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The use of electronic lifestyle activity monitors with adolescents: Implications for motivation, need satisfaction and integration into physical education

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Contents

Background	1
Self-determination theory	1
Wearable technology and self-determination theory	2
Methods.....	3
Participants	3
Intervention	3
Data Generation.....	3
Motivational Regulation	3
Need Satisfaction	4
Context and User Perceptions	4
Data Analysis.....	4
Results.....	5
Pre-post changes in motivational regulation and need satisfaction	5
Competence.....	6
Relatedness.....	6
Controlled motivation.....	7
Short Term Motivation	7
Discussion.....	7
Implications for Practice	9
Dissemination	9
Conference presentations.....	9
Publications.....	9

Background

Studies show that considerable proportions of young people do not meet their national physical activity (PA) guidelines (Farooq et al. 2017). Health interventions are particularly important as they provide the foundation for an active lifestyle (Timmons et al. 2012). Yet, over a number of decades' PA interventions targeting young people have only produced modest effects (Lubans et al. 2016). Finding new ways to motivate young people to be active is, therefore, vital. Although technology has been associated with physical inactivity (see Pratt et al. 2012), healthy lifestyle technologies, such as wearable 'fitness' devices (e.g., Fitbits) are suggested to provide new and exciting opportunities for PA promotion (Chung, Skinner, Hasty & Perrin, 2017). The purpose of this project was to explore whether wearable healthy lifestyle technologies influence adolescents' motivation for PA.

Self-determination theory

Self-determination theory (SDT) is a widely applied theoretical framework in the study of youth PA (Van de Berghe et al. 2014) and has been used to guide understandings on the motivational impact of digital technologies on youth PA behaviours (e.g. Goodyear et al. 2016). The theory proposes that in order for individuals to be optimally motivated, behaviours should be self-determined, or in other words, volitional. More self-determined forms of motivation are associated with PA adherence (Teixeira et al. 2012).

Six different types of motivation are proposed to exist along a continuum ranging from lower to higher levels of self-determination (Ryan and Connell, 1989), which can further be divided into autonomous motivation, controlled motivation and amotivation (e.g. Haerens et al. 2010).

Autonomous motivation is based on the values or personal interests of the individual (Van de Berghe et al. 2014). In contrast, controlled motivation is less self-determined and based on demands that are externally or internally posed (Van de Berge et al. 2014). Finally, amotivated is evident when an individual lacks motivation and volition with respect to a particular behaviour (Deci and Ryan, 1985).

More self-determined forms of motivation lead to positive PA outcomes (Owen, Smith, Lubans, Ng & Lonsdale, 2014), thus, youth PA programmes should that promote autonomous motivation are recommended (Aelterman et al. 2013).

Vallerand (1997) argued that social factors influence self-determined motivation through the satisfaction of three psychological needs. The three antecedents of competence (a desire to feel capable and confident when executing behaviours), autonomy (perception of choice in their behaviour) and relatedness (an experience of connectedness with others) are proposed to influence an individual's motivational state. If wearable technology is to promote optimal motivational functioning, then the BPN should be satisfied through the Fitbit features.

Wearable technology and self-determination theory

The wearable technology explored within this study was the Fitbit Charge PA wristband with a digital display and the associated app. The Fitbit allows users to monitor PA progress, tailor PA goals, record workouts, share and compete with friends, earn badges, log food and track sleep patterns. In reference to self-determination theory, these functions demonstrate clear potential for positive impact on competence, autonomy and relatedness.

Competence could be positively satisfied by the Fitbit providing feedback on PA performance through badges, alerts and prompts. For example, when an individual achieves 10,000 daily steps - his/her Fitbit will vibrate and flash to signify that this PA goal has been achieved. In relation to self-determination theory, positive feedback on PA behaviours can increase perceptions of competence and impact positively on self-determined motivation in young people (Nicase et al. 2006). Autonomy can be satisfied by the potential to personalise PA targets. Individuals may alter the pre-determined daily step goal, distance travelled and active minutes to suit their individual PA needs. Research consistently suggests environments, in which young people have a sense of choice over their PA behaviours, leads to higher levels of PA (e.g. Roemmich et al. 2012). Relatedness could be satisfied through the social features on the app. For example, the app allows individuals to form Fitbit friends,

communicate with these friends and challenge their friends to PA competitions. When young people perceive a high sense of relatedness they are more likely to exhibit higher engagement in PA behaviours (Shen et al. 2012).

The relationship between the constructs of SDT (competence, autonomy, and relatedness) and the features and functions of the Fitbit device and app, highlight clear potential for healthy lifestyle technologies to positively influence young people's motivation for PA. Using SDT as a guiding theoretical framework it was hypothesised that, in this study, after wearing the Fitbit participants would experience greater need satisfaction, greater self-determined forms of motivation and less amotivation

Methods

Participants

One hundred 13-14 year olds (53 females, 47 males) were invited to participate in the study.

Participants were recruited from five physical education classes within two schools. The two schools differed in their socio-economic demographics; school one was a non-selective private school and school two was a comprehensive state school. Due to 16 pupils being absent at the post-test assessment the final sample consisted of 84 pupils (44 girls, 40 boys).

Intervention

Participants were provided with a Fitbit Charge to wear for an 8-week duration. An 8-week duration was selected because this period allows for the identification of behaviour change in step based programmes (Lubans and Morgan, 2008). The Fitbit Charge was used as the object of the intervention. Fitbit profiles were provided to participants using personalised email addresses and passwords. Instructions were provided on the functional capabilities and operational features of the device and the app. Participants were instructed to wear the Fitbit for the eight-week period.

Data Generation

Motivational Regulation

Prior to being issued with the Fitbit device (PRE) and at week 8 (POST) pupils completed the Behavioural Regulations in Exercise Questionnaire II (Markland & Tobin, 2004). The questionnaire

was adapted to replace the term exercise with PA in order to assess motivation towards PA. The BREQ II consists of 19 items that represent five different subscales. For data analysis mean scores for autonomous motivation, controlled motivation and amotivation were calculated.

Need Satisfaction

Pupils also completed the Psychological Need Satisfaction in Exercise scale, modified to the PA context (Gunnell et al. 2012) pre- and post- intervention. This measure consists of a 16 item scale that assesses the three BPN in a PA context.

Context and User Perceptions

To generate contextual understandings on how pupils used the Fitbit device and app, and their perceptions on the role of this technology in PA promotion, data were generated from 9 focus group interviews (4-6 members) in week 8 (POST). Each individual pupil was asked to respond to a statement. For example, “I would recommend using the Fitbit to other people my age because...”. Following the individual responses, the group were then prompted to share their thoughts and perceptions on the responses until they reached a level of agreement.

Data Analysis

Data from the need satisfaction and motivational regulation questionnaires were analysed using the Statistical Package for the Social Sciences (SPSS) version 22. Descriptive statistics were calculated for all dependent variables using mean and standard deviations. In order to assess the motivational differences pre and post Fitbit, the differences between sex and interactions between sex and time a Multivariate Analysis of Variance (MANOVA) was conducted.

Concepts from the framework of SDT were used to analyse the focus group data. The concepts are operationalised in terms of exploring competence, autonomy, and relatedness and locating the form of self-determination i.e. lower to higher levels of self-determination. This resulted in themes from the analysis related to: (i) competence, (ii) relatedness, (iii) controlled motivation, and (iv) short-term motivation. While short-term motivation was not a key focus of the analytical questions, across the data sets this was identified as a significant component of the qualitative data and was, therefore, included as a key theme.

Results

Pre-post changes in motivational regulation and need satisfaction

Descriptive statistics for need satisfaction and motivational regulation scores for boys and girls, pre and post Fitbit can be found in table 1. A repeated measures MANOVA test was conducted to test the impact of the Fitbit on need satisfaction and motivational regulation. The results showed a significant difference in motivational outcomes across time, $F(6, 77) = 8.72, p = 0.00, \eta^2 = 0.41$ and sex, $F(6, 77) = 2.47, p = 0.03, \eta^2 = 0.16$. There was no significant interaction between sex and time, $F(6, 77) = 1.99, p = 0.07, \eta^2 = 0.13$.

In relation to need satisfaction univariate tests revealed non-significant interaction effects between sex and time for competence, $F(1, 82) = 5.49, p = 0.06, \eta^2 = 0.02$, autonomy, $F(1, 82) = 2.04, p = 0.16, \eta^2 = 0.24$ and relatedness, $F(1, 82) = 0.00, p = 0.93, \eta^2 = 0.00$. Univariate tests indicated there were no significant difference in competence $F(1, 82) = 0.02, p = 0.88, \eta^2 = 0.00$ and autonomy $F(1, 82) = 0.09, p = 0.93, \eta^2 = 0.00$ between boys and girls, however, girls had significantly higher relatedness scores compared to boys $F(1, 82) = 4.72, p = 0.03, \eta^2 = 0.05$. Univariate tests identified significantly lower competence scores, $F(1, 82) = 8.5, p = 0.005, \eta^2 = 0.91$, autonomy scores, $F(1, 82) = 13.49, p = 0.00, \eta^2 = 0.14$ and relatedness scores, $F(1, 82) = 5.81, p = 0.02, \eta^2 = 0.07$ post intervention.

In relation to motivational regulation univariate tests revealed significant interaction effects between sex and time for amotivation, $F(1, 82) = 4.98, p = 0.03, \eta^2 = 0.06$ and autonomous motivation $F(1, 82) = 7.24, p = 0.01, \eta^2 = 0.08$. There was no significant interaction effect between sex and time for controlled motivation, $F(1, 82) = 0.36, p = 0.55, \eta^2 = 0.00$. Univariate tests indicated girls had significantly higher autonomous motivation scores compared to boys, $F(1, 82) = 7.24, p = 0.01, \eta^2 = 0.08$ and girls had significantly lower amotivation scores compared to boys, $F(1, 82) = 5.73, p = 0.02, \eta^2 = 0.65$. Between boys and girls non-significant differences in controlled motivation scores were apparent, $F(1, 82) = 0.11, p = 0.74, \eta^2 = 0.02$. Univariate tests identified significantly higher

amotivation scores, $F(1, 82) = 38.00, p = 0.00, \eta^2 = 0.32$ and significantly lower autonomous motivation scores, $F(1, 82) = 17.00, p = 0.00, \eta^2 = 0.17$ post intervention. There was no significant difference in controlled motivation scores post intervention, $F(1, 82) = 0.36, p = 0.55, \eta^2 = 0.00$.

Competence

Data suggested that non-personalised targets of, for example, 10,000 steps were undermining the pupils sense of competence. Pupils commented that the standardised target of 10,000 steps was unfair especially if you lacked the ability to achieve those targets: *“You can feel under pressure to do a certain amount of steps or to be better than what you're maybe capable of”* (School 2, Focus Group 3). The pressure of not obtaining the steps also negatively impacted how the participants viewed themselves: *“Then you sit there and you realise it's seven o'clock and you've got, like, ten steps, you feel really bad”* (School 1, Focus Group 2). The pupils uses of the Fitbit and the Fitbit app, therefore, had a negative influence on their perceptions of competence due to pre-determined targets that were not relevant to their individual needs.

Relatedness

Competition with peers emerged as a key component function of the app that promoted social relationships. Pupils reported that they set up competitions in their peer groups and that these competitions encouraged them to engage in more PA: *“I learnt that I was encouraged to do a lot more sports when I was wearing the Fitbit and I wanted to try and beat my friend's record, like”* (School 1, Focus Group 1). However, the pupils also acknowledged that competition did not always have positive implications: *“it became a competition between people, which is sometimes good but sometimes bad”* (School 2, Focus Group 4). The competitive element resulted in peer pressure to achieve goals: *“Some people maybe feel peer pressure to do fitness, to keep their steps and stuff up”* (School 2, Focus Group 2). Competition was a central feature of the Fitbit device and app. For some, the competitive element encouraged more PA, whereas for others, striving to beat their peers resulted in negative feelings of self.

Controlled motivation

The competition element was an external pressure to engage in PA. Pupils reported on how the competition encouraged them to be more active: *“It makes you do a lot more walking because you want to try and beat your friends on it as well.”* (School 1, Focus Group 3). It also emerged that the externally prescribed PA target of 10,000 steps was acting as a source of controlled motivation:

“when you look at your steps, sometimes you think it's not high enough, so you do that or something, just to try and get your steps up. That's what quite a lot of people did.” (School 2, Focus Group 1).

The pupils commented on the external pressure of achieving the prescribed 10,000 steps: *“it's good for features for walking and finding out what you do, but no as in it sets limits. It says you should do this and it pressurises you”* (School 2, Focus Group 3). This evidence suggests that pupils were motivated to engage in PA through feelings that were not self-determined and that competition may act as a form of introjected regulation in which pupils engaged in PA through feelings of pressure or guilt.

Short Term Motivation

The novelty effect was a key component to the Fitbit raised by pupils. It was consistently reported that after about four weeks' pupils became bored of the Fitbit: *“I used it for the first four weeks, then just gave up”* (School 1, Focus Group 2). While this novelty period made some pupils more physically active, following the first four weeks their reported PA levels declined; *“It did for the first four weeks, and then the last couple of weeks I just sat at home all day.”* (School 1, Focus Group 2). Some pupils discussed how after the initial novelty period they were discouraged to engage in PA *“I feel like, in the first few weeks, I was motivated more, but then by the end I was just sort of discouraged by— It's not like I didn't do exercises, just— I don't know.”* (School 2, Focus Group 5). This evidence suggests that while the Fitbit serves to promote PA, for the pupils in this study, the Fitbit may have only produced modest and short-term effects.

Discussion

The purpose of this study was to examine if healthy lifestyle technologies impact on young people's motivation for PA. In using SDT as a guiding theoretical framework, it was hypothesised that after an

eight-week period of wearing the Fitbit and using the Fitbit app participants would experience greater need satisfaction, greater self-determined forms of motivation and less amotivation. The results, however, identified significant declines in competence, autonomy, and relatedness, alongside reduced levels of autonomous motivation. Furthermore, following the eight-week period significant increases in amotivation were observed.

In examining the relationship between the Fitbit and young people in further detail, data suggested that peer-comparison was a key factor in undermining the BPN. For example, it is reported that when individuals lose in competitions perceptions of competence and intrinsic motivation decreases (Vallerand, Gauvin and Halliwell, 1986). The competitive element provided the participants with competence/incompetence information through the social comparison of performance. Similarly, the predetermined 10,000 step goal may actually lead pupils to feel less competent when they don't achieve the daily goal.

Although it was previously argued that feelings of autonomy could be increased through the tailoring of PA goals on the Fitbit app, the decreased feelings of autonomy experienced may have been a result of the predefined targets within the device. Vallerand and Losier (1999) argue that competition may undermine self-determined motivation through the impact on perceived autonomy and competence. If individuals feel pressured into competition or engagement, then a loss autonomy will ensure and self-determined motivation will be reduced. The qualitative evidence supports the proposed mechanism that pressure and guilt may be the process through which autonomy was undermined.

The unique features of the online communications offered through the Fitbit app that lead to reductions in need satisfaction. The competitive elements may create isolation from peers and thus undermine relatedness. Although the qualitative evidence suggested that some pupils found the competitive element engaging, there was also an awareness from some individuals that the competition element could also be detrimental and that engagement in PA could be the result of external pressure from peers.

Theoretically the role of competition can be explained by the compromising of the BPN that could have resulted in the evidenced reductions to autonomous motivation and increases in amotivation. Although increases in controlled motivation were not significant, data indicates that the Fitbit acted as a source of external pressure (through the achievement of goals) and internal pressure (guilt). Indeed, when individuals engage in behaviours through feelings of guilt or social approval their behaviour is controlled through introjected regulation (Deci and Ryan, 2000). In turn, when behaviours are regulated by controlled motivation individuals are less likely to engage in long term maintenance of behaviours (Deci and Ryan, 2000; Markland and Ingeldew, 2007).

Implications for Practice

Data from this study demonstrated that, while clear potential exists, healthy lifestyle technologies impact negatively on young people's motivation for PA. Competition, peer-comparison and social-comparison to normative pre-determined targets result in only short-term motivational effects. This evidence suggests that young people negatively relate to dominant public health discourses of, for example, 10,000 steps, that are promoted through consumer-orientated technologies. It also highlights that peer influence through digital technologies may play a negative role in PA promotion in young people. This research provides evidence for practitioners to support and educate young people regarding the personalisation aspect of these devices.

Dissemination

Conference presentations

Kerner, C., and Goodyear, V. (2016). "You've done 10,000 steps today, you're healthy—The use of wearable technology in adolescents" British Educational Research Association Conference: Leeds, September 2016.

Publications

Kerner, C., and Goodyear, V. (2017). The motivational impact of wearable healthy lifestyle technologies; a self-determination perspective on Fitbits with adolescents. *American Journal of Health Education*. **In review.**

Goodyear, V., and Kerner, C. (2017). Adolescents engagement with Fitbits: A Foucault perspective.
Sport Education and Society. **In Preparation.**

FACULTY OF ARTS & SCIENCES

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Project: The use of electronic activity monitors with adolescents:
Implications of motivation, need satisfaction & integration into physical education

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Account activity 2015-16:

Date	Amount (£)	Amount (£)	Comments
	Income	Expenditure	
14-Oct-15	4506.80		80% of total grant claimed by EHU
27-Oct-15		-2253.40	80% of grant due to University of Birmingham
20-Nov-15		-1950.00	Purchase of 25 activity wristbands
13-Jun-16		- 390.00	Conference registration 13-15 Sept C Kerner: British Educational Research Association
	4506.80	-4593.40	Subtotals
28-Apr-17:			
Balance		-86.60	

Final 20% of grant due to EHU on completion and submission of final report
 Final 20% of grant due to University of Birmingham to be paid on release of final grant

Liz Whittle
 Manager of Faculty Administration
 Faculty of Arts & Sciences, Edge Hill University

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