “agree or kind of true”, 5 “strongly agree or completely true”. The items assessed both injunctive norms which evaluates whether important others approve/disapprove of the desired behavior (e.g., “people who are important to me approve of me taking part in regular physical activities over the next week”), as well as descriptive norms which assess whether important others perform the behavior themselves (e.g., “my mum/dad (guardian) participate in physical activities regularly”; 3). Possible scores
for subjective norms could range from 6 to 30. The internal consistency for the six item scale was acceptable (α = .73).

**Perceived Behavioral Control (PBC).** PBC was assessed using six items scored on a 5-point Likert scale using the following descriptors: 1 “strongly disagree or completely false”, 2 “disagree or kind of false”, 3 “maybe”, 4 “agree or kind of true”, 5 “strongly agree or completely true” that captured both internal and external control (3). Internal items reflected the perceived easy or difficulty of performing PA (e.g., “I have the ability to exercise regularly in the next week”). External items reflected the participant’s belief that they have control over the behavior (e.g., “I have control over whether I can take part in regular physical activities in the next week”; 3). The internal consistency for this scale was good (α = .79).

**Intention.** Intention to perform PA over the course of the next week was assessed in this study using items taken from Ajzen (3). Participants responded to four items scored on a 5-point Likert scale using the following descriptors: 1 “strongly disagree or completely false”, 2 “disagree or kind of false”, 3 “maybe”, 4 “agree or kind of true”, 5 “strongly agree or completely true”. A sample item was, “I plan to take part in regular physical activity next week”. The four-item scale displayed a high degree of internal consistency (α = .84).

**Self-Efficacy.** Both task and barrier efficacy were assessed. Task efficacy was assessed using an adapted version of the Self-Efficacy Scale (33). Participants rated their confidence to complete regular PA for increasing time periods (10, 30, and 60 min) at various intensities (light, moderate and hard) on a color-coded scale ranging from 0% (no confidence at all) to 100% (completely confident). To calculate an overall task efficacy value, scores for each item were then summed and divided by the number of items. Higher task efficacy scores on the scale equate to greater efficacy to participate in PA for longer periods of time at a greater intensity level. The task efficacy scale also demonstrated an excellent level of internal consistency (α = .95). Barrier efficacy was assessed using a modified version of the Barrier Efficacy Scale (33). Six salient items derived from a previous pilot study were rated on a color-coded scale from 0% (no confidence at all) to 100% (completely confident). Participants rated their confidence to perform regular PA in the presence of six common barriers (e.g., “the weather is very bad”, “I have a lot of school work to do”) that prevent children and adolescents from participating in PA. Scores were summed and divided by the number of items to derive barrier efficacy. Internal consistency was high (α = .86).

**Physical Activity.** The Physical Activity Questionnaire for Children (PAQ-C) was used to assess PA behavior in the previous week (15). This is a self-administered seven day recall of PA designed for elementary school children who are currently in the school system and have recess as a regular part of their school week. The PAQ-C is a 9-item measure scored on a 5-point Likert scale from 1 to 5, with higher values indicating greater levels of PA. A sample item is: “In the last 7 days, what did you do most of the time at recess?”. Overall PA is provided by deriving the mean of all 9 items. Evidence exists confirming the reliability and validity of the PAQ–C (15).
Procedure

Several steps were taken to ensure children completely understood the questions related to both the TPB and self-efficacy constructs. First, wording and presentation changes were made based on consultation with other Year 7 and 8 students and teachers from a pilot study. From this consultation the following steps were taken to ensure clarity and comprehension. First, a clear and simple operational definition of organized and nonorganized PA was provided before completing the TPB scales. Second, a clear and simple operational definition of mild, moderate, and hard PA was provided along with accompanying pictures before completing the self-efficacy scales. Third, trained research assistants administered the questionnaire package visually using overhead projection. This ensured that each question was properly explained, read and completed before students moved on to the next question.

All study procedures and related documents were approved by the regional ethics committee. Contact was initiated with the school principal to discuss the study purpose and procedures and to obtain consent to approach the students. Once permission was obtained, researchers made contact with the school children via the respective class teachers. Participant information sheet and consent forms were then administered for parental consent. Children completed assent forms. Once parental consent was obtained, the researchers returned to the school and administered the social cognitive measures at time 1 (T1) and then returned one week later (T2) to administer the PAQ-C questionnaire. The response rate was high at 90%.

Results

Descriptive Statistics

Descriptive statistics and bivariate correlations for the variables of interest are presented in Table 1.

Table 1 Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Subjective norm</td>
<td>4.15</td>
<td>.63</td>
<td>.42**</td>
<td>.59**</td>
<td>.63**</td>
<td>.42**</td>
<td>.40**</td>
<td>.35**</td>
</tr>
<tr>
<td>2. Attitude</td>
<td>4.46</td>
<td>.69</td>
<td>—</td>
<td>.50**</td>
<td>.54**</td>
<td>.57**</td>
<td>.49**</td>
<td>.40**</td>
</tr>
<tr>
<td>3. PBC</td>
<td>4.34</td>
<td>.63</td>
<td>—</td>
<td>.50**</td>
<td>.54**</td>
<td>.57**</td>
<td>.49**</td>
<td>.40**</td>
</tr>
<tr>
<td>4. Intention</td>
<td>4.41</td>
<td>.68</td>
<td>—</td>
<td>.50**</td>
<td>.54**</td>
<td>.57**</td>
<td>.49**</td>
<td>.40**</td>
</tr>
<tr>
<td>5. Task efficacy</td>
<td>81.31</td>
<td>19.31</td>
<td>—</td>
<td>—</td>
<td>.66**</td>
<td>.51**</td>
<td>.49**</td>
<td>.40**</td>
</tr>
<tr>
<td>6. Barrier efficacy</td>
<td>67.42</td>
<td>22.30</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>.46**</td>
<td>.49**</td>
<td>.40**</td>
</tr>
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</table>

Notes: PBC = perceived behavioral control; PAQ-C = Physical Activity Questionnaire for Children. Subjective norm, attitude, perceived behavioral control, and goal intention were scored on a scale of 1–5. Task efficacy and barriers efficacy were rated on a confidence scale ranging from 0 (not at all confident) to 100 (completely confident) with higher values indicating greater perceptions of efficacy for PA. Subjective PA behavior was assessed using a 5-point scale with higher values representing greater levels of PA during the previous week.

Because of missing data for some variables, N varied from 636 to 642.
Predicting Physical Activity Intention

A hierarchical regression was conducted where intention served as the dependent measure. The three constructs of the TPB (i.e., subjective norm, attitude, and PBC) were entered simultaneously into Step 1 of the regression equation and were found to significantly predict intention \(F(3,635) = 284.17, p < .001\), accounting for 56% of the response variance. Task and barrier efficacy were entered into Step 2 and were also found to contribute significantly to the prediction \(R^2\Delta = .01, F(2,633) = 8.55, p < .001\), accounting for 1% of the response variance. When all variables were entered together, PBC (\(\beta = .37, t = 10.61, p < .001\)) and social norms (\(\beta = .29, t = 8.72, p < .001\)) emerged as the two strongest predictors of intention, followed by attitude (\(\beta = .15, t = 4.44, p < .001\)) and task efficacy (\(\beta = .12, t = 3.26, p < .001\)). Barrier efficacy (\(\beta = .02, t = .57, p > .05\)) did not make a significant unique contribution to intention.

Predicting Physical Activity Behavior

A second hierarchical multiple regression analysis was conducted whereby self-reported PA behavior represented the dependent variable\(^1\). Intention was the first variable entered in the regression and was found to be a significant predictor \(F(1,630) = 97.95, p < .001\), accounting for 13% of the response variance. PBC was entered in Step 2 and also contributed significantly to the prediction \(R^2\Delta = .01, F(1,629) = 6.79, p < .01\), accounting for 1% of the variance. Finally, the inclusion of task and barrier efficacy in Step 3 resulted in a further increase of 16% in the amount of explained variance \(R^2\Delta = .16, F(2,627) = 70.70, p < .001\). When all variables were considered together in the model, barrier (\(\beta = .35, t = 7.73, p < .001\)) and task efficacy (\(\beta = .16, t = 3.26, p < .001\)) emerged as the two strongest predictors of PA behavior, followed by intention (\(\beta = .12, t = 2.42, p < .01\)). PBC (\(\beta = .03, t = .53, p > .05\)) did not make a significant unique contribution to PA.

Discussion

The purpose of this prospective study was to integrate Self-Efficacy Theory within the TPB framework to predict PA intentions and behavior in a large sample of youth. Overall, results generally supported the hypotheses. For the prediction of PA intention, the TPB variables of attitude, subjective norm, and PBC were found to explain 56% of the variance in intention. The addition of the two self-efficacy variables increased the explained variance by a modest 1%. In the final model, PBC was found to be the strongest individual predictor of intention followed by subjective norm and attitude.

The amount of variance in intention explained by the TPB variables was higher than other studies, which have typically explained between 30 and 47% of variance in youth populations (14,20,36). One reason for these different findings is the substantial contribution subjective norms made to the prediction of intentions in our study. Subjective norms were assessed using both injunctive norms (what participants felt important others expected them to do) and descriptive norms (whether important others actually perform the behavior), which is consistent with the recommendations of Ajzen (2). Furthermore, the assessment of injunctive norms
included reference to the specific time frame (i.e., one week) that corresponded with the time frame of the intention measure. Typically the assessment of norms has only included the injunctive component with no time reference. Hence, these two methodological improvements most likely contributed to the increased prediction of intentions, as is evident in other studies that have used both types of norm (38). Sampling might be another reason to explain these different findings. Our sample consisted of both boys and girls aged between ten and twelve years, which differs from other research studies that have used younger (36) and older (43) aged participants.

The addition of the self-efficacy constructs resulted in a modest but statistically significant increase in the amount of variance explained in intention. This finding is lower than other studies which have used self-efficacy measures that are conceptually similar to PBC (22,43). Furthermore, in the final model, task efficacy was the weakest significant independent contributor to intention, whereas barrier efficacy essentially made no contribution at all. These results suggest that compared with PBC, neither task nor barrier efficacy were salient constructs for the formation of PA intentions in this sample.

For the prediction of PA behavior, intention explained 13% of the variance in behavior. The addition of PBC resulted in a modest (1%) increase of the explained variance; however the addition of the two self-efficacy constructs increased the explained variance by 16%. The final model explained 30% of PA behavior, with the strongest independent predictors being barrier and task efficacy, followed by intention. These results suggest that efficacious beliefs to perform activities and overcome obstacles to regular PA participation are important in the prediction of self-reported PA behavior in school-aged children. Compared with the findings of Trost et al. (43) and Motl et al. (35), our findings provided larger amounts of explained variance in PA behavior. These disparate findings may be related to sampling differences or to the different self-efficacy and behavioral measures used.

From our data, there was a differential effect of self-efficacy and PBC in explaining PA intentions and behavior. Self-efficacy was not a strong predictor of intentions, but was a strong predictor of PA behavior. Conversely, PBC was the strongest individual predictor of intention but the weakest predictor of behavior. There are several potential explanations for these findings. The first is related to scale correspondence between the self-efficacy, PBC, intention and PA measures (13). The PBC items reflected participant’s control over regular PA participation and general perceived ease or difficulty to be physically active over the following week, whereas (a) task efficacy assessed participant’s confidence to be active at specific levels of intensity and duration and (b) barrier efficacy assessed participant’s confidence to overcome common obstacles that interfere with PA. The PBC scale corresponds better to the general measurement of intention (“I plan to do regular physical activity in the next week”) than to the specific measurement of PA (structured activities that the person actually participates in over the past week). Conversely the task efficacy and barrier efficacy scales correspond better with specific PA than with general intentions. Furthermore, the PAQ-C primarily focuses on structured and organized PA whereas the PBC is congruent with volitional behavior and hence, PBC may have little bearing on the PA measure used.

Another plausible explanation for the lack of effect of PBC to behavior may be related to the age of the children and the nature of volitional PA. Children in this
study were young (11–13 years) and still very much subject to parental and school influence and control. Hence, although a child may indicate they have greater control to perform regular PA, the opportunity for volitional PA is limited.

The results of Study 1 highlight the importance of theory integration in predicting PA in a youth population. As both task and barrier self-efficacy were found to be particularly important for predicting subjective PA behavior, further research is required to test the utility of these constructs in predicting objectively measured PA behavior—this was the aim of Study 2. The hypothesis was that children who were more highly efficacious toward regular PA would perform greater amounts of PA and expend more energy in a 7-day period than their less efficacious counterparts.

Methods—Study 2

Participants

Participants were 67 primary school children (Grades 7 and 8) recruited from Southwestern Ontario, Canada. Participants were required to communicate in English, and obtain parental consent. The sample consisted of both male ($n = 25$) and female ($n = 42$) participants who ranged in age from 10 to 13 years ($M = 11.59$, $SD = .88$), and represented a variety of ethnic groups (North American 55%; Arab 10%; British 9%; European 9%; Asian 6%; other 5%; African 3%; Aboriginal 2%; and Caribbean 2%).

Measures

**Physical Activity Behavior.** Objective PA was assessed using the Actical® (MiniMitter, Oregon), a small (approximately $2.8 \times 2.7 \times 1.0\text{cm}^3$), lightweight (17g), and water resistant omnidirectional accelerometer. The device is sensitive to low frequency movements in the range of 0.5–3.2 Hz, which is the common range for human movement (25). The Actical® has been shown to be a valid and reliable predictor of energy expenditure in youth (25). Participants were instructed to wear the device on the right hip during the waking hours of a 7-day period. Data were collected at 15-s epochs, and were converted to 1-min epochs for data analysis (16). For complete data, participants were required to provide a minimum of ten hours per day for at least five days (including weekend; 42). The Actical® sensors were programmed with the participant’s personal information (e.g., age, weight, and height) to provide an estimate of activity-related energy expenditure (AEE—the number of kilocalories expended per minute per kilogram of subject weight). Adopting a pragmatic approach, AEE per day were summed and divided by the days worn to provide mean daily AEE.

In addition, the average time per day in minutes within predetermined intensity cut-points (i.e., sedentary, light, moderate, and vigorous) was compared between efficacious groups. These cut-off points were in line with those defined by Trost et al. (44). Finally, as with Study 1, the PAQ-C (15) was used to assess participant’s self-reported PA behavior over the course of the previous 7 days.
Self-Efficacy. As with Study 1, both task and barrier efficacy were assessed. Internal consistency was high for both task ($\alpha = .93$) and barrier efficacy ($\alpha = .92$).

Procedures

Identical ethical and documentation procedures to Study 1 were followed. Once school and parental consent was obtained, the researchers returned to the school and administered a demographic form (e.g., sex and ethnicity) and self-efficacy questionnaire (task and barrier), which were completed during school time. Participants ($n = 21$) who scored in the upper and lower quartiles of task (upper $M = 98.08$, $SD = 1.12$ and lower $M = 63.33$, $SD = 10.92$) and barrier efficacy (upper $M = 93.03$, $SD = 3.23$ and lower $M = 46.78$, $SD = 11.48$) were identified and contacted the following week for the next phase of the study. They were all informed that they had been randomly selected to take part in a PA monitoring study. At the beginning of the school week, the targeted sample of children was asked to wear the Actical® monitor for seven consecutive days. The researchers returned one week later to collect the devices and administer the PAQ-C.

Treatment of the Data

Separate ANOVAs were used to determine whether differences in AEE and PAQ-C scores would exist between the high and lower efficacious groups. Before analysis, assumptions for ANOVA (i.e., normality, outliers, linearity, missing data) were checked (39). Normality and linearity were satisfied but there were two cases of missing data. These participants provided less than five days of data making it difficult to reliably estimate weekly habitual PA (42). In addition, one case was an extreme outlier as inspection of the Boxplot procedure showed that this case extended more than three box-lengths from the edge of the box. These three cases were eliminated from subsequent analysis.

Results

Descriptive Statistics

Descriptive statistics for the overall sample and the subgroups of ‘high’ and ‘lower’ self-efficacious children are provided in Table 2.

Objective Physical Activity. Significant differences between groups for AEE ($F(1,16) = 7.23$, $p < .05$; partial $\eta^2 = .31$) were found. Children who reported high levels of task and barrier efficacy expended more energy through PA compared with their lower efficacious counterparts. Results also showed a significant trend effect for the moderate and vigorous cut-off points. That is the high efficacy group ($M = 164.02$, $SD = 40.24$) spent more time in moderate physical activity ($F = 3.65$, $p < .08$, $\eta^2 = .19$) compared with the lower efficacy group ($M = 131.54$, $SD = 24.49$). The high efficacy group ($M = 5.80$, $SD = 5.56$) also spent more time in vigorous activity ($F = 3.84$, $p < .07$, $\eta^2 = .19$) compared with the lower efficacy group ($M = 1.52$, $SD = 1.71$). No significant differences or significant trend effects were found
for sedentary (high efficacy group $M = 388.25$, $SD = 45.46$; lower efficacy group $M = 416.99$, $SD = 30.16$) or light activity (high efficacy group $M = 254.14$, $SD = 29.34$; lower efficacy group $M = 270.27$, $SD = 55.85$).

**Subjective Physical Activity.** Children who reported high levels of task and barrier efficacy were more physically active ($M = 3.61$, $SD = .55$) than their lower efficacious counterparts ($M = 3.01$, $SD = .71$; $F(1,16) = 4.12$, $p = .06$; partial $\eta^2 = .21$).

**Discussion**

This second study sought to determine whether task and barrier efficacy could differentiate levels of objectively measured PA. Our hypothesis was supported; children who had high efficacious beliefs were significantly more active and expended more energy than their less efficacious counterparts. The observed effect size was large ($\eta^2 = 0.31$). Values over 0.14 are considered a large effect (12). Self-efficacy scores for participants in the lower self-efficacy group ranged between 47% and 63%. Therefore, we propose the effects found would be greater in a sample that included truly low efficacious children, who are likely to be minimally active or sedentary. As the children’s efficacious profile was based on their task and barrier efficacy scores, future research should delineate which one is more important in explaining objectively measured PA.
The correlation between subjective and objective measures of PA was of a moderate magnitude \( (r = .36) \), which is consistent with previous research reported in children (37). Our findings suggest that although these two PA constructs share common variance they are essentially measuring different types of PA. This is not surprising given the fact that the PAQ-C is designed primarily to assess structured leisure time PA whereas the Actical® is designed to assess any free living ambulatory PA. The fact that self-efficacy was found to be highly related to both PA measures further strengthens the importance of self-efficacy in understanding PA behavior in this population.

Using essentially two different types of PA also highlights the possibility that the TPB variables intention and PBC might have performed better in an integrative model predicting objectively measured PA. The fact that this integrative model was not tested using objectively measured PA is a limitation of this study. Costs associated with the Actical® however, made it impossible to replicate Study 1 using this device.

A final observation warrants discussion regarding AEE in this sample population. The mean AEE \( (517.87 \text{ kcal/day}) \) found in this study is comparable to studies of other youth populations using the current 'gold standard' technique of doubly labeled water. Johnson, Russ, and Goran (28) reported values of 598 kcal/day and 313 kcal/day for boys and girls respectively. If converted to 2.16 MJ/day \( (1 \text{ MJ} = 239 \text{ kcal}) \), our findings are also similar to those of Montgomery et al. (34), who found AEE values of 2.7 MJ/day and 1.8MJ/day for boys and girls respectively.

When the average time per day in minutes within predetermined intensity cut-points (i.e., sedentary, light, moderate, and vigorous) was compared between efficacious groups, notable differences were seen at both moderate and vigorous PA. The high efficacious group spent 170 min per day engaging in moderate to vigorous PA, whereas their lower efficacy group spent 133 min per day. Once again, we propose the differences found would be greater in a sample that included truly low efficacious children. These data are in line with other children studies using similar accelerometry cut-off points. For instance, Guinhouya et al. (21) found that 8–11 year old French children spent 141 min per day in moderate to vigorous PA and Trayers et al. (41) found 8–12 year old inner city British children spent approximately 145 min per day in moderate to vigorous PA. As mentioned previously, it is recommended that children and adolescents participate in at least 60 min of moderate intensity PA most days of the week, preferably daily (17). However, others have argued that 90 min or more of moderate to vigorous activity is necessary to reduce cardiovascular risk among children (4). At this stage, whether children are meeting the recommended daily PA seems to be a function of which intensity cut-off points are being used as well as which recommendations are being followed. Future work is needed to clarify this important issue.

In summary, the results of Study 1 suggest that integration of the TPB and Self-Efficacy Theory allows for a more complete understanding of PA intentions and behavior in school-age children. In particular, it seems that PBC is an important predictor of PA intentions, whereas task and barrier efficacy are important predictors of subjectively measured PA. Furthermore, these two efficacious constructs are
important predictors of objectively measured PA (Study 2). Self-efficacy Theory based interventions targeted toward increasing PA in children are warranted.

Notes

1. Determining whether intention serves as mediator would provide a stronger theoretical test of the proposed integrated model. Barron and Kenny (9) have pointed out that a variable functions as a mediator when it meets the following conditions: (a) the independent variable (PBC, task efficacy, barrier efficacy), the mediator variable (intention) and the dependent variable (PA) must affect one another (b) the effect of the mediator must stay statistically significant when regressed with the independent variable and (c) the effect of the independent variable on the dependent variable must be statistically nonsignificant when regressed with the mediator. All conditions for mediation were satisfied with the exception of one—the independent variable (i.e., PBC-beta = .13, task efficacy-beta = .37 and barrier efficacy-beta = .43) stayed statistically significant (all p values < .009) when regressed with the mediator (intention). The failure to show this reduction suggests that intention is not a potent mediator.

2. There were more males (n = 7) than females (n = 4) in the high self-efficacy groups. Conversely there were more females (n = 5) than males (n = 2) in the lower self-efficacy groups. Research has shown that male children are typically more active than female children (e.g., Johnson, Russ, & Goran (28)). Hence, separate ANCOVAs were conducted were gender served as the covariate and AEE (objective measure of PA) and PAQ-C (subjective measure of PA) scores served as the dependent variables. Before conducting these analyses, the assumptions underlying the use of ANCOVA were tested and met (39). Results parallel those reported in the manuscript suggesting that the differences found in objective and subjective PA are because of self-efficacy and not gender.

References


