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Examining the Effectiveness of a Pilot Physical Literacy–Based Intervention Targeting First-Year University Students: The PLUS Program

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Abstract

The transition into university is often considered the first major life transition and is associated with significant declines in physical activity (PA). It remains, however, unclear how to best prevent or attenuate these declines. The concept of physical literacy (PL) and the enhancement of PL may hold some promise, as it is considered foundational for lifelong PA engagement. Specifically, it targets the motivation, confidence, physical competence, knowledge, and understanding to maintain PA. The purpose of this study was to evaluate the effectiveness of a pilot PL-based intervention. First-year university students ($N = 65$, $M_{age} = 17.85 \pm 0.51$; $n = 46$ females) were enrolled in a quasi-experimental study. Participants in the intervention condition ($n = 26$) entered a 12-week program intentionally designed to facilitate novel movement skills through aerial, water, and land-based activities, within a fun and engaging group-based environment. Participants in the control condition completed baseline and follow-up assessments only. All participants completed baseline and follow-up assessments of movement competence, motivation, knowledge, and confidence. Results found a significant time by condition interaction, $F(1, 58)$ 4.92, $p = .03$, $\eta_p^2 = 0.08$ in PL, suggesting the intervention was effective in enhancing overall PL. There were also significant time by condition interactions for motivation, $F(1, 59)$ 5.19, $p = .03$, $\eta_p^2 = 0.08$, and knowledge and understanding, $F(1, 59)$ 6.90, $p = .01$, $\eta_p^2 = 0.11$ when examining PL subdomains. Overall, results from our pilot PL-based intervention show promise as a modality to help first-year university students maintain active lifestyles, but future trials with larger samples are required.

Keywords

physical literacy, first-year university students, transition, physical activity, intervention, movement competence, confidence, motivation, knowledge and understanding

Introduction

There is evidence of many positive physical and psychological outcomes associated with physical activity (PA) participation across the lifespan (Poitras et al., 2016; Warburton, Nicol, & Bredin, 2006). Participation in PA is related to reduced risk of depression and stress (Jewett et al., 2014) and enhanced academic outcomes and executive function (Esteban-Cornejo, Tejero-Gonzalez, Sallis, & Veiga, 2015; Lambourne & Tomporowski, 2010), and is also used as a coping mechanism for stress management for younger people (Cairney, Kwan, Veldhuizen, & Faulkner, 2014). However, despite these benefits, approximately 68% of young adults are not meeting PA guidelines (Government of Canada, Statistics Canada, 2014). Emerging adults in particular face many barriers to engagement in PA as they transition out of high school, with many entering postsecondary settings that require shifts in priorities with changing academic and domestic roles and responsibilities (Gómez-López, Gallegos, & Extremera, 2010; Gyurcsik, Spink, Bray, Chad, & Kwan, 2006; Kwan & Faulkner, 2011). This specific period is often considered the first major life transition that an individual faces and is correspondingly marked by sharp declines in PA (Bray & Born, 2004; Kwan, Cairney, Faulkner, & Pullenayegum, 2012). Therefore, given the many physical, psychological, and

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academic benefits of PA, the emerging adulthood period represents a critical life stage for PA intervention.

To design effective interventions, it is important to consider theory-based determinants of PA behaviors. The concept of physical literacy (PL), as a holistic framework, has received increasing attention having been identified as the foundation of PA engagement. As a multidimensional construct, PL is described as "the motivation, confidence, physical competence, understanding, and knowledge to maintain PA at an individually appropriate level throughout life" (Whitehead, 2007, p. 204). It posits that an individual with proficient movement skills will feel confident in their movement abilities and will be more motivated to continue to engage in activities that develop and strengthen their skills. Furthermore, the knowledge and understanding of the importance of PA to health and well-being will contribute to one's motivation to engage in physical activities that develop movement skills. Although there are varying definitions of the concept, the domains in Whitehead's definition are consistent across most conceptualizations (Edwards, Bryant, Keegan, Morgan, & Jones, 2017). While PL has been observed in the literature for some time, empirical inquiry has not kept pace for theorizing around the construct. As such, critical gaps in our knowledge exist. For example, PL has not been well studied in relation to PA behaviors, even though each individual subdomain of PL (i.e., competence, confidence, motivation, and knowledge) is considered to be an important correlate of PA during the early life stages (e.g., Self-Efficacy Theory or Self-Determination Theory; Bray, 2007; Brunet & Sabiston, 2011; Robinson et al., 2015; Stodden et al., 2008). In addition, although the concept of PL has seemingly been widely implemented programmatically, particularly for school-aged children in educational and sport contexts, its popularity has outpaced the empirical evidence to support them. As a result, there is a substantial gap in the literature in the evaluation of PL-based interventions. Furthermore, to our knowledge, there has been little focus on PL in the emerging adulthood population.

To be effective, PL-based programs must be developed with intentionality that is aimed at *all* of its core domains: movement competence, confidence, motivation, and knowledge and understanding. The environmental contexts in which programs are implemented should be considered most salient, as the development of PL will only take place in settings perceived as fun and enjoyable to individuals (Cairney, Bedard, Dudley, & Kriellaars, 2016). It is unlikely that individuals will derive feelings of confidence and mastery or will feel motivated to engage in physical activities that are not enjoyable. In other words, an effective PL intervention must include activities that not only develop movement competence but are also viewed as fun and exciting to provide a context that facilitates the development of each domain of PL (Cairney et al., 2016). The complexity of these activities needs to be appropriately scaled so that they are novel and challenging while allowing for opportunities of creativity and mastery. In addition, activities should take place in a social environment to enhance the enjoyment of participants as they interact with their peers (McCarthy, Jones, & Clark-Carter, 2008), to provide opportunities to gain confidence from ones' evaluations of other's perceptions of themselves, to learn vicariously by observing others succeeding in tasks (Bandura, 1997), and to create cohesion among the group, and to maintain motivation to continue engaging in the activities over time (Burke, Carron, Eys, Ntoumanis, & Estabrooks, 2006). The importance of creating a safe, enjoyable, challenging, and social environment is clear when considering the relationship between these affective elements and sustained engagement in PA (Allender, Cowburn, & Foster, 2006).

The postsecondary setting represents a unique environment that is ideal to develop effective PL-based interventions targeting emerging adults transitioning out of high school and into university or college. A university campus can leverage the already established knowledge exchange methods and messengers and subsidized PA facilities, staff, and programs to facilitate the delivery of an intervention directly to students. In addition, the social nature of existing campus settings (e.g., residences, classes, specialty clubs, etc.) is a natural fit that enables any incoming intervention to take place in a group setting, thus aligning with the ideal PL context.

Therefore, within a PL framework with special considerations for the emerging adulthood population transitioning out of high school, we designed an intervention to intentionally target PL, and specifically each of its four domains (i.e., movement competence, confidence, motivation, and knowledge and understanding). The objective of the current study was to evaluate the effectiveness of this pilot intervention on each individual domain of PL and, importantly, on PL as a single (collective) construct. While our study is largely exploratory, we hypothesize that the PL-based intervention will have a positive impact on students' PL and that we would see greater improvements in movement competence, confidence, motivation, and knowledge and understanding in comparison with typical students enrolled at first-year university.

Method

Study Design and Participants

Utilizing a quasi-experimental study design, a total of 69 students were initially recruited for the current pilot study: The Physical Literacy intervention in first-year University Students (PLUS) study. Eligible participants were first-year students, aged 17 years or older, transitioning directly from high school, and residing at one of the campus residence buildings. Participants in the intervention arm ($n = 26$) were specifically recruited from residences designated as Healthy Active Living (HAL) communities and were enrolled on a

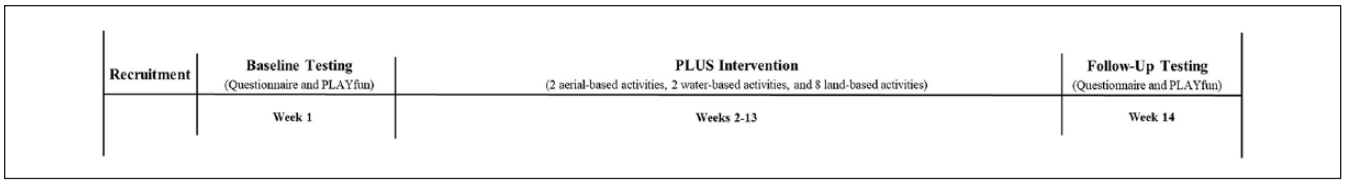

Figure 1. PLUS intervention study protocol.
Note. PLUS = Physical Literacy intervention in first-year University Students.

first-come first-served basis. Two of the 12 residences on campus were designated as HAL communities, and included periodic events and seminars throughout the year to provide students' exposure to information relating to healthy active lifestyle behaviors. All incoming residence students have the opportunity to self-select rooms within a HAL community. Given the pilot nature of the current study, we intentionally targeted a group that would likely have an initial interest in the program that we were proposing. To account for potential selection bias, we recruited two control groups: one control group ($n = 20$) living in a HAL community and another non-HAL control group ($n = 23$) living in any of the other university residences.

Procedure

Participants were recruited several ways. First, an email was sent out to all students who were assigned into one of the HAL communities during the summer prior to moving to campus, giving a brief explanation of the PLUS intervention and the study requirements. It was stated that participation in the study included baseline testing comprised of PL assessments, including the completion of a questionnaire; followed by weekly engagement in one of two sessions (i.e., 8:30 a.m.-9:30 a.m. or 9:30 a.m.-10:30 a.m. group) during the fall semester; and postintervention testing with the same assessment protocol. If their schedule did not permit, or if they did not want to commit to the 12-week intervention program, students were asked to participate in the control arm, taking part in baseline and postintervention testing only. Participants were also recruited throughout welcome week, where research assistants had the opportunity to engage with first-year university students at orientation events at all campus residences to promote participation in the study. Students interested in participating in either group were instructed to contact the research team by email and were subsequently scheduled into baseline testing the second week of the fall semester. For pragmatic purposes, each intervention session (i.e., earlier or later group) had a maximum of 15 participants, and once it reached capacity, all prospective participants were invited to take part as control participants. Please refer to Figure 1 and the Supplementary Material (see p. 2) for a timeline of the full procedure and PLUS intervention study protocol.

Once signed up, participants were scheduled to an in-person testing session at the athletic center on campus to complete PL assessments. A reminder of the appointment was sent to each person 1 day prior to testing. Follow-up testing was completed 12 weeks later, where participants were again scheduled for in-person PL assessments. Participants completing the testing were compensated with a $20 gift certificate. All study material and procedures were approved by the institutional research ethics board, and all participants provided written, informed consent prior to their baseline testing session.

The PLUS Intervention

The PLUS intervention program took place over 11 consecutive weeks and consisted of 1-hr weekly sessions, intentionally designed to introduce novel movement skills through game-based activities. Led by four trained undergraduate students (i.e., intervention leaders), the primary aim was to develop weekly sessions to enhance the proficiency, motivation, confidence, and knowledge and understanding by engaging in various movement-based activities. The goal was to create a fun and engaging group environment, focusing on nontraditional physical activities, promoting novel movements on land, air, and water. For example, our aerial sessions had participants take part in the high ropes course located on campus, or participating in various challenge-based games and tasks on the climbing wall. One session was dedicated to movement in water, including different games with the use of inner tubes in the water. Other weeks included sessions introducing participants to "High Intensity Interval Training (HIIT)" using outdoor equipment on campus; "capture the flag" utilizing the athletic fields; "beach and cottage games" primarily focused on throwing, catching, and aiming skills through some popular games (i.e., KanJam, Ladderball, and Ring Toss); and "adapted sports" where participants learned and participated in seated volleyball and goal ball (sports for those with lower limb and visual impairments). A detailed study and program manual was developed, whereby each session was carefully developed to describe how each domain of PL were to be targeted during each week. Following each session, the intervention leaders completed an implementation checklist to ensure that the intervention was delivered as planned, as well as to provide feedback for necessary modifications for future sessions.

Study Measures

Each PL domain was measured for all participants at baseline and follow-up. We used, or adapted, validated measures that best captured each of these central constructs.

Movement competence. Movement competence was evaluated utilizing the PLAYfun tool which is intended for use in individuals aged 7 and above (Canadian Sport for Life, 2013; also see Cairney et al., 2018). The assessment is composed of 18 different movement tasks (e.g., one handed catch, gallop and crossover) within five domains: (a) running; (b) locomotor; (c) object control—upper body; (d) object control—lower body; and (e) balance, stability, and body control. Trained assessors evaluated participants on each task using a modified visual analog scale (VAS). The scale measures 100 mm in length and was translated into a score from 0 to 100 per item. The VAS is divided into four categories: initial (0-25 mm), emerging (25-50 mm), competent (50-75 mm), and proficient (75-100 mm). The total score was calculated by averaging the 18 tasks, and domain scores were calculated by averaging tasks included within each domain. Higher scores indicate greater movement competence. Internal consistency for the pre- and postintervention scale scores were good (Cronbach's αs ranging from .84 to .86).

Confidence. Confidence, or self-efficacy, for engaging in PA and sports was assessed using two items. Adhering to recommendations by Bandura (1997, 2006) for assessing self-efficacy, each item was prefaced with the stem "I am confident in my ability to . . ." and was rated using an 11-point scale, 0 (*not confident*) to 10 (*totally confident*). The individual items were ". . . engage in physical activity (e.g., running, yoga, skating)" and ". . . engage in sports (e.g., soccer, baseball, ultimate frisbee)." The total confidence score was calculated by averaging the two items. Internal consistency for the pre- and postintervention scale scores were acceptable (αs ranging from .73 to .90).

Motivation. Motivation was assessed via the 24-item self-report Behavior Regulation in Exercise Questionnaire-3 (BREQ-3; Mullan, Markland, & Ingledew, 1997; Markland & Tobin, 2004). The BREQ-3 includes 24 items rated on a 5-point Likert-type scale ranging from 0 (*not true for me*) to 4 (*very true for me*). Example items include "I exercise because other people say I should" and "I don't see the point in exercising." We used the Relative Autonomy Index (RAI) as a reflection of overall motivation, and the degree to which a participant has self-determined (i.e., autonomous) forms of motivation. Higher positive scores on the BREQ-3 RAI indicate greater motivation. Internal consistency for the pre- and postintervention scale scores were good (αs ranging from .69 to .90).

Knowledge and understanding. Given the lack of consensus on how best to measure knowledge and understanding as it pertains to the domain of PL, we selected five items from the BREQ-3 that we believe best represent the knowledge and understanding of the importance of engaging in regular PA. Specifically, the items included (a) "It's important to me to exercise regularly," (b) "I don't see why I should have to exercise," (c) "I think it is important to make the effort to exercise regularly," (d) "I don't see the point in exercising," and (e) "I think exercising is a waste of time." Items 2, 4, and 5 were reverse scored so that higher scores reflected a stronger knowledge and understanding. The items were then summed and averaged to generate a total score. Internal consistency for the pre- and postintervention scale scores were acceptable (αs range from .71 to .81).

PL composite score. A single measure of PL was calculated using standardized scores from each of the aforementioned measures. Specifically, standardized z-scores were calculated separately based on the total scores for PLAYfun, confidence, motivation (i.e., RAI score), and knowledge and understanding. The standardized scores were then summed, with higher values reflecting greater overall PL. Internal consistency for the pre- and postintervention PL composite scores were good (αs ranging from .77 to .79).

Data Analysis

All statistical analyses were conducted using SPSS 25. Descriptive statistics were computed and used to describe demographic information of participants. Separate one-way analyses of variance (ANOVAs) were computed to determine whether there were differences in baseline scores on the outcomes measures (i.e., movement competence, confidence, motivation, knowledge and understanding, and the composite score of PL) between all groups. To ascertain that any change in the outcome measures over time could be attributed to participation in the PLUS intervention, and not other opportunities that may be available through living in a HAL residence, 2 (HAL control vs. non-HAL control) × 2 (Time 1 vs. Time 2) repeated measures ANOVAs were also computed on the outcome measures between the control groups. Given that there were no baseline or differences over time between the two control groups ($ps > .05$), the groups were combined into a single control group for all subsequent analyses. Mixed 2 (intervention vs. control) × 2 (Time 1 vs. Time 2) repeated measures ANOVAs were used to examine within-subject changes in the outcome measures between study conditions. Significant interactions were decomposed and evaluated using paired-sample t tests to examine the change in mean scores within each group.

Table 1. Participant Characteristics and Demographics.

	Total (N = 65)		Control (n = 39)		Intervention (n = 26)		F or χ^2 (p value)
	n	%	n	%	n	%	
Age, M (SD)	17.85	(0.51)	17.85	(0.49)	17.85	(0.54)	0.00 (.99)
Gender							0.50 (.82)
Female	46	70.0	28	72.0	18	69.0	
Male	19	30.0	11	28.0	8	31.0	
Other	0	0.0	0	0.0	0	0.0	
Ethnicity							2.59 (.63)
White/Caucasian	19	29.0	12	31.0	7	27.0	
East Asian	24	37.0	13	33.0	11	42.0	
South Asian	15	23.0	9	23.0	6	23.0	
Black/Latin American	4	6.0	2	5.0	2	8.0	
Other	3	5.0	3	8.0	0	0.0	
Parental education							3.90 (.57)
Some secondary	2	3.0	2	5.0	0	0.0	
Completed secondary	5	8.0	2	5.0	3	12.0	
Some college	2	3.0	2	5.0	0	0.0	
Completed college	9	14.0	6	15.0	3	12.0	
Some university	4	6.0	2	5.0	2	8.0	
Completed university	43	66.0	25	64.0	18	69.0	

Results

Demographics and Group Characteristics

Of the 74 participants who completed baseline assessments, 65 participated in the follow-up assessment (88% response rate). Subsequent analyses included those with both baseline and follow-up assessments (intervention n = 26 and control n = 39). Our sample included 17- and 18-year-old first-year university students, who were mostly female (70%), and from relatively diverse ethnic backgrounds, and highly educated households. Complete details of participant characteristics are shown in Table 1.

Mean scores and ANOVA summaries across the domains of PL at baseline and at the 12-week follow-up are shown, by group, in Table 2. Preliminary examination of the baseline scores showed that the control group (M score = 53.90) began with significantly lower movement competence (i.e., PLAYfun total) scores compared with the intervention group (M score = 58.25). Baseline scores, however, for confidence, motivation, and knowledge and understanding were not significantly different between groups (ps > .05).

Composite Score of PL

Overall, findings showed significant improvements in first-year students' PL for those in the intervention condition. While results of the 2 × 2 (time by condition) repeated measures ANOVA showed no main effect for time, $F(1, 58) = 0.00$, $p = .99$, $\eta_p^2 = 0.00$, there was a significant time by group interaction, $F(1, 58) = 4.92$, $p = .03$, $\eta_p^2 = 0.08$. Although post hoc analyses were in the hypothesized direction, they did not reach statistical significance. That is, PL scores increased among participants in the intervention condition, $t(22) = -2.01$, $p = .06$, $d = 0.29$, whereas they decreased among control participants, $t(36) = 1.57$, $p = .13$, $d = 0.17$.

Individual Domains of PL

Movement competence. Results from a series of 2 × 2 repeated measures ANOVAs showed no main effects for time for PLAYfun total scores and PLAYfun subdomain scores (ps > .05). In addition, the time by condition interactions were also nonsignificant for PLAYfun total scores, $F(1, 62) = 0.26$, $p = .62$, $\eta_p^2 = 0.004$, nor were they significant for any of the subdomain scores for running, $F(1, 62) = 0.16$, $p = .68$, $\eta_p^2 = .003$, locomotor, $F(1, 62) = 1.28$, $p = .26$, $\eta_p^2 = .02$, object control—upper body, $F(1, 62) = 1.97$, $p = .17$, $\eta_p^2 = .03$, object control—lower body, $F(1, 62) = 0.32$, $p = .57$, $\eta_p^2 = .01$, and balance, stability, and body control, $F(1, 62) = 0.45$, $p = .51$, $\eta_p^2 = .01$.

Confidence. Results from the 2 × 2 repeated measures ANOVA showed no main effects for time, $F(1, 59) = 2.88$, $p = .10$, $\eta_p^2 = 0.05$. The time by condition was also nonsignificant, $F(1, 59) = 1.93$, $p = .17$, $\eta_p^2 = 0.03$, between groups, although there appears to be a small effect. As an exploratory post hoc test, we conducted paired-sample t tests, which

Table 2. Comparison of Physical Literacy Scores by Condition.

	Control		Intervention			
	M (*SD*)		*M* (*SD*)		*F*	*p* value
PL composite						
Time 1	–0.24	(3.32)	0.79	(2.00)	1.92	.17
Time 2	–0.74	(3.56)	1.22	(1.89)	6.17	**.02**
Interaction (Group × Time)					4.92	**.03**
Movement competence						
PLAYfun Tool Time 1	53.90	(8.57)	58.25	(6.77)	4.73	**.03**
PLAYfun Tool Time 2	55.05	(9.09)	58.41	(5.85)	2.70	.11
Interaction (Group × Time)					0.26	.62
Confidence						
Time 1	6.91	(2.40)	7.44	(1.19)	1.05	.31
Time 2	7.03	(2.25)	7.98	(1.23)	3.85	**.05**
Interaction (Group × Time)					1.93	.17
Motivation						
Time 1	12.25	(5.86)	12.87	(4.70)	0.20	.66
Time 2	10.34	(6.45)	13.11	(4.73)	3.41	.07
Interaction (Group × Time)					5.20	**.03**
Knowledge and understanding						
Time 1	3.61	(0.41)	3.66	(0.41)	0.19	.67
Time 2	3.37	(0.63)	3.69	(0.38)	5.18	**.03**
Interaction (Group × Time)					6.90	**.01**

Note. PL = physical literacy; Bold text indicates $p < .05$.

indicated that confidence scores increased significantly among participants in the intervention condition, $t(23) = -2.39$, $p = .03$, $d = 0.46$, whereas there was no change over time among control participants, $t(36) = -0.22$, $p = .84$, $d = 0.02$.

Motivation. Results from the 2 × 2 repeated measures ANOVA showed no main effects for time, $F(1, 59) = 2.59$, $p = .11$, $\eta_p^2 = 0.04$. However, there was a significant time by condition interaction, $F(1, 59) = 5.19$, $p = .03$, $\eta_p^2 = 0.08$, with a moderate effect. Post hoc analyses indicated that motivation scores remained relatively stable among participants in the intervention condition, $t(23) = -0.49$, $p = .63$, $d = 0.08$, whereas they decreased significantly among control participants, $t(36) = 2.90$, $p < .01$, $d = 0.36$.

Knowledge and understanding. Results from the 2 × 2 repeated measures ANOVA showed no main effects for time, $F(1, 59) = 2.59$, $p = .11$, $\eta_p^2 = 0.04$. However, there was a significant time by condition interaction, $F(1, 59) = 6.90$, $p = .01$, $\eta_p^2 = 0.11$, with a moderate effect. Post hoc analyses indicated that knowledge and understanding scores remained relatively stable among participants in the intervention condition, $t(23) = -0.98$, $p = .34$, $d = 0.15$, whereas they decreased significantly among control participants, $t(36) = 2.90$, $p < .01$, $d = 0.45$.

Discussion

Overall, the results from the pilot study are promising, suggesting that a PL-based intervention can be effective in enhancing overall PL. A significant time by condition interaction indicates that participants in the intervention condition improved their PL by the end of the 12-week program, and with a moderate effect size. In the examination of the specific domains of PL, we found notable improvements in some of the core domains. Specifically, while findings suggest that there was no overall change with respect to movement competence, small-to-moderate effect sizes were evident in the time by condition interactions for motivation, confidence, and knowledge and understanding. Overall, the results suggest that the intervention was effective in enhancing first-year university students' PL but may have been particularly successful in terms of enhancing or maintaining specific domains of PL.

Findings from the current study are important, as we have not only demonstrated that it is possible to improve PL in emerging adults but that the intervention had a positive impact on key psychological factors that are known correlates of PA behaviors. Although there is evidence to suggest that PA motivation tends to be high as students enter university (Kwan, Bray, & Martin Ginis, 2009), few have investigated the specific changes in PA motivation during students' first year at university. However, a number of studies have found a general discordance between their motivation and subsequent behaviors (Gyurcsik et al., 2006; Kwan et al., 2009). Results from the current study suggest that motivation for PA decreases during students' first semester and that a PL-based intervention may be an effective method to help attenuate these declines in motivation.

Importantly, self-efficacy or the confidence to engage in activity is considered among the most robust predictors of PA behaviors, while knowledge is critical in the formation of motivation (Trost, Saunders, & Ward, 2002). Evidence suggests that self-efficacy is particularly critical during this major transitory period (Bray, 2007; Deliens, Deforche, De Bourdeaudhuij, & Clarys, 2015; Gyurcsik et al., 2006; Zhou, Wang, Knoll, & Schwarzer, 2016). Having the confidence to move and engage in physical activities appears to be a necessary condition for students to maintain activity following the transition out of high school. Knowledge and understanding of the benefits of PA also appears to be important during the emerging adulthood period. Indeed, findings indicate that instrumental attitudes and outcome expectations are related to PA behaviors (Kwan et al., 2009; Rovniak, Anderson, Winett, & Stephens, 2002).

Although the intervention was successful in maintaining and improving the psychological domains of PL, there were no observable changes in motor competence. This perhaps should not be entirely surprising given that the PLUS intervention was only offered once per week—and the weekly activities were more intended to expose participants to a range of novel movement skills through participation in non-traditional games rather than focus on the specific practice of movement skills. As mentioned earlier, however, baseline movement competence was slightly higher for those in the intervention condition, which could mean that there was a response bias with those selecting to participate in the intervention generally having more proficient movement skills. Regardless, it should be noted that both groups were generally competent in their movement skills, with scores ranging from 53.90 to 58.41 indicating that they are in the lower level of competence meaning that they have acquired fundamental movement skills (i.e., scores between 51 and 75) but were not necessarily proficient overall (i.e., scores between 75 and 100). Furthermore, these differences at baseline were not statistically significant, and movement competence remained stable between the baseline and follow-up assessments for both groups.

Together, not only will improvements in PL have implications in terms of possible short-term behaviors, but are considered the necessary factors and conditions to lead a healthy active life—important as these emerging adults transition into adulthood and face other major life transitions (e.g., marriage, having children, beginning or changing careers, etc.). Critically, we know behaviors track well from emerging adulthood into later adulthood (Tammelin et al., 2014), and that it becomes increasingly challenging to change behaviors later in life (Gordon-Larsen, Nelson, & Popkin, 2004). Targeting PL during the transition into emerging adulthood appears beneficial at this critical point in time. Furthermore, as mentioned above, participants in the control groups (one control group living in a HAL community and another non-HAL control group living in any of the other university residences) showed no differences at baseline or overtime in PL. This is despite the HAL community control participants being exposed to periodic events and seminars over the year that provided information pertaining to healthy active lifestyle behaviors. Thus, we should not assume that these initiatives are always impactful in the way they are intended and, importantly, not to the same extent as more focused interventions or structured programs such as the PLUS intervention.

To the best of our knowledge, this is the first intervention study to target PL in the emerging adulthood population. Although this study showed some promising results, there are a number of notable limitations worthwhile to consider. First, given that this was a pilot study, our sample size was small limiting our ability to perform advanced statistical analyses, such as structural equation modeling, that should be pursued in future research. Second, it would be interesting to investigate the effects of a longer intervention over the entire school year and whether the effects would be larger over a longer period of time. Third, we used a convenience sampling frame, including a first-come first-served approach in our recruitment of participants in the intervention condition. This leaves open the possibilities of response biases and confounding, although there were no discernable differences in the responses between the two intervention groups. In addition, our overall sample included in the study may not be representative of the broader student population. Future trials with larger samples and random allocation are required. Finally, the measure we used to assess knowledge and understanding was based on items from the BREQ-3, which was used to assess motivation. This poses an issue with colinearity, and future work that includes discrete measure of knowledge and understanding is needed. Given the lack of consensus, future research should develop and validate PL-based measure of knowledge and understanding.

Conclusion

The intentionally developed PL-based PLUS intervention can have a positive effect on PL in students transitioning into university. The PLUS intervention was found to have no significant changes in movement competence but improvements in confidence, knowledge and understanding, and an attenuating effect for motivation. Given the potential for positive effects on PL for transitioning students, the PLUS intervention has potential to be delivered as a cocurricular program offered to transitioning students, as well as to the broader student body. Overall, given the typical declines in PA, the PLUS intervention may be a promising approach in promoting the maintenance of lifelong engagement in PA.

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ORCID iD

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