Relationships Between Negative Affect and Academic Achievement Among Secondary School Students: The Mediating Effects of Habituated Exercise

Hairul A. Hashim, Golok Freddy, and Ali Rosmatunisah

Background: The current study was undertaken to examine the associations between self-determination, exercise habit, anxiety, depression, stress, and academic achievement among adolescents aged 13 and 14 years in eastern Malaysia. Methods: The sample consisted of 750 secondary school students (mean age = 13.4 years, SD = 0.49). Participants completed self-report measures of exercise behavioral regulation, negative affect, and exercise habit strength. Midyear exam results were used as an indicator of academic performance. Structural equation modeling was used to analyze the data. Results: The results of structural equation modeling revealed a close model fit for the hypothesized model, which indicates that higher levels of self-determination were positively associated with habituated exercise behavior. In turn, exercise habit strength fostered academic achievement and buffered the debilitative effect of stress, depression, and anxiety on student academic performance. The analysis of model invariance revealed a nonsignificant difference between male and female subjects. Conclusion: The findings support the notion that habituated exercise fosters academic performance. In addition, we found that habituated exercise buffers the combined effects of stress, anxiety and depression on academic performance. The finding also supports the roles of self-determination in promoting exercise habituation.

Keywords: adolescents, physical activity habit, negative emotions

Stress has the potential to adversely affect individual states of health either through direct impact or through the mediation of health risk behaviors. Identification of school-related stress is important for at least 2 reasons. First, it has been implicated that stress precedes the elevation, recurrence, and exacerbation of depression. In fact, adolescents who reported higher levels of stress were 4 times more likely to exhibit depressive symptoms. Indeed, elevated rates of a depressed mood associated with stress do not merely indicate adolescents’ moodiness; rather, they represent substantial risk of developing clinically significant depressive disorders and impaired functioning. Even more worrisome, depression is often comorbid with other psychological disorders, such as anxiety-related disorders, among adolescents.1,2 Thus, early exposure to appropriate stress-coping strategies may be effective in preventing the development of depression and other clinically significant psychological disorders.1

Among adolescents, school environment has been identified as one of the sources of stress. In fact, school related stressors have been found to be the highest ranked sources of stress among secondary school students in Malaysia.3 This is not at all surprising given the fact that the Malaysian schooling system has long been criticized for its examination-oriented approach.4 In this regard, the roles of habituated physical activity (PA) and exercise may be considered.

Exercise Habit

Habit has been defined as a tendency to repeat past behavior in a stable context.5 Consistent with this definition, a number of researchers have conceptualized habit as a frequency of past behavior.6 However, Ajzen5 argued that past behaviors are insufficient to explain habit. Instead, Ajzen5 opines that habit should be viewed as a process-oriented construct that consists of a) strong stimulus-response bonds, b) automaticity, c) negative consequences if they are not executed, and d) predictable patterns of engagement.

In terms of exercise, Grove and Zillich7 suggest that strong habits are associated with a) the urge to exercise when exposed to PA cues, b) minimal conscious effort for initiation and execution, c) feelings of guilt when exercise is not performed, and d) planned and routine exercise involvement. Indeed, these processes have been shown to exhibit significant positive relationships on exercise stage-of-change \( r = .67 \) as well as self-reports of exercise frequency \( r = .39 \), intensity \( r = .25 \), and

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duration \((r = .26)\). Promoting PA habit early is undeniably critical for its persistence into adult life. Indeed, it has been shown that habitual exercise during adolescence increases the chances of both physical and psychological health during adulthood.  

Evidence exists suggesting that habituated exercise and PA are associated with higher levels of perceived competence and lower levels of anxiety and depression. Moreover, evidence also exists suggesting that regular participation in PA moderates the effects of stress on health. For instance, Haughland, Wold, and Tosheim revealed that students who have low levels of PA were likely to experience higher levels of stress and health complaints.

Current PA literature also reveals that habituated exercise is positively related to academic performance. For instance, in a study involving 884,715 students in California, United States in grades 5, 7, and 9, Grissom found positive associations between levels of fitness and academic performances. Similarly, in a recent review involving 14 published studies between the years 1967–2006 and involving 58,000 students, Trotter observed a positive association between regular exercise and academic performance in 11 of the studies. However, 3 of the reviewed studies revealed trivial to no relationship between PA and academic achievement. In fact, these contradictory findings are also evident in another review from 1984–2004. In this review, Taras observed an inconsistency in the PA-academic performance relationship. The researcher opines that further studies are needed to better understand the PA-academic outcome relationships.

Despite numerous benefits associated with habitual PA and exercise, the level of inactivity among adolescent is rising. Studies conducted among Malaysian children and adolescents have also indicated low and moderate levels of exercise. For instance, Dan, Mohd Nasir, and Zalilah found that a majority of adolescents in their study performed low (35%) and moderate (62%) levels of PA. Given the high level of physical inactivity among children and adolescents, a growing number of researchers believe it is necessary to further investigate factors that could potentially enhance adolescent involvement in PA.

**Self Determination Theory (SDT)**

SDT is a useful framework for understanding individual exercise motivation. This theory postulates that behavior is regulated by different motivational processes that reside along a continuum from amotivation on one end to intrinsic motivation on the other end. Extrinsic motivation, on the other hand, lies between these 2 processes. Amotivation is the lack of motivation to act, while extrinsic motivation exists when a person acts to attain a separable outcome. On the contrary, intrinsic motivation exists when individuals participate out of inherent pleasure and interest in an activity. Combined scores along the continuum provide a measure of the degree of motivation of an individual and are often referred to as the self-determination index. This theory further postulates that higher self-determined motivation is likely to lead to positive adaptive outcomes such as increased behavioral engagement. In PA and exercise settings, higher levels of self-determination were found to promote higher PA participation, enhance self-initiated PA behaviors and consequently promote health among adolescents.

In summary, stress is a naturally occurring experience in human life. For adolescents, schools have been identified as a major source of stress. Regular participation in PA and exercise has the potential to moderate the effects of stress on adolescent mental health. However, studies investigating the buffering moderating effect of PA and exercise on the stress-academic outcome relationship are scarce. Furthermore, despite the suggestion that PA and exercise might promote academic achievement, mixed findings have been observed. Therefore, the objective of this study is to investigate the networked relationship among self-determination, exercise habit strength, stress, anxiety, depressive symptoms and academic performance among adolescents using structural equation modeling.

We hypothesize 1) a significant positive association between self-determination and habit strength; 2) a significant positive association between exercise habit and academic achievement; 3) a negative association between stress, anxiety, depression, and academic achievement; and 4) a significant reduction in the negative effects of stress, anxiety, and depression on students’ academic achievement as a result of increased exercise habituation.

**Methods**

**Participants**

Secondary school students \([N = 750, \text{ boys } = 492 (65.6\%)\) and \(\text{ girls } = 258 (34.4\%)]\) were randomly selected from 3 schools in 1 of the eastern states in Malaysia. They were aged 13–14 years with a mean age of 13.40 ± 0.49. The percentages of participants of age 13 and 14 were 59.9% and 40.1%, respectively. In terms of ethnic backgrounds, the majority of the participants were Malays (98.8%) followed by Indian (0.5%), Chinese (0.4%), and other ethnic groups (0.3%). Participation was voluntary, and we obtained informed consents from the participants and their respective parents or guardians.

**Instrumentations**

**Exercise Habit Strength Questionnaire.** Exercise habit strength was measured using an 18-item Exercise Habit Strength Questionnaire. Participants were asked to reflect on their feelings and attitude toward exercise and rate their agreement or disagreement using a 6-point Likert scale. The questions tap 4 dimensions (automaticity, negative consequences, stimulus cue, and patterned action) representing the processes associated with habitual behavior. In terms of the measure’s validity and reliability, evidence of good internal consistency for the subscales and evidence for criterion-related validity.
via correlation with objective fitness measures, such as the PWC170 ($r = .24$) and PWC75% ($r = .32$), have been reported.22

**Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2).** Exercise motivation was measured using the BREQ-2.23 Each statement reflects the underlying reasons for an individual’s decision to engage, or not engage, in physical exercise. Participants were asked to indicate to what extent each of the provided statements was true for them. Responses were indicated on a 5-point Likert scale anchored by 0 (“not true for me”) to 4 (“very true for me”). The statements are related to the 5 types of behavioral regulation proposed in the SDT. They were external regulation, introjected regulation, identified regulation, intrinsic motivation, and amotivation. The BREQ-2 can be scored by compiling separate subscale scores or computing the relative autonomy index (RAI).20 The RAI is a single score that taps the degree to which an individual is more or less self-determined in the regulation of his/her behavior. Item scores were first multiplied by their specific weightage (amotivation = –3; external regulation = –2; introjected regulation = –1; identified regulation = +2; intrinsic regulation = +3) followed by the summation of these weighted scores. Higher scores represent higher levels of self-determined motivation. Adequate factorial validity and reliability has been reported for this measure in an adolescent sample.23

**Depression Anxiety Stress Scale-21 (DASS-21).** The DASS-21 was used to measure students’ levels of stress, anxiety and depression. Participants were asked to reflect on the extent to which each statement in the questionnaire applied to them in the past week. The responses are attached on a 4-point Likert scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much or all the time). Evidence of excellent psychometric properties of the DASS-21 has been extensively reported.24

**Academic Performance.** Academic performance was based on the midyear exam results where each student sat for 8 subjects. The data obtained from the school authorities were in the form of a single GPA where individual letter grades were converted to numeric data ($A = 1, B = 2, C = 3, D = 4, E = 5, F = 6$) and averaged. In this regard, a lower GPA reflects a better academic performance. In correlation terms, a negative correlation between exercise habits with academic achievement simply means that higher habit is associated with better academic performance. On the other hand, a positive correlation between negative affect and academic performance means that the higher the negative affect (stress depression and anxiety), the poorer the academic performance.

**Procedures**

Permission to conduct the study was obtained from relevant authorities. Specifically, approval to conduct the study was obtained from the relevant human ethics committees, ministry of education, and the school principles. Following approval from the respective authorities, an explanatory letter and information packets were sent to the school to be distributed to students. Students who were interested in taking part were then given the consent forms for themselves and their parents or guardians.

Students who agreed to participate and were permitted to by their parents were given the questionnaires. Questionnaire administration took place in a classroom setting and was observed by the second and third authors. Students spent an average of 10 minutes completing the questionnaire.

**Analysis**

Structural equation modeling (SEM) was used for data analysis. SEM is a family of statistical methods that allows for the analysis of complex relationships between 1 or more independent variables and dependent variables. The variables in the SEM models are represented by either latent variables or observed variables. While observed variables are directly measured variables, latent variables do not have direct measures and are often measured by multiple observed variables. Furthermore, the analysis takes into account the measurement error in observed variables so that the relationships of latent variables are estimated while controlling for measurement errors. Schematically, latent variables are represented by a circle while observed variables are represented by a square. SEM also allows for a test of direct and indirect effects. A direct effect refers to a direct path between one variable and another. In Figure 1, the relationship between RAI and exercise habit, exercise habit and academic achievement, and negative affect and academic achievement represent the direct effects. On the other hand, indirect effects occur when the relationship between one variable and another is mediated by a third variable. In Figure 1, an indirect effect is observed in the relationship between negative affect and academic achievement via exercise habit (See Kline25 for review).

An SEM model fit can be assessed using multiple fit indices. In the current study, we used the maximum likelihood estimation procedure along with selected fit indices, such as chi-square, the goodness fit index (GFI), the cumulative fit index (CFI), the expected cross validation index (ECVI), and the Akaike information criterion (AIC) to evaluate the model fit.25 A nonsignificant chi-square value indicates that the data describe the model. Values of 0.90 or greater for GFI and CFI indicate a close-fitting model. An index recommended for comparing models in smaller samples is the ECVI. Models with smaller values indicate the best potential for replication in samples of equivalent size. Smaller values for AIC indicate a better fit of the models.25 Data computation was performed using AMOS 18.

**Model Testing**

A total of 2 models were tested. The models were formulated on the basis of findings from previous studies.11,12,21 Specifically, Model 1 postulates that a higher level of
Exercise Habit

Self-determination is positively associated with habituated exercise. In turn, exercise habit strength is predicted to promote academic achievement. Combined effects of stress, anxiety, and depression, represented by negative affect, are predicted to affect academic performance negatively. It is hypothesized in such a way on the account that some studies have shown a high intercorrelation between the 3 DASS-21 subscales among adolescents. As a result, some researchers have suggested that the DASS-21 should be used as a measure of undifferentiated negative affect among adolescents.

Model 2 is similar to Model 1 with the exception of the correlated error terms for stress, anxiety, and depression factors. In fact, this model is hypothesized to yield the closest model fit. It is also hypothesized that habituated exercise would mediate the debilitative effect of negative affect on student academic performance. Models 1 and 2 are illustrated in Figure 1.

Results

Before the SEM analysis, scores were computed and examined for outliers and distributional properties. Missing values were minimal, and a mean substitution was used. Multivariate outliers were detected using Mahalanobis distance. At a 0.05 cut-off point, 106 cases were identified as outliers and were discarded from further analysis. Inspection of the skewness and kurtosis indices revealed some departures from normality. However, no variable transformations were deemed necessary. The full-sample descriptive statistics are presented in Table 1.

SEM results revealed an adequate model fit for Model 1 ($\chi^2 = 60.44, \text{df} = 8, P > .001; \text{GFI} = 0.97; \text{CFI} = 0.93; \text{ECVI} = 0.13; \text{AIC} = 86.44$). Furthermore, inspection of individual factor loadings revealed significant loadings of all paths in the hypothesized directions. However, analysis of Model 2 revealed further improvement in the model fit indices ($\chi^2 = 48.14, \text{df} = 5, P > .001; \text{GFI} = 0.98; \text{CFI} = 0.95; \text{ECVI} = 0.12; \text{AIC} = 80.14$). In fact, compared with Model 1, these improvements were statistically significant ($\Delta \chi^2 = 12.3, \Delta \text{df} = 3, P < .01$). Furthermore, significant factor loadings were obtained for all paths in the expected directions. Results of the direct effect of negative affect on academic achievement revealed a loading of 0.75 while loading of the indirect effect of negative affect on academic achievement was $-0.31$, a reduction of 0.44 percents of the total effect of negative affect on academic achievement. Detailed results are presented in Tables 2 and 3.

The model was then further tested for invariance between male and female samples. The results of the chi-square difference revealed model invariance between the 2 samples in terms of the measurement model ($\Delta \chi^2 = 6.12, \Delta \text{df} = 5, P > .05$) as well as the structural model ($\Delta \chi^2 = 8.14, \Delta \text{df} = 8, P > .05$). Detailed descriptions of individual path loadings for both male and female samples are also presented in Table 3.

Discussion

School can be a stressful environment for some adolescents. Given its exam-oriented approach, academic-related
Table 1  Descriptive Statistics for the Primary Measures

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Exercise habit strength</th>
<th>Academic</th>
<th>Stress</th>
<th>Anxiety</th>
<th>Depression</th>
<th>Amotivation</th>
<th>External regulation</th>
<th>Introjected regulation</th>
<th>Identification regulation</th>
<th>Intrinsic motivation</th>
<th>Relative Autonomy Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Boys</td>
<td>Mean 34.77</td>
<td>2.81</td>
<td>10.27</td>
<td>6.31</td>
<td>6.18</td>
<td>3.08</td>
<td>3.31</td>
<td>2.54</td>
<td>7.38</td>
<td>10.22</td>
<td>27.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD 14.80</td>
<td>1.07</td>
<td>5.43</td>
<td>4.62</td>
<td>4.29</td>
<td>3.15</td>
<td>3.45</td>
<td>2.74</td>
<td>3.92</td>
<td>4.18</td>
<td>22.83</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>Mean 36.96</td>
<td>3.41</td>
<td>12.59</td>
<td>8.50</td>
<td>7.72</td>
<td>2.91</td>
<td>3.68</td>
<td>3.32</td>
<td>7.82</td>
<td>10.68</td>
<td>28.24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD 13.60</td>
<td>0.91</td>
<td>5.79</td>
<td>4.84</td>
<td>5.40</td>
<td>3.04</td>
<td>3.71</td>
<td>2.91</td>
<td>3.83</td>
<td>4.29</td>
<td>21.51</td>
</tr>
<tr>
<td>14</td>
<td>Boys</td>
<td>Mean 36.86</td>
<td>2.59</td>
<td>10.31</td>
<td>6.02</td>
<td>5.92</td>
<td>2.56</td>
<td>2.71</td>
<td>2.67</td>
<td>7.49</td>
<td>10.59</td>
<td>30.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD 14.26</td>
<td>0.92</td>
<td>4.87</td>
<td>4.41</td>
<td>4.26</td>
<td>2.93</td>
<td>3.09</td>
<td>2.71</td>
<td>4.09</td>
<td>4.37</td>
<td>23.68</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>Mean 33.53</td>
<td>2.80</td>
<td>11.23</td>
<td>7.41</td>
<td>6.85</td>
<td>2.61</td>
<td>2.94</td>
<td>1.99</td>
<td>7.11</td>
<td>9.78</td>
<td>27.84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD 13.95</td>
<td>0.95</td>
<td>5.16</td>
<td>4.21</td>
<td>4.99</td>
<td>2.70</td>
<td>2.97</td>
<td>2.33</td>
<td>3.71</td>
<td>4.25</td>
<td>21.50</td>
</tr>
<tr>
<td>Overall</td>
<td>Boys</td>
<td>Mean 35.76</td>
<td>2.71</td>
<td>10.29</td>
<td>6.20</td>
<td>6.07</td>
<td>2.84</td>
<td>3.04</td>
<td>2.61</td>
<td>7.45</td>
<td>10.39</td>
<td>28.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD 14.61</td>
<td>1.01</td>
<td>5.17</td>
<td>4.53</td>
<td>4.27</td>
<td>3.05</td>
<td>3.30</td>
<td>2.74</td>
<td>4.00</td>
<td>4.26</td>
<td>23.26</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>Mean 35.66</td>
<td>3.18</td>
<td>12.07</td>
<td>8.09</td>
<td>7.40</td>
<td>2.80</td>
<td>3.40</td>
<td>2.82</td>
<td>7.55</td>
<td>10.34</td>
<td>28.08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD 13.80</td>
<td>0.97</td>
<td>5.59</td>
<td>4.63</td>
<td>5.25</td>
<td>2.92</td>
<td>3.46</td>
<td>2.77</td>
<td>3.79</td>
<td>4.29</td>
<td>21.46</td>
</tr>
</tbody>
</table>
Exercise Habit

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stress has been identified as a primary source of stress among adolescents in Malaysia. Although the present findings indicated a moderate level of stress among participants, with normal levels of depression and anxiety, it should be acknowledged that the present participants were in a nonexam year. Specifically, the Malaysian schooling system obligates students to sit for 3 national level examinations at the ages of 12, 15, and 17. The present participants’ noninvolvement in these exams partly explains the low to moderate level of stress observed in this study. Thus, the levels of negative emotions in the current study should not be generalized beyond this age group.

Previous findings have identified habituated exercise as a potentially effective stress regulation strategy. Indeed, it was found that students who have low levels of exercise were likely to experience higher levels of stress and health complaints. Contrary to this notion, the current study indicated that those who report higher exercise involvement also report higher levels of emotional distress. Although it is difficult to conceive of such a relationship, it is speculated that it results from an internal conflict between the desire to exercise and one’s focus on academic achievement. This speculation certainly is not unfounded. In fact, in 2 studies involving Malaysian students in eastern28 and northern states29 of Malaysia involving 750 and 500 school students, respectively, it was found that exercise habit correlated most highly with introjected regulation. Indeed, this form of regulation is driven by the need to increase social approval and self-worth or to avoid internal pressure and negative feelings (eg, exercising to avoid feelings of guilt).30

Although it has received little scientific attention, there is a widespread belief among Malaysian educators that active involvement in sports is the reason for student underachievement. For instance, Majzub and Rais,30 in a study among 300 educators concerning boys’ underachievement in exams, revealed that educators believe that academic achievement requires undivided attention on exam preparation. One of the respondents remarked “It’s (Malaysian education system) an exam-oriented system and mugging of facts; girls like to work hard handling homework; they accommodate well with the exams.” In turn, active involvement in sports and PA are believed to take away study hours; one of the respondents remarked that underachievement in boys was because “Boys like to shine in sports and games.” Without doubt, this notion awaits further empirical studies to identify the nature of this belief and strategies to overcome this negative belief of active involvement in sports and PA.30

Although the present findings suggested that exercise habituation is accompanied by higher levels of emotional distress, it also suggests that exercise habituation mediates the negative effect by almost 50%. Unfortunately, despite numerous benefits of habituated PA and exercise, it has been shown that PA levels progressively decline from late childhood through adolescence.31 It remains a challenge for researchers and practitioners alike to find effective ways to promote exercise habituation.

### Table 2 Direct and Indirect Effects Between the Primary Measures for Model 2

<table>
<thead>
<tr>
<th></th>
<th>Negative affect</th>
<th>Relative Autonomy Index</th>
<th>Exercise habit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct effect</td>
<td>Indirect effect</td>
<td>Direct effect</td>
</tr>
<tr>
<td>Exercise habit</td>
<td>0.62</td>
<td>–</td>
<td>0.35</td>
</tr>
<tr>
<td>Depression</td>
<td>0.48</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Stress</td>
<td>0.46</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.47</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Academic performance</td>
<td>0.75</td>
<td>–0.30</td>
<td>–</td>
</tr>
</tbody>
</table>

### Table 3 Path Loadings for Models 1 and 2 and Gender-Specific Path Loadings for Model 2

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Male sample</th>
<th>Female sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>URW</td>
<td>SRW</td>
<td>URW</td>
<td>SRW</td>
</tr>
<tr>
<td>RAI → Habit strength</td>
<td>0.24</td>
<td>0.37</td>
<td>0.22</td>
<td>0.36</td>
</tr>
<tr>
<td>Habit strength → Academic achievement</td>
<td>–0.012</td>
<td>–0.18</td>
<td>–0.04</td>
<td>–0.49</td>
</tr>
<tr>
<td>Negative affect → Academic achievement</td>
<td>0.39</td>
<td>0.38</td>
<td>0.76</td>
<td>0.75</td>
</tr>
<tr>
<td>Negative affect → Habit strength</td>
<td>5.81</td>
<td>0.39</td>
<td>8.71</td>
<td>0.62</td>
</tr>
<tr>
<td>Stress → Negative affect</td>
<td>2.03</td>
<td>0.75</td>
<td>1.25</td>
<td>0.47</td>
</tr>
<tr>
<td>Depression → Negative affect</td>
<td>1.79</td>
<td>0.76</td>
<td>1.13</td>
<td>0.48</td>
</tr>
<tr>
<td>Anxiety → Negative affect</td>
<td>1.61</td>
<td>0.61</td>
<td>1.10</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Abbreviations: URW, Unstandardized regression weight; SRW, Standardized regression coefficient; RAI, Relative Autonomy Index.
In line with previous findings, the current study reinforces the importance of higher levels of self-determination in promoting exercise habituation. Indeed, we are in agreement with other researches, such as Lonsdale and colleagues, that exercise intervention strategies may be best grounded on a self-determination framework. Moreover, we are also in agreement that PA and exercise intervention is best achieved within school settings, especially through physical education (PE) classes.

Specifically, we perceive that greater self-determination within a PE setting may be promoted using learner-centered instructional strategies, which acknowledge student needs and preferences while at the same time providing opportunities for adopting autonomy. This is critical given that secondary school has been found to limit students’ opportunities to make certain important decisions and involve excessive rules and discipline, poor teacher-student relationships, and homogeneous grouping by ability. Thus, providing students with some level of autonomy may foster the positive development of self-determination.

Promoting exercise habituation, in turn, may mediate the effects of negative emotions on students. Furthermore, promoting habituated exercise within the population could be associated with substantial reductions in direct health care costs as well as reductions in indirect costs associated with reduced work productivity, disease-related disability, and premature death. Because PE programs are an institutionalized component of most education systems, they provide a convenient platform for promoting a physically active lifestyle.

Apart from the primary findings, it is worth mentioning that the present findings also contribute to an understanding of the measurement of negative emotions. Specifically, among adults, substantial evidence exists supporting the psychometric properties of DASS-21 in both clinical and nonclinical populations, as well as across various cultural groups. However, there is a debate over whether the DASS-21 is suitable for use in younger respondents. In fact, there is the view that the DASS-21 is best used as a unidimensional measure of negative affect among adolescents. Several researchers, for instance, believe that adolescents may not be able to distinguish their emotional experience measured by the DASS-21. Thus, its usage as a measure of differentiated negative affect among adolescents should proceed with caution. Consistent with this notion, the model with a general negative affect factor yielded a good model fit. In fact, a recent study in Malaysia confirmed this idea.

In summary, school can be a source of stress for adolescents. Poor negative emotion regulation strategies will adversely affect not only students’ academic performance but also their psychological well being. The present finding revealed that habituated exercise has the potential to buffer the adverse effects of negative emotions on academic achievement. Promoting exercise habituation remains a challenge for practitioners and researchers alike given the age-related decline in PA participation among adolescents. Consistent with previous studies, self-determination is positively related to exercise habituation and may be used as a guiding framework for promoting the development of exercise habits. The school setting, and particularly the setting of physical education classes, is viewed as an excellent platform to promote this cause.

While we believe these findings contribute to adolescent exercise literature, we must, of course, acknowledge the potential limitations surrounding our study. Firstly, as in other survey-based research, our findings may be influenced by recall error and social desirability biases. Secondly, the sample was limited to 13- and 14-year-old students, thereby restricting our ability to generalize the findings outside this age range. We encourage other researchers to study other age groups to determine if our findings are age-specific or generalized.

References


