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Use of Facebook in physical activity intervention programme A test of self-determination theory

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The use of information and communications technology in physical activity intervention programmes has been found to be effective in some instances. We conducted a field study to examine the changes to activity level and psychological consequences of incorporating social network interactions into physical activity intervention programme using the self-determination theory framework. Sixty-two students from a local university in Singapore were allocated into four groups comprising a control group, a 3 hours physical activity intervention group, a 3 hours physical activity intervention group linked via Facebook, and a 1 hour physical exercise intervention group linked via Facebook. Measures on the level of physical activity, perceived autonomy, competency, relatedness, enjoyment and vitality were taken before and after the intervention programme. Repeated ANOVA and MANOVA analyses were conducted. The results showed that participants in the two groups with the 3 hours physical activity intervention reported a significant increase in the level of physical activity level compared to participants in other groups. Although the use of social network sites did not have any material effect on the physical intervention programmes, it enhanced competence and enjoyment in the activity. This suggests that the use of social network sites in physical activity intervention programmes yielded some positive psychological effects but the maximization of benefits need to be studied further.

KEY WORDS: Physical activity, Physical intervention, Self-Determination, Social network site theory, Subjective vitality.

Physical inactivity is identified as the fourth leading risk factor for global mortality, and is a key risk factor for non-communicable diseases (NCDs) such as cancer, cardiovascular diseases, and diabetes (WHO, 2014). In contrast, physical activity brings about benefits ranging from improved fitness

functions to psychological well-being (CDC, 2011). Recent trends also suggest that there is more acceptance of the notion of “exercise is medicine” among health promoters (see <http://exercisemedicine.org/>). Physical activity promotion is thus a common strategy adopted by policy makers, governmental agencies, schools and workplace settings, thus giving rise to a range of intervention programmes aimed at increasing physical activity level (Lau, Lau, Wong, & Ransdell, 2011).

As it stands, some of these physical activity intervention programmes have been traditionally delivered via face-to-face mode (Allen & Morey, 2010). In face-to-face mode there is a huge reliance on actual meetings between the activity leader and members for dissemination of information and guidance of activity. Health education, health risk assessments, goal setting and establishment of commitment contracts are a few specific interventions featured in individualised programmes (Allen & Morey, 2010). A systematic review by Wu, Cohen, Shi, Pearson, and Sturm (2011) found that individually adapted behavioral change programmes and programmes aimed at providing social support, presumably involving face-to-face intervention, are generally effective in increasing activity levels but they are least cost-effective in comparison with other strategies. Some researchers even noted that the effects of intervention based on face-to-face modes have been small (Lau et al., 2011). In part, this is because intervention programmes implemented through face-to-face mode have a high attrition rate as they are subjected to constraints in time schedules, running costs and accessibility (Sevick et al., 2000). It has been noted that there is a trend towards alternative modes of intervention delivery (Allen & Morey, 2010), signifying the importance of exploring new ways of enhancing adherence and preference towards such programmes to improve their effectiveness.

Improvements in information and communications technology such as the Internet, computer kiosks and mobile phones, offer the possibility of reducing the attrition rate of physical activity intervention programmes (Nigg, 2003). Studies have indicated that the use of information and communications technology has many advantages, including flexible time schedules (Nigg, 2003), access to a large population (Marcus, Nigg, Riebe, & Forsyth, 2000), and delivery of individualised feedback and social support for exercise participants (Lau et al., 2011). A review also showed that many eHealth intervention initiatives yielded positive results in encouraging participation in physical activities (Norman et al., 2007). As such, it can be concluded that the use of information and communications technology as a tool for increasing physical activity and promoting other health-related behaviour is promising.

eHealth can be broadly understood as the utilization of the information and communication technology (ICT) to promote health and health care (Eng, 2001). The advantage of eHealth intervention over the conventional face-to-face intervention includes more proactive approach in participant recruitment in a large population, more individualized intervention cater for large population, as well as the capability of delivering the intervention through a variety of channels (Nigg, 2003). The effectiveness of eHealth intervention in promoting physical activity has been supported by systematic review whereby most studies had significant improvement at post-intervention (Lau, Lau, Wong, & Ransdell, 2011).

Given the widespread utilization of social network sites today, it seems inevitable that the next generation of physical activity intervention programmes could be more readily delivered or enhanced through this medium. Boyd and Ellison (2008) define social network sites as web-based services that enable individuals to construct a public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections. The popularity of social network sites is most clearly observed among young adults. Most young adults have at least one social network account, with many of them logging on to their social network site at least once a day to maintain relationships with their existing network of friends by exchanging information with each other (Bonds-Raacke & Raacke, 2010; Boyd & Ellison, 2008; Gangadharbatla, 2008; Raacke & Bonds-Raacke, 2008).

However, there have been few studies conducted in the area of physical intervention programmes delivered through social network sites. One of the few studies recently found that the use of social network sites with other forms of communication produced a significantly higher level of weight loss among college students in a weight loss programme (Napolitano, Hayes, Bennett, Ives, & Foster, 2013). In addition, there is limited empirical research evidence in the psychological aspects of physical activity intervention delivered through the social media platform, thus limiting the understanding on the motivation aspects of such strategies.

To this end, we speculated that additional interactions with the participants through social media platforms may serve to increase physical activity level and adaptive psychological consequence. The purpose of this field study was to preliminarily examine the effects of utilizing Facebook as a motivational tool to increase physical activity level and enhance psychological consequences of physical activity.

The process of building intervention programmes to increase physical activity participation should be theoretically driven (Wang, Liu, Lochbaum,

& Stevenson, 2009). In particular, theories in motivation have been useful in providing a psychological explanation to changes in exercise behaviour through intervention programmes. These include self-determination theory (SDT) which has been widely used to understand human behavior, and has been used in many studies in examining exercise behaviour and physical activity participation (Hagger & Chatzisarantis, 2008; Ryan & Deci, 2007; Silva, et al., 2010; Teixeira, Carraça, Markland, Silva, & Ryan, 2012; Wilson & Rodgers, 2004).

SDT is a macro-theory that includes five mini-theories. The cognitive evaluation theory deals with the effects of extrinsic rewards, evaluations and feedback on intrinsic motivation. The organismic integration theory focuses on the processes through which motivation for non-intrinsically motivated activities can be internalized. Causality orientation theory is another mini-theory that focuses on individual differences in people's tendencies to orient towards environment and regulate behaviors in different ways. Another framework within SDT is the goal contents theory, which distinguishes between intrinsic and extrinsic goals and their impact on motivation and well-being. Finally, the basic psychological needs theory (BPNT) explains in detail the concept of the basic psychological needs and their relations to psychological health and well-being. The basic psychological needs theory is used in this study.

SDT posits that humans have innate tendencies to actively pursue development and psychological growth by mastering challenges and integrating their experiences into a coherent sense of self (Deci & Ryan, 1985). Within the BPNT, three basic psychological needs were identified as critical nutrient for the intrinsically motivated or autonomous behaviours: (a) autonomy, a sense of freedom in making choices, initiating and regulating behaviours; (b) competence, the beliefs of one's capability in completing goals and producing desired outcome; and (c) relatedness, one's feeling of belongingness and success in socializing (Ryan & Deci, 2000). When all three basic needs are satisfied, they will sustain one's intrinsic motivation and self-regulate autonomous behaviours. This helps an individual to internalise and transform other controlled regulation into more autonomous form of regulation.

In the case of physical activity participation, it is understood that when a person's basic psychological needs are satisfied through the physical activity intervention programme, there is greater likelihood for autonomous regulation to exercise and thus potential for higher activity level. The use of SDT has been applied to various health behaviour in school-based exercise intervention programme (Chatzisarantis & Hagger, 2009) and leisure-time context (Vansteenkiste, Simons, Soenens, & Lens, 2004). For example, Chatzis-

arantis and Hagger (2009) conducted a school-based intervention to change pupils' physical activity intentions and self-reported leisure-time physical activity behaviour over a 5-week interval of time. The results found that students taught by autonomy-supportive teachers reported higher intentions to exercise during leisure time and participated more in leisure time physical activities compared to students in the control condition. Vansteenkiste et al. (2004) used short-persuasive messages that stated the benefits of Taibo in either autonomy-supportive or controlling ways in a fitness class teaching Taibo exercises. It was found that autonomy-supportive environments promoted more autonomous motivation and persistence in class.

However, there is virtually no research examining the applicability of SDT in the context where a social media component is coupled with the physical activity intervention programmes. The current study, albeit exploratory in nature, seeks to examine if the three psychological needs could be promoted through the use of social network sites, resulting in higher physical activity participation, enjoyment, and well-being. In the SDT context, enjoyment is an indicator of intrinsic motivation (Ryan & Deci, 2000) and vitality is an indicator of well-being (Ryan & Frederick, 1997).

In the current study, Facebook was selected as an appropriate social network site to deliver the intervention programme to enhance participants' level of physical activity as it was one of the more popular social network sites in Singapore. Currently, there are about 2.5 million Facebook users in Singapore with 59% of them aged between 18 to 34 years old. In addition, approximately 70% of them use Facebook daily (Socialbakers, 2011).

The potential for social network platforms such as Facebook to complement physical activity promotion effort lies in its inherent information sharing and relationship building features. Social network sites are different from other forms of internet services in that they are organised around people and their relationships. As such, the motivation in accessing the network sites is to maintain relationships with the existing network of friends and not in exchanging of information (Bonds-Raacke & Raacke, 2010; Boyd & Ellison, 2008; Gangadharbatla, 2008; Selwyn, 2009). An effective social network site will have regular updates and members who are familiar with each other so that there is a sufficient level of trust between members in sharing information (Leng, 2013). Hence, the value of social network sites lies in the engagement with the members of the social network and generating a shared purpose (Deighton & Kornfeld, 2009; Kozinets, De Valck, Wojnicki, & Wilner, 2010).

Given the nature of social network sites, it is not unexpected that a recent study has found success in using social network sites in implementing

weight loss programmes (Napolitano et al., 2013). Social network sites can provide social support which can encourage physical activity and weight loss among participants (Hwang et al., 2010; Voorhees et al., 2005). SDT, with its explanation of autonomous motivation resulting from social relatedness needs fulfilment could be a suitable theoretical framework for studying interventions with a social network component. Furthermore, as competency level is likely to be improved as knowledge support for increasing or starting physical activity can be provided via social media during such a program, increase in autonomous motivation may perhaps be observed and explained by SDT. Finally, an autonomously supportive climate can also be infused within the social media space by purposefully posting materials that targets participants' need for autonomy. The current study incorporated the promotion of three psychological needs through the use of Facebook. This is outlined in the method section.

Given the potential for increased physical activity level and positive psychological consequence by coupling social media component with physical activity programme, we undertook a field study to examine the effectiveness of a Facebook-based physical activity intervention programme using SDT as a theoretical framework.

Methods

PARTICIPANTS

Participants were recruited from undergraduate students in a local university in Singapore on a voluntary basis. A total of 62 students between 19 to 25 years of age were recruited with equal gender distribution (mean age = 22.30 years, SD = 1.51). Participants were assigned into four groups. A field study was used in the current project. Ethical approval was sought from the university Ethical Review Board. Permission to collect data with the students was obtained from the Head of Department of the Physical Education and Sports science and the lecturers who taught the classes.

INTERVENTIONS

The participants in the first group, Group A ($n = 7$), did not receive any intervention and served as a blank control group. These participants did not take part in any formal activity classes during the semester. In Group B ($n = 17$), participants of this group participated in a 3 hours physical fitness class each week for eight weeks as the intervention. The class is a regular fitness module offered by the university, taught by experienced university lecturer. The full duration of the module is 12 weeks for a total of 36 hours. It is a free elective, in the first 8 weeks; a typical lesson usually consisted of a one-hour lecture and one hour of introduction to

a set of exercises or apparatus for fitness development. The students were given the remaining time for practicing. The activities were mainly strength and conditioning with moderate intensity. Group C ($n = 14$) is similar to Group B, that is, 3 hours of physical fitness class taught by university lecturer. In addition, participants in this group were linked through Facebook. Regular posts were updated on the Facebook wall page including polls, articles related to physical fitness and health, discussion topics, sharing of photographs and videos. These posts provided participants choices in physical activities, rationale for doing exercises, means to build competencies in exercises and opportunities for interaction, thus incorporated the SDT constructs of autonomy, competence, and relatedness. In Group D ($n = 24$), participants participated voluntarily in a 1 hour physical exercise programme each week for eight weeks as the intervention. They were not taking part in any physical activity module offered by the university. During the programme, participants were exposed to various aerobic exercises designed and supervised by one of the researchers in a training room. Participants were given autonomy and encouraged to utilize the training room for additional exercises and physical activity beyond the weekly supervised lessons. Similar to Group C, participants in Group D were linked through Facebook. All the participants from Groups B to D achieved at least 80% of attendance rate and were all familiar and users of Facebook.

For the groups that involved the use of Facebook, a specific weekly agenda was drawn up and adhered to. In Week 1, all the participants were welcomed to the group. In Week 2, participants indicated topics related to exercise that they would like to read about. A few articles and questions related to the topics were posted for discussion. In Week 3, photos of participants working out in the gym were posted in the Facebook and participants were encouraged to upload their photos. From Week 4 to Week 8, participants shared on Facebook various topics, success stories, personal achievements, photos and video clips. Through the social network site, relatedness is promoted by linking up the participants; competence is enhanced by providing information and facts; and finally autonomy is promoted by allowing participants the freedom to post materials on facebook.

MEASURES

Six outcome measures were determined both immediately before and after the intervention programme. These were physical activity level, perceived autonomy, perceived competence, relatedness, perceived enjoyment and vitality. The measure of physical activity targets at eliciting behavioral outcome, while the remaining five targets psychological consequences of the intervention.

Physical activity. The short-form of the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003) was used to assess the frequency and duration of physical activity of the participants in the last 7 days. The reliability and validity of the short form IPAQ has been tested in more than 12 countries by Craig and his colleagues. Across these countries, the pooled correlation of repeated moderate-to-vigorous physical activity (MVPA) measures obtained by the IPAQ is 0.76; and the pooled correlation between MVPA measures obtained by the IPAQ and accelerometer is 0.30. In the IPAQ, walking is given a value of 3.3 METs (METs are multiples of the resting metabolic rate), moderate intensity activities are given 4.0 METs, and vigorous intensity activities with 8.0 METs, according to the scoring protocol from Craig et al. (2003). The MET-min per week for the three categories were computed using MET level \times minutes of activity/day \times days per week. The three categories were added to give

the sum of the total MET-minutes/week. After which, we used categorical score to classify the physical activity into four categories (< 1000 MET-min/week = 1; 1000 to 1999 MET-min/week = 2; 2000 to 2999 Met-min/week = 3; \geq 3000 MET-min/week = 4). The mean score of the four categories was used in the main analysis.

Intrinsic motivation inventory. The Intrinsic Motivation Inventory (IMI) is a multidimensional measurement device intended to assess participant's subjective experience related to a target activity in laboratory experiments (Deci, Eghrari, Patrick, & Leone, 1994; Ryan, Koestner, & Deci, 1991). For the purpose of this study, we selected four main subscales from the IMI to assess participants' enjoyment (7 items; e.g., "I enjoyed working out very much"), perceived competence (6 items; e.g., "I think I am pretty good at working out"), perceived autonomy (7 items; e.g., "I believe I had some choice about working out") and relatedness (8 items; e.g., "I am close to the people who work out with me"). The participants responded on 7-point Likert-type scales ranging from 'strongly disagree' (1) to 'strongly agree' (7). The mean scores of each construct were used in the analyses.

Subjective vitality scale. The subjective vitality scale is a 7-item questionnaire used to assess the subjective vitality of the participants. An example item is "I have energy and spirit". Vitality is defined as a feeling of possessing energy available to one's self (Ryan & Frederick, 1997). A 7-point Likert-type scales ranging from 'strongly disagree' (1) to 'strongly agree' (7) was used. We used the mean score of the scale in further analysis.

DATA ANALYSIS

First, descriptive statistics of key variables were computed. Next, a series of repeated multivariate analysis of variance (MANOVA) were conducted to investigate if there were time (between pre and post) and group differences. One of the assumptions of MANOVA is that the dependent variables should be related conceptually, and correlated with one another at a low to moderate level. If they are highly correlated, one runs the risk of multicollinearity (Tabachnick & Fidell, 2007). Therefore, the physical activity, enjoyment, and vitality were conducted using separate MANOVAs, from the three psychological needs. Since the sample size is small and unequal across groups, the output of MANOVA provided a Box's M test to test the equality of variances across the groups. The statistical analysis was performed using SPSS software version 20.0 and statistical significant level was set at $p \leq 0.05$.

The first repeated MANOVA used physical activity as the dependent variable, the second repeated MANOVA used autonomy, competence, and relatedness as the dependent variables, the third and fourth repeated MANOVA used enjoyment and vitality as the dependent variables, respectively.

Results

Table I below shows the descriptive statistics of the six measures in the 4 groups. For each measure, the mean values before and after the intervention programme are reported. The standard deviations are reported in parentheses. The results of the ANOVAs are also shown in Table I.

TABLE I
Group Means and F-values of ANOVAs

	Group A Control		Group B 3-hours Fitness Class		Group C 3-hours Fitness Class via Facebook		Group D 1-hour Fitness Class via Facebook		F-value (Time Effect)	F-value (Group Effect)
	Pre	Post	Pre	Post	Pre	Post	Pre	Post		
Physical Activity	1.57 (.53)	1.86 (1.07)	2.88 (1.11)	3.47 (.80)	2.57 (1.02)	3.43 (1.05)	1.92 (.88)	2.00 (.87)	8.53**	13.32**
Autonomy	5.07 (.91)	5.23 (.82)	5.50 (.57)	5.31 (.83)	5.07 (1.19)	4.82 (.94)	5.18 (.89)	5.43 (.69)	.01	1.25
Competence	3.42 (1.17)	3.61 (1.41)	4.60 (.80)	5.09 (1.03)	4.58 (.87)	5.13 (.82)	3.95 (1.13)	4.77 (1.02)	18.86**	3.92*
Relatedness	5.25 (.40)	5.00 (.84)	5.62 (.63)	5.51 (.75)	5.00 (.88)	5.40 (.86)	5.03 (.59)	5.23 (.77)	.35	1.78
Enjoyment	3.97 (.75)	4.53 (1.20)	5.20 (.73)	5.20 (.73)	5.17 (.92)	5.17 (.92)	4.97 (1.01)	5.65 (.81)	20.39**	2.58
Vitality	3.95 (1.21)	4.31 (1.05)	4.63 (1.16)	5.05 (1.16)	4.85 (0.77)	5.33 (0.98)	4.73 (0.89)	5.15 (0.75)	25.01**	1.85

Note. ** $p < .01$, * $p < .05$

PHYSICAL ACTIVITY LEVEL

There was significant improvement in the level of physical activity level from pre- to post-intervention, Wilk's $\Lambda = .872$, $F(1, 58) = 8.53$, $p < .01$, $\eta^2_p = .13$. The results of post hoc ANOVA showed that the change in the level of physical activity in Group B and Group C were higher than Group A and Group D, $F(3, 58) = 13.32$, $p < .01$, $\eta^2_p = .41$. This means that the weekly 3 hours physical fitness class increased participants' physical activity levels significantly, this is expected because the participants in these two groups had more opportunities to do physical activity within the exercise classes.

There was no significant difference in the reported physical activity levels between Group B and Group C. This suggests that the additional intervention of using Facebook did not have a material effect on the physical activity levels. There was also no significant difference in the change in level of physical activity between Group A and Group D. This suggests that the 1 hour physical exercise programme was not effective in increasing the level of physical activity.

Psychological consequences

The results of the repeated MANOVA showed that there were significant group differences in the three psychological needs, Wilk's $\Lambda = .663$, $F(9, 134) = 2.74$, $p < .01$, $\eta^2_p = .13$, as well as time effect between pre- and post-intervention, Wilk's $\Lambda = .738$, $F(3, 55) = 6.51$, $p < .01$, $\eta^2_p = .26$, but no interaction effects. Follow-up ANOVAs revealed that the four groups differed in competence, specifically, Groups B and C were higher in competence compared to Group A ($p < .05$). In addition, there was significant increase ($p < .01$) in competence from pre- to post-intervention among the three intervention groups. It is noteworthy that the competence level of Group D increased the most compared to Groups B and C. There were no differences in autonomy and relatedness.

In terms of enjoyment, the multivariate results of the repeated MANOVA showed that there were significant changes from pre- to post-intervention, Wilk's $\Lambda = .740$, $F(1, 58) = 20.39$, $p < .01$, $\eta^2_p = .26$, and significant interaction effects, Wilk's $\Lambda = .663$, $F(3, 58) = 9.81$, $p < .01$, $\eta^2_p = .34$. Specifically, there was no change in enjoyment for Groups B and C from pre- to post-intervention, but the enjoyment level of Group D increased significantly from pre- to post-intervention. The control group (Group A) also reported higher enjoyment at post-intervention; however, Group D had significantly higher enjoyment than Group A. The results show that the structured lessons may have a suppression effect on participants' enjoyment level.

Finally, the results of the last repeated MANOVA revealed that there were significant time effect on vitality, Wilk's $\Lambda = .706$, $F(1, 60) = 25.01$, $p < .01$, $\eta^2_p = .29$, but no group or interaction effects. At post-intervention, all groups reported higher vitality, compared to pre-intervention.

Discussion

The increase in usage of the internet and mobile phones has provided an important channel to widen the reach of physical activity interventions in children and adolescents (Marcus et al., 2000). The use of information and communications technology in physical activity intervention programmes has been found to be effective in general (Lau et al., 2011). In the current study, we examined the effectiveness of a Facebook-based physical activity intervention in terms of the change in physical activity level and psychological consequences, based on SDT as the guiding theoretical framework.

As it is a field study that is exploratory in nature, we examine and present the various findings with the intention of documenting interesting

effects that are associated with the interventions applied. First, there are some changes to the physical activity levels due to factors other than the inclusion of Facebook and SDT related effects. It was found that participating in a physical fitness class increases the level of physical activity among participants. In a structured lesson, the activity level is usually high as the participants are engaged in a 3-hour session each week. It is thus not surprising that there is a change in the physical activity level of those in the two structured lessons groups.

Contrary to our expectation that the use of social media in physical activity interventions would be impactful for increasing activity level, the results suggest that the additional use of Facebook may not have increased the level of physical activity participation significantly. While the literature suggests that there is potential in leveraging on social network sites to implement intervention programmes to increase the level of physical activity among participants, the results of this study suggest that the implementation of such programmes need to be examined further. Putting interactive activities on Facebook including polls, discussion, videos and articles did not significantly increase the level of physical activity among participants in the study when compared with the control group. This suggests that the use of social network sites alone cannot be effective in intervention programmes (Napolitano et al., 2013).

As we utilized SDT as the theoretical framework for structuring the Facebook associated interventions but did not find the expected heightened physical activity level, we suggest that the intended effect of getting participants more autonomously motivated towards physical activity with the nurturing of basic needs through social media has not been evident. Given that physical activity participation is a complex issue, other structural factors may be impacting physical activity level more directly than the SDT related effects expected of social media involvement.

As for the psychological consequences associated with our interventions, there are some signs suggesting that motivational characteristics linked with SDT were associated with the interventions implemented, though again not entirely due the inclusion of Facebook as a strategy. For example, we found that level of competence increased in the structured fitness class groups and in Group D. In the structured fitness class, students were taught concepts and skills related to fitness and conditioning. They were also given time for practice as well as to complete the course assignments. As such, it was not unexpected that the level of competence increased after 8 weeks.

Interestingly, the competence level of Group D (1 hour unstructured programme with Facebook) increased significantly after 8 weeks. Partici-

pants in this group took part voluntarily in the study and were given autonomy in the programme. In addition, they were linked up via Facebook and were encouraged to post comments to each other. As such, the need for autonomy and relatedness may have been fulfilled to some extent. According to SDT, fulfilment of the three psychological needs can enhance the intrinsic motivation for the task (Ryan & Deci, 2000). For Group D, the increase in competence level may have also led to the increase in enjoyment among its participants. In comparison, the two structured fitness class (Groups B & C) did not show any change in their enjoyment levels from pre- to post-intervention. These two groups participated in the study as part of regular classes conducted in the university. Consequently, there was less autonomy as compared to participants in Group D who participated voluntarily. This may explain the absence of a significant increase in the level of enjoyment.

Extending further, as participants in Group B and C were part of a regular class, they already knew each other as members of other classes. Although participants in Group C had access to the social network site, the medium may not have provided significantly more opportunities for interaction as they were already meeting each other in other classes. Consequently, this may explain the lack of significant difference in changes of social relatedness between respondents in Group B and C. The social network site in this case may not have provided much benefit in terms of relatedness to the participants in Group C. In contrast, participants in Group D volunteered for the study and were less likely to meet each other regularly as part of other classes. Members in this group were able to connect with others with similar interests through the activities on Facebook and learn more about a physically active lifestyle through the articles and videos. Consequently, the potential of the social network site can be exploited further by this group by reaching out and engaging members to participate in physical activities.

In part, the limited effect of physical activity intervention programme delivered on social network sites may be explained by the different levels of involvement between participating on social network sites and being physically more active. The environment on social network sites favors a quick emotive response as opposed to a cognitive or behavioural response. As such, participants may participate actively on social network sites. However, when required to provide a behavioral response i.e. being more physically active, the participant may behave differently (Leng, 2013).

The use of social network site as a medium for physical intervention programmes faces another limitation. Some studies have suggested that there are demographic differences between members and non-members of social network sites. Members of social network sites tend to be younger than the gen-

eral population (Cha, 2009; Gangadharbatla, 2008; Kelly, Kerr, & Drennan, 2010; Peluchette & Karl, 2008). As such, they are not representative of the population and whether an effective physical intervention programme that is delivered via social network sites can be similarly effective in other demographic groups remain to be established.

Future research should examine the effectiveness of naturally occurring social network site in physical intervention programmes. In this study, the social network was artificially created and consequently, the level of trust and sharing with members on the network may be much lower than in naturally occurring social networks. As such, cyber ethnographic research or participant observation on the internet may provide further insights into the effectiveness of physical intervention programmes delivered via social network sites (Mathy, Schillace, Coleman, & Berquist, 2002).

In conclusion, our research effort in examining the effects of Facebook interventions on physical activity level and psychological consequence yield some evidence that suggest that the intended SDT effects are present, but limited to some change in enjoyment and competence. Effecting actual improvement in physical activity levels with the help of social media platforms would certainly require intervention strategies that are more complex. SDT related ideas and strategies are certainly worth considering in the future.

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