EFFECTIVENESS OF A FACEBOOK INTERVENTION ON PHYSICAL ACTIVITY BEHAVIOUR:
AN INTEGRATION OF IDENTITY THEORY AND SELF-DETERMINATION THEORY

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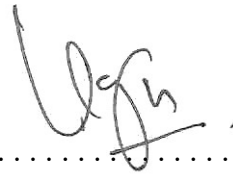Doctor of Philosophy

2020

Statement of Originality

I hereby certify that the work embodied in this thesis is the result of original research and has not been submitted for a higher degree to any other University or Institution. In addition, I declare that to the best of my knowledge, this thesis is free of plagiarism, and contains no material previously published or written by another person, except where due reference has been made in the text.

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I have reviewed the content and presentation style of this thesis, and I declare that it is free of plagiarism and of sufficient grammatical clarity to be examined. To the best of my knowledge, the research and writing are those of the candidate except as acknowledged in the text and/or the Author Attribution Statement. I confirm that the investigations were conducted in accord with the ethics policies and integrity standards of Nanyang Technological University and that the research data are presented honestly and without prejudice.

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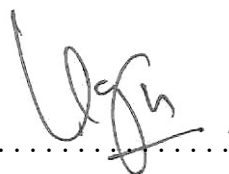
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Authorship Attribution Statement

This thesis **does not** contain any materials from papers published in peer-reviewed journals or from papers accepted at conferences in which I am listed as an author.

12 December 2020

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Yong Tze Woon

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As this journey ends, I will begin another to share with my two girls the experiences that will grow in them the identity of a woman whose life is worth living.

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Summary

Obesity rates are rising worldwide and its associated health problems prompt the need to examine the problem beyond current practices, to use other perspectives to devise more effective physical activity interventions. Physical activity behaviour can be understood through self-determination theory. Current research on motivation suggested that physical activity behaviour has over the years transited from one that is intrinsic in nature to an externally regulated behaviour. At the same time, identity researchers also observed a change in human behaviour to be more fragmented because of technological changes in the society. This thesis puts together a literature review outlining the new environment that we operate in and how that has modified our behaviour from the perspectives of identity theory and self-determination theory. Studies based on identity theory, self-determination theory and combination of the two theories have shown that both theories can be integrated to address the gaps in physical activity intervention. As there are also limited studies on physical activity identity or exercise identity, its measurement, validity and reliability, there is a need to review the foundations of identity theory and develop an adequate, valid and reliable identity scale that can address physical activity behaviour. From an understanding of identity theory and self-determination theory, this thesis also examines the association between identity, self-determination and physical activity behaviour. Lastly, the thesis evaluates the effectiveness of a physical activity intervention through the integration and application of both theories. The thesis aims to understand the identity-motivational influences of physical activity behaviour through three studies.

In the first study, an exercise and sport identity scale (ESIS) was developed and validated using exploratory structural equation modeling (ESEM). A 22-item, 7-factor (importance to identity, private self-esteem, public self-esteem, continuity, uniqueness,

exploration and commitment) ESIS was found to have sufficient validity and reliability of an exercise identity scale.

In Study 2, ESIS was further validated with an independent sample using confirmatory factor analysis (CFA). It was further verified that the 22-item, 7-factor ESIS had sufficient validity and reliability. Three second order factors (social identity, personal identity and ego identity) were also confirmed in the ESIS. In the same study, Intrinsic Motivation Inventory (IMI) was validated using CFA and was found to consist of four factors (interest, perceived competency, perceived choice and perceived relatedness). ESIS and IMI were tested for association and significant association was found between identity and motivation, verifying the purpose of the study that the two theories can be used together to examine physical activity behaviour.

Study 3 was an intervention study to examine if modern online social media environment, Facebook, had an influence on the effectiveness of physical activity intervention. Guided by identity theory and self-determination theory, ESIS and IMI were used to measure the changes in the psychosocial state of participants in a ten-week intervention, it was found that a combination of physical activity intervention with social media influence caused a positive change in exercise and sport identity, intrinsic motivation and intensity of physical activity, more than a traditional physical activity intervention.

This thesis also discussed the strengths, limitations and issues surrounding the use of the identity-motivation model in physical activity intervention. In conclusion, the outcomes of the three studies present a potential model to understand physical activity from a psychosocial perspective that is relevant to the technologically driven environment we now live in.

Chapter 1

Introduction

1.1 Background of the Study

1.1.1 Obesity and its health risks-An inactivity pandemic

In 2010, 3.4 million people died from causes related to being overweight or obese (Ng et al., 2014). People from the American regions and European regions are amongst the most obese people in the world (WHO, 2017a). World Health Organization reported that worldwide obesity tripled from 1975 to 2016 (WHO, 2018c). The prevalence of obesity is also increasing in Singapore. Obesity rate peaked in 2010 at 10.8 % for local residents between 18 to 69 years old (Epidemiology & Disease Control Division, 2010). This was double the obesity rate in 1992 and has maintained at 8.7 % in 2017 (Ministry of Health & Health Promotion Board, 2017). The obesity rate is increasing globally and locally.

The causes of obesity are linked to the changing lifestyle that brought about excessive energy intake and sedentary lifestyle (Biddle et al., 2010; Giovannucci et al., 1995; Miller et al, 1997). This worrying trend is a cause of mortality and other health problems. Obesity also lowers the quality of life. It was reported that people lose on average 3.9 % of years and live through 3.8 % of disability-adjusted life-years that become part of one's life due to overweight and obesity (Ng et al., 2014). The health risk associated with obesity includes diseases such as diabetes, hypertension, high total cholesterol, cancers and mortality. It has been shown that the risks of heart-related diseases, stroke, diabetes, certain cancers and mortality increase with increasing body mass index (WHO, 2014).

The high death rates and consequences of obesity necessitates the need for regular monitoring of its prevalence and intervention in all populations (Cole et al., 2000; Gortmaker et al., 2011; Swinburn, 2008). Increasing physical activity is one of the strategies to address

obesity and its associated problems. Causal associations were found between regular physical activity and reduced rates of type 2 diabetes and its related risk to coronary heart disease, hypertension and colon cancer (Pate et al., 1995). It was recommended that one participates in "moderate-intensity cardiorespiratory exercise training for at least 30 minutes a day on at least 5 days a week for a total of at least 150 minutes, vigorous-intensity cardiorespiratory exercise training for at least 20 minutes a day on at least 3 days a week for a total of at least 75 minutes, or a combination of moderate- and vigorous-intensity exercise to achieve a total energy expenditure of at least 500-1000 MET min a week" (Garber et al., 2011). Studies estimated the proportion of American adults who met the similar physical activity guidelines can be as low as 3.4 % (Zenko et al., 2019). One in four adults and three in four adolescents fail to meet the WHO recommendation for physical activity. The prevalence of inactivity is anticipated to increase to as high as 70 % (WHO, 2018).

One of the reasons for people not meeting the recommendation for physical activity is the changing patterns of transportation, increased use of technology and urbanization (WHO, 2018a). Technological development in social and work environment in developing and developed countries has brought about radical changes in our lives. From the beginning, technologies extended our human functions. Radio, telephone and television extend the functions of the human eyes and ears into the world. Later, automobile and planes extend the human reach to parts of the world beyond where we live. More recently, the World Wide Web made our social network denser than the face-to-face interactions we had before. The need to move around to interact is slowly replaced by remote interactions and that do not support physical activity which is lacking is people.

1.1.2 Physical activity interventions

One way is to get people to choose physical activity over sedentary activities. In a meta-analysis on weight-loss intervention studies, Miller et al. (1997) established that studies on weight-loss programmes returned mixed results. While there were studies that reported weight loss, there were also studies that reported negligible weight loss or even weight gain. The interventions in the meta-analysis consisted of traditional face-to-face programmes. Although this mode of intervention programmes has been effective in enhancing physical activity participation, its effects have been small (Lau et al., 2011). McGowan (2012) proposed that obesity is a multi-factorial phenomenon that requires interdisciplinary inquiry. Contemporary research recognized that the challenge of getting people to take part in any physical activity is driven by the sociocultural values placed on physical activity and how integrated physical activity is in people's everyday lives (Edensor, 2002; Morris, et al., 2012; WHO, 2018; Wilcox et al., 2003; Zhang, et al., 2007). In a qualitative research, researchers found that the determinants of physical activity is a complex interplay between motivation, self-regulation skills, unique social environment and physical environment (Lacaille et al., 2011). The findings share similarities with an earlier study by Kaplan et al. (1991) where psychosocial determinants such as membership to a group, gender, race and other unique social factors play a part in influencing physical activity behaviour. These studies suggest that psychosocial determinants can influence physical activity behaviour and perhaps psychosocial changes is one of the interventions to bring about effective physical activity behaviour changes.

1.1.3 Theoretical framework

Physical activity participation or exercise is an intricate interplay between physiological, psychological, social and environmental factors (Biddle & Mutrie, 2001). Exercise behaviour has been studied from the perspective of motivational determinants in psychology (Biddle & Mutrie, 2001). A theory that has been recognized and commonly used to understand human motivation in the area of physical activity or exercise is Self-Determination Theory (SDT; Deci & Ryan, 1985a).

SDT posits that humans have an innate tendency towards active engagement and growth development (Deci & Ryan, 1985a). This tendency or motivation varies in the level of autonomy or control. Behaviours that are autonomous originate from within one's self (Reeve, 2002). On the other hand, a behaviour that is controlled is driven by an external force and is not autonomous. The behaviour happens because the person feels pressured by an external force to participate in it. Based on these different characteristics, SDT proposes that three forms of motivation exist: intrinsic motivation, extrinsic motivation and amotivation; and they differ in the level of autonomy. These three forms of motivation lie on a continuum ranging from high to low self-determination.

Other than the three different forms of motivation that drive behaviour, SDT also specifies the situations that determine the extent of self-determination. One of the conditions is all humans have three basic psychological needs; the need for competence, autonomy and relatedness. The need for competence refers to the person's desire to be able to interact with the environment, to be in control and competent over its outcomes (Deci, 1975; Deci & Ryan, 1985a). The need for autonomy refers to the desire to participate in activities of one's choice and to be able to have control over one's own behaviour (deCharms, 1968; Deci, 1975; Deci & Ryan, 1985a). The need for relatedness refers to the feeling of connection or belonging to a social group (Baumeister & Leary, 1995; Deci & Ryan, 1985a). Basically, SDT suggests that

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when the needs are satisfied, one exhibits behaviour guided by the most self-determined forms of motivation. Conversely, when the needs are not met, one exhibits behaviour reflective of low self-determination.

SDT has been used as a basis for empirical interventions on physical activity regulation (Biddle & Nigg, 2000; Fortier & Kowal, 2008; Wilson, Mack, & Grattan, 2008). In a review (Fortier, Duda, Guerin, & Teixeira, 2012) on SDT and its use to predict physical activity and develop physical activity interventions, it was found that more autonomous motivation is observed when psychological needs were met through need-supporting environments. The satisfaction of needs in turn predicted positive physical activity and psychological outcomes. Edmunds, Ntoumanis and Duda (2008) examined the influence of teaching style on need satisfaction, physical activity motivation and physical activity behaviour in a girls' exercise class, and found that girls who experienced an autonomy supportive, well-structured, and interpersonally involving teaching style showed greater need satisfaction to those who received the conventional teaching style. This also predicted more autonomy to engage in physical activity on their own. Physical activity class attendance was significantly higher in a class designed and conducted using a teaching style backed by SDT.

Recently, there was a growing attention on the use of technology to deliver physical activity intervention. Specifically, researchers tested computerized interventions based on SDT, using platforms such as personal digital devices or the Internet, to increase participation in physical activity (Lacaille et al., 2009; Patrick, Canavello, & Williams, 2009). Data on the intervention feasibility and preliminary evidence of the impact on motivation showed promise in its use on physical activity intervention.

At the same time, contemporary evidence also shows that with increased use of digital technology in our lives, people are no longer driven by inclinations towards growth development. People are taking on multiple roles and are showing signs of divided

functioning, conflict within oneself and detachment from responsibility and community. These phenomena are also explained by psychological theories (Broughton, 1987; Greenwald, 1982). In line with these theories, Gergen (1994) asserted that the post-romantic self that grows and struggles for unity (growth development) is now replaced by a modern self who is fragmented and populated by diverse identities that are shaped by the new and parallel social environment that resides in the online realm. In view of people being fragmented and lacking self-determination, motivation theory on its own is not complete to address behavioural issues such as decreasing physical activity levels. Therefore, arising a need to look for mechanisms that can strengthen motivation theory and lead to effective interventions.

One such idea that can explain the modern human self who is populated by multiple identities is Erikson's developmental theory (Erikson, 1968). It consists of eight stages of ego development, each a continuum between two polar states that is attained after the individual goes through a process of equilibration or crisis (Clayton, 1975). The eight stages are listed below:

1. Early infancy- trust versus mistrust

2. Later infancy- autonomy versus doubt or shame

3. Early childhood- initiative versus guilt

4. Middle childhood- industry versus inferiority

5. Adolescence- identity versus role confusion

6. Early adulthood- intimacy versus isolation

7. Middle adulthood- generativity versus stagnation

8. Late adulthood- ego integrity versus despair (Erikson, 1968)

Several researchers have elaborated and refined Erikson's theory. His theory was later refined to explain identity construction that is relevant in late modern societies today (Côté & Levine, 2002).

Later, identity theory evolved from Erikson's work and has since been used independently as a basis in physical activity research. Identity theory provides the time-period context to support SDT in the understanding of physical activity behaviour. Bélanger-Gravel and Godin (2010) found in a study that involved children's identification to physical activity that physical activity was correlated to self-identity and intention, accounting for 14.9% of the variance of physical activity behaviour. Self-identity was also shown to be an independent predictor of intentions (Armitage & Conner, 1999; Sparks & Guthrie, 1998).

Deci and Ryan (2002) talked about people possessing the innate strive to seek challenges, to internalize and adapt practices to integrate with the culture, to unite knowledge and personality, so as to attain a sense of self. These traits were also described by identity theorist (Erikson, 1968; Côté & Levine, 2002). Current social-cognitive studies depict personality as an assembly of self-schemas or selves that originate and evolve from environmental influences. Personality is a collection of schema to serve a variety of goals and identities, each unique for different social contexts (Bandura, 1989; Higgins, 1987; Markus & Nurius, 1986; Mischel & Shoda, 1995). Thus, we see independent studies making associations between social contexts (Gergen, 1991, 1999; Mick & Fournier, 1998), self and identity (Bandura, 1989; Gergen, 1991, 1999; Higgins, 1987; Markus & Nurius, 1986; Mick & Fournier, 1998; Mischel & Shoda, 1995; Ryan & Deci, 2002) and motivation towards a unified self (Ryan & Deci, 2002). This also suggests a relationship between motivation and identity.

People are driven to maintain or enhance feelings of continuity, self-esteem, distinctiveness, belonging, efficacy and meaning in their identities (Vignoles et al., 2006). Vignoles and colleagues (2006) used a multilevel regression design to test if motivation influence factors of identity such as sense of continuity, distinctiveness, meaning and self-esteem. These factors were perceived to be important to individual participants was well as in contexts such between individuals and in a group. Interestingly, this finding was the same across various populations. In addition, motives for belonging (relatedness) and efficacy (competence) raises self-esteem and one's definition of identity. Conversely, identity factors were found to satisfy the need for self-esteem and efficacy. Evidence from this study suggests that there is an association between motivation (to belong, attain efficacy, self-esteem) and identity formation. This points to the potential to integrate theories of identity and motivation (Vignoles et al., 2006).

There were studies that integrated identity and motivation. Strachan et al. (2012) found in the area of exercise behaviour that exercise identity was significantly correlated with motivation. Exercise identity strength was also found to have interaction effect with higher forms of motivation. The relation found between identity theory and motivation theory in this study suggests that they can be used integrally in physical activity interventions. Evidence from more recent studies also propose the integration of identity theory and self-determination theory as basis for research (Strachan et al., 2012).

1.2 Statement of the Problem and Significance of the Study

The rising health issues and mortality caused by obesity worldwide presents a problem that urgently needs attention and solutions (WHO, 2013b). Modernisation, affluence and prevalent use of technology has exacerbated the obesity problem (Biddle et al., 2010; Giovannucci et al., 1995; Miller et al, 1997). Physical activity is one of the factors that can prevent and reverse obesity and its related diseases. However, a substantial proportion of

people still fail to meet the physical activity requirement for healthy living (WHO, 2018a). This proportion is also set to increase. If no new effort is made to intervene the lack of physical activity, obesity and its problems will eventually become problems not just for the individual but for the nations.

Meta-analysis of physical activity interventions has shown mixed results (Miller et al., 1997). Contemporary studies have also suggested new ways to design physical activity interventions (Bandura, 1989; Gergen, 1991, 1999; Higgins, 1987; Markus & Nurius, 1986; Mick & Fournier, 1998; Mischel & Shoda, 1995; Ryan & Deci, 2002). Literature review showed different perspectives on physical activity behaviour as one that is not just shaped by a single definite determinant but by multiple factors (Biddle & Mutrie, 2001). It has also highlighted two constructs to understand physical activity- motivation and identity (Ryan & Deci, 2002). There were studies that reported positive results and feasibility to further research into the motivation-identity aspect of physical activity (Strachan et al., 2012).

Identity theory and SDT are promising basis to address some of the limitations in physical activity intervention. However, there was no standardized measurement for exercise identity. Most exercise identity scales lack a strong foundation from identity theory, mainly because the theory is multi-faceted. There is also a need to formulate an exercise identity measurement that is validated against self-determination and exercise behaviour. While studies have showed correlation between exercise identity and self-determination, it is not clear what is the relationship of these two constructs to physical activity. There is a need to find the association between identity, self-determination and physical activity so that effective intervention programmes can be designed to address the obesity pandemic that is happening to us.

Therefore, it is significant to examine the motivation-identity collection of knowledge to create a new knowledge base to address the twenty-first century obesity pandemic.

1.3 Aims of Research

The purpose of the study is therefore to develop an exercise and sport identity model and scale based on the foundations of identity theory as set out by Erikson (1968) and researchers on the theory. Next, the study attempts to examine the validity and reliability of the scale and find the association with motivation and physical activity. A third part of the study is to examine the effectiveness of using social media as an environment to influence exercise and sport identity, motivation and physical activity.

Chapter 2

Literature Review

The literature review looks at the prevalence of obesity, its health risks, inactivity, together with the impact of technology on human behaviour and the human self. The section explains this phenomenon using identity theory and self-determination theory (SDT). Using current research findings in these two theories, a model is proposed to integrate identity theory and SDT to look at the gaps to overcome the issues faced in physical activity interventions.

2.1 Obesity, Health Risks and Inactivity

The prevalence of obesity in the world has tripled from 1975 to 2016. In 2016, there was an estimate of more than 650 billion adults over the age of 18 years worldwide who were obese. Over 340 million children and adolescents between the ages of 5 to 19 years old were overweight or obese and 41 million children under the age of 5 years old were overweight or obese (WHO, 2018c). In 2016, the prevalence of overweight adults was highest in the American regions (62.5 %) and lowest in the South East Asian regions (21.9 %) (WHO, 2017a). The prevalence of elevated body mass index increases with country income level for up to high income levels. The prevalence of overweight in high income countries was more than double that of low and lower middle income countries (WHO, 2017b). This is a worrying trend as countries become more affluent. The overweight and obesity problem continues to aggravate and sees no sign of improving over the years. Figures 2.1 and 2.2 show the prevalence of overweight among adults of by region and income level.

Percentage of population overweight among adults 18 years and above
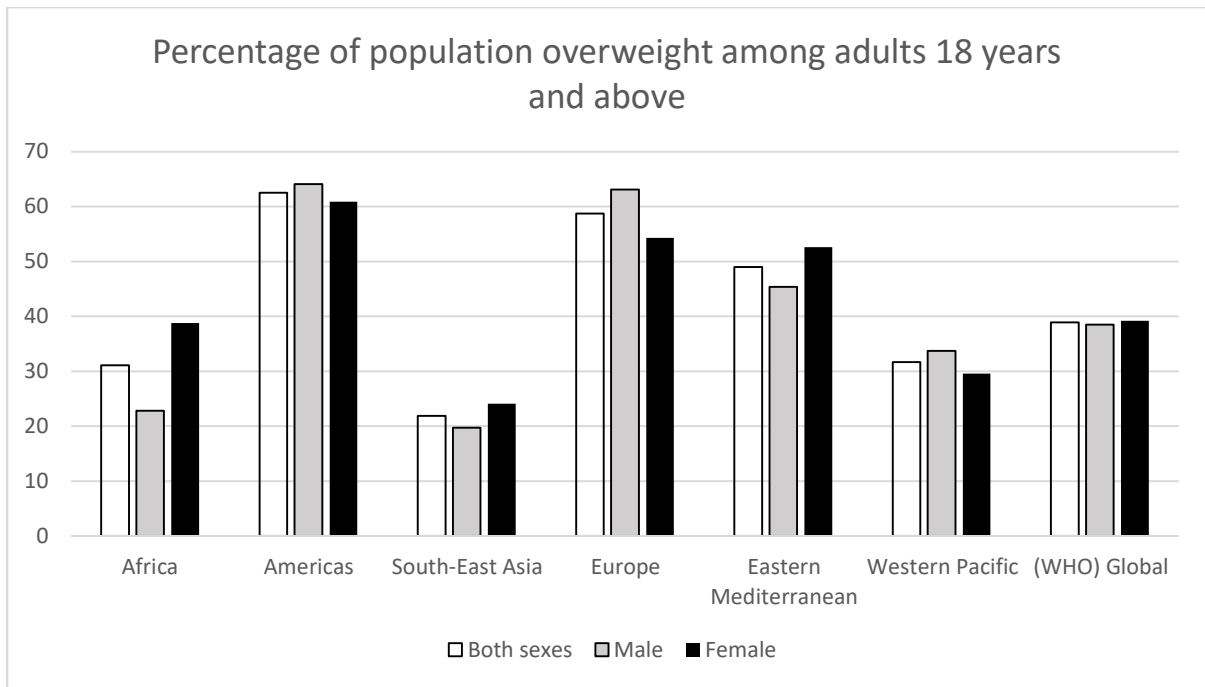
Figure 2.1. Prevalence of overweight adults in different regions in the world by sex. Adapted from "Global health observatory data repository: Prevalence of overweight among adults, BMI ≥ 25, age-standardized estimates by WHO Region", by World Health Organization, 2017. Copyright 2017 by World Health Organization (WHO).

Percentage of population overweight among adults 18 years and above
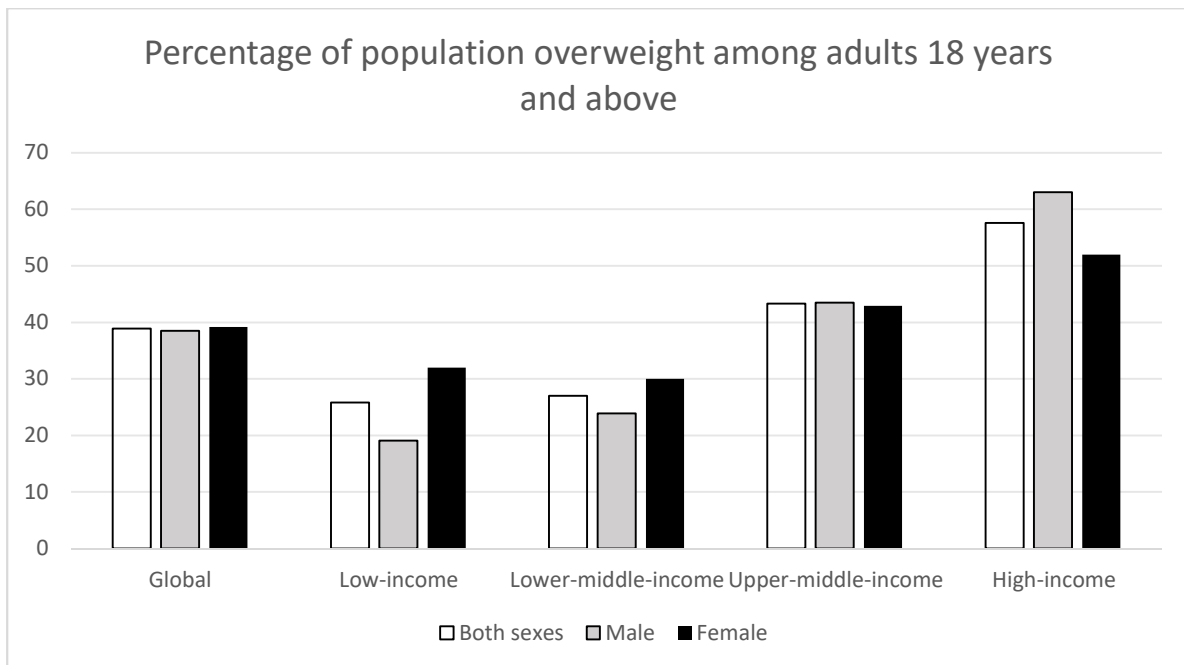
Figure 2.2. Prevalence of overweight adults in different income level in the world by sex. Adapted from "Global health observatory data repository: Prevalence of overweight among adults, BMI ≥ 25, age-standardized estimates by World Bank income group", by World Health Organization, 2017. Copyright 2017 by World Health Organization (WHO).

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The national population health survey 2016/17 (Ministry of Health & Health Promotion Board, 2017) showed the incidence of obesity in Singapore from 1992 to 2017 increased from 5.1 % to 8.7 %. It peaked in 2010 at 10.8 % of the population being obese. At its peak, the prevalence of obesity increased by 3 times for the men in 2010 while the women registered an increase of about 4 % in 2017 (Ministry of Health & Health Promotion Board, 2017). Table 2.1 shows the prevalence of obesity in Singapore population from 1992 to 2017. In an earlier survey, the prevalence was highest in the 30-39 years age group. When examined by gender, men in the 40-49 years age group and women in the 50-59 years age group reported the highest prevalence of obesity (Epidemiology & Disease Control Division, 2010). Table 2.2 shows the distribution of the prevalence of obesity in 2010 by the age groups and gender.

Table 2.1

Prevalence of obesity in Singapore population (%) by gender from 1992 to 2017

Gender	1992	1998	2004	2010	2017
Male	4.1	5.3	6.4	12.1	7.0
Female	6.1	6.7	7.3	9.5	10.3
Total	5.1	6.0	6.9	10.8	8.6

Table 2.2

Prevalence of obesity in Singapore population (%) by age-groups and gender (2010)

Age (years)	Males	Females	Total
18 – 29	15.4	5.8	10.6
30 – 39	16.1	8.7	12.3
40 – 49	10.3	11.1	10.7
50 – 59	9.8	13.2	11.5
60 – 69	5.7	8.7	7.2
18 – 69	12.1	9.5	10.8

There is a trend of rising obesity rates from 1992 to 2010. Although the incidence of obesity in men improved from 2010 to 2017, the obesity rates in women further increased from 2010. It still remains a concern because the latest incidence across both men and women were above the baseline in 1992. The other concern over the prevalence of obesity in Singapore and worldwide is that it is a cause of several health risks and chronic health problems. As affluence and economic security of Singapore improved, it changed from an environment that saw malnutrition and poor sanitation, one of high prevalence of infectious diseases to one of high prevalence of chronic and degenerative diseases associated with more affluent lifestyles. Today cancer, cardiovascular disease and diabetes are among the top ten disease conditions affecting Singaporeans (National Registry of Diseases Office, 2012). National Registry of Diseases Office (2019) reported the ten most frequent cancers of male and female Singaporeans (Figures 2.3 & 2.4). Chronic diseases such as coronary heart disease and stroke are also the leading causes of death (Lee, Loprinzi, & Trost, 2010). Together,

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cancer, coronary heart disease and stroke accounted for about 60 % of all deaths in Singapore

(Epidemiology & Disease Control Division, 2003).
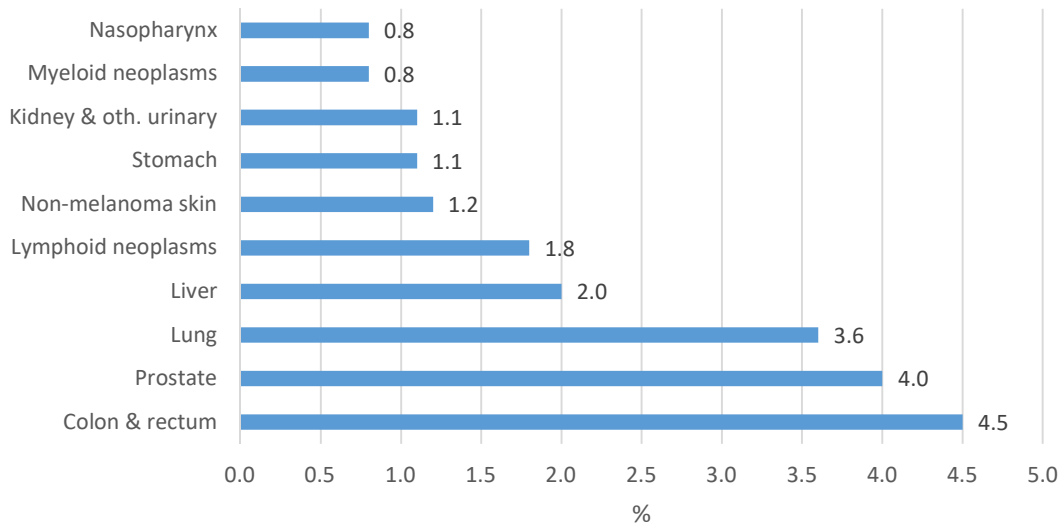
Figure 2.3. Ten most frequent cancers in male Singaporeans (%) from 2013-2017. Retrieved from "Singapore Cancer Registry 50th Anniversary Monograph - Appendices", National Registry of Diseases Registry, 2019, p. 171. Copyright 2019 by National Registry of Diseases Registry.
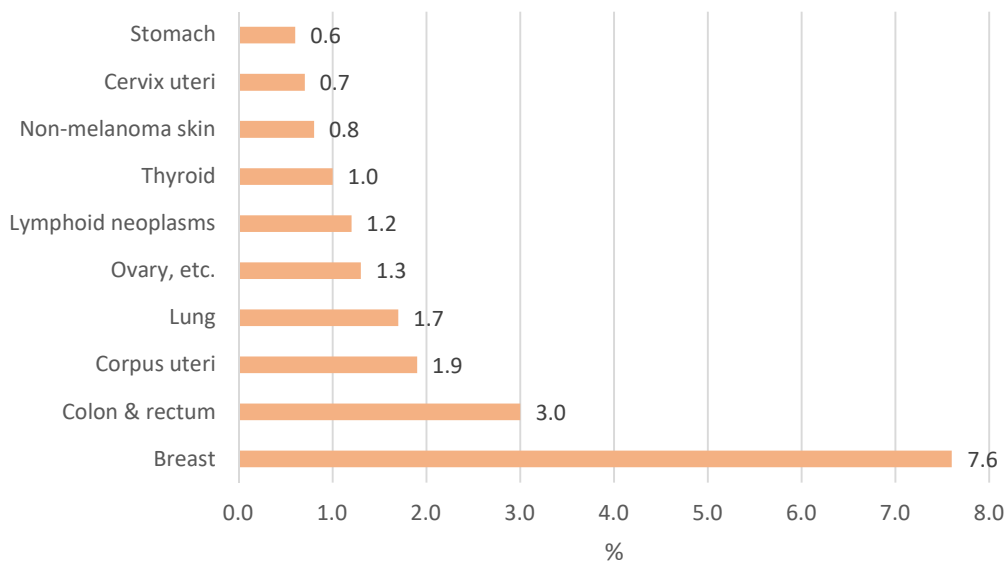
Figure 2.4. Ten most frequent cancers in female Singaporeans (%) from 2013-2017. Retrieved from "Singapore Cancer Registry 50th Anniversary Monograph - Appendices", National Registry of Diseases Registry, 2019, p. 173. Copyright 2019 by National Registry of Diseases Registry.

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Studies have shown that cancers such as colorectal and breast cancer are associated with lack of physical activity (Giovannucci et al., 1995; Holmes et al., 2005). Such cancers are associated with elevated plasma lipids and plasma glucose in our bodies from high fat foods (Dunstan et al., 2012; Grantham et al., 2004). The effect of elevated plasma lipids and plasma glucose was exacerbated by increased inactivity (WHO, 2013a). Studies that examined the effects of exercise on postprandial lipemia and postprandial plasma glucose have demonstrated that physical activity can reduce peak plasma lipids and plasma glucose. Dunstan et al. (2012) measured plasma glucose in three conditions and found that moderate-intensity physical activity lowered plasma glucose more than light-intensity physical activity. Both moderate- and light-intensity physical activity conditions produced significantly lower plasma glucose than uninterrupted sitting condition. Therefore, light-intensity activity breaks and moderate-intensity activity breaks between prolonged sittings have significantly lowered the glucose levels in blood. Grantham et al. (2004) also found that prolonged exercise has a similar effect on plasma lipid profiles. Thus physical activity and the lowering of plasma lipid and plasma glucose can reduce the effects of intake of energy-dense foods that are high in fats and reduce obesity and the risk of health problems such as hypertension and cancers (Dunstan et al., 2012; Grantham et al., 2004).

Engaging in regular physical activity can delay all-cause mortality. One can do that by participating in more physical activities and less sedentary activities, to meet the recommended physical activity levels (US Department of Health and Human Services, 2008). In addition, physical activity lowers blood pressure, improves lipoprotein profile, C-reactive protein and other cardiovascular heart disease biomarkers. Insulin sensitivity is enhanced and weight management is better controlled (US Department of Health and Human Services, 2008). Physical activity participation is also known to maintain bone mass and cut down chances of falling. It also prevents and improves mild to moderate depressive disorders and

anxiety. Physical activity enhances feelings of well-being, cognitive function, quality of life and is associated with lower chance of dementia and loss of cognitive function (Garber et al., 2011).

To reduce the prevalence of obesity and its related health problems, physical activity intervention is one area to look into. The lack of physical activity is one key factors for several lifestyle diseases. Warburton et al. (2006) and Powell and Pratt (1996) have shown that physical activity can prevent obesity and its related chronic diseases such as cardiovascular disease, hypertension, osteoporosis, diabetes, cancer, depression and premature death. The World Health Organization (2005) has also reported the consequence of lack of activity on obesity. There is significant agreement between various studies on the benefits of physical activity on physical and mental well-being. Being more physically active is one of the strategies to address obesity and its associated problems. The World Health Organization (2013a) and other researchers (Garber et al., 2011; Goh & Pang, 2012) recommend individuals to participate in physical activity for at least 60 minutes a day for children and 150 minutes per week for adults; or more specifically, to participate in moderate-intensity cardiorespiratory exercise training for at least 30 minutes a day on at least 5 days a week for a total of at least 150 minutes, vigorous-intensity cardiorespiratory exercise training for at least 20 minutes a day on at least 3 days a week for a total of at least 75 minutes, or a combination of moderate- and vigorous-intensity exercise to achieve a total energy expenditure of at least 500-1000 MET min a week. Many of the adults do not meet this requirement in order to reap the advantages of being regularly active. Therefore, it is imperative to intervene in the declining health situation globally and locally through exercise.

The National Health Survey 2010 (Epidemiology & Disease Control Division, 2010) reported that the percentage of male Singaporeans who engaged in regular physical activity

decreased significantly from 28.1 % (18-29 years old) to 16.7 % (30 to 39 years old) (Table 2.3). This percentage remained almost constant for the male Singaporeans until about 50 years old when an increase was observed. The percentage of female Singaporeans who participated in regular physical activity was almost constant across the various age groups. The percentage of leisure-time inactivity amongst male Singaporeans increased from 30.0 % (18-29 years old) to 48.4 % (30-39 years old) (Table 2.4). The same trend was also observed for female Singaporeans in the same age-groups. Physical activity levels or inactivity levels of male Singaporeans took a turn for the worse after 29 years old. The three main reasons for not participating in any physical activity were a lack of time (due to work or family commitment), laziness and lack of interest.

It was also identified that an increase in physical inactivity due work becoming more sedentary, transportation becoming less reliant on human power, and increasing urbanization have caused the rapid increase in obesity in many developed countries worldwide (WHO, 2013a). According to accelerometer data in a study, over seven thousand youths aged from nine to eleven years, in the United Kingdom spent about 420-460 minutes each day in sedentary behaviour. That accounted to about 60-65% of measured time (Biddle et al, 2010). In Singapore, a study on 128 male and 116 female adolescents between 12–15 years old, from seven different schools found that they do not meet the national and international recommendation of at least 60 minutes of moderate-to-vigorous physical activity daily. Sedentary time accounted for the majority of the weekday and weekend time. Step count accumulated in school was 16% greater than step count accumulated out-of-school time. All these suggest that Singapore youths on their own are not moving enough (Chia, Mukherjee, & Lye, 2010). Sedentary behaviours appear from childhood to adolescence. One of the reasons for sedentary activity was time spent on media viewing. With technology advancing rapidly and evolving constantly, viewing electronic content on mobile devices or internet

access has become a significant cause of sedentary behaviour. This has implications for physical activity intervention studies that may become dated in the technologically dominated environment (Biddle et al., 2010). There is a need to examine if current physical activity interventions are still effective in the new environment.

Table 2.3

Percentage of male and female Singaporeans who participated in regular physical activity across various age-groups

Age (years)	Males	Females	Total
18 – 29	28.1	15.9	22.0
30 – 39	16.7	13.4	15.0
40 – 49	17.7	15.7	16.7
50 – 59	23.9	14.7	19.3
60 – 69	32.2	17.3	24.5
18 – 69	22.8	15.2	19.0

Table 2.4

Percentage of male and female Singaporeans who are inactive across the various age-groups

Age (years)	Males	Females	Total
18 – 29	30.0	47.6	38.8
30 – 39	48.4	63.3	56.1
40 – 49	55.8	59.1	57.4
50 – 59	49.3	66.7	58.0
60 – 69	56.8	76.6	67.0
18 – 69	47.0	60.9	54.0

2.2 Physical Activity Intervention

Physical activity intervention is one of the methods to address obesity and its health risks. Miller and colleagues (1997) performed a meta-analysis on weight-loss interventions involving diet, exercise and a combination of diet and exercise. It found significant weight loss from the three types of intervention, although diet and combination of exercise and diet proved more effective. In the same meta-analysis of weight-loss programs from 1969 to 1994, Miller and colleagues (1997) found that weight-loss programs using exercise as an intervention had a mean weight-loss of $2.9 \pm .4$ kg. Of these studies, some reported negligible weight-loss or even weight gain (Miller et al., 1997). While it is clear that physical activity can improve the quality of life and reduce the risk of costly health problems, studies on weight loss programs returned mixed results. Individuals can lose weight by following a structured intervention involving physical activity (Miller et al., 1997). However, in spite of the knowledge on the causes of obesity, its health risks and interventions, obesity rates continue to creep upwards in Singapore and globally (Epidemiology & Disease Control

Division, 2010; WHO, 2013a; 2013b). Finding effective physical activity intervention remains a challenge.

McGowan (2012) proposed that the cause of obesity is multi-factorial because of its interdisciplinary nature. It can be approached from the medical field, public health perspective or nutritional perspective. Physical activity interventions were traditionally centered on physical aspects. Many physical activity intervention programmes, typically used the mode of face-to-face intervention (Lau, Lau, Wong, & Ransdell, 2011). Although this mode of intervention programme has been effective in enhancing physical activity participation, the effects have been small (Lau et al., 2011). This kind of traditional intervention program is also subject to time schedules, and running costs, and constraints to limited accessibility (Sevick et al., 2000), which results in high attrition rate. Therefore, there is a need to find alternative ways to reduce the attrition rate.

Information and communications technology (ICT) such as internet and portable devices offer possibilities of reducing the attrition rate in physical activity (Nigg, 2003). The use of ICT has many advantages. Some of them provide flexible time schedules customized to the individual's schedule (Nigg, 2003); ICT has the potential to reach a large population compared to small group sizes in face-to-face interventions (Cavallo, 2012; Marcus et al., 2000); ICT has the potential to satisfy participants' preferences as it is individualized, unlike group interventions that are one-size fits all (Nigg, 2003); because of its individualized nature, it delivers individualized feedback and social support for exercise participants (Lau et al., 2011). With technological advancement, a larger proportion of the population has access to internet. This meant that internet users become more representative of a population today compared to earlier years; and physical activity using ICT can target groups such as older adults or less privileged groups in the community (Lenhart et al., 2003). One study found that more than half the people who used ICT as a mode of physical activity intervention identified

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internet as an important source of health information, further suggesting the feasibility of the ICT as a suitable medium for intervention (Marshall et al., 2005)

ICT can overcome many of the challenges associated with face-to-face intervention and is therefore a promising tool for enhancing physical activity and health-related behaviour. A review has shown that most of the ICT interventions have superior positive results in influencing physical activity (Norman et al., 2007). Another review reported positive changes in physical activity behaviour in eight of the fifteen ICT intervention studies (Vandelanotte et al., 2007). The efficacy of physical activity intervention can vary depending on a few factors. One of the factors is the amount of interaction with the online instructor. Vandelanotte et al. (2007) found that 78 % of interventions reported positive behavioural change because they had more than five interaction sessions. This implied that interventions were more effective if there was more regular online interaction between participants and instructor. In the same review, Vandelanotte et al. (2007) also found that theory-based interventions were more effective in producing positive outcomes than those that were not (56 % against 50 %). However, the results also suggests that not all theory-based interventions were effective. The data pointed that social cognitive theory was commonly found in most of the theory-based interventions that yielded positive outcomes. In another study, it was found that participants who underwent Facebook intervention experienced increases in social support and physical activity level (Cavallo, 2012). These findings suggest that an effective intervention has a social element both in theory and application. However, further studies are needed to determine the theoretical basis and its effectiveness for its inclusion in ICT-based physical activity interventions.

Currently, there are about 2.9 million Facebook users in Singapore (Internet World Stats, 2014) with 59% of them aged from 18-34 years old and approximately 70% of them use Facebook daily (Socialbakers, 2011). Thus, Facebook potentially provides a feasible

platform for researchers to build intervention programmes to enhance people's physical activity behaviours in this period of time.

2.3 Impact of Technology on Human Self

We are living in a part of human history where modern technology and social technology such as Facebook permeates our lives (Gergen, 1991). This period has seen significant changes in human behaviour not seen in the earlier periods. Modern technology such as internet and recently its applications have opened doors to entertainment, communication and education. It has also displaced traditional technology such as television as sources of entertainment and communication (Lenhart et al., 2001). The significance of modern technology is seen in the speed of development. Hannemyr (2003) compared early technologies such as radios, telephone, television with internet development and their reach. Radio took 37 years to reach 50 million listeners. Telephone took 34 years to reach 50 million customers and it took 13 years for television to reach the same number of viewers. It only took internet 4 years to reach 50 million subscribers (Zapoleon, 1999). The speed for technology to reach out to the same number of users increased exponentially. Locally, Infocomm Development Authority of Singapore (2013) found that about 84% of households had access to home internet. Of these households, almost all of them were connected to the internet via the faster broadband. Eighty-five percent of households had access to a home computer. When it comes to households with younger users, about 97% of households with school-going children had home computer access and about 96% had home internet access. Almost half of households with school-going children had more than 2 computers at home.

In the past fifteen years, the number of internet users tripled from one billion to nearly three billion (International Telecommunication Union, 2014; Internet Society, 2014); users changed their fixed internet access from dial-up to the faster broadband; and their usage

shifted from text-based to now, video consumption. Globally, the number of users in developing countries exceeds those in developed countries; there are now more mobile broadband subscribers than fixed internet subscribers, and smartphones have dominated the mobile access (Internet Society, 2014).

The top uses of internet from 2000 to 2003 were email, entertainment and news. From 2003, instant messaging became a popular use among the top uses of the internet. Hoffman and colleagues (2004) also reported that a significant proportion of people had increased contact with friends and relatives through email. In Singapore, the top three uses of internet were also for communication, leisure and searching for information (Infocomm Development Authority of Singapore, 2015) (Table 2.5). Smartphones have also overtaken laptops as the most used form of media (Infocomm Development Authority of Singapore, 2015) (Figure 2.6). Infocomm Development Authority of Singapore (2015) surveyed mobile users and found that communication (sending or receiving email and using social media) and getting information made up the top 3 activities on mobile devices such as mobile phones and tablets (Table 2.6). As can be seen, mobile communication such as social media and emails have become a common form of internet use amongst Singaporeans, with people in the 15 -24 and 25 – 34 year-old age groups being the highest proportions of social media users. Of the group of users of social media, there were about 2.9 million Facebook users in Singapore (Internet World Stats, 2014). In an earlier survey, 59% of Facebook users were aged from 18-34 years old and approximately 70% of them use Facebook daily (Socialbakers, 2011). As the number of internet users in the world expands exponentially, this resulted in many becoming more socially connected than before. The substantial number of users also meant that social technology is ideal for mass programs where communication is required.

Table 2.5

Top activities in the internet from 2012 to 2014

Primary Internet activity group	2012	2013	2014
Communication	71 %	83 %	82 %
Leisure activities	61 %	72 %	77 %
Getting information	49 %	65 %	62 %
Online Banking	17 %	34 %	31 %
Purchasing or ordering goods or services	17 %	40 %	26 %
Education or learning activities	14 %	22 %	17 %
Government organizations/ public authorities	7 %	16 %	15 %
Creating content	13 %	7 %	8 %
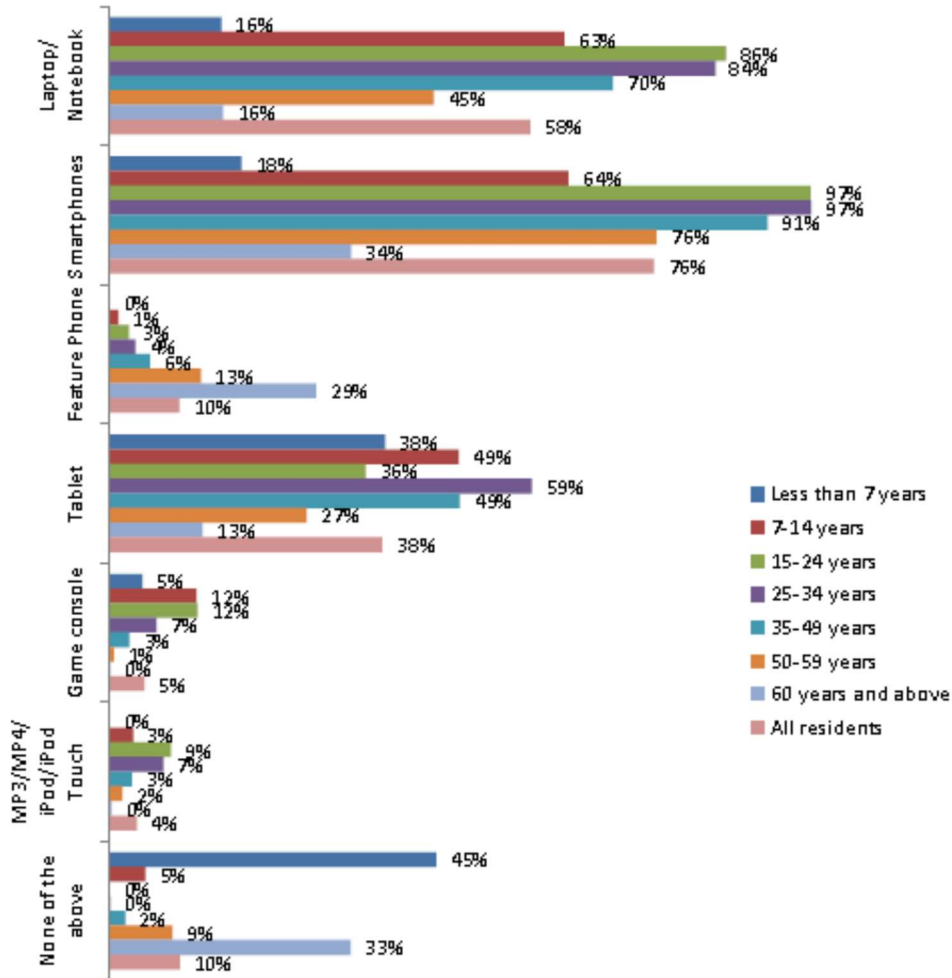
Figure 2.5. Portable device use by different age groups. Reprinted from "Annual survey on Infocomm usage in households and by individuals for 2014", Infocomm Development Authority of Singapore, 2015, p. 13. Copyright 2015 by Infocomm Development Authority of Singapore.

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Table 2.6

Top ten uses on mobile devices by different age groups

Activity	<7 years	7-14 years	15-24 years	25-34 years	35-49 years	50-59 years	≥ 60 years	All residents
Using social networks	0 %	39 %	78 %	78 %	68 %	51 %	36 %	63 %
Using instant messaging	2 %	46 %	61 %	58 %	57 %	54 %	45 %	55 %
Sending or receiving emails	0 %	18 %	58 %	64 %	62 %	52 %	45 %	54 %
Getting information or general web browsing	0 %	28 %	56 %	62 %	57 %	48 %	43 %	52 %
Downloading or watching movies, short films or images	68 %	43 %	53 %	46 %	37 %	35 %	24 %	41 %
Reading online news	0 %	8 %	32 %	40 %	42 %	34 %	36 %	34 %
Getting information about goods or services	0 %	6 %	29 %	44 %	36 %	31 %	19 %	31 %
Checking account information	0 %	0 %	19 %	42 %	37 %	29 %	12 %	27 %
Purchasing or ordering goods or services or making transactions	0 %	3 %	29 %	43 %	33 %	19 %	13 %	27 %
Playing or downloading computer or video games	49 %	42 %	35 %	23 %	17 %	18 %	19 %	25 %

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Gergen (1991) examined the impact of new technology such as internet and social media on human behaviour and identity. The first is the expansion of human connection from internet. Humans have become more connected and isolated all at the same time. Similar sentiments were also written by Castells et al. (2006) and Katz and Rice (2002). Social technology such as internet or social networking platforms bombards us with a multitude of information. While knowledge is now easily accessed or even fed to us, this is mostly incoherent and unrelated to the individual. The individual is shaped by disjointed relationships that pull us in different directions, willing us to play different roles in different situations. Identity of humans has therefore evolved from belief in a stable inner core and rational one to a relational one. Gergen also describes this as multiphrenia, the splitting of the individual into an aggregation of multiple self-investments. This is an outcome of taking on multiple interests or roles, in an effort to exploit the potentials of social technology. So as one's potential is raised by these technologies, one continues to use these technologies increasingly, creating a vicious cycle creating multiple selves.

At the micro level, the expanding human connection also built walls between people. People prefer to use technologies in lieu of physical connection to build relationships with others. While people feel more secure behind the wall of humanless technology and support from the software, there is distancing between people. There is a tendency to isolate the self from the rest of the world who do not share the same realities and values with oneself. There is a development of a sense of superior good and to label the rest as problems. Technology has advocated groups of self-righteousness in a sea of antagonism (Gergen, 1991). Some examples of these included democratic expression of minority or suppressed groups such as feminists, gay groups, religious groups and such into the public. Sometimes, these online groups exhibited destructive offline behaviours such as the burning of churches and vandalism of synagogues. Another form of isolation comes from the detachment of the

human self from images created by media and technology. People misread the signals from these images and retreat into the world of all-round entertainment, beautiful and interesting people. As a result, they become loners. They also have issues with expression and control, good and evil. They become detached from the world of common morality and physical world (Gergen, 1991). For some life was found in the virtual world.

Multi-tasking also became part of our lives. The obstacles of time and space, to social relationships have been removed. Past relationships can be renewed through voice, video and interactions across vast distances. Time and space have been re-conceptualized in the internet age and differentiated them from the historical time and space (Durkheim, 1965; Frissen, 2000; Haddon, 2001; Lee & Liebanau, 2000; Rifkin, 1987; Tsatsou, 2009). The limits of time can now be stretched through multi-tasking. It is no longer limited. This breaking down of time constraints in terms of communication through technology offers people virtual reality of experiences in the past or future. Internet spaces such as social media and interactive online games remove conventional constraints of time. Online activities are not bounded by time. They can operate at any time, in parallel with real world activities, challenging one's identities and concept of time (Baudrillard, 1995). Heidegger (1971) also argued that the evolution of mass media and communications has created new 'electronic spaces', diminishing physical spatial distances, creating multiple identities in different time and 'space' contexts. One can be a different identity in a different context all at the same time. The concept of virtual space also presents us opportunities to engage people in exercise interventions asynchronously in a virtual sense. We are no longer bounded by physical, synchronous exercise classes.

Anxiety also became synonymous with technology. Mick and Fournier (1998) described the behaviour of people and the associated psychological reactions like anxiety and stress in the internet environment (Cowan, 1983; LaPorte & Metlay, 1975). Some view

technology as freedom, control and efficiency (Asbell, 1963; Canham, 1950). Others see technology as a form of damage to the environment. Some also see that technology makes humans incompetent, more dependent and more passive, putting the human race on a path towards self-destruction (Ellul, 1964; Glendinning, 1990; Hill, 1988). These paradoxes in technology initiated changes in the environment that modifies the self-identity of people in life's different aspects such as work and marriage (Carver, Scheier, & Weintraub 1989; Holahan & Moos 1987; Lazarus & Folkman 1984).

Technology has replaced the humanist tradition of 'self' with a 'self' that was integrated with a technological object. The humanist tradition of self is a sense of coherent center of being. The humanist traditional self is an individualist self that is an autonomous and separate being, each bent on maximizing self-gain. Instead, the loss of this sense of self (individualism, autonomy and uniqueness) towards the immersion in multiple and extended relationships have led to a lesser distinction between persons and machines. Implements such as eyeglasses, hearing aids, false teeth, breast implants and wrist watches are attached to the human body to reproduce or enhance a human function (Gergen, 1991). McLuhan (1966) also gave examples of other extensions of humans in the forms of radio, telephone, television and film. Radios and telephones are our ears extended into the world to hear from distances beyond or audible range. Television and film are the extension of our eyes to see from distances beyond our sight. Humans have extended ourselves in various technology to the point that it is necessary and the pair becomes indistinguishable. Even media can serve as social and cultural extension of the human self. In the most traditional form, a luxury car can represent the social status of an individual. If we look at social media such as Facebook, it is an extension of a collection of social and cultural statuses (McLuhan, 1966; Rothenberg, 1993). When we immerse in the sea of information on social media, we can lose our individualism and shift to relational consciousness (Gergen, 1991). Other than being an

influencing force, social media has become a powerful form of identification and presentation of our selves to others.

Because of a change in self, beliefs, thoughts and values have also changed. Gergen (1999) also proposes two changes in the individual self with the invention of technology. The first was a change from a self with virtuous mind, meritorious conduct and moral action to one that was undermined. The second was when the individual self became one with radical polyvocality (extreme and consisting of multiple meanings; diverse) was opposed to parochial univocality (narrow and unambiguous; uniform). These changes were brought on by changes in thoughts that were shaped by technological progress. When communication changed from oral form to print form, a culture was changed and common forms of thought were altered. People depended on recall and more elements of concrete (as opposed to abstract) and redundancy (as opposed to precision) in communication (Ong, 1982). In the oral society, people were able to determine the real intentions from face-to-face interaction, where words, facial expressions, gestures and physical context complements the interactions. The print however allows interpretation of information with no such context and is detached from the original context. Further, with the advancement in technology from print to electronic media, beliefs and thoughts shifted further along the continuum of thought, moral and self-presentation. The exponential expansion of information, people and opinions we are exposed to on media makes us privy to multiple realities. With almost unlimited exposure, we are also exposed to conflicting information and opinions. For example, with issues such as human rights, abortion and euthanasia, multiple perspectives can be found. Thus, the human self has taken on a state of radical polyvocality and lack of moral conviction. This meant that people's perception to behaviours have changed. This includes physical activity behaviour and it is necessary to re-examine physical activity in this new environment.

Authors such as Auge (1995), Meyrowitz (1985) and Relph (1976) reinforced that electronic social media communications have cut down the necessity for face-to-face communication, diminishing the value of "place-formed communities". The speed and extent of changes that electronic social media communication systems have brought about overwhelmed the forces that held value for place, identity and ideology and suggested that they are diverse and open to change. This resulted in uncertainty in the creation of new physical place. Such creation of place is also more diverse and difficult to foresee, thus changing the way human behave in comparison to that in place-formed communities (Webber, 1964).

From the changes seen at the beginning of modernization in various parts of the world such as the rise of industrial revolution, the European renaissance and the decline of feudalism, the process of individualization, where a society reorganizes and people begin to experience autonomy, also evolved unlike before (Beck, 1992). People were removed from their prescribed social roles. People were freed from traditional social positions but also forfeited many social supports. This transformation in societal structure has led to a change in culture and hence behaviour. In Western societies where reorganization has stabilized, individualization has been institutionalized and replaced collectivization (Côté & Levine, 2002). With individualization, people become more self-aware as they make their own decisions to choose identities from a complex selection of roles the environment creates. Modern societies in many cities are associated with this process of individualization. Thus it is common to develop one's self as an individual rather than a member of a collective community (Buchmann, 1989). Along with the change is also the impact on identity: multiphrenia, loss of control and a loss of sense of self (Gergen, 1991).

With so many choices to make in the daily life and the multiple roles each has, it becomes clear that identity is in a constant flux. This was also described by Côté and Levine

(2002) as a state of moratorium. Inevitably, this phenomenon has on impact on human behaviour. Exercise, for one has to compete for time in the multiple alternatives in one's choices. To reiterate, there is increasing sedentary behaviour in Singaporeans from all ages. (Chia, Mukherjee, & Lye, 2010; Epidemiology & Disease Control Division, 2010). The reasons stated also reflect competing choices such as work, family or other interests (Epidemiology & Disease Control Division, 2010).

There are close associations between technology, internet, media with physical space, time and identity. It is clear how identity has been influenced and can be influenced by development in technology and the rise of internet. The profusion of technology has given us a few conditions: multiphrenia, erosion of the centered self: the deterioration of truth and authority; and the emergence of new versions of relationships (Gergen, 1991). Goldman (1989) and Weigart and Franks (1989) have argued that the contradictions of the modern technology driven societies have created a widespread attitude of dissidence and uncertainty in people. Exposed to simultaneous conflicts, today's users of technology hesitate back and forth in a perceptual space of uncertainty that is difficult to resolve (Gergen, 1991; Gregg, 1995). Such is the kind of environment and mechanism that shape a person's identity and disposition in the modern period. There is a need to understand identity and its theories in order to address some of the behavioural issues we face in the present time as this is evident in several aspects of human behaviours including physical activity behaviour.

2.4 Identity Theory

The mechanism of identity construction in the modern period due to the influence of technology can be traced to several mediating factors. In contrast to the pre-modern times (tribal communities to feudal societies), constructing an adult identity was a simple process where the adult assumed the prescribed roles that family members or significant others

adopted. Those who did not conform to their expected role would be sanctioned in some way. Identity formation is a social-cultural process (Côté & Levine, 2002).

As people form modern societies, where autonomy over life decisions has displaced obligation, identity formation has become an increasingly complex, uncertain and lonely process where many people are not prepared for (Erikson, 1968). For the major parts of humanity, identity formation was fitting into the social roles the environment ascribed rather than going through a period of exploration and exercising individual choice over one's roles. The problems of identity formation seen today were not common then. People are not familiar with being faced with choices over matters related to personal meaning and identity. And people in the modern times have not developed the means to cope with making decisions to deal with the new complexity in modern societies; sometimes creating consequences they have to live with (Gergen, 1991).

The dramatically different process of forming an adult identity for modern people and having to make more choices is described as a state of multiphrenia (Gergen, 1991). This was also described by Côté and Levine (2002) as a state of moratorium. In this state of multiphrenia or moratorium, many have not developed the means to make appropriate choices (Côté & Levine, 2002). The outcome of this inability to make choices are uncertainty about their belief system; lack of commitment to a course of action; open to influence by external sources; and lack of awareness of the need to develop a sense of meaning in their children. People lack a sense of identity grounded in a social community and are not able to make choices that life-sustaining technology has given (Côté & Levine, 2002). One of which is maintaining a healthy and good quality life. This process of identity formation is understood through identity theory and is explained in the subsequent section.

2.4.1 Identity formation, stages of identity formation and identity crisis

The formation of one's identity has its foundation in Erik Erikson. In particular, Erikson focused on identity formation in adolescence. Erikson's main proposition in the topic is that it is a psychosocial process linking childhood to adulthood to develop a viable adult identity (Erikson, 1968). The process can lead to an outcome along the continuum between identity confusion and identity unity. The adult identity is influenced by psychological, social, cultural and historical factors during adolescence (Erikson, 1968). It is therefore critical we understand the key influences at each stage of identity formation. Erikson believed that we pass through eight distinct stages of development as we grow. Each stage is defined by a specific conflict between opposing impulses or behaviours. The resolution or inability to resolve these conflicts affect our personality and identity. The eight stages are "oral-sensory stage, muscular-anal stage, locomotor stage, latency, adolescence, young adulthood, middle adulthood and late adulthood" (Erikson, 1968). Each stage is defined by a conflict between two poles of behaviours.

The first four stages are childhood stages. In the oral-sensory stage which typically takes place in an infant's first year of life, is marked by conflicts between trust and mistrust. At this stage, infants learn that they can trust others to fulfil their basic needs. If they are not able to, they will perceive the world as a precarious and unreliable place. Between 1-3 years of age marks the muscular-anal stage, where the child experiences either autonomy or shame (doubt). Parents who encourage exploration helps develop a sense of autonomy in their children, while parents who restrict their children can build their doubt over their abilities. Between 3-6 years old, the child undergoes the locomotor stage where he experiences either initiative or guilt. Children at this age need to develop initiative and independent decision making. If they are not encouraged to do so, they will learn guilt about their desire for independence. The last stage of childhood stages is latency, which takes place between 6 to

12 years old. At this stage, children are learning adult skills such as reading, writing and logic. If they are encouraged to do so, they develop the motivation to keep learning and practicing, otherwise they will feel inferior and unmotivated.

At 12 years old, children enter the adolescence stage where they are searching for a personal identity. They begin to experiment with expressions such as music, friends or dressing. If they are not able to find an identity or regret what they found, they experience role confusion. This stage can be short or can potentially last till the twenties.

In the adulthood stages, the adult meets different kinds of challenges. In the young adulthood stage, one struggles between intimacy and isolation. Adults start looking for close, reciprocal relationships. If they are not successful, they end up feeling isolated. In the middle adulthood stage, one contends between generativity and stagnation. This stage can happen between 40 to 65 years old. The adult assesses if they have produced any value or achieved anything in life. If they have not, they may feel a sense of stagnation. Lastly, in the late adulthood stage, the adult faces ego integrity or despair. This usually happens after 65 years old. If the adult feels content on reflecting his life, he achieves ego integrity. If he feels that his time has been wasted, he experiences despair (Erikson, 1968).

Erikson believed that identity formation is a multidimensional theory that covers aspects of psychology, personal and social dimensions at each stage of identity formation. These three aspects are interrelated. The psychological dimension (ego identity) is a subjective sense of self-sameness over space-time continuity and its components; the personal dimension is the range of behaviour and character that makes individuals unique; and the social dimension is the acknowledged roles within the social community (Erikson, 1968). Erikson believes that in order for a unit identity to be developed, these three dimensions need to interact synergistically during the identity formation stage, otherwise there will be a subjective sense of identity

confusion, a mismatch observed between character and behaviour and a lack of commitment to integrate into roles recognized in a community (Erikson, 1968).

Erikson's theory on identity formation applies to all cultures. He asserts that stability of one's identity in any culture lies in the interaction between social structure and one's mind. By this he meant that in order to develop one's social identity, the person's psychological sense of space-time continuity should be synthesized into the social structure to validate the commitments that integrate the person into the culture. According to Erikson, people, regardless of cultural background, can develop a sense of ego identity by integrating into a community and gaining recognition of one's role in the community (Côté & Levine, 2002).

Erikson also explained his theory through three continuities: a sense of alignment of oneself with the self; interrelationships alignment between others and the self; and the influence of integration between other and other on the self. The first continuity is the sense of sameness of the self over time, or what Erikson terms as ego identity. The second refers to an individual's relationships with others that shape and maintain one's personal and social identities. A gap in the relationship between the three identities disrupts the stability of the three identities, although a strong ego identity can help tide through periods of unstable relationships with others. The third continuity refers to the stability of relationships in a community. When these relationships in the community are continuous and stable, the members' personal and social identities within the community are protected. However, if these relationships are threatened, people's personal and social identities may undergo revision. Unstable community relationships can create difficulties for those attempting to transit to adulthood. This effect can be exacerbated by a low sense of ego identity and unstable self-other relations (Côté & Levine, 2002). This is also a way to understand ego, personal, social identity and behaviour. Figure 2.6 summarizes Erikson's (1968) concepts of identity formation, its processes and outcomes.
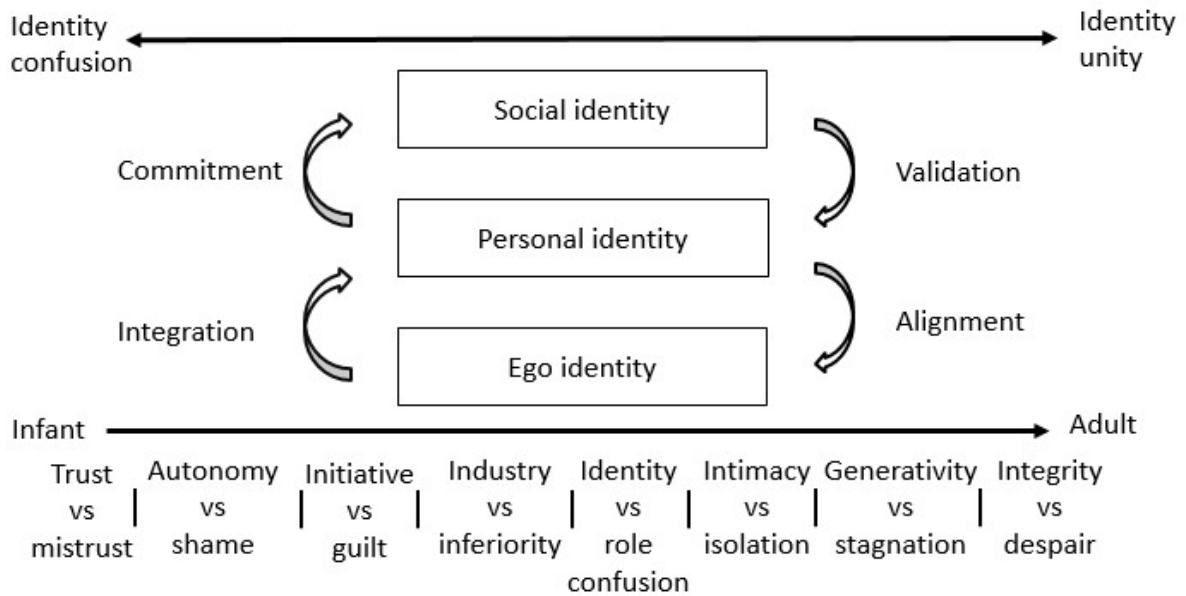
Figure 2.6. Depiction of Erikson's (1968) concept of identity formation through the stages of life.

Using Erikson's three continuities, Côté and Levine (2002) explained identity formation problems observed in an extensive proportion of adults in Western societies, especially geographically mobile urban dwellers. The mobility and the lack of a stable and structured society hampers the formation and maintenance of identities of these people. The lack of a stable identity also meant that behaviours tend to be inconsistent. When it comes to physical activity, an environment lacking identity support for physical activity behaviour can hamper physical activity levels. Therefore, to develop an identity for physical activity, there must be synergy between the psychological, personal and social dimensions.

In transiting to adulthood, identity formation treads through a process Erikson termed as identity crisis. It can be in many forms, from severe to mild, short to prolonged, and muted to aggravated (Erikson, 1958, 1968, 1975). It is a period when an individual's identity during childhood is no longer suitable in adulthood, but a new identity has not been formed.

Typically, this takes place during adolescence and ends between late adolescence to early adulthood. For some people, this phase continues to become a part of their lives and never ends (Côté, 2000).

Identity crisis leads to identity confusion. It is often portrayed as incoherence in personal images, life goals, personal roles or exploration (Erikson, 1975). Identity confusion is often seen as prolonged moratoria, coupled with impulsive attempts such as making sudden choices, denial or sometimes regressive pathology, in an attempt to end the moratorium (Erikson, 1968).

Identity crisis of some form is a universal part of one's development from childhood to adulthood. This transition to adulthood is a social process. Established cultures provide the structures in the form of initiation, guidance or mentorship for this transition. The adult communities in these structures offer some form of guidance to ease people through this period of identity confusion to gain a sense of ego identity. Under other conditions, this process presents itself as a challenge. If the person masters the challenge, it enhances the ego and rewards the person with a sense of achievement and self-determination so that he feels accepted and welcome in an adult community (Côté & Levine, 2002). Conversely, when the structures of transition from childhood to adulthood are insufficient or unkind, or the adult community is not accepting, the identity crisis can become a stress and a form of turmoil (Rohner, 2000; Schlegel & Barry, 1991).

It is interesting to note that Erikson claims that the extent and source of the identity crisis is largely external. It originates from cultural factors rather than biological ones. He suggests that biological factors do not bring about the crisis unless a culture does not provide the guidance for the ego on how to master the new energies and competencies brought on by the biological factors. For many youths, their impulse and availability of choices incite many

changes in the absence of guidance. Therefore, the period of adolescence is a source of identity crisis, especially if it involves a big gap between the expectations in childhood and adulthood (Benedict, 1938).

Erikson believed that identity crisis need not be severe in order for ego development to take place. Especially in the modern societies, identity crisis is least severe for people who are attached to the technological culture of their environment. Instead of the harsh and protracted identity crises, most people go through them in a subdued and almost indiscernible form, often over a lengthy period of time (Côté & Levine, 2002). In contrast to premodern societies, the adult community guided their young people over a shorter time period with a high chance of successful integration.

Erikson's theory has its critiques. First it was difficult to objectively evaluate his theory. It was because there were many components in the process of establishing an identity. In addition, each individual must form a unique synthesis of all the disparate parts (Marcia, 1980; Waterman, 1993a). Sorell and Montgomery (2001) discussed the contemporary relevance of Erikson's work. They identified the gaps and areas where no other researchers have worked on yet. Nevertheless, many have found Erikson's work to offer a useful framework for analyzing developmental histories.

2.4.2 Ego identity

Understanding ego identity is important in identity formation. Contemporary Identity research have been heavily influenced by Erik Erikson. The main principle of Erikson's work on ego identity is that one's psychology, biology and social setting makes up his identity. Essentially, identity is made up of both the psychological perspective and the sociological perspective and the key difference between the two is one represents the individual part of the concept of identity. A substantial part of Erikson's work focused on understanding identity

formation from adolescence to adulthood. Understanding his theory allows us to assess how events, influenced by cultural, social, psychological and historical factors during adolescence affect adulthood identity (Côté & Levine, 2002).

The central idea is understanding of ego and its developmental process. Ego is the organized part of the personality structure that includes defensive, perceptual, intellectual-cognitive and executive functions (Côté & Levine, 2002). It can also be understood as the personality agency that is responsible for behaviour, cognitive and emotional control. This active but largely unconscious agency of the personality performs two functions: the synthetic function and the executive function. The synthetic function actively defines situations and constructs of reality, while the executive function produces presentations of self and management of impressions. Conscious awareness can also reside in the ego, although not all of the operations of the ego are conscious. Ego appears to include many of the characteristics and traits found in social psychology and personality theory (Côté & Levine, 2002).

Erikson's theory on ego identity formation outlines the development of the ego over a person's life cycle. There are eight psychosocial stages of ego development, regardless of culture differences: (a) trust versus mistrust, (b) autonomy versus shame and doubt, (c) initiative versus guilt, (d) industry versus inferiority, (e) identity versus identity or role confusion, (f) intimacy versus isolation, (g) generativity versus self-absorption or stagnation, and (h) integrity versus despair (Erikson, 1968). There are two postulates of his theory. The first is that people have a tendency to gain mastery over their interaction with their social environment. This predisposition drives mastery or competence, and provides the stimulus for ego development. The second is that the psychological processes that make up the ego are shaped early in life compared to the challenges that result from the need to overcome any difference between physiological needs (id) and social expectations (super ego).

The essence of ego development is the drive that humans are inclined to make an effort to overcome and gain mastery over their environment. The environment poses challenges that help the person develop more elaborate cognitive schema to handle more complex challenges. This is achieved when the ego learns from the experiences and combines the learning to develop a stronger capacity to overcome more complex challenges and apply more complex behaviours to master the environmental challenge. Therefore, the person increases his ego strength and executive functions to move to more advanced level of competence. It is this process where the person experiences increasingly complex challenges that he gains higher levels of competence to traverse through his psychosocial development through Erikson's eight stages. However, Erikson also proposed the challenges facing the person must contain meaning to develop ego. If the person is not able to understand, say a series of random or arbitrary social obstacles with respect to his existing cognitive schema, he cannot develop the required cognitive schema from that experience to overcome the challenge.

Ego is developed by the psychological tension between the id and the environmental challenges. The ego fails to develop if it is not able to overcome its environment or it attempts to overcome an environment that is beyond the ego. Frustration from the tension between the id impulses and the environmental demands can damage the ego. Several researchers (Côté, 2000; Côté & Allahar, 1996; Côté & Levine, 1987) have studied the impact of ego mastery from long term frustrations. Ego mastery is discouraged when children are put through childlike dependency and marginalization in educational institutions. The ego capacity of an individual is not optimally developed as he passes from childhood to adulthood. Without challenges, the ego becomes weak and passive, and the id or super ego may overwhelm and dominate over the person, resulting in formation of a self that is not able to meet the expectations of the environment. Erikson referred to this as the development of ego identity.

Ego identity also refers to the strength that the ego has to master the environment and keep a stable identity across space and time. The space-time continuity of identity manifests itself in subjective and objective events. It could be a perception experienced by the person or a behaviour exhibited by the person in the presence of others. This stability and continuity is observed in the forms of personal identity and social identity. These two forms of identities are distinctively different but interrelated in some ways (Côté & Levine, 2002). These ego properties are relevant in both independent and interdependent cultures.

To illustrate the space-time continuity of ego identity, imagine a person losing his sense of self at one point in time, his affect, behaviour and cognition can become uncertain and unpredictable. In the same argument, maintaining the ego identity is a fundamental psychosocial requisite state so that an adult can function as expected by his society (Côté & Levine, 2002). Ego quality develops when one is validated by his community for the objective forms of personal and social identity shown. A community interacts with the individual through a combination of personal and social roles that validate the ego identity, further motivating the individual to engage the environment. Relational interaction with significant others and social institutions is the main source of strength for the ego. Therefore, positive and negative features of social interaction can reflect both ego weakness and ego strength (Erikson, 1968). Surmise to say, when a person experiences a greater sense of ego identity, his personality becomes more unified; when a person's personality is more unified, his life becomes more coherent with the environment in general; the more coherent a person's life, the more predictable and stable is his behaviour and role in life. The relationship between psychological and social worlds is dialectic, so the direction of causation works both ways. Greater validation of social identity can nurture ego identity (Côté & Levine, 2002).

In summary, a healthy ego in adulthood allows one to proactively master his environment, to exhibit a unity in behaviour and personality, and to discern his strengths and

weaknesses to appropriately to create an impact in his environmental context (Erikson, 1968). The more the ego is able to synthesize data about itself and its environment, and regulate its behaviour (executive function), the stronger it is. On the other hand, the unhealthy ego is one that is passive and withdraws from the environment, one that is incapable of taking control of behaviour in a coordinated way and uses unnecessary defence mechanisms to deny the objective context of the social environment to one's belief (Côté & Levine, 2002).

2.4.3 Personal and social identity

Erikson (1968) explained that the personal characteristics that separate one person from another is known as personal identity. Personal identity was further elaborated by Goffman (1968). To Goffman, person identity is about a person's biography. The biography is unique and makes that person an individual within the social environment. The signs that classify us as an individual and differentiate us from others are our personal identity. The process of personal identity formation is complex and continuous. The process profiles who we are within the society as an individual. It is also closely associated with the society that attributes a personal or individual identity on individuals (Goffman, 1968).

Social identity is the acquisition of social roles that a person plays in society (Erikson, 1968). Society characterizes people and ascribes the attributes and norms to any given categorization. Social identity is defined by the category and attributes that a person possessed in relation to others (Goffman, 1968). Therefore, social identity is a form of identity that is established based upon the relationship to other people and is associated with the social categories such as gender and age.

The three forms of identity-ego identity, personal identity and social identity, are associated to one another. The development of each is dependent on the others and the social

contexts we are exposed to. This will be further elaborated in the understanding of identity formation and its link to social structures.

There is limited research on the relationship between ego, personal or social identity on physical activity participation. This is one of the research questions this thesis intends to answer. In the thesis of Pearson (2008), she found that personal and social identity had a positive influence on physical activity levels. However, only social identity had an effect on adherence of physical activity levels after a three-month gap from the end of exercise intervention. In another research, Murphy and colleagues (1996) found that failure to identify with the athlete's role and explore alternative roles to being an athlete were associated with the impediment and delay in career development in intercollegiate student athletes. Both these studies suggested that by establishing an identity, people take on the behaviour. In the same argument, in order to encourage physical activity, an exercise identity has to be established, and desirable outcomes can be expected with early construction of an exercise identity. Therefore, this thesis intends to find out what are the components that define and distinguish exercise identity between individuals. When that is established, the thesis will find out how does exercise identity relate to physical activity levels and if establishing a social identity promotes exercise adherence.

2.4.4 Other identity theories

There are several sub-theories in identity theory. This section describes some of the foundational theories during the development of identity theory. The key aspects of each theory and its mediators provide the necessary information that influenced the identity formation process are put together to propose a model that can be applied to identity formation in physical activity behaviour.

Marcia (1964) developed the Identity Status Paradigm. The central concept behind Marcia's identity status paradigm is that identity formation (defined as "formation of social role and ideological commitments") in youth takes place through the individual making choices and decisions. The identity statuses are the choices and decision made based on the 2 x 2 matrix of two dimensions: exploration and commitment. They pick up the differences how individuals deal with identity issues and make identity commitments. These are decision making dimensions that are behavioural indicators for personal identity formation. Exploration is defined as the conscious deliberation and response to alternative goals, roles and values. Commitment is defined as the consolidation of the deliberations as courses of action (Marcia, 1964). The cross-tabulation of these two dimensions yield four identity statuses: Identity diffusion, identity foreclosure, identity moratorium and identity achievement. The operational definition of the four statuses is distinguished in terms of the extent of conscious choice-making (exploration) about commitments to various domains of worth and purpose (Marcia, 1964). People with identity diffusion show low levels of conscious choice-making in the past and little commitment to any role; Those with identity foreclosure show low levels of choice-making in the past but high levels of future commitment; People with identity moratorium exhibit active choice-making but incompletely formed commitments; Identity achievements show firm commitments for present or future roles after having been through a period of conscious choice-making. Table 2.7 outlines and exemplifies Marcia's four identity statuses.

Table 2.7

Marcia's four identity statuses

Identity status	Characteristics	Examples
Identity diffusion	Making no commitment; Doing no soul-searching; Wandering without goals; Becoming angry and rebellious	"I really have no idea what I'll do after graduation. I'll just have to see what happens."
Identity foreclosure	Conforming; Accepting identity and values from childhood; Choosing to identify with others rather than self-examination; Becoming inflexible	"Everyone in my family goes into the military after high school, so that's what I'm going to do."
Identity moratorium	Searching for identity; Exploring various alternatives; Delaying making commitments	"I don't know what I want to do when I graduate, so I'm going to apply to college and for jobs. Then I'll decide which would be best for me."
Identity achievement	Exploring options; Committing self to direction in life and occupation; Finding own identity	"I'm going to start college in the fall. My parents wanted me to go into the family business after I graduated, but I decided that what I really want to do is go to school and become a scientist."

Marcia's work has validated identity formation across cultures in certain parts of Western cultures. His work has also provided predictions in the study of identity formation in these Western cultures. Marcia's studies found how family background variables were able to predict identity status, establishing the association between family background and family status. He also found link between personality and identity status. Marcia also found some developmental patterns in the identity statuses suggesting that identity status can change. Prior socializing experiences in schools have also been shown to be associated with identity statuses, suggesting that socialization influences identity status.

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The factors that distinguish identity statuses hierarchically are levels of maturity of self-regulation and complexity of social functioning (Marcia, 1964, 1993). Identity diffusion is the least mature and least complex status. Identity foreclosure is a more mature status than identity diffusion because some form of commitment is embraced. Identity moratorium is a more complex status than diffusion and foreclosure because the individual is taking proactive steps in autonomously considering alternatives. Identity achievement is generally considered the most mature and functionally complex status (Marcia, 1964).

Critics of identity status paradigm questioned the application of the four-category identity status in all cultures and the representativeness of all forms of the identity stage described by Erikson (Côté, 1996; Côté & Levine, 1988; Van Hoof, 1999). Marcia and later other identity status theorists have been criticized by Côté and Levine (1988) for using a definition of identity that does not fully describe the identity as used by Erikson. Marcia has not captured the interrelationship between the social and psychodynamic domains that results in identity formation. Marcia (1980) defines identity as an internal structure that is self-constructed and a dynamic organization of abilities, beliefs, drives and experience. Erikson (1968) had described identity as including more than the sum of all the consecutive identifications that one has taken up. Identity is a unique product that is continually formed from the accumulation of experience and interaction with the social environment. As such the social process is a critical part of identity.

Another critique is the question if identity statuses are processes or outcomes. Although Marcia referred them as processes where individuals make decisions to establish and maintain one's personal identity, the individual can also adopt different processes in different domains of identity. Also, the construct validity of identity status is questionable. When individuals can display different statuses for different domains, an overall status representing central identity is found from interview. However, as Archer (1985) pointed that

with deeper interview, there is a lower possibility of defining this central identity status, as different identity statuses emerge. Literature has also ascertained that individuals have shown conflicting patterns of functioning to their central identity (Bourne, 1978a, 1978b; Marcia, 1980, 1987). These overall identity statuses have also been misidentified as outcomes or general dispositions (Waterman, 1988).

Research has also suggested that conscious exploration is not a requirement for and oftentimes does not take place in identity achievement. Many studies conducted on the identity statuses also focus more on the classification aspects than the developmental aspects (Côté, 2006). Therefore, Marcia's identity status should be used in the relevant context to avoid the misrepresentations described by literature. However, it is useful to know that identity can be classified as a continuum between commitment and exploration. The question on the other hand is whether is continuum is more applicable as a construct related to social identity, personal identity or ego identity?

Several neo-Erikson extensions of identity theories have emerged to address the issues of earlier models. One such was Berzonsky's (1989) Identity Style Model. He formulated a model that depicts the process of personal identity development that was absent in Marcia's Identity Status Model. Berzonsky posited three distinct identity styles. An identity style represents how an individual solves problems or copes against daily situations. The identity styles are the different ways an individual makes decisions that make a difference to their personal identities and life. Berzonsky (1990) premised that personal identity is formed through a process of social interactions and claimed that individuals use any of the three styles during identity formation in adolescence and adulthood. Identity style is usually stable and not likely to change. Thus, identity style can be understood to be a characteristic and the style that an individual presents is his chosen preference.

People choose their preferred style from the three identity styles to suit themselves. The three identity styles are informational style, normative style and diffuse-avoidant style. The informational style includes information seeking, problem-focused coping (Berzonsky, 1992), active exploration (Schwartz, 1996), flexible commitment (Berzonsky & Neimeyer, 1994), need for cognition (Berzonsky, 1993) and high levels of self-esteem (Nurmi, Berzonsky, Tammi, & Kinney, 1997) as strategies. The informational style seems to be the basis of the moratorium and achievement statuses in Marcia's Identity Status Model (Berzonsky, 1989). The normative style is represented by imitation and conformity. Closed-minded approach (Berzonsky, 1993b), rigidity, dogmatic commitment (Berzonsky & Neimeyer, 1994), stable self-conceptions (Nurmi, Berzonsky, Tammi, & Kinney, 1997) and suppression of exploration (Schwartz, 1996) are part of normative style. This corresponds to foreclosed status and is associated with achievement (Berzonsky, 1989). Lastly, diffuse-avoidant style represents putting off and evading action. It is associated with low levels of commitment, low self-esteem and unstable self-conceptions (Berzonsky, 1989). Diffuse-avoidant people still engage in exploration but is unsystematic and aimless (Berman et al., 2001).

The three identity styles add a process dimension to Marcia's Identity Status Model. Identity style transforms personal identity from a static outcome to a dynamic process where one's perception of self is constructed. The Identity Style has been shown to be applicable to adults (White & Jones, 1996; White, Wampler, & Winn, 1998). Schwartz et al. (1998) found that identity style classifications were reliable as responses were similar in paper-and-pencil and computerized testing situations but this is not the case for identity status classifications. Identity Style classifications have also been found to be stable across cultural environments as compared to Identity Status (Schwartz, Berman, Portes, Berman, & Briones, 2001).

Grotevant (1987) extended on Marcia's work. He designated exploration from Marcia's Identity Status model as a process while the commitment as the outcome. His work further defined exploration as a function of two components: Abilities and orientations. Abilities refer to skills such as critical thinking, perspective taking and problem solving. Orientations refer to the attitudes such as flexibility and decisiveness that would affect one's willingness to explore. Thus the 2 x 2 matrix of the two independent components gives the likelihood of exploration (Grotevant, 1987).

Grotevant (1987) also identified five antecedents to the exploration process: (a) information-seeking tendency, (b) presence of competing forces in one's life, (c) satisfaction of one's current identity, (d) expectations of the exploration process, and (e) willingness to explore (Grotevant, 1987). Each of these antecedents contributes to an individual's level of identity exploration. Together, they predict the extent of exploration the individual undertakes.

While Grotevant's (1987) model specifies the components that make up and influence the exploration process, it does not define the causes for exploration to be a continued process in life (Kerpelman et al., 1997b). Control theory (Powers, 1973) emphasized on reciprocal causation and mutual influence, and used that to look at the microprocesses between the social interaction and one's ego, personal and social identity, that drives exploration and identity formation (Kerpelman & Lamke, 1997; Kerpelman et al., 1997a, 1997b; Kerpelman & Smith, 1999). Identity Control Theory was adopted by Grotevant (1997) and later refined to include Berzonsky's (1997) three identity styles.

Identity Control Theory was criticized for not being able to determine the source of one's identity and for inconsistency with the choice orientation in Erikson's theory (Adams, 1997). As a result, its essential assumptions contradict the Eriksonian model and its validity

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needs to be further established. However, the theory provides closer look at the identity exploration process and the development of ego identity.

Waterman (1990) found differences in exploration and commitment, even though participants were in the same identity status. In addition, he also found that achieved individuals grouped themselves into two categories: the first acquired a high level of personal meaning from the pursuits that was explored and committed to; The second had goals, values and beliefs that were relatively extrinsically motivated (Waterman, 1992a, 1993a). This suggested an association with motivation theory that was outlined by Deci and Ryan (1985a). Waterman observed that personal meaningfulness manifested to a lower extent in participants in foreclosed and moratorium groups compared to those in the achieved status, and not at all in diffused participants. Waterman (1990) termed this personal meaningfulness dimension as personal expressiveness and defined it as feelings of optimal experience that accompany the discovery of one's set of best potentials, and participation in activities that are reflective of their potentials (Waterman, 1990). It can be seen as a form of happiness. However, personal expressiveness extends beyond hedonic enjoyment. It is enjoyment that involves a sense of purpose, direction and fulfilment (Waterman, 1993a, 1993b, 1995). The idea of personal expressiveness is akin to Maslow's (1968) idea of self-actualization in the hierarchy of needs. The key to understanding personal expressiveness is that it is a state that is accompanied by an activity. That is the combination of the individual's characteristics (locus of control, motivation orientation and identity exploration and commitment) and the characteristics of the activity that the individual participates in (that matches the individual's inherent potentials) that produces feelings of personal expressiveness (Waterman, 1990).

Waterman (1992b) also looked at the reasons people seek and commit to alternative identities. First, the environment may restrict the options one has to explore (Côté, 1996; Phinney & Rosenthal, 1992). Second, competing social demands or competing activities may

distract one into making socially acceptable choices than to pursue one's inherent interests (Grotevant, 1987; Waterman, 1992b). Third, one might refuse the chance to seek his ideal self when faced with difficulties or distractions involved in achieving the interest or potential (Waterman, 1992a).

Like previous extensions of identity theory, personal expressiveness provides an additional dimension to the identity status paradigm (Waterman, 1992a). The dimension personal expressiveness helps to clarify is the person's motivations to explore and commit to an objective or intent. Thus the intimate link with motivation theory. It is a form of personal identity and is considered the focus of one's life (Waterman, 1995). Ego identity appears to correspond closely to these potentials. Therefore these two concepts seem to share the same experiences (Waterman, 1990). It can be applied to personal domains such as choice of recreational activities and career. (Schwartz & Waterman, 1998).

Luyckx, Goossens, Soenens and Beyers (2006), and subsequently, Luyckx et al. (2008) expanded on Marcia's model by developing an identity formation model that further added two processes to exploration and commitment respectively. Exploration was divided into exploration in breadth and depth. Commitment was divided into commitment making and identification with commitment. A fifth interrelated identity dimension was subsequently introduced to capture identity formation in present day. The five dimensions are exploration in breadth, exploration in depth, commitment making, identification with commitment and ruminative exploration (Luyckx et al., 2008). This model recognizes the dynamic nature of identity, where commitments are formed through exploration of alternatives broadly (in breadth) and committing to one of the alternatives; the commitments are evaluated by exploring in depth. This is also provided they are aligned to one's sense of self and self-concept. Identity development in this aspect is a lifelong process of trial-and-error where the person experiments with a series of career choices, relationships and belief systems before

committing to a set of ideals that will take him to adulthood. It is also a process where commitments are revisited and reconsidered (Fadjukoff, Pulkkinen, & Kokko, 2005).

Luyckx et al.'s (2008) model has connection with self-determination theory. Identification with commitment is similar to the idea advanced in Deci and Ryan's (2002) self-determination theory (Soenens et al., 2007). When one considers and commits to the alternatives that are consistent with one's potentials, liken to the idea of autonomy within self-determination theory, the commitment might lead one to discover his self (Schwartz, 2002; Schwartz, Mullis, Waterman, & Dunham, 2000).

Stryker and Burke (2000) looked at identity from a sociological perspective. This perspective places society social structures as the key to the development of people's identity. According to Stryker's identity theory (1980), the roles one play determines how others see the person and who the person is in society (e.g., parent, spouse and employee). Each role has different meanings and expectations attached to it and together these internalized expectations form the guiding basis for social behaviour (Stryker, 1980). The relationship between identity and behaviour is also one that is reciprocal. While identity guides the behaviour people take on, the behaviour also mutually validates and reinforces people's identity.

A different flow of research has been developed from social identity theory (Tajfel & Turner, 1979) and self-categorization theory (Turner, 1985; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). The social identity theory, developed by Tajfel and Turner (1979), is a social psychological model that explains the process of identity (social identity) development through the concept of group membership. Social identity theory concludes that people assume a critical part of their social identity by being a member of a group. Group membership provides the opportunity for people to attain and maintain positive self-esteem. The theory embodies Festinger's (1954) theory of social comparison which posits that people

evaluate themselves by comparing with others. According to social identity theory, people acquire positive self-esteem and social identity by appraising their own group more favourably than groups not related to them.

The cognitive and social processes that are fundamental to social identities and group behaviour can be better understood through the self-categorization theory (Turner, 1985; Turner et al., 1987). Self-categorization theory posits that when people are categorized into explicit social groups, they tend to perpetuate the same traits of the same group and the differences with different groups. Members of the group are no longer seen as unique individuals but rather as copies of the group that they belong to. Moreover, in order to strengthen similarity with members of the own group to distinguish themselves from other groups, people aim to adopt the norms and values that are central to the group. What follows is that people indeed become a prototype of their own group (Hogg & Abrams, 2003).

Kurtines (1999) expanded on the Identity Status Paradigm. He developed a co-constructivist perspective where identity formation is a process between individuals and their socio-cultural environments (Côté, 1993, 1996). The process between the individual and their environment involves exercising choice, restraint, accountability and honesty in this perspective. Individuals are viewed as self-regulated agents who are proactive and make choices to facilitate exploration. The process of making a choice in exploration requires skills such as creativity, restraint of judgment, evaluation and critical discussion. The first three are personal skills while the fourth is an interpersonal skill. Kurtines believed that critical identity (personal and social identities) is a sense of self developed and adapted by critical problem solving and discussion and healthy individuals have the capacity to form a critical identity by late adolescence. This is dependent of whether the individuals possess the necessary skills. Individuals who possess critical identity are usually more socially responsible and connected to the society (Elias et al., 1986).

Key to Kurtines' idea is that identity development happens as a result of interaction between self and the society where the individual's identity formation and the societal-institutional processes influence one another in this reciprocal relationship (Briones, 1997). This has implication on the assimilation or alienation of individuals to an institution or society (Côté, 1993). Kurtines introduced a set of competencies that can aid identity development. This is seen in his intervention programmes where these competencies helped participants improve their quality of lives significantly (Berman & Schwartz, 1999; Kurtines, Silverman, Schwartz, & Montgomery, 2000; Schwartz & Kurtines, 2000).

Adams and colleagues (1987, 1996) expanded on Kurtine's idea on the interplay between self and the environment. Adams divided the social context into the micro level and the macro level. The micro level refers to interpersonal interactions and relations which affect personal identity. Macro level refers to the encompassing social and cultural context in which social identity is developed. Adams also considered forming of a self and identity as a balance between two processes: differentiation and integration. Differentiation is the process and drive of one to profess himself as a unique individual. Integration is the social element of process and inclination to become part of a bigger group. Extreme levels of either differentiation or integration can lead to alienation or over dependence on the group culture in conducting oneself. In accordance to Erikson's ideas, Adams (1997) outlined two forms of identity: personal identity and collective identity (social identity). Personal identity represents the facets of self that have been distinct from others. Collective identity represents facets of self that has been integrated from the social environment (Adams, 1997). An outcome from this idea is that differentiation is likely to inhibit openness to change in identity from social influences while integration is apt to promote openness to change from social influences (Côté, 1993; Grotevant & Cooper, 1986). Adams sees that change in identity can originate and begin in two ways: One is the integration of new elements from the social environment

into the identity. The second is change when the real self and the ideal self are incompatible. Usually, distress ensues in the second case (Erikson, 1950; Kroger & Green, 1996; Levinson, 1977). Self adaptation processes such as the informational style and critical decision making are used to close the disparity between the real self and ideal self (Dunham et al., 1986; Erikson, 1950; Levinson, 1977). Identity change can also take place for reasons like desire to be an individual distinct being unique from the rest, to be self-motivated, to be connected, to be socially responsible, for justice or to care for another. These can become the motivation to change. Adams model incorporated the viewpoint from personal and social identity and the motivations for change.

Côté (1997) introduced a sociological perspective of identity. It examines social and personal identity from a macro perspective. Côté's theory augmented Kurtines', Adams' and Marshall's theories where the personal and social identities are embedded within the micro and macro contexts (Adams & Marshall, 1996; Kurtines, 1999). Côté's model also focused on the personal-social and social-structural levels of analysis while Erikson had focused on ego-personal level of analysis. Collectively, these ideas give rise to a broader framework that integrates the various processes of identity formation into a more coherent one. A summary of the sub-theories in identity theory is shown in Table 2.8.

Table 2.8

Summary of sub-theories in identity theory and the key postulates

Sub-theories in identity theory	Researchers	Key postulates
Identity Status Paradigm	Marcia (1964)	Formation of social role and ideological commitments take place through individual choice making and decision making. There are two dimensions: exploration and commitment; four identity statuses are derived from a combination of exploration and commitment (identity diffusion, identity foreclosure, identity moratorium and identity achievement)
Identity Style Model	Berzonsky (1989)	Personal identity development process has three distinct identity styles, which is how an individual makes decisions that defines his personal identity. It involves social interactions and is a characteristic of the individual. It tends to be stable and not likely to change. The three styles are informational style, normative style and diffuse-avoidant style.
Extension of Marcia's (1964) Identity Status Paradigm	Grotevant (1987)	Defined exploration as a process and commitment as an outcome. Exploration was further defined as a function of abilities and orientations in a 2 x 2 matrix. Identified five antecedents to the exploration process: information-seeking tendency, presence of competing forces, satisfaction of one's identity, expectations of the exploration process, and willingness to explore.
Control Theory	Powers (1973)	Looked at the microprocesses between social interaction and ego, personal and social identities to explain exploration and identity formation.
Personal expressiveness in identity status	Waterman (1990)	Found some individuals expressed personal meaningfulness (intrinsic motivation) in their identity status. Personal expressiveness was used to express the personal meaningfulness. It is a combination of locus of control, motivation orientation, identity exploration and commitment.

Expanded on Marcia's (1964) Identity Status Paradigm	Luyckx et al. (2006); Luyckx (2008)	Further divided exploration into exploration in breadth and exploration in depth; divided commitment into commitment making and identification with commitment; and added ruminative exploration. The commitment is likened to autonomy in the self-determination theory. Hence, motivation was seen to have association with identity.
Sociological perspective in identity	Stryker & Burke (2000)	Social structures such as roles determine how others see the self, his meaning and expectations in society. This forms the basis for behaviour. This relationship between identity and behaviour is reciprocal.
Social Identity Theory	Tajfel & Turner (1979)	A social psychological model that explains the process of identity development through group membership. People assume a critical part of their social identity by being a member of a group through attaining and maintaining positive self-esteem.
Self-Categorization Theory	Turner (1985)	People categorized into explicit social groups perpetuate the same traits of the same group and differences with different group.
Expanded on Marcia's (1964) Identity Status Paradigm	Kurtines (1999)	A co-constructivist perspective of identity formation where the individual interacts with his socio-cultural environment to develop his personal and social identities. This interaction is a reciprocal one where the self and society influence each other. A set of competencies can help identity development.
Expanded on Kurtines' (1999) idea on reciprocal relationship between self and environment	Adams et al. (1987)	Defined social context into macro and micro levels of interactions which develops the social identity and personal identity respectively. Further defined identity formation as a balance between the processes of differentiation and integration.
Sociological perspective to identity	Côté (1997)	Personal and social identities are embedded within the micro and macro contexts (Adams & Marshall, 1996; Kurtines, 1999).

Putting together the key concepts and common aspects of the identity theories from Erikson to Côté, a proposed process for identity formation and its proposed components can be studied. Figure 2.7 shows the proposed identity formation process and its components. The key to identity formation is that it is a social process and formation of a strong ego identity is related to a more internal motivation regulation, which will be discussed in the following sections. Identity formation is an interaction process between the individual and the social context. The process is also moderated by several factors highlighted by several researchers. What is not known from the figure is what constitutes ego identity and how it can be measured. Another question is what are the factors that can influence social identity? If this process were true, what is the relationship between identity, motivation and physical activity behaviour? Therefore this proposed model that is put together from various researchers is useful in guiding the research to determine the factors that affect formation of an exercise identity and to validate an exercise identity measurement scale that is associated to physical activity behaviour.

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┌──────────────┐    ┌──────────┐    ┌──────────┐    ┌──────────┐    ┌──────────────┐    ┌──────────┐
│ Social,      │ ⇨  │ Social   │ ⇄  │ Personal │ ⇄  │ Ego      │ ⇄  │ Needs        │ ⇨  │ Physical │
│ cultural     │    │ identity │    │ identity │    │ identity │    │ satsfacton & │    │ activity │
│ environment  │    │          │    │          │    │          │    │ motivation   │    │ behaviour│
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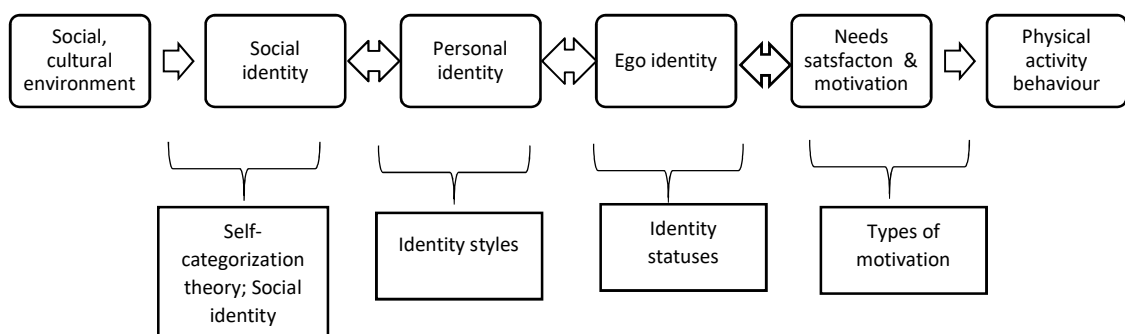
Figure 2.7. A model depicting how identity formation process leads to physical activity behaviour.

2.4.5 Identity formation in today's context

Identity formation has been studied by many and differences exist in them. This section further integrates the traditional Erikson model and concepts from other theorists. Erikson's concepts on social identity, personal identity and ego identity can be linked as depicted in Figures 2.8 to 2.11. This model follows the convention of the personality and social structure perspective (PSSP) in specifying the levels of personality, interaction and social structure (Côté & Levine, 2002).

This is also in accordance with Berger and Luckmann's (1966) work on the "social construction of reality". This model explains the process where culture and identity are formed or changed through the interaction between the social structure and individual. Figure 2.8 explains that culture and social structure are closely related to identity formation of the individual. Arrow 1 shows the relationship between social structure and interaction. The arrow represents a causal relationship between social structure and interaction in the form social norms such as laws, values or rituals. This process is the socialization or social control mechanism that shapes one's social identity. Human behaviour is thus structured based on the social structure.

Arrow 2 represents the expression between interaction and personality. In this process, the individual internalizes the interactions and develops individual constructions of reality. Then the individual re-engages in the interaction process (arrow 3) to present suitable impressions to others. Therefore, depending on the individual's ego and capacities, the individual's behaviour is partly a product of past internalizations. The four arrows are in continuous motion as one forms his identity (Côté & Levine, 2002).

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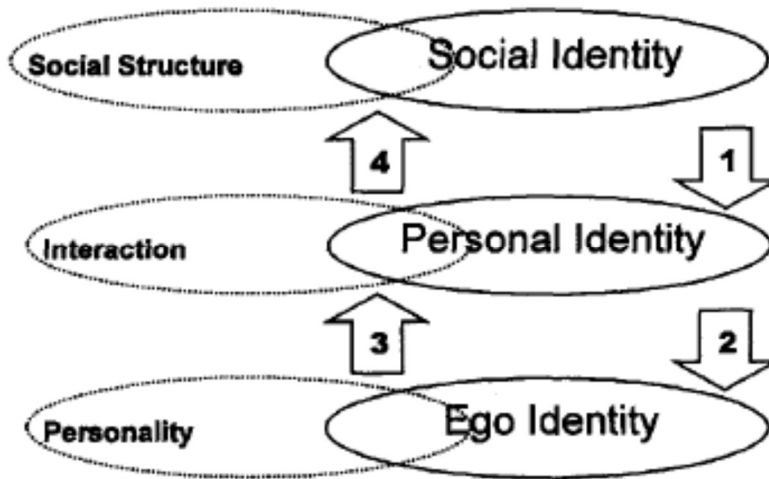
Figure 2.8. The social psychological factors in identity formation. Reprinted from *Identity Formation, Agency and Culture: A Social Psychological Synthesis.* (p. 131), by J. E. Côté and C. G. Levine, 2002, Mahwah, New Jersey: Lawrence Erlbaum Associates. Copyright 2002 by Lawrence Erlbaum Associates, Inc.

Figure 2.9 extends the social psychological process of identity formation by looking at objective and subjective elements of identity. Objective elements represent the actual behaviour occurring in daily activities representing social and personal identity, and how one's behaviour is carried out in terms of ego identity. The subjective element refers to the individual's subjective experience of his mental process and the subjective experience of his behaviour that manifests in personal and social identity (Berger & Luckmann, 1966). These four components present a comprehensive analysis of identity formation.
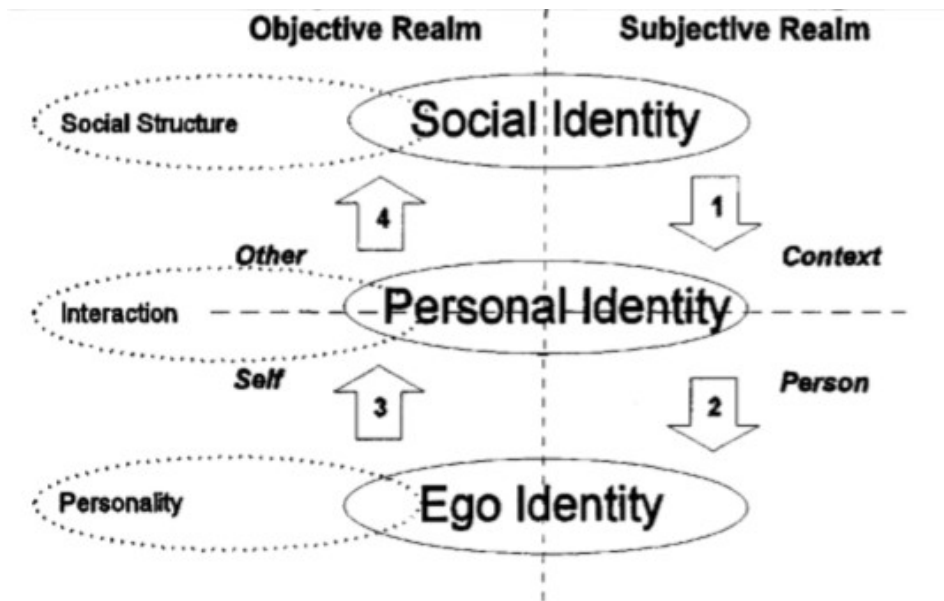
Figure 2.9. The objective and subjective measures of identity. Reprinted from *Identity Formation, Agency and Culture: A Social Psychological Synthesis.* (p. 134), by J. E. Côté and C. G. Levine, 2002, Mahwah, New Jersey: Lawrence Erlbaum Associates. Copyright 2002 by Lawrence Erlbaum Associates, Inc.

Figure 2.10 introduces concepts of identity negotiation and reflexivity in identity formation and maintenance. Identity negotiations can occur when people attempt to manage aspects of their identities to defend or change them. The similar process for the subjective realm is reflexivity where people respond to the expectations of the community (Giddens, 1991). An individual's social structure limits his personal identity through validation or challenge by others. From that, one's ego identity is shaped and he presents behaviour that affirms or discredits the social identity. Through these three identity structures and four processes, identity is formed, maintained or modified depending on whether a behaviour is validated or not. This process is continuous and prevails over everyone in a social community. Differences arise according to the profile of the community, the resources the person has or events that impact this process over one's life. The person may go through

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having one's ego identity broken or unified with the community, or one's personal identity

stigmatized or accepted. (Côté & Levine, 2002).
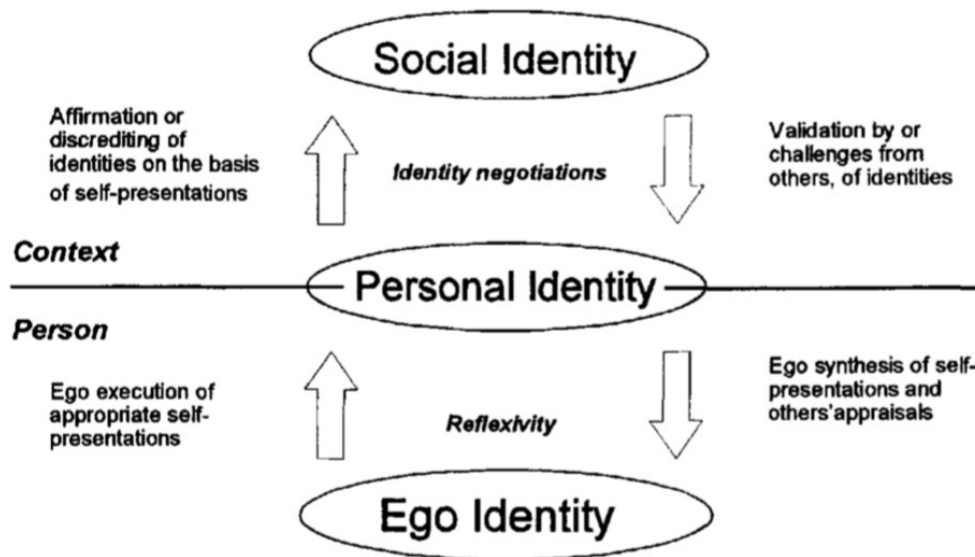
Figure 2.10. Identity formation and identity maintenance processes. Reprinted from *Identity Formation, Agency and Culture: A Social Psychological Synthesis.* (p. 135), by J. E. Côté and C. G. Levine, 2002, Mahwah, New Jersey: Lawrence Erlbaum Associates. Copyright 2002 by Lawrence Erlbaum Associates, Inc.

Figure 2.11 represents identity formation that is pertinent to modern societies. In

modern societies, social identities often comprise of multiple roles that need to be continually

managed to form the ideal perceptions with others around the identities that one values. This

is because of the expanded network due to technological development and decline in respect

for authority (Côté & Levine, 2002; Gergen, 1991). At the personal identity level, the self is

presented increasingly based on superficial representations or images rather than substance

(Gergen, 1991; Goffman, 1971). At the ego identity level, people either passively accepts a

circumstance (diffused); or remain open to new experiences and are flexible in their views

(moratorium). As Whitbourne (1996) observes, many inherent changes such as declining

physical health and role changes, take place as one ages. These changes can influence and change an individual's identity. The model depicted in Figure 2.11 suggests that social media such as Facebook can be the social structure and plays a role in reinforcing the social, personal and ego identity.
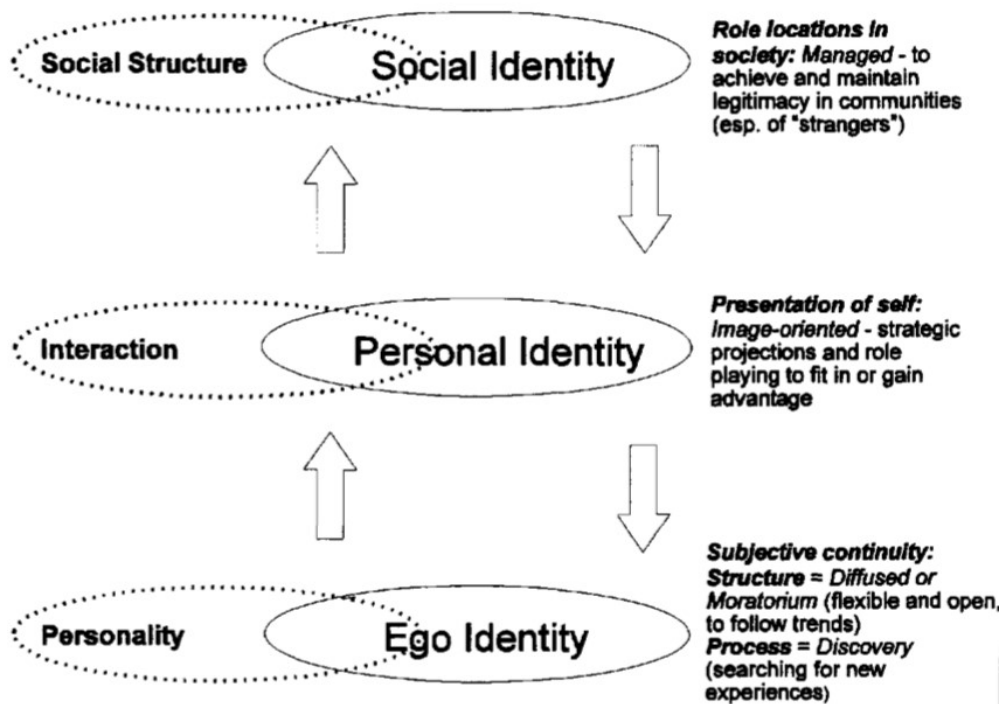
Figure 2.11. Identity formation patterns in late modern society. Reprinted from *Identity Formation, Agency and Culture: A Social Psychological Synthesis.* (p. 137), by J. E. Côté and C. G. Levine, 2002, Mahwah, New Jersey: Lawrence Erlbaum Associates. Copyright 2002 by Lawrence Erlbaum Associates, Inc.

2.5 Self-Determination Theory

Self-Determination Theory (SDT) plays an important role in identity formation. SDT (Deci & Ryan, 1985a; Ryan & Deci, 2000) combines both the humanistic, developmental and behavioural theories. That means, SDT recognizes that there is strong evidence towards a

range of human behaviour from active engagement and development from one end to
fragmentation and conditioned behaviour at the other end.

SDT adopts an organismic and dialectical framework for the study of personality
growth and development. From an organismic perspective, SDT perceives humans as active
and growth-oriented organisms that seek to overcome challenges in their environment, so as
to realize their potentials and capacities. This is what identity theorists hold on to and also one
side of the dialectical view. The other refers to the social environments that can either
promote the individual's inherent inclinations, or overwhelm them.

SDT is based on two assumptions. First, it assumes that all individuals have innate
and constructive tendencies to form a more elaborate and unified sense of self. Individuals
also have a tendency to form connections among aspects of their own psyche, with other
individuals and groups in their social worlds (Deci & Ryan, 2002). Angyal (1965), has
characterized this integration into two forms: autonomy and homonomy. Autonomy refers to
the tendency towards organization of the inner self and holistic self-regulation. Homonomy
refers to the tendency towards integration of oneself with others. The healthy development of
the individual requires these two tendencies complementing each other.

The second assumption states that there are distinct and specific social-contextual
factors that impede human nature's process of growth and development. SDT predicts a
continuum of developmental results, ranging from "an active and integrated self to a
fragmented, passive and alienated self" (Deci & Ryan, 2002). Therefore, SDT combines the
interaction between an active, integrated individual and the social contexts which can either
nurture or impede the individual's growth. Social environments can either promote the
growth and integration tendencies which the human psyche is endowed with or they can

disrupt the growth and integration, resulting in behaviours and experiences that alienates the person and hinders development.

In addition to the two assumptions, the concept of fundamental psychological needs is central to SDT. SDT posits three basic psychological needs (need for competence, relatedness and autonomy), each essential and defining the type of environment that either supports or thwarts the key human functioning (Ryan & Deci, 2002). Social environment that satisfies the three basic needs supports the healthy functioning of the self through need fulfilment, engagement, mastery and synthesis, while social environment that thwarts the three basic needs diminishes motivation, growth, integrity and well-being to the self (Ryan & Deci, 2000). Thus the concept of basic needs link the two assumptions and is the basis for predicting whether conditions support optimal outcomes in development or behaviour within a specific situation.

In SDT, the three basic needs are present in all cultures and developmental periods (Ryan & Deci, 2000). They are innate needs and not motives acquired from external sources. Although they may have different expressions, their core characteristics are the same. It is human nature to continuously strive for these needs and gravitate towards environment that provides for them. This is regardless whether people are aware of their needs or not (Ryan & Deci, 2002).

The need for competence refers to one's inherent need to feel effective in the interactions with the social environment and exhibit one's abilities (Deci, 1975; Harter, 1983; White, 1959). The need for competence drives people to look out for challenges that match their capacities and to persist in developing and maintaining those capacities or skills. Competence is a felt sense of belief in one's capacity and effectiveness in dealing with any challenge (Ryan & Deci, 2002).

Relatedness refers to the sense of connection to others, concern for and being shown concern for by others, and the feeling of a sense of belonging with others and with one's community (Baumeister & Leary, 1995; Bowlby, 1979; Harlow, 1958; Ryan, 1995). Relatedness indicates the inclination to connect with, be part of and accepted by a community. The need to feel related to others concerns the psychological sense of belonging with others in an integral and secured community, and not being in a community for the attainment of a formal status or certain outcome.

Autonomy refers to being the perceived origin of one's own behaviour (deCharms, 1968; Deci & Ryan, 1985b; Ryan & Connell, 1989). It is related to acting from interest, one's integrated values or one's own will. The behaviour of autonomous individuals is an expression of the self. If the actions are influenced by external sources, the individual can agree with the influences, and act according to the value and with initiative. Autonomy is often confused with independence, which means free from influence or not relying on external sources but SDT does not see autonomy and dependence as conflicting or antagonistic. One can behave according to the values of others provided he congruently endorses them (Ryan, 1993; Ryan & Lynch, 1989).

2.5.1 Self-determination theory and its components

SDT consists of several mini-theories, each associated with specific context. The mini-theories are linked to the organismic and dialectic assumptions that involve the three basic psychological needs. Put together, they extend over all types of human behaviour in all domains, and together they constitute SDT. The following sections describes some of the mini-theories of SDT.

2.5.2 Cognitive evaluation theory

Cognitive Evaluation Theory (CET) describes the influence of social contexts on a person's intrinsic motivation. It describes elements of social context such as autonomy supportive (informational), controlling and amotivating factors and links them to motivation (Deci, 1975; Deci & Ryan, 1980). Intrinsic motivation, classically defined, originates from the satisfactions inherent in action. This is opposed to extrinsic motivation, which is contingent on outcomes that are separate from the action. Motivation can also be described using the concept of perceived locus of causality (deCharms, 1968; Heider, 1958). SDT has followed deCharm's concept of perception of locus of causality in parts. That is intrinsic motivation generally entails an internal perceived locus of causality and it tends to be undermined when factors tend towards an external perceived locus of causality. However, the concept that extrinsic motivation entailing perceived locus of causality to be external to themselves is not adopted. This is more fully explained in Organismic Integration Theory (OIT).

Initial studies all found that tangible rewards that are concrete (money) or symbolic (good player award), lowered intrinsic motivation if they were expected to be part of the activity and their receipt depended on participating in the activity (Deci, 1971, 1972a, 1972b; Kruglanski, Friedman, & Zeevi, 1971; Lepper, Greene, & Nisbett, 1973). In the early studies by Deci, he found that positive feedback, verbal rewards or praise enhanced rather than decreased intrinsic motivation. Despite the controversy in the eroding of intrinsic motivation by tangible rewards, a meta-analysis of 128 experiments verified that environmental influences such as expected tangible rewards that require participating in the activity decreases intrinsic motivation for that activity, whereas verbal rewards has a tendency to enhance intrinsic motivation (Deci, Koestner, & Ryan, 1999).

CET suggests that contextual events such as rewards or positive feedback can support or diminish the satisfaction of the needs for competence and autonomy, in the process influencing intrinsic motivation. Such is the integral relation between the needs for competency and autonomy with contextual events and intrinsic motivation (Deci, 1975; Deci & Ryan, 1980). Specifically, Deci and Ryan (1980) suggested two cognitive processes that affect intrinsic motivation. One is the change in perceived locus of causality and the other is the change in perceived competence. This meant that an increase in perception towards an internal locus of causality enhances the need for autonomy and hence increase intrinsic motivation. An increase in perceived competence also enhances intrinsic motivation. For example, the effect of positive feedback has been explained by CET to enhance intrinsic motivation when people feel a sense of competence and often together with a sense of autonomy (Fisher, 1978; Ryan, 1982).

Controlling aspects and informational aspects of social environment have also been found to influence the perceptions of causality and competence and hence affect intrinsic motivation. Controlling aspects are those that represent pressure towards specific outcomes or tangible reward for specific behaviour. These environmental contexts tend towards an external perceived locus of causality and undermine intrinsic motivation. Studies have also shown that impendence of punishment (Deci & Cascio, 1972), setting of deadlines (Amabile, DeJong, & Lepper, 1976), imposing targets (Mossholder, 1980), scrutiny (Lepper & Greene, 1975; Plant & Ryan, 1985), competition (Deci et al., 1981) and evaluation (Ryan, 1982; Smith, 1975) all decreased intrinsic motivation when they are experienced as controls. The informational aspects of social environment are related to effectance-related inputs such as positive feedback. In earlier studies (Fisher, 1978; Ryan, 1982), these influences have been found to enhance intrinsic motivation. Swann and Pittman (1977) and Zuckerman et al. (1978) reported that providing choice on a task enhanced intrinsic motivation. Koestner et al.

(1984) demonstrated that empathy and non-controlling factors can help maintain intrinsic motivation. On the other hand, Deci and Cascio (1972) showed that negative feedback undermines intrinsic motivation. Vallerand and Reid (1984) further showed that negative feedback is mediated by a decrease in perceived competence. The mediators and process is summarized in Figure 2.12.
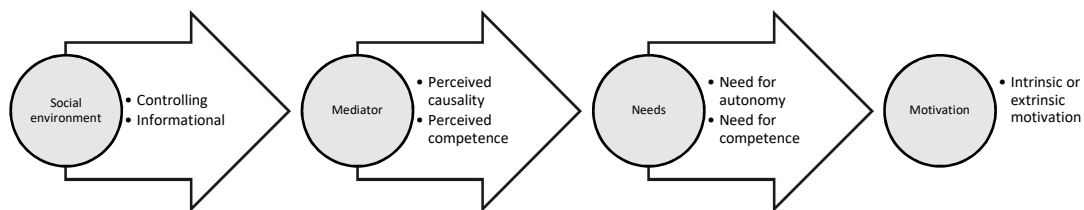
Figure 2.12. Motivational process consisting of mediators and its influence on needs and motivation.

More recent studies extended on the traditional CET model to show that variations in the environment on motivation. Ryan (1982) found that positive feedback, if administered in a pressurizing environment can turn the positive feedback into controlling influence. Ryan, Mims and Koestner (1983) showed that tangible rewards administered in a non-judgemental context supports autonomy and do not diminish motivation. Reeve and Deci (1996) also observed that competition can be perceived as either informational or controlling depending on the environmental context.

Studies have also found that behaviour can be motivated by internal events that are independent of the social environment. Ryan (1982) found that feelings of self-worth can be reliant on their performance outcome such that the behaviour is performed to validate one's self-worth. Ryan contrasted this with task-involvement and reasoned that when the behaviour is ego-involved, it will appear to be controlling relative to when the behaviour is task-

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involved. Results have also verified this reasoning that ego involvement or self-controlling regulation associates with lowered intrinsic motivation, whereas task involvement or more autonomous self-regulation maintains or enhances intrinsic motivation (Plant & Ryan, 1985; Rawsthorne & Elliot, 1999; Ryan, 1982). A revised motivational model including the internal factors is shown in Figure 2.13.
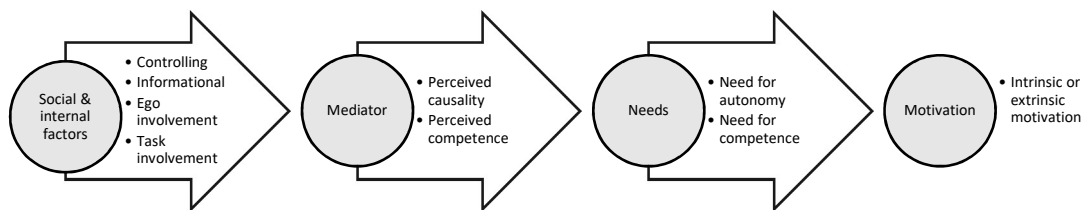
Figure 2.13. Revised motivational process based on research on Cognitive Evaluation Theory.

Deci and Ryan (2000) posited that relatedness has a more remote influence in the promotion of intrinsic motivation than competence and autonomy, although satisfaction of the need for relatedness is important for maintaining intrinsic motivation in some interaction activities between people. Anderson, Manoogian and Reznick (1976) indicated that when children participated in an engaging activity in the company of a stranger who did not pay attention to them, the children displayed low intrinsic motivation on the activity. This suggests that when the need of relatedness is not met, it can undermine intrinsic motivation. Frodi, Bridges and Grolnick (1985) also found that infants tend to exploratory behaviour (intrinsically motivated curiosity) when there is evidence that the children are in a secured relationship with the primary caregiver.

CET provides the framework that shapes the social and internal factors that influence motivation. This will be useful when CET is integrated with identity theory in formulating physical activity intervention.

2.5.3 Organismic integration theory

Organismic Integration Theory (OIT) is concerned with the internalization and integration of values and external regulations. It focuses on extrinsic motivation and its development and dynamics; explains the relationship between autonomy and extrinsically motivated behaviours; and outlines the processes where people adopt the values and characteristics of their social groups and cultures (Deci & Ryan, 1985b; Ryan & Connell, 1989). OIT is based on the assumption that people have the innate inclination to integrate their experiences with their sense of self. When significant others or important reference groups use external prompts to influence one to do an uninteresting activity that one is not intrinsically motivated to do, the individual tends to internalize the initial external regulation and integrate it into their sense of self. Then the individual would become more self-determined when carrying out the extrinsically motivated behaviour. This is a natural process of internalization where people convert from external regulation into self-regulation, becoming more integrated to the self (Schafer, 1968). OIT views internalization as a continuum instead of a dichotomy (Bandura, 1996). Regulation of extrinsic behaviours is internalized to different degrees and different autonomy. Those regulations that have been more internalized becomes more autonomous extrinsically motivated behaviour whereas those whose regulations that have been less internalized becomes more controlled form of extrinsic motivation behaviour (Ryan & Deci, 2002). Figure 2.14 shows the degree of self-determination based on the regulation.
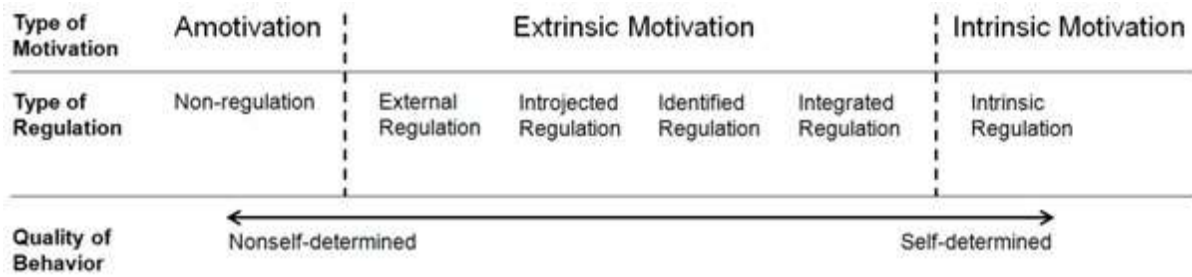
Type of Motivation	Amotivation	Extrinsic Motivation				Intrinsic Motivation
Type of Regulation	Non-regulation	External Regulation	Introjected Regulation	Identified Regulation	Integrated Regulation	Intrinsic Regulation
Quality of Behavior	Nonself-determined ←					→ Self-determined

Figure 2.14. The self-determination continuum with types of motivation and regulation. Reprinted from *Handbook of Self-Determination Research.* (p. 16), by E. L. Deci and R. M. Ryan, 2002, University of Rochester Press. Copyright 2002 by E. L. Deci and R. M. Ryan.

Motivation is a continuum of behaviour arranged from amotivation (left) to intrinsic motivation (right). Amotivation is the state of lacking the intention to act. Amotivation is a result of the individual feeling incapable of achieving the desired outcomes because of a lack of contingency (Rotter, 1966; Seligman, 1975) or a lack of competency (Bandura, 1977; Deci, 1975) or not recognising value the activity or the outcome it would give (Ryan, 1995). Intrinsic motivation is the state of doing something out of interest and inherent satisfaction. It is a self-determined behaviour. Extrinsic motivation falls between amotivation and intrinsic motivation. There are different degrees of motivations, each characterized by different regulations.

Extrinsic motivation is characterized by four types of regulations: external regulation, introjected regulation, identified regulation and integrated regulation. External regulation is the least autonomous form of extrinsic motivation. The purpose of external regulation is to satisfy an external demand or fulfil a social expectation or need. External regulation has an external perceived locus of causality. Some examples are rewards and avoidance of punishment (Ryan & Deci, 2002).

Introjected regulation involves an external regulation that is partially internalized but not regarded as part of the integrated self. Introjected regulation can be controlling; tasks are

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performed to avoid shame and guilt; or to attain feelings of worth or ego enhancements (Deci & Ryan, 1995). Ryan (1982) has shown that when ego, a form of introjected regulation, is involved, people lose intrinsic motivation, thus suggesting that this form of regulation is controlling.

Identified regulation involves evaluating of a behavioural goal or regulation and accepting the behaviour as important to oneself. Identification is a crucial part of the process of reconstructing an external regulation into self-regulation. This usually comes with a high level of perceived autonomy and a relatively internal perceived locus of causality (Ryan & Deci, 2002).

Integrated regulation is a result of identifications that have been evaluated and brought into coherence with own values, goals and needs. This is the most autonomous form of extrinsic motivation. Integrated extrinsic motivation also shares many qualities in common with intrinsic motivation. Although both are volitional behaviours, the difference between the two is that integrated regulation behaviours are done to attain personally important goals rather than for inherent interest and enjoyment (Ryan & Deci, 2002).

While CET looks at intrinsic motivation from the social environmental factors, OIT focuses on the extrinsically motivated behaviours that are not inherently interesting. However, some of these activities promote benefits that are valuable to oneself. Such behaviours are typically prompted by significant others through different forms of regulations. This suggests that the need for relatedness to others is fundamentally core for internalization of behaviours. Ryan, Stiller and Lynch (1994) showed that children were more internalized in their regulations and exhibited positive school-related behaviours when they were more securely connected to and cared for by parents and teachers. Thus, relatedness,

together with the other two needs can be used for promoting internalization in extrinsic motivation and maintaining intrinsic motivation (Ryan & Deci, 2002).

Competence and autonomy still play a significant role together with relatedness in promoting internalization of extrinsic motivation. OIT suggests that support for competence will contribute to internalization and the subsequent self-regulation of extrinsically motivated behaviours. If people feel incompetent in the activity, they are not likely to internalize the behaviour. Instead, people will likely find a reason not to participate in the activity, even in the presence of significant others (Ryan & Deci, 2002).

According to OIT, autonomy support is an important factor to determine if internalization, which is supported by relatedness and competence, will be partial (introjection) or fuller (integration). Although some internalization may occur without autonomy support, the type of internalization that will result in adaptive behaviours such as persistence, adaptability and drive will take place when autonomy support is present. To integrate the regulation of a behaviour, people must find and take to the meaning of the behaviour and synthesize that meaning to their psychology. This process of internalization occurs when people experience autonomy and freedom from external demands, giving them the basis for converting a value and regulation into their own (Ryan & Deci, 2002).

Studies have provided supporting evidence for OIT. Grolnick and Ryan (1989) showed that when parents provided more support for autonomy and relatedness, children experienced greater internalization and integration of school values. Williams and Deci (1996) showed that medical students whose instructors were more supportive of autonomy demonstrated greater internalization of biopsychosocial values. Deci et al. (1994) manipulated three supportive factors (meaningful rationale, acknowledgement of the person's perspective and provision of choice) in a laboratory experiment with an uninteresting activity.

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They found that internalization is dependent on the presence of the number of supportive factors. They also found that the amount of support is correlated to the degree of internalization.

Wilson et al. (2003) showed that in a 12-week structured exercise programme, participants reported that identified regulation was a stronger predictor of exercise than intrinsic motivation, although both regulations predicted exercise behaviours, exercise attitudes and physical fitness. Interestingly, introjected regulation has been shown to be positively correlated with strenuous exercise behaviour in some studies (e.g., Wilson, Rodgers, & Fraser, 2002) but not in other studies (e.g., Wilson et al., 2003). One of the explanations for the anomaly was a proposition by Ryan (1995). While intrinsic motivation was expected to produce more positive exercise behaviour than internalized extrinsic regulations, the context of the exercise activity influences the extent of the outcomes. With internalized extrinsic regulations, when the exercise activities undertaken were important but lacked intrinsic appeal, there is a tendency to internalize the role of such activities (Ryan, 1995). Research demonstrated that because of the considerable value (health and aesthetics) that society places on exercise, introjected and identified regulations positively predict exercise behaviour (Ryan, 1995). It seems exercise behaviour is an extrinsically motivated activity that requires internalization of the values imposed by society to initiate and sustain the action. SDT also covers element of the social context where individuals operate in and is relevant to this study.

According to SDT, autonomy supportive condition is associated with need satisfaction and self-determined motivational regulations. Such conditions are usually marked by low degree of control by external sources, the discernment of other people's perspectives, and the provision of choices that guide and aid the decision making process (Deci & Ryan, 1985a; Ryan & Deci, 2000). Wilson and Rodgers (2004) also found that female students and staff

enrolled in a school-based team physical activity event, perceived autonomy support from friends was positively associated with intrinsic motivation and identified regulation. This supports the proposition that less control by external sources such as significant others raises motivation. Further, Standage, Duda and Ntoumanis (2003) also showed that an environment for a group of secondary school physical education students that supports autonomy was positively correlated to the satisfaction of the need for competence, autonomy and relatedness and predicted higher self-determined motivation.

2.5.4 Causality orientations theory

According to SDT, a person's social context and his inner resources that have developed over time from interaction between the self and the social context determines his motivation, behaviour and experience in a situation (Ryan & Deci, 2002). Causality Orientations Theory (COT) depicts the differences in individuals' inner resources and in the tendencies to orientate toward the social environment that supports their autonomy, controls their behaviour or are amotivating. It predicts the experience and behaviour from the enduring orientations of the person (Deci & Ryan, 1985a). COT specifies three orientations (autonomous orientation, controlled orientation and impersonal causality orientation), differing by the degree of self-determination.

Autonomy orientation comprises of regulating behaviour based on interests and self-endorsed values. From CET and OIT, this orientation is related to a person's tendency towards intrinsic motivation and integrated extrinsic motivation. Controlled orientation is associated with orienting towards controls and directives on how one should behave. This is related to introjected external regulation in OIT. Impersonal causality orientation involves focusing on indicators of ineffectance and not behaving intentionally. This is related to amotivation (Ryan & Deci, 2002).

Koestner, Bernieri and Zuckerman (1992) examined the behaviours, traits and attitudes between two groups; individuals who were more autonomous and individuals who were more controlled. They found that autonomy-oriented individuals displayed a strong and positive correlation between behaviours and traits or attitudes, while control-oriented individuals showed weak or negative correlation between behaviours and personality aspects. Thus, this study and other empirical studies have drawn conclusion on the link between autonomy and integration by showing congruence among personality, awareness and behaviour for autonomy-oriented individuals.

2.5.5 Basic psychological needs theory

Basic Psychological Needs Theory (BPNT) explains the relation of motivation and goals to well-being and health (eudaimonic well-being). It describes the associations of value configurations and regulatory styles to psychological health, across time, gender, situations and culture (Ryan & Deci, 2000). Research on BPNT has focused on three areas: Examination of need satisfaction as an influence on well-being within-person (daily fluctuation in well-being from variation in need satisfaction) and between-persons; examination of the relationship between need satisfaction and goal attainment or well-being; lastly, examination of need satisfaction and well-being across cultures (Ryan & Deci, 2002).

Studies have found that general satisfaction of the basic needs for competence, autonomy and relatedness contributed to the general well-being such as positive affect, perceived health, self-esteem, inverse of anxiety and vitality between-person and within-person in various contexts (Baard, Deci, & Ryan, 2000; Ilardi et al., 1993; Kasser & Ryan, 1999; Reis et al., 2000; Sheldon, Ryan, & Reis, 1996).

Studies have also shown that youth athletes' motivation and adaptive outcomes were greatly influenced by peer-created motivational climate such as coaching style and learning

climate (Deci & Ryan, 2000; Hagger & Chatzisarantis, 2011; Hagger et al., 2010). This lends evidence to the intention in this thesis to examine using Facebook as an environment to influence motivation for physical activity.

2.5.6 Hierarchical model of intrinsic and extrinsic motivation

Vallerand (1997) proposed that different motivation can exist in behaviour in three levels of hierarchy; global, contextual and situational levels. For example, one can engage in activities out of enjoyment. This is intrinsic motivation at the global level. However, the same person can exhibit extrinsic motivation in a specific context such as exercise. In a specific situation such as running, one can exhibit intrinsic motivation provided the social situation one is in.

Vallerand also proposed how one's social interaction can have an impact on one's motivation and how the motivation can yield different consequences at different levels. Another proposition of the model is there is a recursive bottom-up influence of situational motivation on contextual motivation. That means repeated engagement in intrinsically motivating activities at the situational level, coupled with experiencing their benefits can play a role in influencing contextual intrinsic motivation. Experiencing situational intrinsic motivation repeatedly has a positive effect on one's contextual motivation.

Vallerand's (1997) hierarchical model of intrinsic and extrinsic motivation theorizes that motivation at a given level is derived from two sources: Social factors and influence from motivation at the next higher level in the hierarchy. Social factors refer to human and nonhuman factors encountered in one's social environment. Human factors can be feedback or comments from another person. Nonhuman factors can be external factors such as signs or rewards. These factors are also categorized by their level of generality. Social factors at each level were found to have deep impact on motivation (Deci & Ryan, 1985b; Vallerand, 1997).

Vallerand (1996) examined the effects of success or failure in a situational variable on situational, contextual and global motivations. The findings showed that failing at a task undermined situational intrinsic motivation and increased amotivation, relative to succeeding in the task. However, contextual and global innovations were not significantly affected by this situational social factor.

Vallerand (1997) also postulated that the influence of social factors on motivation is mediated by perceptions of competence, autonomy and relatedness. This is in agreement with CET (Deci, 1975; Deci & Ryan, 1985b, 1991). Vallerand's Hierarchical Model further posits that such mediating factors take place at each of the three levels in the hierarchy. The mediating role of competence need satisfaction at the situational level had been studied by Sansone (1986), Vallerand and Reid (1984, 1988) and Whitehead and Corbin (1991). They found positive relationship between satisfaction of the need for competence and intrinsic motivation. Reeve and Deci (1996) found support for the mediating role of autonomy on intrinsic motivation. In addition, Ryan (1982) found a stronger relation when the environment supports perception of competence and autonomy. Results from a study by Blanchard and Vallerand (1996a) showed that the impact of individual and team performance on self-determined forms of motivation in basketball players is mediated by the degree which individuals feel connected to other teammates.

Blanchard and Vallerand (1996b) examined the impact of social factors on motivation, mediated by perceived competence, autonomy and relatedness at the contextual level. The results supported the causal sequence where social factors (such as an autonomy supportive style) determined perceptions of competence, autonomy and relatedness, which in turn influenced self-determined motivation. Guay and Vallerand (1997) and Vallerand, Fortier and Guay (1997) also found support for these mediating links at the contextual level.

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Ratelle et al. (2002) also found support for the role of perception of competence as a mediator at the global level of the hierarchy. Overall, results from various studies have indicated that perceptions of competence, autonomy and relatedness can mediate the impact of social factors on motivation at the various levels of hierarchy.

Vallerand (1997) further postulated that motivation at a given level can be influenced from motivation at the next higher level in the hierarchy. This means global motivation has a stronger influence on contextual motivation than on situational motivation, and contextual motivation influences situational motivation. Studies by Williams et al. (1996) and Blanchard, Vallerand and Provencher (1998) found similar result in support of this postulate. It is also interesting that motivation at one level can be influenced by a recursive bottom up motivation from the next lower level. Evidence was found in a study by Blanchard, Vallerand and Provencher (1998) on basketball players. Blanchard and Vallerand (1998) also tested the postulate with individuals in an exercise program. Results showed that global motivation influenced contextual motivation towards exercise (top down effect) and in turn contextual motivation had a recursive bottom-up effect on global motivation. Figure 2.15 depicts the processes of the hierarchical model. The model shows that basic needs can influence motivation at different levels and the recursive bottom-up effect on global motivation lends empirical proof for the employment of exercise as an intervention to influence motivation at the contextual or even global level.
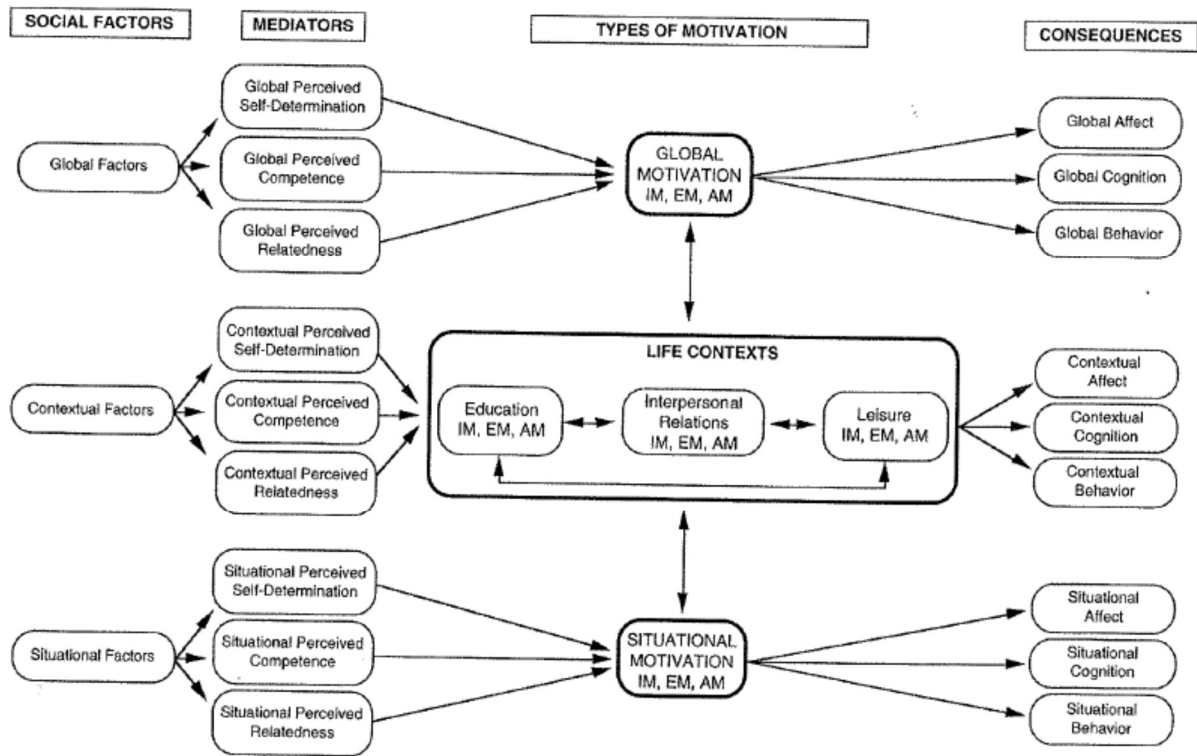
Figure 2.15. The Hierarchical Model of Intrinsic and Extrinsic Motivation. Reprinted from *Handbook of Self-Determination Research.* (p. 41), by R. J. Vallerand, 1995, Rochester University Press. Copyright 2002 by E. L. Deci and R. M. Ryan.

2.5.7 Goal contents theory

Goal contents theory (GCT), a mini-theory in SDT, premised that goals pursued in an activity differ in their potential to satisfy the basic psychological needs (autonomy, competence and relatedness) and the impact on the well-being of individual. These goals are differentiated by the content (intrinsic or extrinsic) (Sebire, Standage, & Vansteenkiste, 2008). Research on GCT has shown that material and extrinsic goals do not enhance need satisfaction and well-being, regardless whether one is successful at attaining the material or extrinsic goal (Kasser & Ryan, 1996; Niemiec et al., 2009). Extrinsic goals reflect desires to achieve something with external value such as social recognition, fame, a good image or financial success. On the other hand, intrinsic goals such as intimate relationships, personal growth, personal interest or community service contributes to health and wellness.

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Vansteenkiste et al. (2006) found that individuals adhere better to intrinsically framed goals than extrinsically focused goals. Well-being which is the outcome of the goal content can be defined as emotional (affect) and cognitive (satisfaction with life) (Diener et al., 1985). There are two dimensions of affect: positive affect which reflects a state of excitement, energetic and alertness; negative affect which reflects the state of anguish and lack of pleasure (Tellegen, Watson, & Clark, 1999). Satisfaction with life is a cognitive judgement by an individual about the extent of the gap between the actual circumstances and the expectation (Diener et al., 1985; Pavot & Diener, 2008).

In a study by Antunes et al. (2018), it found that older adults participating in physical activity reported that intrinsic goal content such as health was the most important motive to participate in physical activity whereas extrinsic goal content such as social recognition was the least important. In an earlier study on 461 undergraduate students, intrinsic goal content was found to predict physical activity behaviour and aerobic fitness (Sibley & Bergman, 2016). These studies show that intrinsic goals has a positive relationship to physical activity behaviour and can potentially be used as an intervention for physical activity research.

2.5.8 Relationships motivation theory

Relationships motivation theory (RMT), another mini theory, postulates that a person's basic psychological need for relatedness motivates one to seek relationships, develop identities and join social groups to connect with others. This need for social relatedness is essential to well-being of a person. Ryan, Bernstein and Brown (2010) have shown that people who do not connect with others and do not report a sense of belonging, suffer from ill effects. On the other hand, not all relationships foster a sense of relatedness. Sometimes, even satisfaction of relatedness need is not sufficient to ascertain if a relationship is good (Deci & Ryan, 2014). These relationships can be qualified by their quality. High quality relationships

not only satisfy the relatedness need, they also promote the experience of a sense autonomy and a sense of competency. That is to say a positive relationship is one that promotes the three basic psychological needs which are essential to the well-being of people (Deci & Ryan, 2014; La Guardia et al., 2000).

There are studies that have shown that when satisfaction of autonomy and competency needs are met in a relationship, people experience higher quality relationships that are more secured, promotes a greater sense of attachment and greater psychological well-being. These observations apply across people, time, age and culture (Deci & Ryan, 2014). In a study by Lim and Wang (2009), they found that autonomy support during physical education class fostered more self-determined forms of behaviour regulations in physical education. In a review by Standage and Emm (2014), it was concluded that the quality of relationships within the physical activity setting contributed to the physical activity engagement quality as guided by RMT. Further studies have also shown that mutuality of autonomy and autonomy support within a relationship enhances the relationship. It is important that a person not only receives autonomy support but also gives autonomy support in a relationship in order to experience a positive relationship (Deci et al., 2006).

RMT also postulates that low quality relationships that are superficial tend to place importance on extrinsic factors such as wealth, fame or image. People who place more importance on extrinsic factors see their partners more as objects for attaining extrinsic goals than individuals to relate to (Kasser & Ryan, 1996). Such relationships were associated with poorer well-being and less satisfying relationships (Kasser & Ryan, 2001). The type of relationship also has an impact on development of an individual's perception of relationship as holding extrinsic or intrinsic value. Individuals in a relationship that is controlling tend to develop stronger extrinsic goal orientation and treat people as objects (Kasser et al., 1995; Williams et al., 2000).

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The key premise in RMT is that a quality relationship requires not merely satisfaction of the need for relatedness but also satisfaction of the need for autonomy and competence. The relationship is stronger when such needs are not only received but given by an individual in the relationship. Extrinsic goal orientation that predisposes a person to be seen as an object thwarts the quality of the relationship and well-being. These principles are important in cultivating satisfaction of the need for relatedness in social group.

2.5.9 Research on exercise motivation

Ryan et al. (1997) tested the hypothesis if intrinsic motives facilitated long-term adherence to exercise. Using Motivation for Physical Activity Measure (Frederick & Ryan, 1993), Ryan and colleagues found that adherence was related to motives focusing on enjoyment, competence and social interaction.

Ratelle et al. (2005) examined the outcomes from a motivational conflict between education and leisure activities. Participants involved in an educational task were led to think about an attractive leisure activity through a priming procedure, after which they were to return to the educational activity. Results showed that participants were led to think about an interesting leisure activity experienced significant drop in intrinsic motivation towards the educational activity. This indicates that experiencing a conflict between two motivations can lead to negative consequence in one of the activities.

Research on exercise motivation from SDT has grown considerably. A systematic review on 66 empirical studies on the relationships between SDT constructs, exercise and physical activity behavioural outcomes was done by Teixeira et al. (2012). These included experimental and cross-sectional studies that measured SDT constructs. The results consistently showed positive relationship between more autonomous forms of motivation and physical activity. It also showed that identified regulation predicted stronger initial and short-

term adoption of physical activity than intrinsic motivation but intrinsic motivation predicted stronger long-term physical activity adherence. The literature also consistently showed that satisfaction of the need for competence and more intrinsic motives were positively associated with exercise participation. On the other hand, similar exercise behavioural outcomes were found for different types of motives (intrinsic and extrinsic) and different types of regulation. While the conflicting results could be due to the majority of studies being descriptive and having non-experimental designs but similar results were also found in cross-sectional and experimental designs. In summary, the literature provided evidence for SDT in understanding exercise behaviour and demonstrated how autonomous regulations such as identified regulation and intrinsic motivation can foster physical activity. However, there is still mixed evidence on the relations between specific SDT constructs and exercise, such as the different associations between some SDT constructs and exercise and physical activity promotion.

In a review on SDT, it was found that more autonomous motivation was observed when interventions influenced psychological needs (through need-supporting environments). The authors also proposed a model (Figure 2.16) that depicts the process for health behaviour change in interventions (Fortier et al., 2012).
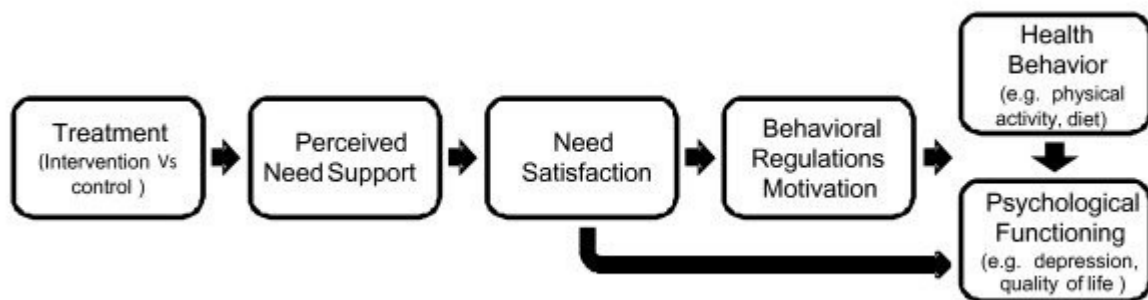
Figure 2.16. SDT process model for health behaviour change in intervention research. Reprinted from " Promoting physical activity: development and testing of self-determination theory-based interventions," by M. S. Fortier, J. L. Duda, E. Guerin, and P. J. Teixeira, 2012, *International Journal of Behavioural Nutrition and Physical Activity,* p. 11. Copyright 2012 by M. S. Fortier, J. L. Duda, E. Guerin, and P. J. Teixeira.

Based on the literature review on SDT, it is suffice to conclude that SDT provides a strong framework in the study of exercise motivation. However, Broughton (1987) and Greenwald (1982) showed that there were signs of distractions leading to multiple roles and inner conflict with the self, divided attention on roles and a lack of attention on responsibility and community. Related to these phenomena, Gergen (1994) asserted that the post-romantic self that grows and struggles for unity (growth development) is now replaced by a modern self who is pervaded by multiple identities from the influence of diverse content imputed by his social environment. In view of people being fragmented into multiple identities and lacking self-determination, SDT on its own is not complete enough to address behavioural issues such as lack of physical activity. Therefore, there is a need to look for mechanisms that can strengthen motivation theory and lead to effective interventions.

2.6 Integrating Identity Theory and Self-Determination Theory

Erikson's developmental theory (Erikson, 1968) is one such idea that explains the multiple identities and its challenges. Some individuals move through the identity stages with ease while others struggle with finding an identity for themselves, ending up in a state of diffusion and inability to identify with the society. It is therefore important in developmental areas to find explanation to why some can breeze through while others struggle to find an identity.

From Erikson's and Arnett's (2000) works, it understood the challenge faced by individuals in modern society to commit to an expanding opportunity of options for growth and development. Expanding options, especially from the bombardment of information in the internet can be a boon or a bane to people depending on the way they interpret and process them. Schwartz (2000) examined the effects of these options on modern groups and found them more tyrannizing than liberating. As a result, some individuals in the technologically

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driven environment may remain in an exploration stage and find difficulty in deciding and arriving at definite identity choices (Schwartz, Côté, & Arnett, 2005).

Research in this area has looked at processes such as how autonomy-supportive parenting (Luyckx et al., 2007) and intrapersonal perfectionism (Luyckx et al., 2008) were meaningful to exploration and commitment. Identifying these environmental and social factors can explain, predict and intervene the development of adolescent identity to lead to well-being and away from distress.

Studying a group individuals who identify themselves with a specific behaviour can throw light on the relationship between identity and the behaviour. In the area of physical activity, the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994) was constructed to measure the extent to which exercise was descriptive of the concept of self ($\alpha = .95$). Wilson and Muon (2008) examined the structural and criterion validity of scores derived from the EIS. Two hundred and sixty nine participants (61 % females) completed the EIS (Anderson & Cychosz, 1994), the Godin Leisure Time Exercise Questionnaire (Godin & Shepherd, 1985) and the Psychological Need Satisfaction in Exercise Scale (PNSE; Wilson, Rogers, Rodgers, & Wild, 2006). Confirmatory factor analyses confirmed that EIS measurement model consisted of two factors: role-identity and exercise beliefs factors. Correlation and multiple regression analyses suggested that both exercise beliefs and role-identity were positively correlated with exercise behaviour and psychological need fulfilment in exercise. This association was reportedly more evident for role-identity. This is one of the few physical activity studies that examined the relationship between identity and psychological needs, an area of motivation. The study provides evidence for criterion validity of EIS responses. However, the evidence to the structural validity of EIS scores was inconclusive and required further research. Wilson and Muon (2008) also proposed that research in this area in the

future may consider using SDT as a theoretical framework for further investigations of identity aspects in exercise contexts.

Strachan and colleagues (2012) used identity theory and SDT as the framework to study if there was association between exercise identity strength and behavioural regulations for exercise. The study used self-report. It was found that exercise identity strength was most significantly correlated ($p < .001$) with the more self-determined forms of behavioural regulation such as identified regulation ($r = .72$), integrated regulation ($r = .82$) and intrinsic motivation ($r = .58$) regulations. In addition, identified regulation was found to moderate the relationship between exercise identity strength and self-regulation ($p < .001$). Overall, this study suggested that variations in exercise identity strength may be distinguished by different behavioural regulation of exercise. In addition, exercise identity strength and identified regulation may have interaction effect with respect to exercise self-regulation. Most importantly, the results support the use of identity theory and SDT together.

Pentecost and Taket (2011) found evidence that supported exercise participation and adherence. One hundred and thirty participants were studied using semi-structured interviews. The participants had chronic conditions and included people who exercised and people who do not. The interview results showed that three factors were important in influencing exercise adherence behaviour: exercise identity, support and perceived benefits of exercise. It also found that social and cultural identities affected the willingness to exercise. People who valued the social and psychological benefits of exercise were also found to be more likely to exercise.

Identity theory and SDT share the same assumption that individuals have natural, innate and constructive inclinations to form a unified sense of self (Sense of continuity with self and others). SDT provides the theoretical framework to explain the function of a set of

psychological needs in determining human behaviour and decision making (Deci & Ryan, 2000), while identity theory provides the socio-psychological framework to explain exercise behaviour. In both theories, social environment that allows satisfaction of the three basic needs supports the healthy functioning (need fulfilment, engagement, mastery and synthesis) of the self while environment that conflicts or does not support the three basic needs is detrimental (diminishes motivation, growth, integrity and well-being) to the self. With the evidence from literature supporting the relationship between identity theory and SDT, especially in the areas of basic psychological needs, intrinsic motivation and identity, this thesis can examine the relationship further.

2.7 Summary

Obesity is a global issue that causes chronic health and lifestyle problems. However, this can be reversed with more physical activity (Dunstan et al., 2012; Grantham et al., 2004). Traditional face-to-face physical activity interventions have been found to produce small effects (Lau et al., 2011) because of constraints to time schedules and accessibility (Sevick et al., 2000). On the other hand, social media, due to its penetration in the society today (Hoffman et al., 2004) offers possibility of reducing attrition rate in physical activity (Nigg, 2003).

Literature review showed that technology exposes us to multitude of information, shaping our identity in ways not seen previously (Castells et al., 2006; Gergen, 1991; Katz & Rice, 2002). Modern human has taken on multiple identities and interests in the multitude of virtual environments. This meant that there is more distraction to any single identity (Côté & Levine, 2002; Frissen, 2000; Haddon, 2001; Lee & Liebanu, 2000; Tsatsou, 2009) and physical activity now has to contend with multiple other identities in a person's life. There is a need to understand this phenomenon brought on by technology on human identity and

behaviour. Identity theory describes how behaviour is shaped through social environment and its influence on social identity, personal identity and ego identity (Côté & Levine, 2002). Literature has also shown that SDT plays an important role in identity formation (Deci & Ryan, 1985a; Ryan & Deci, 2000). There is also evidence that exercise identity was associated with more self-determined forms of behavioural regulation (Strachan et al., 2012) and the basic psychological needs (Wilson & Muon, 2008) indicating the possibility of integrating identity and motivation theories to understand physical activity behaviour. Therefore, this thesis can fill the gaps by further examining how positive physical activity behaviour can be influenced by the modern technologically driven environment through the relationship between identity, motivation and basic psychological needs.

2.8 Research Questions and Studies

With the literature surrounding identity-motivation, this knowledge base can be used to address the small effects seen in some physical activity interventions. Therefore, this thesis aimed to examine the literature on identity and motivation to fill the gaps in physical activity interventions. The following research questions were formed to guide this research:

1. What is a model that can be used to understand physical activity behaviour from an identity-motivation theoretical perspective?

2. What is a valid and reliable measure of physical activity identity that can be used in the model to understand physical activity behaviour?

3. What is the association of the physical activity identity measurement to motivation and physical activity behaviour?

4. How effective is the social media environment in influencing physical activity identity, motivation and physical activity behaviour?

To answer the research questions, three studies were developed. Study 1 developed and tested an exercise and sport identity scale to measure physical activity identity, to see how it fitted the exercise and sport identity model. Study 2 further evaluated the psychometric properties of the exercise and sport identity scale. Study 2 also examined the association of the exercise and sport identity with intrinsic motivation and physical activity. Study 3 was an intervention study to examine how social media can influence exercise and sport identity, intrinsic motivation and physical activity. Table 2.9 shows an overview of the designs of the three studies.

Table 2.9

Overview of designs for the three studies

Study	Purpose	Participants	Instruments	Main analyses
1	To develop and examine the factorial structure of an Exercise and Sport Identity Scale (ESIS)	a) 6 experts (Content adequacy of scale) b) 107 university students (Survey of ESIS)	a) 23-item ESIS b) Demographic information	Exploratory Structural Equation Modeling (ESEM)
2	a) To confirm the factorial structure of the Exercise and Sport Identity Scale developed in Study 1. b) To examine for higher order factors in the Exercise and Sport Identity Scale as proposed in the theoretical model. c) To test the relationship between exercise and sport identity factors, intrinsic motivation and physical activity behaviour.	402 participants from public	a) 22-item ESIS b) Intrinsic Motivation Inventory (IMI) c) Global Physical Activity Questionnaire (GPAQ) d) Demographic information	a) ESEM b) Confirmatory Factor Analysis (CFA) c) Multiple Regression Analysis
3	To examine how different environments (Physical activity and social media intervention) affect the exercise and sport identity, intrinsic motivation and physical activity behaviour.	156 students from Nanyang Technological University	a) 22-item ESIS b) IMI c) GPAQ d) Demographic information	Multivariate Analysis of Variance (MANOVA)

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Chapter 3

Study 1: Scale Development and Exploration of Factor Model of the Exercise and Sport

Identity Scale

3.1   Introduction

3.1.1 Exercise identity

To engage in sustained physical activity is increasingly difficult in today's modern society. This is largely due to changing patterns of transportation, increased use of technology and urbanization (WHO, 2018). Three in four adolescents and one in four adults do not meet the WHO recommendation for physical activity. The prevalence of inactivity is anticipated to increase to as high as 70 % due to changes in transportation, technology and urbanization (WHO, 2018). Physical inactivity has direct impact on noncommunicable diseases such as diabetes, heart disease, stroke, breast cancer and colon cancer. In order to prevent the onset of noncommunicable diseases, it becomes pertinent to develop strategies to increase physical activity. One of the ways is to get people to choose physical activity over sedentary activities. However, the challenge of getting people to take part in any physical activity is determined by the sociocultural values towards physical activity and how integrated physical activity is in people's everyday lives- how physical activity is part of one's identity or social identity (Edensor, 2002; Morris, et al., 2012; WHO, 2018; Wilcox et al., 2003; Zhang, et al., 2007). In a qualitative research on determinants on physical activity behaviour, Lacaille et al. (2011) found that physical activity behaviour is influenced by a complex interplay between motivation, self-regulation skills, unique social environment and physical environment. The findings share similarities with an earlier study by Kaplan et al. (1991) where psychosocial factors such as group membership, gender, race, and other unique social factors play an important role in physical activity behaviour. Therefore, psychosocial determinants play a key role in influencing physical activity behaviour and perhaps

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psychosocial changes is one of the interventions to bring about effective physical activity behaviour changes. In a study to examine the psychosocial correlation with physical activity, factors like identity, social support, self-efficacy, perceived behavioural control and attitude were measured. It was found that identity, social support, self-efficacy and perceived behavioural control accounted for 42 % of the changes in physical activity behaviour (Lorentzen et al., 2007). In order to promote physical activity, WHO (2018) outlined four strategies to increase physical activity levels: Creating active societies; creating active environment; creating active people and creating active systems. Three of the four strategies (creating active societies, environment and people) can be implemented with an understanding of psychsocial factors.

Identity is a multidimensional theory (Erikson, 1968) that encompasses psychosocial factors such as group membership, self-efficacy and personal constructs. Erikson's (1968) Theory of Psychosocial Development covers psychology, social and personal dimensions. Its main tenet on sociocultural determinants of development tells us that individuals develop their identity through stages, shaped by the interaction and influence between the psychological self and environment (Berger & Luckmann, 1966; Côté & Levine, 2002). The psychological dimension, which Erikson (1968) termed as ego identity is the subjective sense of space-time continuity; the personal dimension is the behavioural aspect of a person; and the social dimension refers to the roles one play in the community. These three dimensions interact (as a process) to produce a unit identity of a person (identity confusion or identity unity). Erikson's theory applies to all culture and he asserts that every person develops one's sense of ego identity base on the validation of one's role and his integration in the community, the interplay between social and psychic. Maintaining the ego identity is a fundamental psychosocial condition for effective functioning in adulthood.

Erikson described the three dimensions social identity (Stability of relations in a particular community), personal identity (One's relationships with others that maintain the stability of personal and social identities) and ego identity (Sense of self-sameness over time) in terms of 3 continuities. Table 3.1 depicts the continuity of the three dimensions.

Table 3.1

Three dimensions of identity (Erikson, 1968)

Dimension	Continuity		
Social identity	Unstable	⟷	Stable and continuous
Personal identity	Discontinuity	⟷	Continuity
Ego identity	Confusion	⟷	Unity

Contemporary research have been heavily influenced by Erikson's work as researchers attempt to define the three continuities (Berger & Luckmann, 1966; Côté & Levine, 2002). Social identity is the collation of social roles that an individual might play (Erikson, 1968). Therefore, it is the categories and attributes a person possess in relation to others (Goffman, 1968). Further to the categories and attributes that define a social role, Stryker's identity theory (1980) offers another sociological perspective. There exists a reciprocal relationship between identity and behaviour. This reciprocal relationship is also supported by Briones (1997) and Kurtines (1999). The social identity (social roles) consists of expectations and when they are internalized, guides social behaviour. In turn, the behaviour can reinforce the identity. In a separate line of research, social identity is facilitated by group membership where people derive an important part of their identity by becoming a member of a social group (Tajfel & Turner, 1979). Group membership is thought to provide people the means to attain and maintain positive self-esteem. This theory incorporated Festinger's (1954) theory

of social comparison where people obtain self-evaluations with others. That means, people obtain positive social identity and self-esteem by judging their own social group more positively than other social groups. In a similar line of research, self-categorization theory (Turner, 1985; Turner et al., 1987) asserts that when people are categorized into distinct social groups, they tend to emphasize the similarities among members of the same group and difference between members of different groups. One extension of Turner's Self-categorization Theory is the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994) which measures the degree to which exercise was characteristic of the concept of self.

In the area of personal identity, in addition to maintaining a continuous identity between the self and social, Erikson (1968) also explained that personal identity is also about the personal characteristics that separate one person from the next. This was further elaborated by Goffman (1968) that personal identity is about how unique one is as an individual within a social group. Therefore, a stable personal identity is one that is unique and continuous across time. This is closely associated with the society that validates a personal identity on the individual. This is similar to the work done by social identity researchers such as Stryker (1980), Briones (1997) and Kurtines (1999) where a reciprocal relationship exists between the social environment and self. Adams and colleagues (1987, 1996) worked on the same vein which divided the social context into micro level and macro level. The micro level refers to the interpersonal interactions that affect personal identity. Macro level refers to the social-cultural context where social identity is shaped. Adams viewed the development of identity as a balance between two processes: differentiation and integration. Differentiation is the process of affirming one as a unique self, much like what Erikson (1968) and Goffman (1968) had explained about unique individual in personal identity. Integration is the process of one melding into a larger group; becoming a member of a social group.

Erikson (1968) outlines two key postulates that underlie the development of ego identity of a person. First, humans have a tendency to gain competence when interacting with the environment. Thus, the environment is the stimulus for ego development. The second is that the psychological process comprising the ego is formed at a young age in life. That means human are constantly trying to overcome the conflict between physiological needs (Id) and the social obstacles (super ego) in order to master and control their environment. Therefore, ego is developed by the tension between the id and the super ego. A strong ego identity means one has the ability to control and maintain a stable identity in any situation and time. Maintaining the ego identity is a fundamental psychosocial condition to function effectively in adulthood. Conversely, the unhealthy ego is one that is passive, shows signs of withdrawal, is unable to control behaviour in a unified manner, and uses unnecessary defensive mechanism to interpret cues from the social environment (Côté & Levine, 2002). The manifestation of this stability is seen in the forms of personal and social identity.

Côté (1997) put together the sociological perspective (Kurtines, 1999), personal-social (Adams, 1996) and Erikson's (1968) ego-personal perspecitive to give rise to a broader framework that integrates identity formation into a coherent framework. Taking reference from recent identity scales used by researchers (Balistreri et al., 1995; Luhtanen & Crocker, 1992; Nario-Redmond et al., 2004; Nozick, 1981; Tajfel, 1981; Tajfel & Turner, 1979) to map into the multidimentional theoretical underpinning of Erikson (1968) to provide the foundation to a complete understanding of exercise identity. Figure 2.7 shows the components of identity, related constructs and their relationship.

In summary, developing strategies to encourage physical activity becomes urgent as urbanization circumstantiates sedentary behaviour which leads to higher incidence of noncommunicable diseases in modern societies. Contemporary interventions have also not seemed to produce an effect to physical activity (Lau et al., 2011; Sevik et al., 2000). This

leads us beyond current physical activity intervention models to multilevel, ecological-based type of interventions where multiple levels of influences are taken into consideration as well as the modern environment where socialization now takes place (Buschan et al., 2012; WHO, 2018). Recent studies (Lacaille et al., 2011; Lorentzen, 2007) found multi-factor psychosocial constructs such as identity can significantly account for the change in physical activity behaviour. Identity being a multidimensional construct that encompasses social roles, personal identities and ego identities has been used to measure the extent a behaviour such as physical activity, is descriptive of the self. The relationship between these dimensions is reciprocal and reinforces the behaviour (Briones, 1997; Kurtines, 1999; Stryker, 1980). When internalized as ego identity, the identity also guides behaviour. In the case of physical activity behaviour, the extent to which physical activity describes the self can be developed through the social environment. Therefore, by developing a measure such as exercise identity, we can measure the extent of internalization of physical activity. Secondly, the tool can be used to predict the adherence of the physical activity behaviour. Thirdly, we can devise an intervention based on the measure of exercise identity which indicates the extent of internalization. Currently, there are few instruments to measure exercise identity. Wilson and Muon (2008) reported that more work needs to be done to establish the structural validity of the measurement. Developing a scale to measure identity factors therefore fills this gap and can help us understand and devise better physical activity interventions.

3.1.2 Scale construction and content adequacy assessment

In study 1, an exercise and sport identity scale was developed and examined for model fit, validity and reliability. Figure 3.1 outlines the steps in scale development.

Step 1	**Step 2**	**Step 3**	**Step 4**
Scale construction	Content adequacy assessment	Exploratory Structural Equation Modeling	Validity and reliability test
• Identification of domain • Item generation	• Content analysis • Content validity	• Examine factor structure • Examine the global model fit of the model • Reduce number of items	• Discriminant validity • Internal reliability

Figure 3.1. Procedures for development of the Exercise and Sport Identity Scale (ESIS).

The first step to scale development is to identify the domain and specify the boundaries of the domain for item generation (Boateng et al., 2018). The domain to be defined is identity in the subset of physical activity that has direct impact on the onset of noncommunicable diseases. Caspersen, Powell and Christenson (1985) defined physical activity as the bodily movement produced by skeletal muscles that results in energy expenditure. Physical activity can be categorized into exercise, sport, occupational, household and other activities. This thesis examines the subset of physical activity that is done out of personal choice for the attainment of personal goals and not for work or household. Therefore, exercise and sport fall into this category of physical activity. While there were existing instruments, none had used Erikson's (1968) Theory of Psychosocial Development to examine exercise behaviour on a multidimensional level. Existing literature surrounding Erikson's theory was examined to establish the boundary of exercise and sport identity for scale development. Existing scales were also examined and adapted into the Exercise and Sport Identity Scale (Balistreri et al., 1995; Luhtanen & Crocker, 1992; Nario-Redmond et al., 2004; Nozick, 1981; Tajfel, 1981; Tajfel & Turner, 1979).

After the scale was developed, it was assessed for content adequacy (Schriesheim et al., 1993). This included content validity (Judge panel method, Lawshe, 1975) which is essential to draw conclusions on the quality of the scale, the degree which an instrument consists of an appropriate sample of items to measure the construct (Polit & Beck, 2004), if the items sampled adequately represent the construct (Waltz et al., 2005), and the extent which an instrument adequately samples the research area to attempt to measure phenomena (Wynn et al., 2003). In other words, content validity answers to the extent that the items of a sample composes an adequate operational definition of a construct. It consists of two parts: A priori effort to conceptualize and analyse the domain before item generation to enhance content validity. The second part is a posteriori effort to assess the relevance of the content in the scale through content expert assessment.

The measurement of content validity is the content validity index (CVI). There are 2 types of CVI (Lynn, 1986): Content validity of individual items (I-CVI) and Content validity for scales (S-CVI). The scale items are rated in terms of their relevance to the underlying construct by a panel of content experts. It is recommended a minimum of 3 experts but more than 10 was not necessary (Lynn, 1986; Waltz et al., 2005).

I-CVI is typically measured on an even-numbered scale to avoid neutral and equivocal midpoint response (Davis, 1992; Lynn, 1986; Waltz, & Bausell, 1981). It is computed as the ratio of experts agreeing that the item is relevant. In a 4-pont scale, it is the number of experts giving a rating of either 3 or 4 (If the rating of 3 or 4 represents that the content relevant part of the dichotomy in the ordinal scale), over the total number of experts rating for that item. The I-CVI is the proportion of agreement between the raters. Hence an issue is there could be a chance that the agreement is inflated by chance. Therefore, Lynn (1986) developed a criteria to accept the item by taking into account the standard error of the proportion. It was recommended that all the experts must agree on the content validity in

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order for their rating to be an acceptable reflection of the totality of possible ratings (I-CVI = 1.00), when a panel of five or fewer experts were used. With six or more experts, I-CVIs no lower than 0.78 can be accepted. I-CVI is used to guide the revision, deletion or substitution of items.

Fundamentally, S-CVI is defined as the proportion of items given a rating that represents content valid by two raters (Waltz et al., 2005). Several researchers also offered definitions of S-CVI. In a 4-point scale where a rating of 3 and 4 represent that the item is content valid, Waltz and Bausell (1981) defined S-CVI as the proportion of items given a rating of 3 or 4 by both raters involved. In the case of more than 2 raters, others also define it similarly. Lynn (1986) defined it as the proportion of the total items judged to be content valid. Beck and Gable (2001) defined it as the proportion of items on a scale that achieved a rating of 3 or 4 by the content experts. Others (Grant & Davis, 1997) defined S-CVI differently. They defined it as the proportion of experts who score items as relevant or representative with a rating of either 3 or 4. Many have recommended that a S-CVI of 0.80 or higher can be accepted (Davis, 1992; Grant & Davis, 1997; Polit & Beck, 2004).

Polit and Beck (2006) removed the ambiguity in the definition of S-CVI by refining it to be the proportion of items on a scale that were given a rating of 3 or 4 by all content experts (Universal Agreement (UA) among the content experts: S-CVI/UA). This is more robust in that raters have to agree which items are agreeable, chance agreement between raters are reduced. Also, as more content experts are used, the higher the chance that S-CVI/UA will be low. Hence, the chance of achieving total agreement decreases.

A more liberal definition of S-CVI is the average S-CVI (S-CVI/Ave) which is the average of the I-CVIs. It is the total of the I-CVIs over the number of items. Or it can be calculated as the mean of the proportion of items rated relevant across the experts. Or the count of number of items rated relevant by all experts combined divided by the total number

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of ratings. Waltz et al. (2005) recommends that S-CVI/Ave should be 0.90 as the standard for acceptability.

3.1.3 Exploratory structural equation modeling

After a scale has been developed and surveyed, Exploratory Factor Analysis (EFA) is commonly used to identify the number of latent constructs underlying the items in a scale, reduce the number of items in the scale, examine the structure and relationship between the constructs against the theoretical model, and evaluate the construct validity of the scale. In addition, internal consistency reliability is examined. However, several studies have failed to demonstrate agreement in model fit between EFA and Confirmatory Factor Analysis (CFA) (Asparouhov & Muthén, 2009; Browne, 2001). Exploratory Structural Equation Modeling (ESEM) has been shown to be able to perform the function of EFA. Commonly in EFA, eigenvalues computed from random data are compared with eigenvalues related to the increasing number of factors extracted from the data (Horn, 1965; Glorfeld, 1995). Scree test and Kaiser criteria are other guidelines used to decide on the number of factors. However, these have shown to be problematic and offer little basis to guide the choosing of an appropriate EFA solution (Guay et al., 2015). ESEM, like EFA uses a factor pattern matrix that is freely estimated. In addition, ESEM comprises standard errors for the rotated factor loading solution, the possibility to examine the measurement invariance for an EFA model, the possibility to model residual correlations or inclusion of additional CFA parts (Asparouhov & Muthén, 2009). ESEM also uses many stringent tests of structure (such as measurement invariance) that are also found within the CFA but not EFA.

In this study, ESEM (Asparouhov & Muthén, 2009) was used to test the factor structure of the exercise and sport identity scale. ESEM was used to leverage on the advantages of EFA and CFA while avoiding the drawback of the EFA and CFA. In examining the factor structure, EFA examines all cross-loadings of the items while CFA

allows items to load on their main factors and cross-loadings on other factors are set to zero (Marsh et al., 2009; Morin et al., 2013; Tóth-Király et al., 2017b). The problem when cross-loadings on other factors are set to zero is that systematic measurement error often is part of the model constructed. This is because items are usually not perfect indicators of the constructs and some overlap is expected with other constructs in the model (Morin et al., 2016). As a result of zero cross-loading with other constructs in the model, factor loading tends to be inflated. In a review by Asparouhov et al. (2015), simulation studies showed that small cross-loadings as little as .100 can inflate loading and cause biasness in the results. Goodness-of-fit of the models and the discriminant validity of the factors could also be undermined by the CFA (Marsh et al., 2010, 2014). ESEM identifies exploratory factors by allowing cross-loading, yet provides the model fit to test the model. Thus, it provides a rigorous test of exploratory factors (Asparouhov & Muthén, 2009). ESEM has also been established to produce an improved model fit and improved discriminant validity of the factors (Arens & Morin, 2016; Morin & Maïano, 2011; Morin et al., 2013; Tóth-Király et al., 2017a). In ESEM, both exploratory and confirmatory factors can be created and can be related to a structural equation model framework.

3.1.4 Purpose of study

To address the lack of physical activity as an impact on noncommunicable diseases, understanding the behaviour on a multidimensional level can help target the problem and bring change to physical activity behaviour. The purpose of this study is to develop an Exercise and Sport Identity Scale (ESIS) to understand physical activity behaviour for the purpose of prediction and intervention. The scale development will build on the factor structure proposed by Côté (1997), defined by social, personal and ego identities. The new model will include components put together from the work of Adams (1996), Côté (1997), Erikson (1968), Kurtines (1999) and the identity scales by Balistreri et al. (1995), Luhtanen

and Crocker (1992), Nario-Redmond et al. (2004), Nozick (1981), Tajfel (1981) and Tajfel and Turner (1979). This study also aims to examine the factor structure of the ESIS using ESEM and the validity and reliability of the scale.

Hypothesis 1: It was hypothesized that the global model fit of the newly developed ESIS adequately fits the model described in the literature (Figure 2.7).

Hypothesis 2: It was hypothesized that the ESIS has sufficient discriminant validity and internal reliability.

3.2 Method

3.2.1 Scale construction

A pool of 42 items was put together from previous scales developed and the theory developed from researchers. The following guidelines for item development were used:

- Items are drawn from published identity research.

- Items address a single idea.

- Statements are short and simple; language is familiar to respondents.

- Items should be understood by the respondent as intended of the operational definition.

- There should be internal consistency reliability from the items in the same subscale.

The items for social identity scale were based on Luhtanen and Crocker's (1992) Collective Self-Esteem Scale which was based on Tajfel and Turner's Social Identity theory (1979 & 1986). There were four subscales in the Collective Self-Esteem Scale: Membership, Private, Public and Identity. The items included self-esteem from membership, self-esteem based on one's evaluation of the group, self-esteem based on how one perceives one's membership and self-concept base on membership. Items were generated to define the themes from the view of exercise. The operational definition of exercise social identity is the

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self-concept of an individual. The self-concept is a function of the knowledge of his membership in an exercise group, and the worth and emotion attached to that membership (Tajfel, 1981). There are 4 factors to social identity:

a. Membership self-esteem (M) - how worthy a member of the exercise group is

b. Private self-esteem (Pr) - how good one believes his exercise group is

c. Public self-esteem (P) - how one believes others evaluate his exercise group

d. Importance to identity (I) - how important one's exercise group is to one's self concept

The initial pool consisted of sixteen social identity items; four from membership self-esteem, four from private collective self-esteem, four from public collective self-esteem and four from importance to identity.

Personal identity was heavily influenced by Nozick's (1981) work on personal identity over space and time and Social and Personal Identities Scale developed by Nario-Redmond et al. (2004). Exercise personal identity is defined as continuity (Nozick, 1981) and uniqueness (Nario-Redmond et al., 2004) of one's exercise self-concept perceived over time. Continuity (Co) is the extent that one's future exercise self is causally related to the present exercise self; Uniqueness (U) is the extent that the future exercise self is unique. There were nine items from personal identity; six on continuity and three on uniqueness.

Ego identity was adapted from Erikson (1968), Marcia (1966) and Balistreri et al. (1995). References were made from the Ego Identity Process Questionnaire (Balistreri et al., 1995) and adapted to sports and exercise. Exercise ego identity is defined as the conscious part of identity that influences thoughts and actions on exercise. Thoughts and actions can be classified into exploration (E) and commitment (C) (Marcia, 1966). Exploration refers to the cognitive review, synthesis of options and trying out various exercises over a period. Commitment refers to the personal investment an individual show for an intended a course of

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action or belief towards exercise. Sixteen items were developed; Seven on commitment and nine on exploration.

In total, eight factors make up the ESIS: Membership self-esteem, private self-esteem, public self-esteem, importance to identity, continuity, uniqueness, exploration and commitment. They also make up higher order factors social identity, personal identity and ego identity. These factors together make up ESIS. The ESIS can be depicted in Figure 3.2.
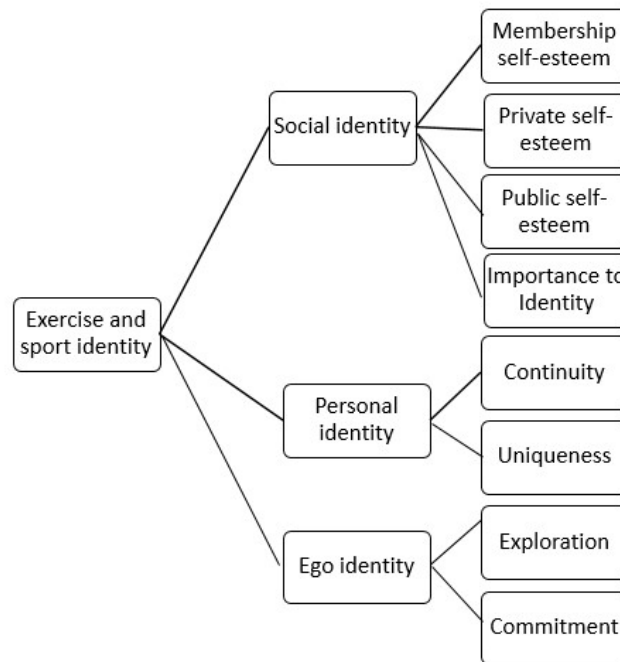
Figure 3.2. A model for Exercise and Sport Identity Scale.

3.2.2   Content adequacy assessment

3.2.2.1 Participants

In the content adequacy, six experts were selected. Four were faculty with physical education and sports teaching experience and two were sportsmen who have participated in international competitions as a player and coach. The two sportsmen were also physical education teachers in school. They were selected because of knowledge in psychometric

scales or experience in physical activity and sport teaching over prolonged period and experience with general exercisers and players from a range of profiles.

3.2.2.2 Procedure

Ethical approval from the Nanyang Technological University Institutional Review Board was obtained (Appendix A). Informed consent was obtained from all participants before conducting the content adequacy assessment. The 42 items were rated on relevance and clarity on a 4-point scale to avoid neutral and equivocal midpoint response (Davis, 1992; Lynn, 1986; Waltz & Bausell, 1981). Relevance was rated as (1) being not relevant, (2) being somewhat relevant, (3) being quite relevant and (4) being highly relevant. Clarity is rated as (1) being strongly disagree; (2) being disagree; (3) being agree and (4) being strongly agree. The operational definition of the items and notes related to the items were also described in the instruction.

3.2.2.3 Content analysis

I-CVI was used to guide item revision, deleting or substituting. After experts rated the relevance and clarity of each item on the 4-point scale, the phrasing of items were revised. Item content was also reviewed and rephrased according to the clarity score and comments from experts. Content validity of the scale was also assessed to determine the acceptability of the scale. CVI was calculated using Microsoft Excel. Items with I-CVIs greater than .78 were be accepted (Lynn, 1986). Items were retained if they met the criteria of S-CVI/UA of .80 (Polit & Beck, 2006) or higher and S-CVI/Ave of .90 or higher (Waltz et al., 2005).

3.2.3   Survey of Exercise and Sport Identity Scale

3.2.3.1 Participants

The number of participants was based on minimizing the model and sampling errors in factor analysis (MacCallum & Tucker, 1991). To reduce model errors, the global fit will be used. Sampling error is dependent on the communalities in the factor analysis. When there is

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good global fit and acceptable communalities, the impact of the errors will be small regardless of the sample size (MacCallum & Tucker, 1991). In the survey study, 107 participants (age 26.3 ± 4.3 years old) were selected from physical education and sport classes in Nanyang Technological University. Of the 107 participants, 52.3 % were male participants and 47.7 % were female participants. There were 12.1 % of the participants who did not participate in any physical activity, 31.8 % participated in moderate intensity physical activity and 50.5 % participated in vigorous intensity physical activity. There were 5.6 % of participants who did not respond to the question on physical activity participation.

3.2.3.2 Procedures

Ethical approval was obtained from the Nanyang Technological University Institutional Review Board (Appendix A). Informed consent was obtained from all participants before conducting the surveys. The questionnaires included demographic information (Appendix B) and the ESIS. The items were measured using a 5-point likert scale, (1) being "strongly disagree" and (5) being "strongly agree". The surveys were conducted in a class setting. Participants were told that they could withdraw from the survey any time and there was no right or wrong response in the survey.

3.2.3.3 Measure

The measure used in the survey was the 23-item ESIS. Table 3.2 shows the items in the 23-item ESIS.

Table 3.2

The Exercise and Sport Identity Scale (23 items)

Item coding	Item wording
Social Identity-Importance to Identity	
SI1	I am a proud member of an exercise/ sport community.
SI2	Belonging to an exercise/ sport community is an important reflection of who I am.
SI3	Belonging to an exercise/ sport community is an important part of my self-image.
Social Identity-Private Self-esteem	
SPr1	I am happy to belong to an exercise/ sport community.
SPr2	I fit well into my exercise/ sport community.
SPr3	I feel good about my exercise/ sport community.
Social Identity-Public Self-esteem	
SP1	My exercise/ sport community is considered good by others.
SP2	People consider my exercise/ sport community to be worthy.
SP3	Others respect the exercise/ sport community that I belong to.
Personal Identity-Continuity	
PCo1	My exercise/sport goals has been the same in the past, now and in future.
PCo2	My beliefs on exercise/ my sport have been the same in the past, now and in future.
PCo3	I have participated in similar intensity in exercise/ sport in the past, now and in the future despite of (challenges at) different phases of life.
Personal Identity-Uniqueness	
PU1	Being an exerciser/ sport person is important to who I am.
PU2	My exercise/ sport defines me as a person.
PU3	I see myself as an exerciser/ sports person regardless of other roles I play in life.
Ego Identity-Commitment	
EC1	I don't expect to change my beliefs about exercise/ sports.
EC2	I have firmly held views concerning my purpose participating in exercise/ sports.
EC3	I am unlikely to alter my exercise/ sports goals.
EC4	I have committed to exercise or participate in sports regularly.
Ego Identity-Exploration	
EE1	I feel a need to learn about different exercises/ sports to find the best one for me.
EE2	I evaluate my views on exercise/ sport through my experiences in various forms of exercises or sports.
EE3	I have reflected on the importance of exercise/ sports in my life.
EE4	I am open to explore new exercises/ sports if someone introduces it to me.

Note. SI= Social (Importance to identity); SPr = Social (Private self-esteem); SP = Social (Public self-esteem); PCo = Personal (Continuity); PU = Personal (Uniqueness); EC = Ego (Commitment); EE = Ego (Exploration).

3.2.4 Data analysis

3.2.4.1 Exploratory structural equation modeling

ESEM was conducted on the 23 items using M*plu*s Version 8.1 (Muthén & Muthén, 2018) with weighted least square mean and variance (WLSMV) adjusted estimator to explore the ESIS model. Table 3.2 shows the items in the ESIS. WLSMV estimation is more suitable for the ordered-categorical nature of Likert scales than traditional maximum likelihood (ML) estimation (Lubke & Muthén, 2004). Missing data was coded with 99. The estimator estimates models with missing data. Oblique geomin rotation was used for exploratory measurement model. The theory specified a priori (eight factors) but Exploratory Enumeration Procedure was used to verify if the factors fitted into the 8-factor model. ESEM was conducted for models from 1-9 factors. Hu and Bentler (1999) proposed guidelines for various fit indices and an inspection of the factor solutions were used for factor retention decisions. Global model fit is evaluated by significance of the chi-square test, the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and the Root Mean Square Error of Approximation (RMSEA). In SEM models, the cutoff criteria CFI > .90, TLI > .90, RMSEA < .08 are regarded as good fit. CFI > .95, TLI > .95, RMSEA < .05 are considered excellent fit (Marsh, Hau, & Wen, 2004). ESEM was conducted until an acceptable model fit was established.

Skewness and kurtosis values of an item within the acceptable limit of ± 2.00 indicated the item is univariate normally distributed (Tabachnick & Fidell, 2013).

Internal consistency tests were conducted using a criteria of an inter-item correlation between .20 and .70 (Kidder & Judd, 1986).

3.3   Results

3.3.1   Content analysis

Preliminary results showed that the 42-item scale did not meet the acceptability criteria (S-CVI/UA of .52 and S-CVI/Ave of .83). Twenty-three items from 42 items had acceptable I-CVI of more than .78 (Mean I-CVI of .78). These items with I-CVI more than .78 were retained and the items that do not meet I-CVI of more than .78 were examined and discarded if the items did not reflect the definition. Table 3.3 Showed the I-CVI and S-CVI of the 42-item scale. Ratings on the clarity scale was also examined together with the qualitative comments on the clarity of the items. Two of the constructs Social identity-Membership self-esteem and Social identity-Importance to identity were combined because qualitative comments from two raters could not differentiate self-esteem and importance of exercise to identity. Qualitative comments sought from the other raters after also suggested that the construct Membership self-esteem seemed irrelevant in exercise group contexts today. It was suggested to combine the two constructs. The construct was named as Social identity-Importance to identity. Items 1 and 15 were combined under the construct Social identity-Importance to identity. Items 5 and 7 were combined and rephrased positively as *I feel good about my exercise/ sport community.* A new item was constructed under the construct Personal identity-Uniqueness, *I see myself as an exerciser/ sports person regardless of other roles I play in life,* was created to reflect three aspects of the construct (Evaluation, definition and self). Another item was created under the construct Ego identity-Commitment, *I have committed to exercise or participate in sports regularly*, to define the construct more completely. All the items were reworded to specify exercise and sport as well as to simplify the items. A second expert review by 4 faculty members and 2 sportsmen on the 23 items showed acceptable relevance and clarity in all the items (Mean I-CVI = 1.00; S-CVI/UA = 1.00 and S-CVI/Ave = 1.00).

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Table 3.3

The I-CVI and S-CVI of the 42-item ESIS

Item number	Item	Number in agreement	I-CVI
1	I am a worthy member of the exercise group I belong to (SM).	6	1.00
2	I feel I don't have much to offer to the exercise group I belong to (SM).	4	.67
3	I am a cooperative participant in the exercise group I belong to (SM).	4	.67
4	I often feel I'm a useless member of my exercise group (SM).	4	.67
5	I often regret that I belong to some of the exercise groups I do (SPr).	6	1.00
6	In general, I'm glad to be a member of the exercise group I belong to (SPr).	6	1.00
7	Overall, I often feel that the exercise groups of which I am a member are not worthwhile (SPr).	6	1.00
8	I feel good about the exercise groups I belong to (SPr).	6	1.00
9	Overall, my exercise groups are considered good by others (SP).	6	1.00
10	Most people consider my exercise groups, on the average, to be more ineffective than other exercise groups (SP).	6	1.00
11	In general, others respect the exercise groups that I am a member of (SP).	6	1.00
12	In general, others think that the exercise groups I am a member of are unworthy (SP).	2	.33
13	Overall, my group memberships have very little to do with how I feel about myself (SI).	4	.67
14	The exercise groups I belong to are an important reflection of who I am (SI).	6	1.00
15	The exercise groups I belong to are unimportant to my sense of what kind of a person I am (SI).	6	1.00
16	In general, belonging to exercise groups is an important part of my self-image (SI).	6	1.00
17	My personal values regarding exercise are extremely important to who I am (PCo).	5	.83
18	My dreams and imagination on exercise are extremely important to who I am (PCo).	3	.50
19	My personal goals and hopes on exercise are extremely important to who I am (PCo).	6	1.00
20	My emotions and feelings on exercise are extremely important to who I am (PCo).	4	.67
21	My thoughts and ideas on exercise are extremely important to who I am (PCo).	4	.67
22	The ways I deal with my fears and anxieties are extremely important to who I am (PCo).	4	.67
23	My feeling of being a unique person, being distinct from others (PU).	4	.67
24	Knowing that I continue to be essentially the same inside even though life involves many external changes are extremely important to who I am (PCo).	6	1.00
25	My self-knowledge, skills, experience, my ideas about what kind of person I really am are extremely important to who I am (PU).	6	1.00
26	My personal self-evaluation, the private opinion I have of myself are extremely important to who I am (PU).	6	1.00
27	I have definitely decided on pursuing the activity for life (EC).	4	.67
28	I don't expect to change my principles and ideals about exercise (EC).	6	1.00
29	I have firmly held views concerning my purpose participating in exercise (EC).	6	1.00
30	When I talk to people about exercise, I am sure to voice my opinions (EC).	3	.50
31	I am unlikely to alter my exercise goals (EC).	6	1.00
32	My values on exercise are likely to change in the future due to circumstances (EC).	4	.67
33	I am not sure that the values I hold on regarding exercise are right for me (EC).	4	.67

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34	I have considered adopting different kinds of exercise (EE).	4	.67
35	I have considered different views on exercise thoughtfully (EE).	4	.67
36	I have tried to learn about different exercises to find the best one for me (EE).	6	1.00
37	I have experienced different forms of exercise that made me change my views on exercise (EE).	6	1.00
38	I have consistently re-examined different values in order to find the exercise that best fits me (EE).	4	.67
39	I have questioned what kind of exercise is best for me (EE).	6	1.00
40	I have evaluated many ways in which exercise fits into my life (EE).	3	.50
41	There has never been a need to question my values on exercise (EE).	4	.67
42	I have not felt the need to reflect on the importance of exercise in my life (EE).	6	1.00
		Mean I-CVI	.83
		S-CVI/UA	.52
		S-CVI/AVE	.83

Note. SM = Social (Membership self-esteem); SPr = Social (Private self-esteem); SP = Social (Public self-esteem); SI = Social (Importance to identity); PCo = Personal (Continuity); PU = Personal (Uniqueness); EC = Ego (Commitment); EE = Ego (Exploration).

Table 3.4

The I-CVI and S-CVI of the reduced 23-item ESIS

Item number	Item	Number in agreement	I-CVI
1	I am a proud member of an exercise/ sport community (SI).	6	1.00
2	Belonging to an exercise/ sport community is an important reflection of who I am (SI).	6	1.00
3	Belonging to an exercise/ sport community is an important part of my self-image (SI).	6	1.00
4	I am happy to belong to an exercise/ sport community (SPr).	6	1.00
5	I fit well into my exercise/ sport community (SPr).	6	1.00
6	I feel good about my exercise/ sport community (SPr).	6	1.00
7	My exercise/ sport community is considered good by others (SP).	6	1.00
8	People consider my exercise/ sport community to be worthy (SP).	6	1.00
9	Others respect the exercise/ sport community that I belong to (SP).	6	1.00
10	My exercise/sport goals has been the same in the past, now and in future (PCo).	6	1.00
11	My beliefs on exercise/ my sport have been the same in the past, now and in future (PCo).	6	1.00
12	I have participated in similar intensity in exercise/ sport in the past, now and in the future despite of (challenges at) different phases of life (PCo).	6	1.00
13	Being an exerciser/ sport person is important to who I am (PU).	6	1.00
14	My exercise/ sport defines me as a person (PU).	6	1.00
15	I see myself as an exerciser/ sports person regardless of other roles I play in life (PU).	6	1.00
16	I don't expect to change my beliefs about exercise/ sports (EC).	6	1.00
17	I have firmly held views concerning my purpose participating in exercise/ sports (EC).	6	1.00
18	I am unlikely to alter my exercise/ sports goals (EC).	6	1.00
19	I have committed to exercise or participate in sports regularly (EC).	6	1.00
20	I feel a need to learn about different exercises/ sports to find the best one for me (EE).	6	1.00
21	I evaluate my views on exercise/ sport through my experiences in various forms of exercises or sports (EE).	6	1.00
22	I have reflected on the importance of exercise/ sports in my life (EE).	6	1.00
23	I am open to explore new exercises/ sports if someone introduces it to me (EE).	6	1.00
		Mean I-CVI	1.00
		S-CVI/UA	1.00
		S-CVI/AVE	1.00

Note. SI= Social (Importance to identity); SPr = Social (Private self-esteem); SP = Social (Public self-esteem); PCo = Personal (Continuity); PU = Personal (Uniqueness); EC = Ego (Commitment); EE = Ego (Exploration).

3.3.2 Exploratory structural equation modeling

ESEM was conducted to evaluate the factor solutions up to nine factors. Table 3.5 shows the results from ESEM models from one to nine factors. The eight-factor and nine-factor models did not give a significant p-value (.01) for χ^2. All other chi-square test of exact fit reject the null hypothesis of exact fit to the data. The seven-factor model was the closest

model to show adequate fit according to most fit indices. χ^2 (113) = 175.76, p < .01, CFI

= .991, TLI = .980, RMSEA = .072. The chi-squares difference tests also support the seven-

factor solution. The chi-squares difference tests also seemed to support a 3-factor solution,

although weaker. The approximate fit indexes improved with the increasing number of

factors. There was good fit from six factors onwards. At eight factors, it began to show

insignificant chi-square results. On an empirical basis, the fit indexes support a seven-factor

model. This also fits the theoretical model where there are seven factors.

Table 3.5

Exploratory Factor Enumeration Procedure on ESIS: Goodness-of-Fit statistics

ESEM Model	χ^2	MD$\Delta\chi^2$	df	CFI	TLI	RMSEA [90 % CI]
1 Factor	927.77**	-	230	.903	.893	.168 [.157, .180]
2 Factor	626.21**	301.56	208	.942	.929	.137 [.125, .149]
3 Factor	556.48**	69.73	187	.948	.930	.136 [.123, .149]
4 Factor	354.69**	201.79	167	.974	.960	.102 [.088, .117]
5 Factor	279.49**	75.20	148	.982	.969	.091 [.075, .107]
6 Factor	213.69**	65.79	130	.988	.977	.078 [.058, .096]
7 Factor	175.76**	37.93	113	.991	.980	.072 [.050, .092]
8 Factor	132.28	43.48	97	.995	.987	.058 [.030, .082]
9 Factor	109.02	23.26	82	.996	.988	.055 [.021, .081]

Note. ESEM = exploratory structural equation model; χ^2 = robust weighted least square; MD$\Delta\chi^2$ = change in χ^2 relative to the preceding model calculated from *Mplus* DIFFTEST function; RMSEA [90% CI] = 90% confidence interval for the RMSEA point estimate. **p < .01.

Exploratory factor analyses were also conducted to evaluate factor solutions up to

seven latent factors to provide information on the item correlation as compared to the ESEM

solution. A WLSMV estimator analysis with an Oblique Geomin rotation was used. Table 3.6

shows the factor loadings of the items. The first factor showed strong loadings from items

describing Social identity-Importance to identity (SI1, SI2 & SI3) of the exerciser. Factor 2

showed strong loadings from the six items from Social identity-Private self-esteem (SPr1,

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SPr2 & SPr3) and Social identity-Public self-esteem. Cross-loading was observed for items from Social identity-Private self-esteem and Social identity-Public self-esteem. SP1, SP2 and SP3 cross-loaded on two factors. The same items loaded negatively on Factor 6. Cross-loading was also observed for Social identity-Public self-esteem (SP1, SP2 & SP3) and Ego identity-Commitment (EC1, EC2, EC3 & EC4). The pattern of the factor loadings from the seven-factor ESEM model for ESIS showed strong loadings were observed from factors 1-6. Factors 3-5 showed strong loadings on Personal identity-Continuity, Personal identity-Uniqueness and Ego identity-Exploration respectively. Factor 6 showed strong loading on Ego identity-Commitment and weak loading on factors related to Social identity-Public self-esteem. Factor 7 showed weak loading on Ego identity-Commitment. Item C4 did not show a substantial and significant loading ($> .32$; Comrey & Lee, 1992) and was removed. The items that loaded on a factor but showed cross-loading were retained because ESEM showed good fit indices to the seven-factor over the six-factor structure. A second factor analysis was conducted to further examine the factor loadings for any further adjustment to the factor structure.

Table 3.6

Factor loadings and factor correlations on seven-factor, 23-item ESIS

Factors							
Items	**Factor Loadings**						
	1	2	3	4	5	6	7
Social identity-Importance to identity							
SI1	.39*	.58*	.09	.05	-.01	-.19*	.21*
SI2	.68*	.23	.08	.13*	-.04	-.04	.09
SI3	.79*	.08	-.08	.02	.10*	.22*	-.06
Social identity-Private self-esteem							
SPr1	.37*	.51*	-.03	.09	.18*	.05	-.02
SPr2	.16	.70*	-.11*	.13	.03	.05	.13
SPr3	.24*	.67*	-.05	.20*	-.02	.04	.09
Social identity-Public self-esteem							
SP1	.06	.83*	.04	-.12	.11*	.21*	-.07
SP2	-.03	.86*	.01	-.11	.07	.21*	-.13
SP3	.01	.71*	.27*	.25*	.01	-.16*	.05
Personal identity-Continuity							
PCo1	.06	-.03	.86*	.02	-.02	.07	.04
PCo2	-.04	.19*	.72*	.04	.05	.16*	-.01
PCo3	-.08	-.00	.39*	.33	-.03	-.02	.46*
Personal identity-Uniqueness							
PU1	.03	.07	.08	.64*	.15*	.07	.17
PU2	.12	.09	.06	.88*	.02	-.00	-.13
PU3	.17*	-.07	.00	.55*	.17*	.30*	.12
Ego identity-Commitment							
EC1	.01	.03	.02	.19*	-.06	.83*	.00
EC2	-.01	.20*	.12	.05	.07	.57*	.24*
EC3	.16*	.00	.15*	-.15	.10	.39*	.48*
EC4	.11	.06	-.13	.28	.28*	.11	.44*
Ego identity-Exploration							
EE1	.13	.02	.07	.06	.79*	-.01	-.14
EE2	.14*	-.08	.15*	-.00	.93*	-.05	.01
EE3	-.14*	.24*	-.08	-.02	.77*	.03	.19*
EE4	-.08	.14	-.23*	.13	.61*	.14	.06

	Factor Correlations						
	F1	F2	F3	F4	F5	F6	F7
F1	1.00						
F2	.57*	1.00					
F3	.12	.15*	1.00				
F4	.55*	.45*	.26*	1.00			
F5	.39*	.51*	.00	.40*	1.00		
F6	.23*	.39*	.13	.22*	.47*	1.00	
F7	.24	.31*	.23*	.44*	.33*	.25*	1.00

Note. ESIS = Exercise and Sport Identity Scale. The ESEM model was an exploratory factor analysis with 7 ESIS factors. All parameter estimates are completely standardized.

Item skewness and kurtosis values were within the range between **-** 2.00 and 2.00 (skewness = **-** .89 to - .27, kurtosis = **-** .92 to .02), which indicates all the items were univariate normally distributed (Tabachnick & Fidell, 2013). Results from the internal consistency tests showed that alpha values of the three factors ranged from .85 to .96. The values of the inter-item correlation fell within the .20 to .70 range (see Table 3.7). The corrected item-total correlation estimates ranged from .29 to .90.

ESEM was subsequently conducted on the 22 items (without EC4) to verify the fit indices and factor structure. WLSMV was used as an estimator and Oblique Geomin was used for rotation. χ^2 (231) = 2360.87, p < .01, CFI = .983, TLI = .959, RMSEA = .060, SRMR = .019. The chi-square test of model fit was significant (Ellison & Levy, 2012). The solution led to a 22-item seven-factor ESIS representing Social identity-Importance to identity (three items), Social identity-Private self-esteem (three items), Social identity-Public self-esteem (three items), Personal identity-Continuity (three items), Personal identity-Uniqueness (three items), Ego identity-Commitment (three items) and Ego identity-Exploration (four items). Table 3.7 shows the factor loadings of the seven-factor, 22-item revised ESIS and Figure 3.3 shows the revised model for ESIS. Cross-loadings are present in the factor loadings. The items are retained because the cross-loaded items do not load on an alternative factor, with the exception is Social identity-Private self-esteem factor. However, the alternative factor has significantly lower factor loading with a difference of more than .20. Hinkin (1998) suggested that such difference between primary factors and alternative factors should be considered in retention of items.

Table 3.7

Factor loadings on seven-factor, 22-item ESIS

Factors	Factor Loadings						
Items	1	2	3	4	5	6	7
Social identity-Importance to identity							
SI1	.26*	.52*	.11	.12	.16	-.01	.06
SI2	.57*	.28*	.01	.10	.20	-.02	.03
SI3	.92*	-.08*	.12*	-.01	.02	.07	.05
Social identity-Private self-esteem							
SPr1	.34*	.43*	.18	.04	.01	.09	.20*
SPr2	.16*	.58*	.24	.04	.06	.18*	.06
SPr3	.22*	.58*	.18	.02	.11*	.11*	.07
Social identity-Public self-esteem							
SP1	.18	.30	.45*	.03	-.13	.18	.13
SP2	.03	-.04	.18*	.01	.02	.01	-.01
SP3	-.04	.57*	.28*	.24*	.15*	-.02	.07
Personal identity-Continuity							
PCo1	.03	-.01	.05	.82*	.03	.02	-.04
PCo2	.02	-.02	.08	.77*	-.06	.06	.07
PCo3	-.05	.12	.14	.43*	.37*	.17	-.02
Personal Identity-Uniqueness							
PU1	.06	.07	.06	.10	.66*	.09	.17*
PU2	.20*	.17	-.00	.09	.68*	-.05	.04
PU3	.21*	-.10	.11	.05	.58*	.24*	.12
Ego identity-Commitment							
EC1	.10	-.04	.08	.03	.05	.67*	-.01
EC2	.03	.10	.09	.13	.03	.69*	.09
EC3	.06	-.02	.06	.14	.06	.51*	.11
Ego identity-Exploration							
EE1	.06	.06	.09	-.01	.43*	.25*	.28*
EE2	.14	.05	.05	.02	.03	-.01	.70*
EE3	.09	-.05	.05	.08	.10	.02	.84*
EE4	-.04	.12	.06	-.08	.05	.26	.65*

Note. SI = Social identity-Importance to identity; SPr = Social identity-Private self-esteem; SP = Social identity-Public self-esteem; PCo = Personal identity-Continuity; PU = Personal identity-Uniqueness; EC = Ego identity-Commitment; EE = Ego identity-Exploration

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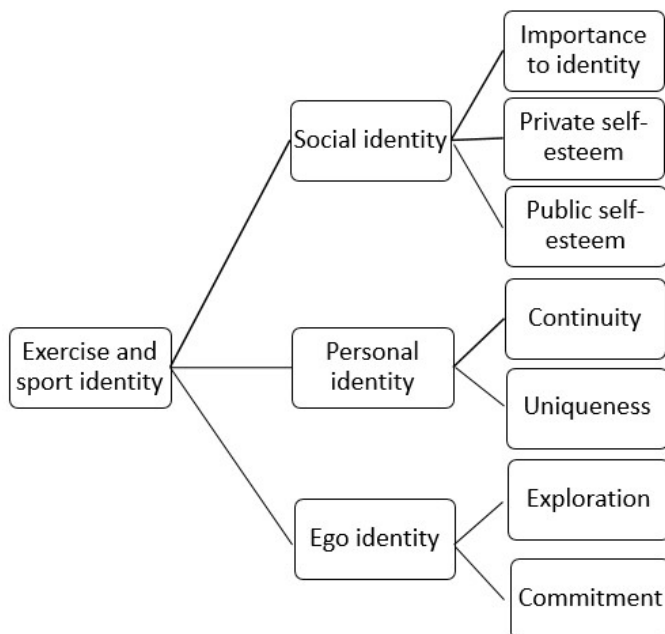
Figure 3.3. The revised model for Exercise and Sport Identity Scale

3.3.3   Factor correlations and internal reliability

Composite scores for each of the three factors and the zero-order inter-factor correlations were calculated based on the EFA findings (see Table 3.8). The factor mean scores ranged from moderate to high ($M = 3.30$ to 3.91, out of 5.00), and Social identity-Importance to identity had the lowest score and Ego identity had the highest score. From Table 3.9, most of the factors were mildly or moderately correlated with the exception of SPr1, SPr2 and SP1 ($r = .29$ to $.90$, $p < .01$), indicating further examination of some of the social identity factors for redundancy. The other factors show adequate discriminant validity (Hair et al., 2010). Acceptable internal reliability was found, where all alpha values were greater than .70 ($\alpha = .78$ to $.96$). The item communalities ranged from .57 to .90. Communalities $> .4$ suggest appropriate sample size (Leandre, Fabrigar, & Wegener, 2012).

Table 3.8

Descriptive statistics and internal reliability for the ESIS (22-item)

	M (*SD*)	α
Social	3.67 (1.31)	.96
Social-Identity	3.30 (1.31)	.89
Social-Private	3.56 (1.27)	.96
Social-Public	3.38 (1.26)	.89
Personal	3.45 (1.06)	.85
Personal-Continuity	3.52 (1.18)	.78
Personal-Uniqueness	3.31 (1.21)	.90
Ego	3.91 (0.80)	.90
Ego-Commitment	3.49 (1.07)	.81
Ego-Exploration	3.66 (1.10)	.89

Table 3.9

Inter-item correlations of ESIS (22-item)

Inter-item correlation [a]

SI1	SI2	SI3	SPr1	SPr2	SPr3	SP1	SP2	SP3
--								
.77**	--							
.65**	.80**	--						
.77**	.77**	.76**	--					
.78**	.70**	.65**	.85**	--				
.83**	.76**	.70**	.89**	.90**	--			
.69**	.58**	.64**	.80**	.80**	.80**	--		
.58**	.49**	.58**	.71**	.73**	.71**	.87**	--	
.76**	.69**	.50**	.76**	.78**	.82**	.69**	.65**	--

PCo1	PCo2	PCo3	PU1	PU2	PU3
--					
.66**	--				
.47**	.48**	--			
.32**	.30**	.54**	--		
.30**	.29**	.48**	.77**	--	
.29**	.33**	.43**	.76**	.74**	--

EC1	EC2	EC3	EE1	EE2	EE3	EE4
--						
.69**	--					
.50**	.59**	--				
.34**	.44**	.31**	--			
.38**	.49**	.44**	.76**	--		
.41**	.57**	.44**	.67**	.77**	--	
.42**	.42**	.34**	.54**	.61**	.72**	--

Note. . SI = Social identity-Importance to identity; SPr = Social identity-Private self-esteem; SP = Social identity-Public self-esteem; PCo = Personal identity-Continuity; PU = Personal identity-Uniqueness; EC = Ego identity-Commitment; EE = Ego identity-Exploration
All inter-item correlations are significant at .01 level

3.4   Discussion

The study examined the factor structure model, the validity and internal reliability of the newly developed ESIS. Based on the literature and existing measurements, an initial eight-factor structure model was expected. Through content adequacy and exploratory structural equation modeling, a seven-factor structure model was derived.

3.4.1 Scale construction

It was established that there was a need for the development of an ESIS to measure the multidimensional influences of physical activity behaviour (Lacaille et al., 2011; Lorentzen, 2007). The scale can help understand the environmental and social influences of physical activity behaviour, which can address the rising prevalence of noncommuniable diseases (WHO, 2018). Literature also suggested that multidimensional measures such as identity can be used to understand and formulate more effective interventions (Kaplan et al., 1991; Lacaille et al., 2011; Lorentzen, 2007). The 42-item ESIS was put together using deductive methods which involved item generation based on the literature review on identity theory and existing scales on identity (Hinkin, 1995). The model consisting of social identity, personal identity and ego identity was put together to illustrate the reciprocal relationship between social-environment, self and physical activity behaviour (Adams, 1996; Côté, 1997; Erikson, 1968; Kurtines, 1999). Specific scales related to social, personal and ego identities were sought to provide the operational definition of the constructs (Balistreri et al., 1995; Luhtanen & Crocker, 1992; Nario-Redmond et al., 2004; Nozick, 1981; Tajfel, 1981; Tajfel & Turner, 1979).

The strength of the model is that it puts together sociological and psychological aspects of physical activity behaviour to better understand the behaviour. The social, personal and psychological aspects of identity form a coherent model to explain the social community influence on physical activity behaviour and the importance of group membership and its

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validation of one's identity and behaviour (Briones, 1997; Erikson, 1968; Kurtines, 1999; Tajfel & Turner, 1979). Next, the model depicts the reciprocal interaction between social, personal and ego identities in producing a unit identity of a person, thereby driving the behaviour (Adams, 1996; Côté, 1997; Erikson, 1968). This made the model admissible to the development of an identity scale.

While the ESIS measures the voluntary subset of physical activity behaviour which is distinct from physical activity related to work or shores, it must also be recognized that there will be instances that the conflating concepts of exercise and sports may need to be differentiated in some cases. Future use of the scale should consider the specific profile of the participants and adapt the scale to be used for its purpose.

There was more than one definition for social, personal and ego identities. A difficulty in the process of scale construction was the in the determination of the criteria between the conflicting definitions of social, personal and ego identities. This was overcome by triangulating the research to Erikson's original work about identity. If the literature departs from the ideas of Erikson, it was excluded from the development of the model and scale.

3.4.2 Content Adequacy

After the initial scale was developed, it was put through the process of content adequacy where the scale items were assessed for the relevance to the construct and the clarity. In order for the scale to be judged to have excellent content adequacy, more than one measure of content validity was reported. Item content validity and scale content validity were evaluated. The content analysis showed the scale to have sufficient content validity from Lynn's (1986) criteria for six experts. It also has an acceptable S-CVI/ UA and S-CVI/ Ave. The scale has met the criteria set by several researchers (Davis, 1992; Grant & Davis, 1997; Lynn, 1986; Polit & Beck, 2004). In addition, two rounds of expert review was performed to ensure acceptable content validity.

The strength of the content adequacy process was that content validity indices across items and scale met the criteria across all CVIs. Secondly, two rounds of review made substantial improvement to the content validity of the item and scale. Substantial improvement was also made to each item. This was also the recommendation of Lynn (1986). Thirdly, qualitative feedback was sought from the raters on the relevance and clarity of the items to be used to refine the items. However, it remains to be verified within each construct if the factors sufficiently represent the construct. This is a limitation observed when two factors in the social identity construct were combined because experts could not differentiate the two factors. Future studies should examine the definition of membership self-esteem and repeat the process to test the relevance of the membership self-esteem factor and verify if the factor sufficiently represents the social identity construct.

While the content adequacy proved to be sufficient, it was not able to assess if the scale consisted of a comprehensive set of items to measure the construct. It was not verified if the scale and its items measure what it is supposed to measure. Therefore, the scale was evaluated for construct validity at the next stage.

3.4.3 Construct Validity

There were several recommendations to determine the sample size in a factor analysis. While large sample sizes produce more stable and precise estimates, there is no agreement on what is a necessary sample size to achieve stable and precise estimates that are less variable across repeated sampling (MacCallum et al., 1999). However, sample size influences solutions in factor analysis. Interestingly, Pennell (1968) found that the influence of sample size to stability of factor loadings diminish when the communalities of the variables increased. A review also found that the use of errors in factor analysis was used to estimate sample size (MacCallum & Tucker, 1991). It was posited that there are model error and sampling error. Model error arises from the lack of fit of the model in the population.

Sampling error arises from a lack of exact correspondence between sample and population. When communalities are high, the impact of sampling error will be small regardless of sample size. When communalities are low, the impact of sampling error is more strongly influenced by sample size. Therefore, in this thesis, fit indices and communalities of variables were used to justify the sample size.

ESEM was used instead of EFA to select the optimal number of factors based on the data. In EFA, the eigenvalues associated with increasing number of factors extracted compared with eigenvalues calculated from data and scree test are usually used to extract the number of factors (Horn, 1965). These guidelines have often shown to produce suboptimal selection of an EFA solution. Using ESEM removes the uncertainty in selection of a solution. ESEM uses robust weighted least squares mean and variance adjusted (WLSMV) estimator. Model fit information of different number of factors were used to provide a solution. It should be noted that decisions had to be made in conjunction with an examination of the adequacy of various solutions and the theoretical background. EFA was also used to provide additional information to validate the items in the factors but not to validate the number of factors. As can be seen, the ESEM and EFA results do not match. However, it was clear that the Item EC4 did not fit in both in the ESEM and EFA models.

The ESEM yielded a seven-factor solution with 22 items. The number of factors matched the theories of identity and the measures provided the empirical data for validation of the factor structure. The results also reflected the broad categories of identity theory – Social, personal and ego identities. Some cross loadings were present. Despite the cross loadings, the items appear to align with the theoretical constructs. According to Hinkin (1998), the items can be considered for retention if the primary factor loadings exceed the alternative factor loadings by .20. In addition, ESEM verified that the seven-factor structure has better fit indices than the six-factor structure. In the case of social identity constructs,

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adjacent factors public self-esteem and private self-esteem seemed to fall under the same factor. Future research should verify if these cross loadings are reproduced. Alternatively, future research should look at the item content to distinguish them.

The factor correlations showed the model to have adequate discriminant validity and alpha scores showed acceptable internal reliability. Given the mild to moderate correlation between most of the factors giving sufficient discriminant validity, social identity factors correlated more strongly to personal identity factors than ego identity factors. This suggests that social identity factors have a stronger association or influence on personal identity than ego identity. This is aligned to the theory and model that the social role provides the stimulus to shape one's personal identity, which in turn shapes the ego identity (Berger & Luckmann, 1966). Three ideas were derived from the research models of Berger and Luckmann (1966) on the social construction of reality. First, there is a relationship between social identity, personal identity and ego identity. He asserts that a causal relationship exists between the social structure supporting social identity and the interaction associated to personal identity. Second, social identity is shaped by the social structure, in the form of laws, norms or rituals. Socialization takes place between this social structure and individual, resulting in affirmation or discredit to the social identity. Third, the social identity validates or challenges the personal identity through interaction with the other individuals. This process is cyclical and through validation or challenge, reinforces the ego identity and shapes the identity of a person. Other researchers also found links between social and personal identities (Reid & Deaux, 1996; Stryker & Burke, 2000). In the work by Stryker and Burke (2000), the result affirms the ideas by Berger and Luckmann (1966) that the social role one plays guides the social behaviour and builds the identity of the person. In addition, this relationship between the identity and behaviour is reciprocal.

A larger sample size may produce a more deterministic factor model, discriminant validity and internal reliability to the scale. The factor loadings of SI1 and EE1 were statistically significant but low. SI1 and EE1 had statistically significant and acceptable factor loadings in the earlier factor analysis. In the content analysis, these two items were also found to be relevant. As there was limitation to the sample size used, a conclusive decision should be made using a separate and larger sample. Item correlation for SPr1, SPr2 and SP1 were high. This can be an issue to the discriminant validity as it suggests that the items could be redundant. Further research should address these issues.

Another limitation is that the sample was non-clinical participants with no control of the profile of the participants. Related to small sample size, the group may exhibit unintended biases in smaller samples. Such sample characteristics may influence the result although the scale is meant for diverse participant profile. Therefore, further research can test the scale against a larger sample size of more diverse participants. As this is a first attempt to develop an ESIS scale, the items may contain complex ideas not intuitively understood by laymen. This may cause poor item performance with item loading on factors that do not accurately capture the construct of that item. Some of the items may need to be re-worded to eliminate any borderline responses.

In conclusion, the results support the 22-item ESIS and showed adequate content validity and factorial validity. The ESIS also fits the proposed model. As this exploratory process is data driven, it is possible that the solution was selected by chance. Therefore, reproduction of the solution across other meaningful samples is essential to further validate the scale. The next study can look at confirmation of the factor structure and construct validity using an independent sample.

Chapter 4

Study 2: Further Validation of the Exercise and Sport Identity Scale

4.1   Introduction

4.1.1   Further validation of the Exercise and Sport Identity Scale

In Study 1, Exploratory Structural Equation Modeling (ESEM) supported a 22-item Exercise and Sport Identity Scale (ESIS) representing seven exercise and sport identity factors: Social identity-Importance to identity (3 items), Social identity-Private self-esteem (3 items), Social identity-Public self-esteem (3 items), Personal identity-Continuity (3 items), Personal identity-Uniqueness (3 items), Ego identity-Commitment (3 items) and Ego identity-Exploration (4 items). While the findings from Study 1 provided the empirical evidence about the factorial structure and psychometric properties of the scale, the proposed measurement model should be further validated using independent samples to verify that a solution is derived not by chance or biasness. In addition, the small sample size in Study 1 carried inherent limitation in validation of the scale. Therefore, replication of the solution across diverse samples can further validate the scale (e.g. Schumacker & Lomax, 2010). Confirmatory Factor Analysis (CFA) is used as it is a more appropriate approach for validation in the later stage of scale development to evaluate the model and factorial structure found through ESEM (Brown, 2006; Cabrera-Nguyen, 2010). The model also has to satisfy internal structure fit in terms of reliability and validity across another sample to ascertain that the model can replicate across different samples.

Figure 3.3 suggests that an alternative factor structure may exist. In the figure, higher order factors exist to the seven factors identified. CFA can also be used to evaluate the higher order factor structure.

4.1.2 Association between identity and self-determination theory

Strachan and colleagues (2012) found that association exists between exercise identity strength and behavioural regulations for exercise through the integration of identity theory and self-determination theory (SDT). Through self-report survey, it was found that exercise identity strength correlated most significantly ($p < .001$) with the more self-determined kinds of behavioural regulation such as intrinsic ($r = .58$), identified ($r = .72$), and integrated ($r = .82$) regulations. This study suggests that different degrees of exercise identity strength may be associated to the different regulations of exercise. In addition, identified regulation was found to moderate the relation between exercise identity strength and self-regulation ($p < .001$), suggesting that exercise identity strength and identified regulation may interact in their relationship to exercise self-regulation. The results suggest the viable integration of identity and motivation in research.

Wilson and Muon (2008) examined the structural and criterion validity of the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994). Two hundred and sixty-nine participants (61 % females) completed the EIS, the Psychological Need Satisfaction in Exercise Scale (PNSE; Wilson et al., 2006), and the Godin Leisure Time Exercise Questionnaire (Godin & Shepherd, 1985). Correlational and multiple regression analyses showed that there was positive association between identity factors (exercise beliefs and role-identity) and motivation (psychological need satisfaction in exercise), as well as behaviour (frequency of exercise). It was also found that role-identity had a stronger association with frequency of exercise and psychological need satisfaction in exercise than exercise beliefs. Wilson and Muon (2008) also suggested that future research can look at SDT and exercise identity collectively, strengthening the feasibility to integrate identity and motivation in research.

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It seems there is an association between identity and self-determination as found by Strachan et al. (2012) and Wilson et al. (2006). It also appears there is an association between exercise identity, psychological needs and exercise behaviour (Wilson et al., 2006). Identity theory and SDT share the same assumption that individuals are naturally and inherently inclined to develop a unified sense of self (Côté & Levine, 2002; Deci & Ryan, 2002; Erikson, 1968). SDT provides the theoretical framework to explain the influence of the situational context or environment on a set of psychological needs and how that drives human behaviour (Deci & Ryan, 2000), while identity theory provides the socio-psychological framework to explain exercise behaviour. In both theories, the social environment plays a critical role in meeting the three basic psychological needs to support healthy functioning of the self. Therefore, Study 2 also examines the relationship between exercise identity, self-determination and physical activity behaviour to provide support for the application of exercise identity to physical behaviour.

4.1.3   Self-determination theory and Intrinsic Motivation Inventory

SDT postulated that there are three basic psychological needs: the sense of autonomy, competency and relatedness (Ryan & Deci, 2000); these three needs are inherent in us and necessary for well-being and psychological growth (Deci & Ryan, 2000). According to Organismic Integration Theory (OIT), a sub-theory of SDT, psychological growth (eg. gaining more autonomy in physical activity), helps in the development of a unified sense of self (Ryan & Deci, 2002). Therefore, the fulfilment of basic needs (in particular, autonomy and competency) has direct and positive influence on intrinsic motivation (Deci & Ryan, 1985b; Ryan & Deci, 2000, 2002). From the works of Ryan and Deci (2002), and Wilson et al. (2006), it can be concurred that there is a relationship between fulfilment of basic needs, intrinsic motivation and identity. Study 1 has developed an identity scale to measure exercise

and sport identity. A measurement tool for intrinsic motivation should be used to determine the relationship between identity and intrinsic motivation.

Intrinsic motivation can be measured by the Intrinsic Motivation Inventory (IMI; Ryan & Deci, 2000). It is a multidimensional measure that assesses how participants perceive their experience in an activity (physical activity). The IMI assesses participants' interest, perceived competence, effort, value, felt pressure, perceived choice and relatedness. The interest subscale on its own is taken as the self-report measure of intrinsic motivation. Perceived competence and perceived choice are reported to be positive predictors of intrinsic motivation while relatedness have positive relationship to activities that involve social interactions. Effort, value and felt pressure subscales are used in relevant studies (Monteiro et al., 2015).

In a review on motivation measures in sports, IMI showed psychometrically strong motivation scales (Clancy et al., 2017). In the review on IMI, five subscales were commonly used to measure intrinsic motivation: Interest/ enjoyment, perceived competence, perceived choice, effort/ importance and pressure/ tension subscales. Various studies used a combination of these five subscales and reported acceptable internal reliability. Around the same period, an independent study found the relatively new, relatedness subscale of the IMI to be a valid and reliable way to identify participant feelings of connectedness while engaging in online exergame (a form of online physical activity) (Kooiman et al., 2016).

4.1.4 Purpose of study

In order to address the limitations of Study 1 and to provide further evidence of the validity and reliability of the ESIS, an independent and larger sample was used to confirm the factor structure of the scale against the proposed model. Study 2 also examined the relationship between exercise and sport identity and motivation. Based on literature review

on the associations and strengths of the IMI, it was used to determine the relationship between identity and motivation. Part of establishing the relationship requires determination of the subscales to be used in IMI in a physical activity setting. From earlier studies, interest, perceived competence, perceived choice, effort, pressure and relatedness subscales have been validated. Therefore, using this as the starting point, these six subscales were tested for model fit.

Hypothesis 1: It was hypothesized that the global model fit of the 22-item, seven-factor ESIS fits the proposed model like the results from Study 1 and has sufficient validity and reliability.

Hypothesis 2: It was hypothesized that a higher order factor exists and the global model fit of the higher order factors fits the proposed model.

Hypothesis 3: It was hypothesized that a six-factor IMI has sufficient global model fit and internal reliability for evaluation of intrinsic motivation in physical activity and sport.

Hypothesis 4: It was hypothesized that there is significant association between exercise and sport identity, intrinsic motivation and physical activity.

4.2   Method

4.2.1   Participants

Participants in Study 2 ($N = 402$; males = 184, females = 218) were recruited from members of the public, sport community and students from university. The participants were recruited face-to-face from sport setting, classroom setting and community setting. Permission was sought from the participants before explaining and conducting the survey. A heterogeneous sample, in terms of gender, age and physical activity levels was recruited to increase data variations (Clark & Watson, 1995). Their mean age was 22.78 ($SD = 6.65$) years.

Of this group, 329 (81.8 %) participants participated in vigorous-intensity sports, fitness or recreational (leisure) activities that bring about big increases in breathing rate or heart rate for at least 10 minutes continuously. Some examples of vigorous-intensity sports are running and football. The participants who were engaged in vigorous intensity activities spent an average of 2.07 ± 1.55 days a week, averaging 1.27 ± 1.04 hours each day on it. Three hundred and twenty-four (80.6 %) participants took part or engaged in moderate-intensity sports, fitness or recreational (leisure) activities that bring about a small increase in breathing rate or heart rate for at least 10 minutes continuously. Some examples of moderate-intensity activities are brisk walking, cycling, swimming and volleyball. The participants who were engaged in moderate intensity activities spent an average of 1.96 ± 1.69 days a week, averaging $1.08 \pm .99$ hours each day on it. All of those who participated in moderate intensity activities also participated in vigorous intensity activities. There were 73 (18.2 %) participants who do not participate in vigorous-intensity or moderate intensity physical activity.

4.2.2 Measures

Exercise and Sport Identity Scale. The 22-item ESIS that was validated in Study 1 was used. There were seven factors: social identity-importance to identity (3 items), social identity-private self-esteem (3 items), social identity-public self-esteem (3 items), personal identity-continuity (3 items), personal identity-uniqueness (3 items), ego identity-commitment (3 items) and ego identity-exploration (4 items). The individual items to represent the seven factors are shown in Table 4.1. The items were measured using a 5-point Likert scale, anchored with "strongly disagree" (1) and "strongly agree" (5).

Intrinsic Motivation Inventory. The IMI (Ryan & Deci, 2000) was also used. The IMI consists of seven components; interest (7 items), effort (5 items), pressure (5 items), perceived competency (6 items), perceived choice (7 items), value (7 items) and relatedness

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(7 items) were used to reflect different determinants of intrinsic motivation. Six components (interest, effort, pressure, perceived competence, perceived choice and relatedness) were used because literature review had shown that these six components were valid and had been used with physical activity research. The items were adapted to reflect physical activity and sport. IMI is measured on a 7-point Likert scale with (1) being not true at all and (7) being very true.

Global Physical Activity Questionnaire. The Global Physical Activity Questionnaire (GPAQ; WHO, 2012) was used to measure the amount physical activity and intensity of physical activity. GPAQ consisted of 4 sections (Work, travelling, recreation and sedentary activities). Only the recreation activity section was used for the purpose of this study. Two components of physical activity were measured: Physical activity duration (PA_d), which is the number of hours spent on physical activity or sport per week; and Physical activity intensity (PA_i) represented at four levels. (0) being no physical activity, (1) being moderate physical activity, (2) being vigorous physical activity and (3) being combination of moderate and vigorous physical activity. Demographic information such as gender and date of birth was collected.

Table 4.1

The 22-Item Exercise and Sport Identity Scale

Item Coding	Item Wording
Social Identity- Importance to Identity	
SI1	I am a proud member of an exercise/ sport community.
SI2	Belonging to an exercise/ sport community is an important reflection of who I am.
SI3	Belonging to an exercise/ sport community is an important part of my self-image.
Social Identity- Private Self-esteem	
SPr1	I am happy to belong to an exercise/ sport community.
SPr2	I fit well into my exercise/ sport community.
SPr3	I feel good about my exercise/ sport community.
Social Identity- Public Self-esteem	
SP1	My exercise/ sport community are considered good by others.
SP2	People consider my exercise/ sport community to be worthy.
SP3	Others respect the exercise/ sport community that I belong to.
Personal Identity- Continuity	
PCo1	My exercise/sport goals has been the same in the past, now and in future.
PCo2	My beliefs on exercise/ my sport have been the same in the past, now and in future.
PCo3	I have participated in similar intensity in exercise/ sport in the past, now and in the future despite of (challenges at) different phases of life.
Personal Identity- Uniqueness	
PU1	Being an exerciser/ sport person is important to who I am.
PU2	My exercise/ sport defines me as a person.
PU3	I see myself as an exerciser/ sports person regardless of other roles I play in life.
Ego Identity- Commitment	
EC1	I don't expect to change my beliefs about exercise/ sports.
EC2	I have firmly held views concerning my purpose participating in exercise/ sports.
EC3	I am unlikely to alter my exercise/ sports goals
Ego Identity- Exploration	
EE1	I feel a need to learn about different exercises/ sports to find the best one for me.
EE2	I evaluate my views on exercise/ sport through my experiences in various forms of exercises or sports.
EE3	I have reflected on the importance of exercise/ sports in my life.
EE4	I am open to explore new exercises/ sports if someone introduces it to me.

Note. SI= Social (Importance); SPr = Social (Private); SP = Social (Public); PCo = Personal (Continuity); PU = Personal (Uniqueness); EC = Ego (Commitment); EE = Ego (Exploration).

4.2.3 Procedures

Informed consent was obtained from all participants before conducting the survey. The questionnaires consisted of the ESIS, IMI, GPAQ and a series of items asking participants' demographic information (see Appendix E). Participants were asked to respond to the questions in the survey truthfully. They were informed that there were no correct or wrong answers and were allowed to withdraw the study any time without negative consequences such as penalty and prejudice. It took about 20 minutes for participants to finish the survey.

4.2.4 Data analyses

Before the analyses, the whole data was analyzed for missing data. Skewness and kurtosis values of the items fell within the acceptable range of ± 2.00, indicating that the data has univariate normality (Tabachnick & Fidell, 2013). Normalized estimate (Mardia, 1970) was used to examine the data for multivariate normality. Normalized estimate higher than 3.00 indicates that the data is not normally distributed. Larger values of normalized estimate can affect the modeling statistics in CFA and is not ideal (Bentler & Wu, 2002). Internal consistency test was conducted using Cronbach's Alpha (α) to test if the items of a factor are related to one another and how consistency the ESIS is. Cronbach's alpha greater than .70 suggests acceptable internal consistency (Cronbach, 1951; Kidder & Judd, 1986)

In the main analyses, ESEM was conducted to compare the fit indices with a previous sample. CFA was later employed to test the psychometric properties of the ESIS and IMI. Both ESEM and CFA were conducted using M*plu*s Version 8.1 (Muthén & Muthén, 2018). An appropriate sample size of 200 or more can provide sufficient statistical power (Hoelter, 1983). When CFA was conducted to determine the psychometric properties of IMI, items were deleted from the subscale if the factor loading is < .60 and if cross loading > .40 appears.

In the CFA, the robust maximum likelihood estimation procedure was used to evaluate the global model fit. Multiple fit indices were used to assess the global model fit: Global model fit is evaluated by significance of the chi-square test, the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA) and the standardized root mean squared residual (SRMR). In SEM models, the cutoff criteria CFI > .90, TLI > .90, RMSEA < .08 and SRMR < .08 are regarded as good fit. CFI > .95, TLI > .95, RMSEA < .05 and SRMR < .05 are considered excellent fit (Marsh, Hau, & Wen, 2004).

After testing for global model fit, internal model fit (internal reliability, convergent validity and discriminant validity of the measurement model) was performed and tested on the ESIS. Other than Cronbach's Alpha (α), internal reliability is further tested using the follow criteria: (a) Composite reliability (CR or ρ) of a factor greater than .70 (Fornell & Larcher, 1981); and (b) Average Variance Extracted (AVE) of a factor greater than .50 (Fornell & Larcher, 1981). Convergent validity is assessed from the proportion of variance shared by the items in a factor. Factor loading estimates present the evidence of the item level convergent validity and values of standardized factor loading for each item should be greater than .50, and ideally greater than .70 (Fornell & Larcker, 1981; Hair et al., 2010). Discriminant validity refers to the degree of distinction a factor is from other factors. Discriminant validity is strong when the confidence interval around estimated correlations between the two latent factors do not include 1.00 (Anderson & Gerbing, 1988). The further test included a more conservative approach to evaluate discriminant validity in that AVE values for any two factors must be higher than the shared variance (i.e., squared correlation) between the two factors (Fornell & Larcker, 1981). The rationale behind the rule is that the factor should explain more of the variance in its items than the variance that it shares with another factor (Hair et al., 2010).

4.2.4.1   Theoretical model

Theoretically, higher order factors form part of the ESIS model. Factors such as importance to identity, private self-esteem and public self-esteem are associated with higher order factor called social identity. Factors continuity and uniqueness describe higher order factor called personal identity and factors commitment and exploration describe higher order factor ego identity. CFA was also used on the ESIS to determine if alternative factor model or higher order factors exist.

4.2.4.2 Multiple regression analysis

Standard linear regression was performed to predict if intrinsic motivation can be predicted from exercise and sport identity. An association would suggest that identity and self-determination have a relationship and future research can integrate exercise and sport identity with motivation. In the application aspect, linear regression was also performed to predict if the amount of physical activity can be predicted by the exercise and sport identity and intrinsic motivation. This was examined using multiple regression analysis.

4.3   Results

4.3.1   Preliminary analyses

There were no missing values in the items. The item mean scores ranged from moderate to high (Table 4.2). All the items were univariate normally distributed because the skewness and kurtosis values of all the items fell between the range of - 2.00 and 2.00 (Table 4.2; Tabachnick & Fidell, 2013). The value of normalized estimate was 28.27, which means the data was not multivariate normally distributed (Bentler & Wu, 2002). Internal consistency tests showed acceptable to good alpha values of the seven factors (α = .79 to .96). Table 4.2 shows the descriptive statistics of the mean item scores and standard deviations, skewness values, kurtosis values, Cronbach's alpha and the inter-item correlation.

Table 4.2

Item scores, skewness values, and kurtosis values of ESIS

Item coding	M	SD	Skewness	Kurtosis				
							Inter-item correlation [a]	
Social Identity (α = .91)					SI1	SI2	SI3	
SI1	3.48	1.40	-.63	-.87	1.00			
SI2	3.32	1.31	-.49	-.80	.77	1.00		
SI3	3.18	1.29	-.34	-.91	.70	.83	1.00	
Social Private (α = .96)					SPR1	SPR2	SPR3	
SPr1	3.68	1.30	-.88	-.24	1.00			
SPr2	3.47	1.27	-.72	-.46	.85	1.00		
SPr3	3.62	1.30	-.89	-.26	.88	.90	1.00	
Social Public (α = .95)					SP1	SP2	SP3	
SP1	3.33	1.25	-.58	-.55	1.00			
SP2	3.32	1.27	-.55	-.65	.91	1.00		
SP3	3.44	1.26	-.70	-.41	.84	.85	1.00	
Personal Continuity (α = .79)					PC1	PC2	PC3	
PCo1	3.17	1.20	-.12	-.88	1.00			
PCo2	3.39	1.24	-.33	-.98	.66	1.00		
PCo3	3.23	1.28	-.24	-.97	.50	.51	1.00	
Personal Uniqueness (α = .91)					PU1	PU2	PU3	
PU1	3.56	1.27	-.57	-.69	1.00			
PU2	3.17	1.31	-.22	-1.05	.81	1.00		
PU3	3.20	1.30	-.21	-1.07	.74	.74	1.00	
Ego Commitment (α = .81)					EC1	EC2	EC3	
EC1	3.58	1.11	-.48	-.42	1.00			
EC2	3.52	1.16	-.60	-.29	.62	1.00		
EC3	3.29	1.26	-.33	-.55	.59	.55	1.00	
Ego Explore (α = .82)					EE1	EE2	EE3	EE4
EE1	3.39	1.18	-.57	-.46	1.00			
EE2	3.60	1.04	-.85	.41	.56	1.00		
EE3	3.70	1.17	-.84	.23	.48	.69	1.00	
EE4	4.05	.94	-1.11	1.24	.44	.54	.52	1.00

Note.

[a] All inter-item correlations were significant at .01 level.

4.3.2 Main analyses

ESEM was conducted with up to nine factors. It showed that the 7-factor model was the closest fit with adequate fit indices (Table 4.3). Table 4.3 also showed the fit indices from Study 1 for comparison. The ESEM factor loadings in Table 4.4 showed clearly seven factors. The difference is this sample showed a distinction between private and public items, aligned to the theoretical model. SI1 and PCo3 had higher cross loading on another factor. All the factors showed significant at the .05 level. The 8-factor model while having better fit indices did not display a clear factor loading for two of the factors probably because of having to split the factor into two. The factor correlation showed ranged from .19 to .74. All correlations were significant at $p = .05$ level.

Table 4.3

Exploratory Factor Enumeration Procedure: Goodness-of-Fit statistics of 2 samples

ESEM Model	χ^2	df	CFI	TLI	RMSEA [90 % CI]
1 Factor	927.77*	230	.903	.893	.168 [.157, .180]
	2398.53*	230	.742	.716	.153 [.148, .159]
2 Factor	626.21*	208	.942	.929	.137 [.125, .149]
	1592.03*	208	.835	.800	.129 [.123, .135]
3 Factor	556.48*	187	.948	.930	.136 [.123, .149]
	1160.74*	187	.884	.843	.114 [.108, .120]
4 Factor	354.69*	167	.974	.960	.102 [.088, .117]
	811.96*	167	.923	.884	.098 [.091, .105]
5 Factor	279.49*	148	.982	.969	.091 [.075, .107]
	570.84*	148	.950	.914	.084 [.077, .092]
6 Factor	213.69*	130	.988	.977	.078 [.058, .096]
	384.84*	130	.970	.941	.070 [.062, .078]
7 Factor	175.76*	113	.991	.980	.072 [.050, .092]
	215.59*	113	.988	.973	.048 [.038, .057]
CFA	536.87*	188	.940	.927	.068 [.061, .075]
8 Factor	132.28	97	.995	.987	.058 [.030, .082]
	169.57*	97	.991	.977	.043 [.032, .054]
9 Factor	109.02	82	.996	.988	.055 [.021, .081]
	115.02	82	.996	.988	.032 [.016, .045]

Note. ESEM = exploratory structural equation model; CFA = confirmatory factor analysis; χ^2 = robust weighted least square; RMSEA [90% CI] = 90% confidence interval for the RMSEA point estimate. First rows of each factor depicts model fit results from Study 1. Second rows of each factors depict model fit results from Study 2. *p < .01.

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Table 4.4
ESEM Solution: Seven factors based on 22 ESIS Items

Factors			Factor Loadings				
Items	1	2	3	4	5	6	7
Identity							
SI1	.21*	.56*	.09*	.13*	.05	.00	-.01
SI2	.70*	.22*	-.02	.06	.07*	.02	.04
SI3	.73*	.05	.13*	.03	-.03	.08*	.04
Private							
SPr1	.19*	.57*	.19*	.04	.00	.07*	.03
SPr2	.01	.81*	.05	.06*	-.01	.03	.09*
SPr3	.08*	.82*	.07*	.02	.01	.02	.03
Public							
SP1	.02	.30*	.64*	.00	.03	.07*	.02
SP2	.03	.01	.92*	.05*	.00	-.01	.07*
SP3	.06	.34*	.50*	.07	.12*	.03	-.05
Continuity							
PCo1	.03	-.00	.02	.03	.84*	.02	-.04
PCo2	.00	-.03	.10*	-.02	.68*	.02	.17*
PCo3	-.03	.14*	-.08	.40*	.39*	.01	.06
Uniqueness							
PU1	.08*	.04	.10*	.75*	.06*	.06*	-.04
PU2	.24*	-.02	.03	.72*	.02	-.02	.03
PU3	.07	.09	.03	.58*	.02	.04	.21*
Commitment							
EC1	.04	-.03	.06	.05	.03	.02	.72*
EC2	-.05	.13*	.06	.20*	-.01	.20*	.51*
EC3	.11*	.03	-.04	-.02	.14*	-.04	.66*
Exploration							
EE1	.15*	-.10	-.00	.13	.00	.55*	.01
EE2	.07	.06	-.02	.01	.07*	.82*	-.06
EE3	-.03	.03	.03	.05	.00	.72*	.08
EE4	.02	.02	.13*	-.04	-.03	.56*	.07

				Factor Correlations			
	F1	F2	F3	F4	F5	F6	F7
1	1.00						
2	.64*	1.00					
3	.52*	.74*	1.00				
4	.56*	.63*	.45*	1.00			
5	.29*	.31*	.31*	.41*	1.00		
6	.37*	.43*	.45*	.54*	.19*	1.00	
7	.28*	.40*	.37*	.53*	.40*	.39*	1.00

Note. ESEM = Exploratory structural equation modeling; ESIS = Exercise and Sport Identity Scale. The ESEM model was an exploratory factor analysis with 7 ESIS Factor. All parameter estimates are completely standardized.

4.3.3   Confirmatory factor analysis

4.3.3.1   Sample and normality

The mean age of the participants was 22.78 ± 6.65 years. On average, those who participated in moderate physical activity exercised for $1.08 \pm .99$ hours and those who participated in vigorous physical activities exercised for 1.27 ± 1.04 hours per week. All the items were univariate normally distributed (skewness = **-** 0.79 to **-** 0.17, kurtosis = **-** 0.84 to 1.04; Tabachnick & Fidell, 2013). However, the normalized estimate was 17.81, indicating that the data was not multivariate normally distributed (Bentler & Wu, 2002).

Given the data was not multivariate normally distributed, CFA was performed on the ESIS. The results showed adequate fit to the 7-factor model, χ^2 (188) = 536.87, CFI = .940, TLI = .927, SRMR = .046, RMSEA = .068, 90% CI [0.061, 0.075]. The findings of the analysis also showed no Heywood cases (e.g., negative factor variance estimate and standardized factor correlations greater than 1.0), thereby indicating the admissibility of the CFA solution for the ESIS (Brown, 2006).

Initial results of the IMI showed poor fit. χ^2 (614) = 2745.05, CFI = .737, TLI = .714, SRMR = .17, SRMR = .140, RMSEA = .093, 90% CI [0.090, 0.097]. Factor loadings of the items were examined and those with low factor loadings of < .60 and had cross loading of > .40 were deleted. The effort and pressure factors loaded under one factor. Effort and pressure factors were deleted from the IMI scale as they could not be distinct from each other. All other factors loaded into individual factors. From the four factors (interest, perceived competence, perceived choice and relatedness), the original 27 items, 11 items were deleted and 16 items remained. The remaining 16 items underwent CFA and the fit results obtained showed good fit (Table 4.5). The 16-item IMI were retained to evaluate for association with ESIS.

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Table 4.5

Fit indices for factor model of the ESIS and IMI

Scale	χ^2	df	CFI	TLI	RMSEA	SRMR
ESIS	536.87*	188	.940	.927	.068	.046
IMI	328.54*	98	.932	.917	.077	.089

4.3.3.2 Reliability and validity

Tables 4.6 and 4.7 present the results of CFA factor loading, CR, AVE, and latent factor correlation matrix with 95% CI of the ESIS. All seven factors had CR values greater than .70 (CR = .80 to .96), and all factors had AVE values greater than .50 (AVE = .55 to .88). All item factor loadings were greater than .50 (λ = .65 to .96), and all except 3 factor loadings were greater than .70, indicating adequate convergent validity for each item (Table 4.7).

Discriminant validity of the scale was also supported as the latent factor correlation coefficients were between .42 to .93 with none of its 95% CI correlation coefficients were 1.00. However, when the more conservative method (i.e., AVE > squared factor correlation) was used, the lack of discriminant validity were identified in one pair of factors. AVE values of Uniqueness (.77) and Commitment (.58) was smaller than their shared variance (.79).

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Table 4.6

Factor loadings and squared factor loadings for the ESIS

Item coding	Factor loadings	Squared Factor Loadings
Identity		
Identity 1	.90	.81
Identity 2	.88	.78
Identity 3	.83	.70
Private		
Private 1	.93	.86
Private 2	.93	.86
Private 3	.96	.92
Public		
Public 1	.96	.91
Public 2	.94	.88
Public 3	.90	.81
Continuity		
Continuity1	.76	.58
Continuity2	.79	.62
Continuity3	.71	.50
Uniqueness		
Unique1	.89	.80
Unique2	.89	.78
Unique3	.85	.72
Commitment		
Commitment 1	.73	.53
Commitment 2	.87	.76
Commitment 3	.66	.44
Exploration		
Exploration 1	.65	.42
Exploration 2	.85	.72
Exploration 3	.80	.64
Exploration 4	.65	.42

Table 4.7

Reliability and validity for the ESIS

	CR	AVE	1. [95%CI]	2. [95%CI]	3. [95%CI]	4. [95%CI]	5 [95%CI]	6 [95%CI]	7. [95%CI]
1. Identity	.91	.76	--						
2. Private	.96	.88	.93* [.89, .97]	--					
3. Public	.95	.87	.83* [.78, .89]	.90* [.86, .93]	--				
4. Continuity	.80	.57	.56* [.43, .68]	.52* [.39, .64]	.53* [.41, .64]	--			
5. Uniqueness	.91	.77	.84* [.79, .89]	.79* [.72, 86]	.69* [.62, .77]	.65* [.52, .77]	--		
6. Commitment	.80	.58	.72* [.65, .79]	.75* [.69, .83]	.71* [.63, .78]	.66* [.53, .78]	.89* [.86, .93]	--	
7. Exploration	.83	.55	.60* [.52, .69]	. 59* [.50, .69]	.60* [.51, .68]	.42* [.27, .56]	.67* [.59, .75]	.77* [.70, .84]	--

Note. CR = Composite Reliability; AVE = Average Variance Extracted; CI = Confidence Interval; the latent factor correlations are presented below the diagonal. Underscored values are those factors lack of discriminant validity when a more conservative criteria is used (AVE > squared factor correlation).
*p < .05.

The IMI was found to be reliable. All four factors of Cronbach's alpha (α) and composite reliability (CR) values higher than .70 (α = .73 to .95; CR = .76 to .91). The average variance extracted (AVE) of three of the factors were higher than .50. The AVE value for factor, perceived choice is .45 (AVE = .45 to .73). Table 4.8 shows the summary of the α, CR and AVE values of the IMI factors.

Table 4.8

Cronbach's alpha, composite reliability and average variance extracted values of IMI factors

Factor	α	CR	AVE
IMI (16 items)	.90		
Interest (4 items)	.95	.90	.71
Competency (4 items)	.95	.91	.73
Choice (4 items)	.73	.76	.45
Relatedness (4 items)	.84	.80	.51

4.3.4   Second order confirmatory factor analysis of Exercise and Sport Identity Scale

4.3.4.1   Global model fit

When second order CFA was performed on the 22 ESIS items to test the overall model fit to the model, the results indicated good model fit to the data, χ^2 (199) = 596.40, $p < .01$, CFI = .932, TLI = .921, SRMR = .050, RMSEA = .070, 90% CI [0.064, 0.077]. Figure 4.1 shows the measurement model. The standardized estimates are all positive, indicating a positive relationship between variables. All the estimates are significant at .01 level, indicating all the path coefficients significantly different from 0.

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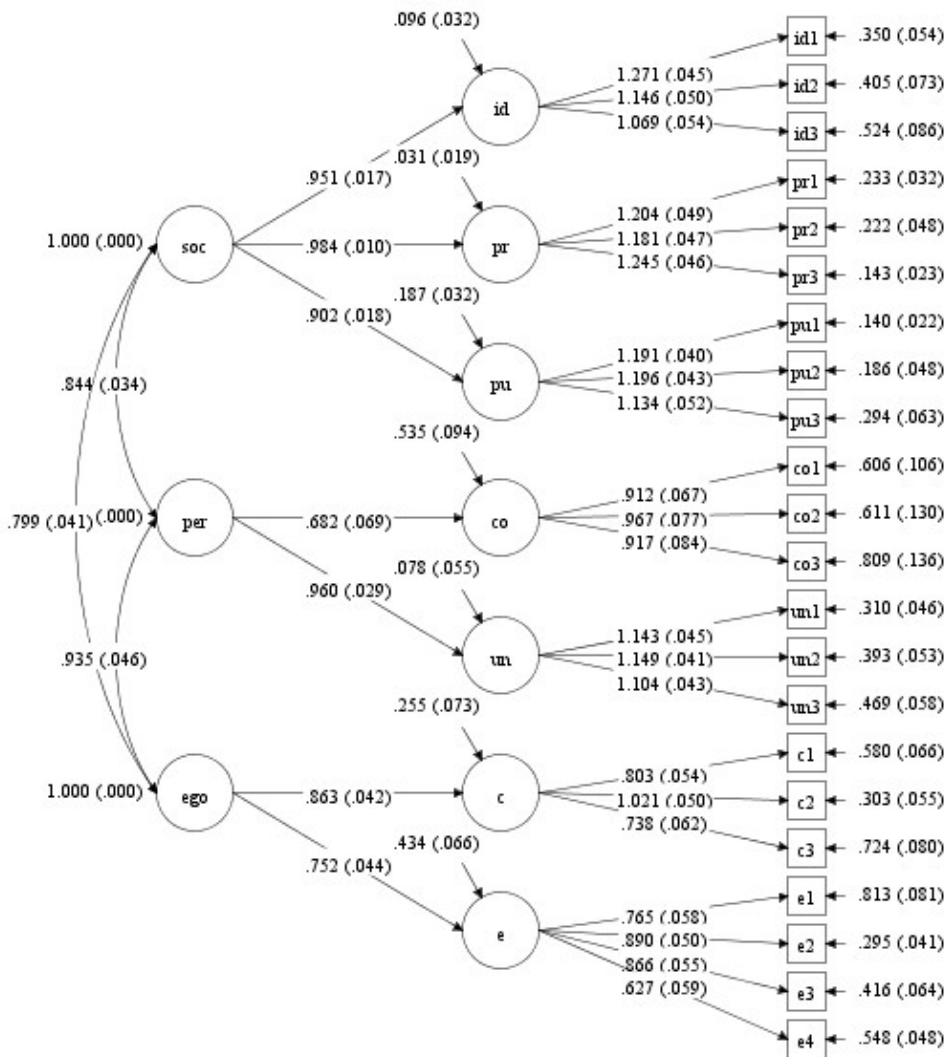
Figure 4.1. Measurement model of ESIS showing the first and second order factors. soc = Social Identity; per = Personal Identity; ego = Ego identity; id = Importance to identity; pr = Private self-esteem; pu = Public self-esteem; co = Continuity; un = Uniqueness; c = Commitment; e = Exploration.

4.3.5 Association between exercise and sport identity, intrinsic motivation and physical activity

The mean scores from the items of the ESIS and IMI were calculated. The means of higher order factors of ESIS (social identity, personal identity and ego identity) and the components of the IMI (interest, perceived competency, perceived

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choice and perceived relatedness) were calculated (Table 4.9). Physical activity

intensity is computed by allocating 0 = no physical activity; 1 = participate in moderate-

intensity physical activity only; 2 = participate in vigorous-intensity physical activity

only; 3 = participate in moderate- and vigorous-intensity physical activity. Physical

activity duration is the number of hours of physical activity in a week. The means are

shown in Table 4.9.

Table 4.9

Descriptive statistics of variables (ESIS, IMI, GPAQ)

Variable	Mean	SD
Exercise Identity	3.44	.89
Social Identity	3.43	1.15
Personal Identity	3.28	.99
Ego Identity	3.59	.79
Intrinsic Motivation	4.98	1.01
Interest	5.22	1.37
Perceived Competency	4.15	1.42
Perceived Choice	5.94	1.17
Perceived Relatedness	4.60	1.49
Physical activity intensity	3.44	.95
Physical activity duration	6.38	4.72

A simple linear regression was used to examine if the factors of intrinsic

motivation significantly predicted exercise and sport identity. The results of the

regression analysis indicated that the four predictors accounted for 60.2 % of the

variance of exercise and sport identity (R^2 = .60, F (4, 397) = 149.84, $p < .01$). It was

found that interest significantly predicted exercise and sport identity (β = .32, $p < .01$),

as did perceived competence (β = .32, $p < .01$) and perceived relatedness (β = .27, p

< .01). However, perceived choice did not significantly predict exercise and sport

identity. A linear regression was also used to test if the factors of exercise and sport

identity significantly predict intrinsic motivation. It was found that the three predictors accounted for 54.8 % of the variance ($R^2 = .55$, F (3, 398) = 160.22, $p < .01$). It was found that social identity significantly predicted intrinsic motivation ($\beta = .45$, $p < .01$), as did personal identity ($\beta = .14$, $p < .05$) and ego identity ($\beta = .23$, $p < .01$).

Linear regression was further used to test if exercise and sport identity significantly predicted physical activity duration and physical activity intensity. The results showed that the three predictors accounted for 20.8 % of the variance ($R^2 = .20$, F (3, 398) = 34.94, $p < .01$). It was found that social identity significantly predicted physical activity duration ($\beta = .26$, $p < .01$), as did personal identity ($\beta = .20$, $p < .01$). However, ego identity did not significantly predict physical activity duration. When linear regression was performed on physical activity intensity, the three predictors accounted for 25.5 % of the variance ($R^2 = .26$, F (3, 398) = 31.08, $p < .01$). It was found that social identity significantly predicted physical activity intensity ($\beta = .29$, $p < .01$), as did ego identity ($\beta = .16$, $p < .05$). However, personal identity did not significantly predict physical activity intensity.

Linear regression was also used to test if intrinsic motivation significantly predicted physical activity duration and physical activity intensity. The results showed that the four predictors accounted for 18.5 % of the variance ($R^2 = .19$, F (4, 397) = 23.71, $p < .01$). It was found that interest significantly predicted physical activity duration ($\beta = .18$, $p < .01$), as did perceived competency ($\beta = .23$, $p < .01$). However, perceived choice and perceived relatedness did not significantly predict physical activity duration. When linear regression was performed on physical activity intensity, the four predictors explained 24.9 % of the variance ($R^2 = .25$, F (3, 397) = 32.74, $p < .01$). It was found that interest significantly predicted physical activity intensity ($\beta = .31$, $p < .01$), as did perceived competence ($\beta = .24$, $p < .01$). However, perceived choice and

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perceived relatedness did not significantly predict physical activity intensity. Tables 4.10 and 4.11 show the results for the regression analysis for the models consisting of exercise and sport identity, intrinsic motivation and physical activity.

Mediation analysis was performed to test the indirect effect of intrinsic motivation on exercise and sport identity and physical activity duration. The indirect effect of intrinsic motivation on exercise and sport identity and physical activity duration was significant ($\beta = .14$, $p < .01$, 95 % CI = .058 to .23). Figure 4.2 shows the path diagram and the standardized estimates of the mediation analysis.
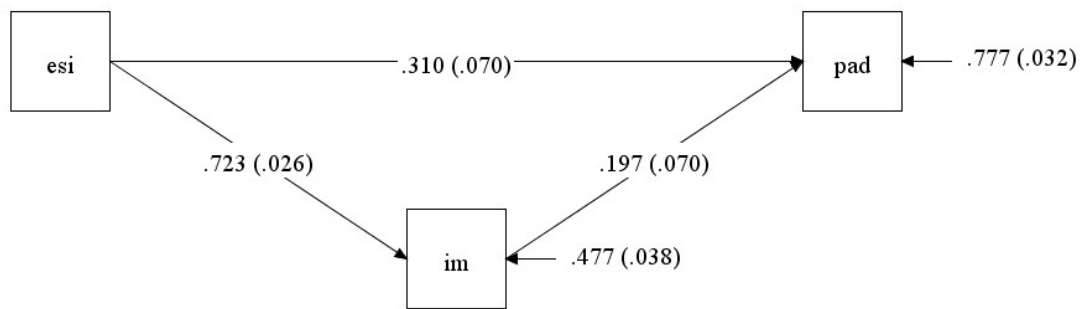
Figure 4.2. Path diagram of mediation analysis. esi = exercise and sport identity; im = intrinsic motivation; pad = physical activity duration per week.

Table 4.10

Regression analysis results for IMI and its factors

IMI and its factors	ESIS			PA$_d$			PA$_i$		
	B	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
IMI	.63	.03	.72**	1.95	.21	.42**	.41	.04	.44**
Interest	.21	.03	.32**	.62	.24	.18**	.22	.05	.31**
Perceived competence	.20	.03	.32**	.77	.21	.23**	.15	.04	.24**
Perceived choice	-.02	.03	-.02	.14	.19	.04	.01	.04	.01
Perceived relatedness	.16	.02	.27**	.25	.18	.08	-.00	.04	-.00

Note. IMI = Intrinsic Motivation Inventory; ESIS = Exercise and Sport Identity Scale; PA$_d$ = physical activity duration; PA$_i$ = physical activity intensity.
*p < .05. **p < .01.*

Table 4.11

Regression analysis results for ESIS and its factors

ESIS and its factors	IMI			PA_d			PA_i		
	B	$SE\ B$	β	B	$SE\ B$	β	B	$SE\ B$	β
ESIS	.82	.04	.72**	2.40	.24	.45**	.54	.05	.51**
Social identity	.40	.05	.45**	1.05	.28	.26**	.24	.05	.29**
Personal identity	.15	.06	.14*	.97	.34	.20**	.11	.07	.11
Ego identity	.29	.06	.23**	.24	.39	.04	.19	.08	.16*

Note. ESIS = Exercise and Sport Identity Scale; IMI = Intrinsic Motivation Inventory; PA_d = physical activity duration; PA_i = physical activity intensity.
*p < .05. **p < .01.*

4.4   Discussion

In the literature review, it has been established that the three psychological needs of autonomy, competency and relatedness are essential to a person's well-being, growth and development of a unified sense of self-a coherent identity (Deci & Ryan, 2000; Ryan & Deci, 2000; Ryan & Deci, 2002). The three psychological needs were measured using IMI (Ryan & Deci, 2000). The ESIS was developed in Study 1 to measure the identification with exercise and sport. It was found to support the factorial structure and psychometric properties of the proposed model. Study 2 further investigated the psychometric properties and the relationship between the ESIS and the IMI. In addition, this study addressed the limitations of Study 1 by using a larger and heterogeneous sample. The discussion elaborates on the four hypotheses in Study 2: (1) The global model fit of the 22-item, seven-factor ESIS fits the proposed model replicating the results from Study 1 and has sufficient validity and reliability; (2) A higher order factor exists and the global model fit of the higher order factors fits the proposed model; (3) A six-factor IMI has sufficient global model fit and internal reliability for evaluation of intrinsic motivation in physical activity and sport; (4) There is significant association between exercise and sport identity, intrinsic motivation and physical activity.

4.4.1   Model fit of Exercise and Sport Identity Scale

The results showed good model fit. There were some cross loadings observed. However, the factor loadings clearly showed a dominant factor in the items. In addition, it was important to retain some of the items that cross loaded because they represent the theoretical construct and content validity of the survey. One of the items was SI1-importance to identity (I am a proud member of an exercise/ sport community). It cross loaded on private self-esteem. However, it was important to retain this item because it represents the theoretical construct of individual self-esteem. Another item was PCo3-

continuity (I have participated in similar intensity in exercise/ sport in the past, now and in the future despite of (challenges at) different phases of life). It cross loaded on uniqueness. The constructs were operationally distinct and it was retained because of the content validity of the item. This also suggests that focus should be given to the wording of the items in future research to differentiate them more clearly. The cross loading in Study 2 was also unlike that in Study 1, suggesting that the likely reason for the cross loading in Study 1 was due to the small sample size. In addition, further validation of the ESIS verified that the structure of the ESIS fits the model proposed and the internal model fit. The ESEM confirmed the seven-factor model of the ESIS with Study 1. The global model fit was thus verified. The CFA further showed that the ESIS had sufficient global model fit, supporting the seven-factor ESIS model.

4.4.2   Validity and reliability of Exercise and Sport Identity Scale

The results showed that ESIS had acceptable internal reliability, convergent validity and discriminant validity with mixed findings for discriminant validity found. While the scale showed that discriminant validity was strong when the confidence interval around correlations between latent factors did not include 1.00 (Anderson & Gerbing, 1988), the more conservative approach where AVE is greater than the shared variance (Fornell & Larcher, 1981) found one pair of factors did not show discriminant validity. The two factors Uniqueness and Commitment are theoretically distinct from each other. The issue with the discriminant validity could be due to other factors. One reason could be an inflation of the latent factor correlations leading to higher shared variance. It has been reported that CFA tends to show such inflation (Asparouhov & Muthén, 2009; Marsh et al., 2010). This being a limitation, suggests that further work on discriminant validity can be done on the ESIS.

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4.4.3   Higher order factors in Exercise and Sport Identity Scale

The ESIS was also examined for alternative factor structure and three higher order factors were found to fit the theoretical model of the ESIS. The standardized estimates also showed significant relationship in line with the theoretical model. While all these showed that the ESIS fits the theoretical model and possesses the requisite validity and reliability, the scale should be subjected to further research to determine any measurement invariance across groups of participants. In a scale validation study, while it is critical to recruit a heterogeneous sample such as different genders, exercise profiles or culture of participants to maximize data variation, participants with different group memberships within a heterogeneous sample may interpret scale items differently (Clark & Watson, 1995). As such, multi-group invariance tests (i.e., addressing the extent to which instrument items convey the same meaning across different participant groups such as male and female participants) should be conducted to provide more evidence for the psychometric properties of the scale (Byrne, 2006).

4.4.4   Factor model and internal reliability of Intrinsic Motivation Inventory

CFA performed on the IMI showed that the items fitted a four-factor IMI instead of a six-factor IMI. The reason was because the effort subscale reported low factor loadings and cross loaded with pressure subscale. In addition, effort and pressure subscale were not particularly relevant to the overall study because the focus was on social factors and the three basic psychological needs in SDT. The four-factor IMI corresponds to literature on IMI where interest, perceived competence and perceived choice subscales are commonly considered measures and positive predictors of intrinsic motivation (Monteiro et al., 2015). Various studies used a combination of these subscales and reported acceptable internal reliability. Perceived relatedness subscale is a relatively new subscale found to be a valid and reliable measure of participant

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connectedness to an activity (Kooiman et al., 2016). The result of the four-factor IMI, especially on perceived relatedness contributed to the few studies that used perceived relatedness as one of the measures of IMI (Kooiman et al., 2016).

Therefore, four subscales (interest, perceived competence, perceived choice and perceived relatedness) were retained in the revised IMI was to examine the association with ESIS to see if exercise identity and self-determination has association and can be used for prediction for physical activity behaviour (Strachan et al., 2012; Wilson et al., 2006). The factors also showed adequate reliability. Although perceived choice factor did not show adequate AVE value, the Cronbach's alpha and CR showed sufficient internal reliability.

4.4.5 Association between Exercise and Sport Identity Scale, Intrinsic Motivation Inventory and physical activity level

The regression analysis showed that identity and self-determination have significant association. That means, a stronger exercise and sport identity is associated with stronger intrinsic motivation. This is also true for the converse. This result supports the premise of the thesis that identities vary correspondingly with the basic personal growth tendencies that are influenced by the basic psychological needs for autonomy, competence, and relatedness (Ryan & Deci, 2003). Social identity has been found to be the strongest influence on intrinsic motivation. Briones (1997) and Kurtines (1999) found that identity formation takes place between individuals and their social environment. The relationship between social identity and intrinsic motivation emphasizes the close relationship between one's environment and his motivation identification with physical activity, suggesting that belonging to an exercise or sport community can impact on the motivation to participate in physical activity. This has implication on what intervention programmes should focus on. In this study, perceived

choice did not have a significant influence on ESIS. The reasons are not known and this provides opportunity to further study this phenomenon.

The duration of participation in physical activity in a week and intensity of the physical activity is significantly associated with intrinsic motivation. Perceived competence was a significant influence on the amount of time spent on physical activity and the intensity of the physical activity. This supports the review by Teixeira et al. (2012) that satisfaction of the need for competence and stronger motivation is positively associated with exercise participation. It also suggests perceived competence has direct link to physical activity behaviour (Kipp & Weiss, 2013). However, perceived choice and perceived relatedness did not have any significant association with the physical activity levels. From goal content theory, the type of motive behind participation in physical activity can influence the type of regulation and perceived psychological needs. Because IMI was used for Study 2 to find the relationship of intrinsic motivation to exercise and sport identity, other spectrum of behaviour regulation such as external regulation was not examined. Therefore, further study can be done to examine other behaviour regulations and their relationship to the basic psychological needs, exercise and sport identity and exercise behaviour to explain this observation.

The duration of physical activity participation and intensity of the physical activity are significantly associated with exercise and sport identity. Social identity and personal identity are significant predictors of the amount of physical activity. This was in line with the model, personality and social structure perspective (PSSP), where the exercise and sport identity model was built on (Côté & Levine, 2002). The model describes the interaction between social, personal and ego identities in developing a unit identity. Therefore, the results support the model by recognizing that the interaction of social and personal identities help to shape the physical activity behaviour. However,

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ego identity did not have any significant association with level of physical activity. This could be because ego development is a long and ongoing process that is not optimally developed till in late adulthood (Erikson, 1968).

The mediation analysis also evaluated and validated the model where intrinsic motivation is a mediator between exercise and sport identity and physical activity behaviour. This meant that when an individual's identification for exercise and sport is raised, his motivation for exercise and sport is enhanced, leading to increased physical activity. Putting together with the findings from the regression analysis, this suggests that intervention targeting to enhance social and personal identity can potentially lead to increase in physical activity.

Overall, the regression analysis supported the hypothesis that there is significant association between exercise and sport identity, intrinsic motivation and physical activity. Some anomalies were found and further examination should be done to find out the reasons for the alternative results. In addition, in order to understand the relationship between exercise and sport identity, intrinsic motivation and physical activity better, further mediation analyses can be used to explore the underlying mechanism which exercise and sport identity influences motivation, or vice versa through a mediator variable (Cohen et al., 2003).

4.4.6 Future research

In conclusion, ESIS has sufficient fit to the model structure and has shown significant validity and reliability. Second order factors social identity, personal identity and ego identity were also found to fit the model. ESIS therefore has the potential to be used further to study exercise and sport-related identity. IMI fitted a four-factor model instead of a six factor model as opposed to the literature. However, it is sufficient to measure intrinsic motivation for the purpose of exercise and sport. Lastly, significant

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associations were found between exercise and sport identity, intrinsic motivation and physical activity. This supports the literature review and premise that the basic psychological needs are necessary to the growth and development of a coherent exercise and sport identity (Deci & Ryan, 2000; Ryan & Deci, 2000; Ryan & Deci, 2002). Some gaps and limitations exist in the scope of this study. Further validation of the ESIS can look at measurement invariance to evaluate the responses to ESIS from different genders and cultures. Further research can also examine the association to other scales related to SDT to strengthen the validity of exercise and sport identity and association with other forms of motivation. Mediation analysis was done to evaluate the relationship between exercise and sport identity, self-determination and physical activity. However, a limitation of this model is that it has not taken into consideration the type of relationship between the social environment influence, identity and intrinsic motivation. Findings from a study by Garry, Broderick and Lahiffe (2008) suggested that social connection influenced changes in social identity and mediated by motivation. This suggests two implications. First, the relationship between identity and motivation could be a two-way one where changes in one moderate the other. This has not been examined in this study and presents a gap to be researched further. Secondly, the social, cultural environment can influence one's motivation or identity, before moderating the other construct and in turn influence a change in behaviour. This meant that the model in Figure 2.7 may not be a linear one and could be revised to reflect the possibility of the environmental influence on motivation and identity. This is also another area to be examined further.

Chapter 5

Study 3: Influence of environment on exercise and sport identity, intrinsic motivation and physical activity behaviour

5.1 Introduction

5.1.1 Relationship between environment, identity, motivation and physical activity behaviour

Study 2 provided evidence of the psychometric properties of the Exercise and Sport Identity Scale (ESIS) and validated the exercise and sport identity model. The ESIS measures the psychosocial factors of exercise and sport identity, namely social identity, personal identity and ego identity. A close relationship was found between exercise and sport identity, intrinsic motivation and physical activity. One of the factors, social identity consistently stood out as the top two strongest predictor of intrinsic motivation and physical activity. This relationship is not a one-way one. Intrinsic motivation was also found to be significantly associated with exercise and sport identity. It was found that perceived relatedness had the strongest association with ESIS. This interrelation between identity, motivation and behaviour was congruent with previous research. Identity formation plays an important role in motivation because it helps one to be aware of the environmental influences that may encourage or discourage further participation in exercise or sport (Young, 2018).

To develop the identity and raise motivation, social support in the social process helps to shape the identity and behaviour (Ryan & Deci, 2007; Vallerand & Losier, 1999). This suggests that strong relationship within the exercise community members helps to build a stronger exercise and sport identity. The social environment thus provides the social support to shape the exercise and sport identity and influence a healthy exercise and sport behaviour. However, urbanization and our technological environment has greatly changed our physical activity behaviour. The prevalence of

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inactivity is anticipated to increase to as high as 70 % due to changes in transportation, technology and urbanization (WHO, 2018). Specifically, digital technology has been listed as one of the causes of inactivity (Owen et al., 2010). On one hand, digital technology has brought about a social revolution, prompted by increasing use of mobile communication and social media, giving rise to positive benefits such as expansion of our social network (Rainie & Wellman, 2012). On the other hand, digital and physical space are now integrated and social connection takes place over virtual space, replacing the need to meet face-to-face (Chayko, 2014). Despite this, information and communications technology (ICT) such as internet and mobile phones still offer possibilities of reducing the prevalence of physical inactivity (Nigg, 2003). The use of ICT has many advantages. Some of them provide flexible time schedules (Nigg, 2003); ICT also holds promise in reaching out to a large group of people and not limited by locations compared to small group sizes in face-to-face interventions (Marcus, Nigg, Riebe, & Forsyth, 2000); ICT has the potential to satisfy participants' preferences as it is individualized, unlike group interventions that are one-size fits all (Nigg, 2003); because of its individualized nature, it delivers individualized feedback and social support for exercise participants (Lau et al., 2011).

ICT is therefore a promising tool for enhancing physical activity and health-related behaviour. A review has shown that most of the ICT interventions have superior positive results in influencing physical activity (Norman et al., 2007). Currently, there are about 2.9 million Facebook users in Singapore (Internet World Stats, 2014) with 59% of them aged from 18-34 years old and approximately 70% of them use Facebook daily (Socialbakers, 2011). Facebook potentially provides a feasible platform for researchers to build intervention programmes to enhance people's physical activity behaviours in this period of time. Wang and colleagues (2015) found that the use of

Facebook in physical activity intervention enhanced enjoyment and raised the sense of competency in the activity. This supports the idea that a relationship exists between digital social environment and physical activity behaviour.

5.1.2   Theoretical framework

In recent years, there was increasing interest in two concepts that influence physical activity: Exercise identity and exercise motivation (Ntoumanis et al., 2018). One of the definitions of exercise identity refers it as the extent to which one holds the role of an exerciser as core aspect of one's identity (Anderson & Cychosz, 1994). What is not known is if there are other factors that define exercise identity and what are these factors. Studies 1 and 2 provided the historical and theoretical background to identity. Identity was a concept developed by Erikson (1968). It is part of a multidimensional theory that encompasses psychosocial factors such as social, personal and ego domains. Collectively, the three explains how an individual develop their identity in stages, through interaction between the psychological self and environment (Berger & Luckmann, 1966; Côté & Levine, 2002). Erikson's identity theory can potentially be adapted to exercise and sport, to provide a framework for exercise and sport identity. Studies 1 and 2 established the model and its psychometric properties. Figure 3.3 shows the exercise and sport identity model. In the application of exercise identity, it has also been shown that individuals with a stronger identity towards exercise have greater fitness and are more physically active (Reifsteck, Gill, & Labban, 2016; Zafeiridou, Sarafi, & Vlachopoulos, 2014). Exercise identity has also been shown to be associated with exercise motivation.

Exercise motivation type can vary along a continuum of self-determination. One end of the continuum consist of intrinsic motivation, integrated regulation and identified regulation. These are higher in self-determination. At the other end are non-regulation,

external regulation and introjected regulation. These are lower in self-determination

(Ryan & Deci, 2002). Figure 2.14 shows the continuum of motivation types. High self-

determination such as intrinsic motivation, identified and integrated regulation have

been found to be associated with adaptive behaviour in health (Ng et al., 2012).
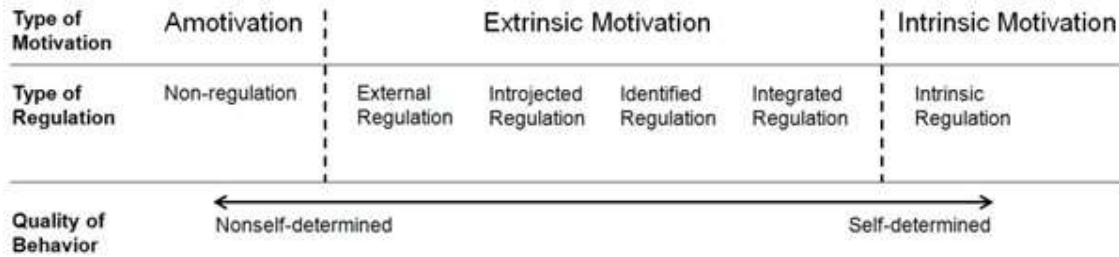
Figure 2.14. The self-determination continuum with types of motivation and regulation. Reprinted from *Handbook of Self-Determination Research.* (p. 16), by E. L. Deci and R. M. Ryan, 2002, University of Rochester Press. Copyright 2002 by E. L. Deci and R. M. Ryan.

The works of Ryan and Deci (2002), and Wilson et al. (2006) showed that a

relationship exists between fulfilment of basic needs, intrinsic motivation and identity.

SDT postulated that the three basic psychological needs of the sense of autonomy,

competency and relatedness are innate and essential for well-being, psychological

growth and the development of a unified sense of self (Deci & Ryan, 2000; Ryan &

Deci, 2000). Intrinsic Motivation Inventory (IMI) measures these three basic needs and

intrinsic motivation. It is apt that the IMI is used to establish the relationship between

exercise identity, motivation and physical activity. In a review on motivation measures

in sports, (IMI) ranks first among six psychometrically strong motivation scales in terms

of bibliometric data (average weighted impact factors) (Clancy et al., 2017). Therefore

the IMI is a valid and reliable tool that can be used together with exercise identity.

The relationship between exercise identity and motivation is clear. Evidence

suggests that there is positive association between exercise identity and exercise

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motivation, and high exercise identity and exercise motivation predict higher level of physical activity (Reifsteck, Gill, & Labban, 2016; Zafeiridou, Sarafi, & Vlachopoulos, 2014). Research also shows that individuals with higher exercise identity tend to be more physically active (Reifsteck, Gill, & Labban, 2016; Zafeiridou, Sarafi, & Vlachopoulos, 2014). It was of significance to establish the relationship between identity, motivation and physical activity behaviour using the ESIS and IMI in Study 2. This study examines the efficacy of an online social environment to changes in identity, motivation, basic psychological needs and physical activity behaviour.

5.1.3 Purpose of study

An intervention study will further provide insight into the influence of a digital social environment such as Facebook on the psychosocial constructs such as exercise and sport identity, as well as intrinsic motivation. A further examination to see if these psychosocial constructs influence physical activity behaviour. Therefore, Study 3 aims to examine the following hypothesis:

Hypothesis 1: It was hypothesized that the physical activity intervention group with Facebook influence has a more significant change in exercise and sport identity, intrinsic motivation, basic psychological needs and physical activity levels over groups with only physical activity intervention, Facebook intervention and no intervention.

5.2 Method

5.2.1 Participants

In order to determine the sample size to attain the desired power, significance criterion (α) and effect size, a power analysis was performed using G*Power 3.1 (Faul et al., 2007). By specifying $\alpha = .05$, power $= .80$ and a medium effect size $= .25$, a sample size of 132 participants (33 participants in each of four groups) was required (Cohen, 1992). One hundred and fifty-six participants (male $= 78$, female $= 78$) were

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recruited from four social groups (39.72 ± 9.98 years) to account for any attrition. All participants were individuals who registered for classes at Nanyang Technological University. Group 1 (n = 38) was a control group consisting of participants in a class. They were not in any exercise programme and did not receive any intervention. Group 2 (n = 41) was a physical activity group consisting of participants who chose to enrol in a fitness exercise module on top of their classes in the course of their choice in Nanyang Technological University. They underwent physical activity intervention. Group 3 (n = 38) was a Facebook group who enrolled in a class in Nanyang Technological University. They maintained a Facebook group but did not receive any physical activity intervention. Group 4 (n = 39) was a physical activity-Facebook group who enrolled in a fitness exercise module on top of their classes in the course of their choice in Nanyang Technological University. They underwent physical activity and Facebook intervention. All three intervention groups and the control group were in the course of the experiment for 10 weeks.

The participants in the Facebook group and physical activity-Facebook group were instructed to maintain a social group and update their progress (post of progress, status, pictures or videos) and activity throughout the 10 weeks. The participants in the physical activity group and physical activity-Facebook group consisted of participants who signed up for the fitness module by choice and they had to complete tasks related to fitness.

Purposive sampling was used. Participants in classes from Nanyang Technological University were recruited because they were in natural group settings typical or an institution. This is a typical case sampling to illustrate similar cases in group formation in institutions. The goal of the sampling method was not to make generalization by random selection of participants as this will not happen in a natural

setting. The purpose was to select participants from natural social settings and examine the changes in exercise and sport identity and intrinsic motivation in these social setting, a phenomenon typical of any institution or organization (Patton, 1990). The sample was not representative of the entire population.

5.2.2   Measures

Exercise and Sport Identity Scale. The scale used in this study was the 22-item Exercise and Sport Identity Scale (ESIS) found in Study 1. There were three second order factors that were used for meaningful comparison. They were social identity personal identity and ego identity. These factors were operationally defined by seven first order factors: Importance to identity (3 items), private self-esteem (3 items), public self-esteem (3 items), continuity (3 items), uniqueness (3 items), commitment (3 items) and exploration (4 items). Figure 3.3 shows the model of the ESIS. The items were measured using a 5-point Likert scale, anchored with "strongly disagree" (1) and "strongly agree" (5).

Intrinsic Motivation Inventory. The Intrinsic Motivation Inventory (IMI; Ryan & Deci, 2000) was also used. The IMI consists of seven factors but four were used: Interest (4 items), perceived competency (4 items), perceived choice (4 items) and relatedness (4 items). The items were adapted to reflect physical activity and sport. IMI was measured on a 7-point Likert scale with (1) being not true at all and (7) being very true.

Global Physical Activity Questionnaire. The Global Physical Activity Questionnaire (GPAQ; WHO, 2012) was used to measure the amount physical activity and intensity of physical activity. GPAQ consisted of 4 sections (work, travelling, recreation and sedentary activities). Only the recreation activity section was used for the purpose of this study. Two components of physical activity were measured: Physical

activity duration (PA_d), which is the total number of hours of physical activity per week; and Physical activity intensity (PA_i) represented at four levels. (0) being no physical activity, (1) being moderate physical activity, (2) being vigorous physical activity and (3) being combination of moderate and vigorous physical activity.

5.2.3 Procedures

Survey was administered at the beginning of the module and after ten weeks from the first survey. Informed consent was obtained from all participants before conducting the first survey. The questionnaires consisted of the ESIS, IMI, GPAQ and a series of items asking participants' demographic information (see Appendix G). Participants were asked to answer the questions in the questionnaire honestly. They were informed that there was no right or wrong answer for the survey and were allowed to withdraw the study at any time without negative consequences such as penalty, prejudice, negative consequences, repercussion, or disadvantage. The participants took approximately 20 minutes to complete the survey.

A Facebook Page was created and moderated by the researcher for the participants in the Facebook group. Participants update their progress (post of progress, status, pictures or videos) and activity put up by the researcher throughout the 10 weeks. The researcher also commented on every post to acknowledge the effort and achievement of the participants. The communication in the Facebook intervention was premised on four domains (connection, comparison, identification and positive experience) developed to illustrate the constructs that social networking sites such as Facebook contribute to influence attitude, intention and behaviour (Moreno et al., 2013). The Facebook Page provided the social connection for participants to identify with physical activity and compare their physical activity behaviour with one another. The researcher made sure there was acknowledgement of effort and achievement of

each participant to create a positive experience on the Facebook Page. The participants in the physical activity group participated in the fitness exercise programme designed by the course lecturer. The outcome of the fitness exercise programme was for participants to learn about the different components of physical fitness, apply a variety of training methods and improve their personal fitness. The physical activity-Facebook group underwent both the interventions in Facebook and fitness exercise programme.

5.2.4 Data analyses

Before the analyses, the data was analyzed for missing data using SPSS 22.0. Skewness and kurtosis values of the items fell within the acceptable limit of ± 2.00 indicating the data was univariate normally distributed (Tabachnick & Fidell, 2013). Physical activity duration and physical activity intensity were excluded from univariate normality test because skewness and Kurtosis were not relevant to the data for physical activity duration and physical activity intensity as the groups were not random to begin with.

Demographic information and baseline measures of current physical activity level, exercise and sport identity and intrinsic motivation were measured before the start of the intervention. The same measures were taken at the end of 10 weeks and the main effect differences was computed through multivariate analysis of variance (MANOVA). Post hoc test, analysis of variance (ANOVA) and paired sample t-tests were conducted to determine if differences exist between groups and interventions.

5.3 Results

5.3.1 Main effects

The descriptive statistics associated with the ESIS, PA and IMI scores were shown in table 5.1. Assumption of normality was satisfied as the distributions showed skewness and kurtosis to be between ± 2.00. Cronbach's alpha showed that ESIS had

good internal reliability. All the factors had α > .80. IMI had good reliability with the

exception of the factor, perceived choice. Table 5.2 showed the correlations between the

variables tested. All the variables were significantly correlated at *p* < .01.

Table 5.1

Descriptive statistics of ESIS, IMI and PA levels

Measurement (before intervention)	*M*	*SD*	α	Min.	Max.	Skewness	Kurtosis
ESIS	3.40	.86	.95	1.18	5.00	-.33	-.36
SI	3.23	1.15	.97	1.00	5.00	-.47	-.6-
PI	3.31	.92	.82	1.00	5.00	-.29	-.10
EI	3.70	.80	.86	1.14	5.00	-.68	.55
IMI	5.43	.84	.91	3.25	7.00	-.48	-.28
In	5.60	1.34	.97	1.00	7.00	-1.09	.77
Co	4.15	1.46	.97	1.00	7.00	-.26	-.46
Ch	5.91	.84	.61	4.00	7.00	-.29	-.87
Re	6.08	.79	.81	4.00	7.00	-.54	-.50
PA$_i$	2.48	.93		0.00	3.00		
PA$_d$	6.40	7.57		0.00	59.00		

Measurement (after intervention)	M	SD	α	Min.	Ma.	Skewness	Kurtosis
ESIS	3.64	.81	.95	1.23	5.00	-.64	-.03
SI	3.55	1.14	.97	1.00	5.00	-.92	.06
PI	3.52	.83	.79	1.17	5.00	-.39	-.02
EI	3.85	.73	.85	1.14	5.00	-.75	.96
IMI	5.51	.75	.89	3.38	7.00	-.43	-.16
In	5.70	1.21	.97	1.00	7.00	-1.22	1.58
Co	4.28	1.36	.97	1.00	7.00	-.26	-.47
Ch	6.00	.76	.56	4.00	7.00	-.22	-1.00
Re	6.07	.76	.79	4.00	7.00	-.44	-.69
PA$_i$	2.55	.87		0.00	3.00		
PA$_d$	6.25	6.12		0.00	40.00		

Note. ESIS = exercise and sport identity; SI = social identity; PI = personal identity; EI = ego identity; IMI = intrinsic motivation; In = interest; Co = perceived competence; Ch = perceived choice; Re = perceived relatedness; PA$_i$ = physical activity intensity; PA$_d$ = duration (hour) of physical activity in a week.

Table 5.2

Correlations between variable tested

Before intervention	ESIS	SI	PI	EI	IMI	In	Co	Ch	Re
ESIS	-								
SI	.91**	-							
PI	.84**	.60**	-						
EI	.86**	.64**	.75**	-					
IMI	.70**	.61**	.62**	.63**	-				
In	.67**	.59**	.57**	.62**	.89**	-			
Co	.60**	.48**	.60**	.55**	.81**	.66**	-		
Ch	.34**	.30**	.27**	.33**	.65**	.48**	.27**	-	
Re	.37**	.38**	.29**	.28**	.58**	.39**	.21**	.42**	-

Post intervention	ESIS	SI	PI	EI	IMI	In	Co	Ch	Re
ESIS	-								
SI	.92**	-							
PI	.85**	.63**	-						
EI	.83**	.59**	.75**	-					
IMI	.69**	.61**	.62**	.58**	-				
In	.68**	.62**	.56**	.59**	.84**	-			
Co	.58**	.48**	.60**	.49**	.81**	.57**	-		
Ch	.30**	.28**	.24**	.26**	.62**	.41**	.29**	-	
Re	.29**	.27**	.23**	.23**	.56**	.32**	.24**	.26**	-

Note. ESIS = exercise and sport identity; SI = social identity; PI = personal identity; EI = ego identity; IMI = intrinsic motivation; In = interest; Co = perceived competence; Ch = perceived choice; Re = perceived relatedness; PA_i = physical activity intensity; PA_d = duration (hour) of physical activity in a week.

$**p < .01.$

MANOVA was used to determine if the differences were significant. In the main effects test, there was significant difference in ESIS scores between interventions. Wilks' Lambda = .78, F (1, 152) = 41.77, $p < .01$, partial η^2 = .22. There was also interaction effects between groups and time. Wilks' Lambda = .72, F (3, 152) = 20.07, $p < .01$, partial η^2 = .28. Between groups effects for ESIS scores was significant (F (3, 152) = 19.33, $p < .01$, partial η^2 = .30). Significant difference was also found in IMI scores between interventions. Wilks' Lambda = .97, F (1, 152) = 5.49, $p < .05$, partial η^2 = .035. There was also interaction effects between groups and time. Wilks' Lambda = .95, F (3, 152) = 2.86, $p < .05$, partial η^2 = .053. Between groups effects for IMI scores was significant (F (3, 152) = 9.30, $p < .01$, partial η^2 = .16). Significant difference was found in PA_d scores between groups (F (3, 152) = 8.78, $p < .01$, partial η^2 = .15). There was interaction effects between groups and time in PA_i scores. Wilks' Lambda = .94, F (3, 152) = 3.48, $p < .05$, partial η^2 = .064. Significant difference was found in PA_i scores between groups (F (3, 152) = 12.00, $p < .01$, partial η^2 = .19).

5.3.2 Post hoc tests

Post hoc tests were conducted to determine where the significant differences were. ANOVA was used to determine if there was a difference in ESIS scores between groups before and after intervention. There was a significant difference in ESIS scores between the groups before intervention (F (3, 152) = 19.63, $p < .01$), and after intervention (F (3, 152) = 23.22, $p < .01$). Post hoc comparisons using Bonferroni Correction test to correct for Type I error indicated that control group had significantly lower ESIS scores (2.69 ± .86) than physical activity group (3.74 ± .67), Facebook group (3.85 ±.68) and physical activity-Facebook group (3.30 ± .74) before intervention. Physical activity-Facebook group also had significantly lower ESIS scores than physical activity group and Facebook group. After intervention, control group still

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had a significantly lower ESIS score (2.86 ± .94) than physical activity group (3.77 ± .64), Facebook group (3.89 ± .55) and physical activity-Facebook group (4.03 ± .51). There was no significant difference in ESIS scores between physical activity group, Facebook group and physical activity-Facebook group after intervention. Table 5.3 also shows the descriptive statistics of the three ESIS factors and the differences between groups.

Interaction effect showed that while exercise and sport identity was different for the four groups at baseline, the intervention in the physical activity-Facebook group had the greatest effect over time (Figure 5.1). Paired sample t-test showed no significant change in ESIS scores in physical activity group and Facebook group at $p < .05$ level. There was significant change in control group and physical activity-Facebook group ($p < .05$). Paired sample t-test was used to analyze any change in the three factors of ESIS. It was found that ego identity became significantly stronger in control group and physical activity-Facebook group. Physical activity-Facebook group also showed significantly stronger social identity and personal identity, in addition to ego identity ($p < .05$).
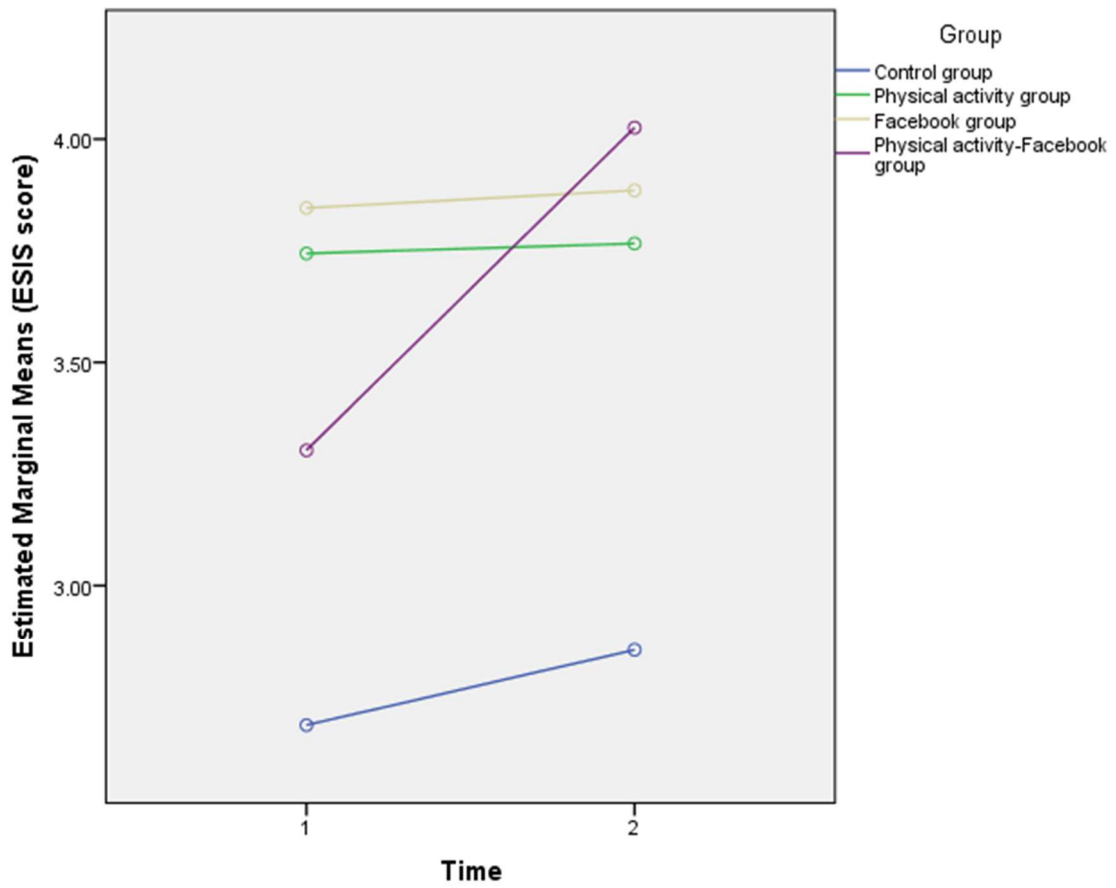
Figure 5.1. Interaction plot for exercise and sport identity. *ESIS = Exercise and Sport Identity Scale.*

Table 5.3

Descriptive statistics and differences in the ESIS factor scores between groups

Factor	Group	Pre-intervention				Post-intervention			
		M	*SD*	F (3,152)	*p*	*M*	*SD*	F (3,152)	*p*
Mean ESIS	1 (n = 38)	2.69[2,3,4]	.86			2.85[2,3,4]	.94		
	2 (n = 41)	3.74[1,4]	.67			3.77[1]	.64		
	3 (n = 38)	3.85[1,4]	.68			3.89[1]	.55		
	4 (n = 39)	3.30[1,2,3]	.74	19.63	.00	4.03[1]	.51	23.22	.00
Social Identity	1 (n = 38)	2.19[2,3,4]	1.23			2.34[2,3,4]	1.39		
	2 (n = 41)	3.71[1,4]	.73			3.75[1]	.74		
	3 (n = 38)	3.93[1,4]	.78			3.95[1]	.70		
	4 (n = 39)	3.05[1,2,3]	.96	26.45	.00	4.13[1]	.62	30.68	.00
Personal Identity	1 (n = 38)	2.89[2,3]	.84			3.03[2,3,4]	.93		
	2 (n = 41)	3.58[1]	.77			3.63[1]	.74		
	3 (n = 38)	3.50[1]	.99			3.68[1]	.75		
	4 (n = 39)	3.24	.96	4.70	.00	3.75[1]	.71	6.93	.00

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	1 (n = 38)	$3.15_{2,3,4}$	0.87			$3.36_{2,3,4}$	0.83	
Ego Identity	2 (n = 41)	3.92_1	0.7			3.91_1	0.64	
	3 (n = 38)	4.04_1	0.63			3.98_1	0.67	
	4 (n = 39)	3.68_1	0.73	11.18	.00	4.12_1	0.52	9.17	.00

Note. Means with different subscripts within rows are significantly different at the $p < .05$ based on Bonferroni Correction post hoc paired comparisons. Group 1 = Control group; Group 2 = Physical activity intervention group; Group 3 = Facebook intervention group; Group 4 = Physical activity-Facebook group.

ANOVA was also used to determine if there was a difference in IMI scores between groups before and after intervention. There was a significant difference in IMI scores between the groups before intervention ($F(3, 152) = 8.58$, $p < .01$), and after intervention ($F(3, 152) = 9.07$, $p < .01$). Post hoc comparisons using Bonferroni Correction test indicated that control group had significantly lower IMI scores ($4.88 \pm .96$) than physical activity group ($5.62 \pm .70$), Facebook ($5.69 \pm .67$) and physical activity-Facebook group ($5.53 \pm .80$) before intervention. After intervention, control group still had a significantly lower IMI score ($5.00 \pm .91$) than physical activity group ($5.68 \pm .55$), Facebook group ($5.62 \pm .69$) and physical activity-Facebook group ($5.73 \pm .62$). There was no significant difference in IMI scores between physical activity group, Facebook group and physical activity-Facebook group before and after intervention. Table 5.4 also shows the descriptive statistics of the four IMI factors and the differences between groups.

Interaction effect showed that while intrinsic motivation was different for the four groups at baseline, the intervention in the physical activity-Facebook group had the greatest effect over time (Figure 5.2). Paired sample t-test showed no significant change in IMI scores in physical activity group and Facebook group at $p < .05$ level. There was significant change in control group and physical activity-Facebook group ($p < .05$). Paired sample t-test was used to analyze any change in the three factors of IMI. It was found that perceived choice became significantly stronger in physical activity-Facebook group ($p < .05$).
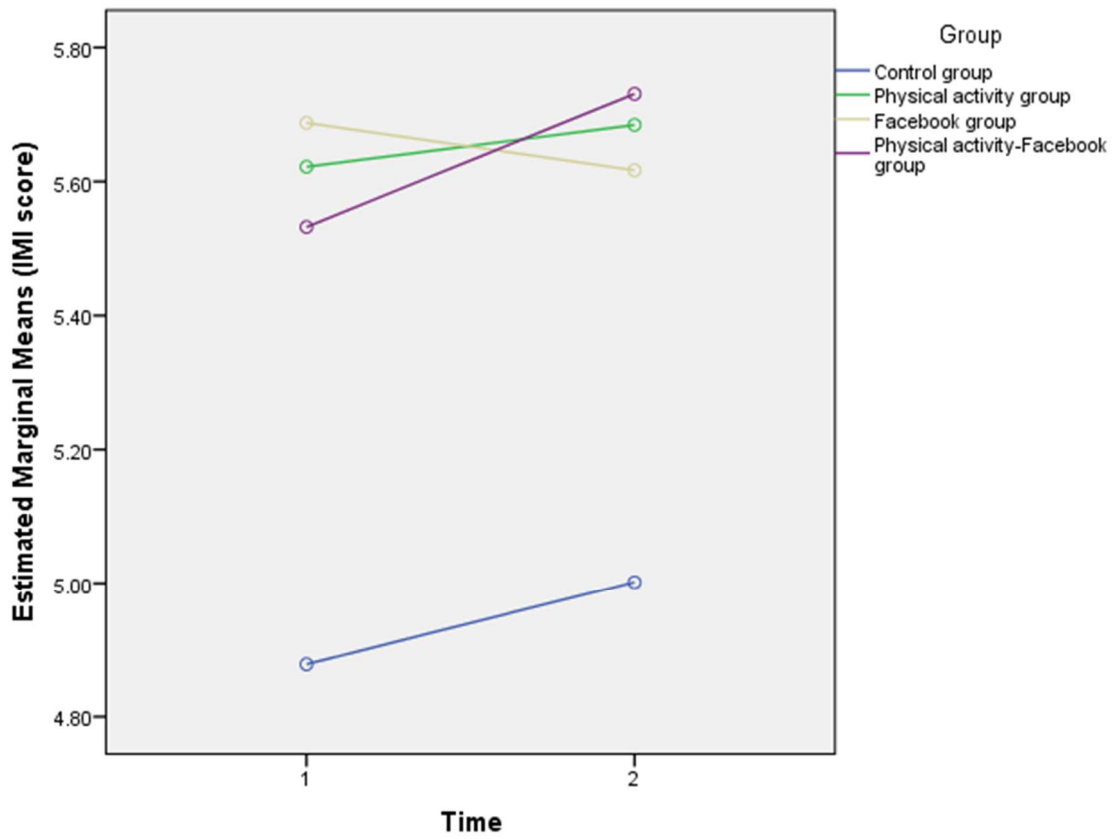
Figure 5.2. Interaction plot for intrinsic motivation. *IMI = Intrinsic Motivation Inventory.*

Table 5.4

Descriptive statistics and difference in the IMI factor scores between groups

		Pre-intervention				Post-intervention			
Factor	Group	*M*	*SD*	F (3,152)	*p*	*M*	*SD*	F (3,152)	*p*
Mean IMI	1 (n = 38)	$4.88_{2,3,4}$	.96			$5.00_{2,3,4}$	.91		
	2 (n = 42)	5.62_1	.70			5.68_1	.55		
	3 (n = 38)	5.69_1	.67			5.62_1	.69		
	4 (n = 39)	5.53_1	.80	8.58	.00	5.73_1	.62	9.07	.00
Interest	1 (n = 38)	$4.55_{2,3,4}$	1.59			$4.74_{2,3,4}$	1.54		
	2 (n = 41)	5.93_1	1.07			5.96_1	.86		
	3 (n = 38)	5.97_1	.96			5.90_1	1.00		
	4 (n = 39)	5.90_1	1.15	12.43	.00	6.16_1	.82	13.34	.00
Competency	1 (n = 38)	$3.46_{2,3,4}$	1.53			$3.65_{2,3}$	1.55		
	2 (n = 41)	4.52_1	1.28			4.55_1	1.16		
	3 (n = 38)	4.46_1	1.25			4.47_1	1.28		
	4 (n = 39)	4.15_1	1.57	4.52	.01	4.43	1.30	3.85	.01

		Mean	SD	F	p	Mean	SD	F	p
Choice	1 (n = 38)	5.64	.81			5.72_4	.75		
	2 (n = 41)	5.90	.82			5.99	.72		
	3 (n = 38)	6.10	.83			5.97	.85		
	4 (n = 39)	5.99	.86	2.07	.11	6.30_1	.64	3.94	.01
Relatedness	1 (n = 38)	5.86_3	.79			5.89_2	.71		
	2 (n = 41)	6.14	.86			6.23_1	.73		
	3 (n = 38)	6.21_1	.75			6.13	.79		
	4 (n = 39)	6.09	.72	1.51	.21	6.03	.80	1.46	.23

Note. Means with different subscripts within rows are significantly different at the $p < .05$ based on Bonferroni Correction post hoc paired comparisons. Group 1 = Control group; Group 2 = Physical activity intervention group; Group 3 = Facebook intervention group; Group 4 = Physical activity-Facebook group.

ANOVA was used to determine if there was a difference in PA_d and PA_i levels between groups before and after intervention. Table 5.5 shows the descriptive statistics and ANOVA results. Post hoc comparisons using Bonferroni Correction test indicated that control group had significantly lower physical activity duration than physical activity group only before intervention and significantly lower physical activity intensity than all other groups before and after intervention. Physical activity group exercise significantly longer than control group and physical activity-Facebook group but not Facebook group before intervention (10.44 ± 10.34). After intervention, physical activity group exercise more than control group only (8.85 ± 6.67). There was no significant difference in PA_i between physical activity group, Facebook group and physical activity-Facebook group before and after intervention.

Interaction effect showed that while PA_i was different for the four groups at baseline, the intervention in the physical activity-Facebook group had the greatest effect over time (Figure 5.3). Paired sample t-test was also performed on PA_d and PA_i within groups. It showed significant increase in PA_i in physical activity-Facebook group at $p < .05$ level. There was no significant change in PA_d in all groups and no significant change in PA_i in the other three groups ($p < .05$). Table 5.6 shows the summary of the significant differences between interventions.
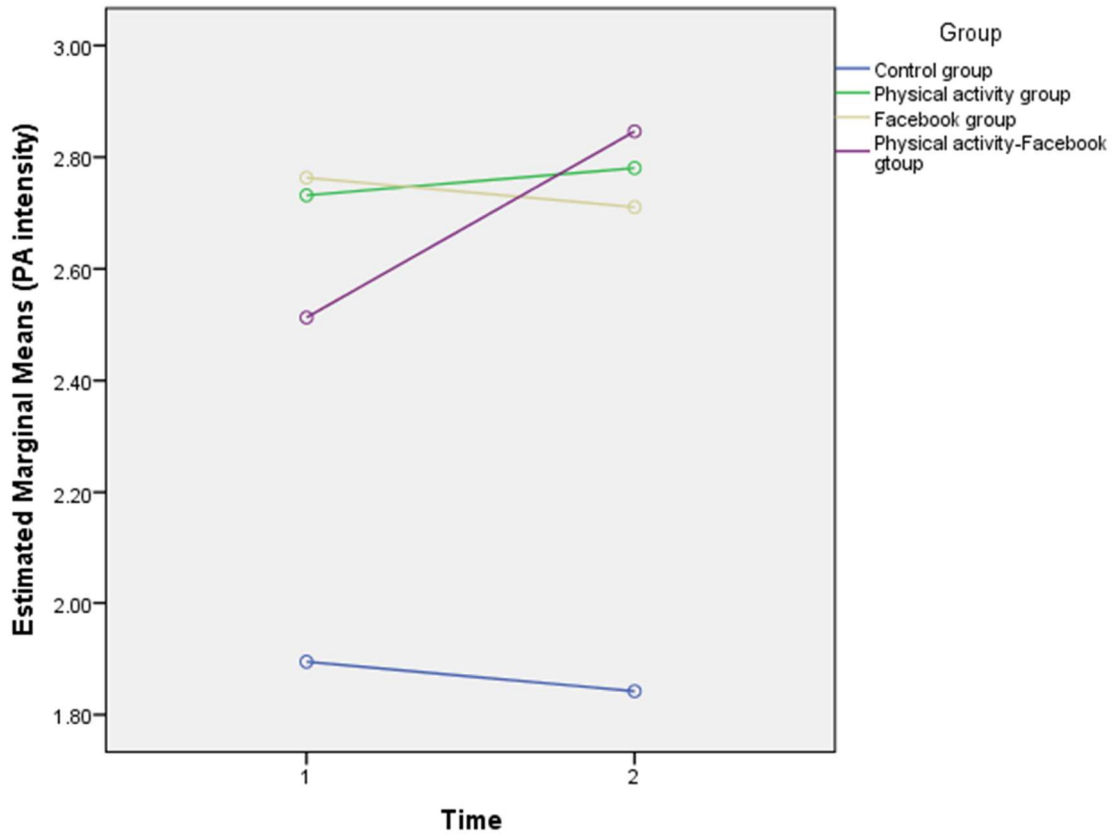
Figure 5.3. Interaction plot for physical activity intensity. *PA = Physical activity.*

Table 5.5

Descriptive statistics and difference in PA_d and PA_i levels between groups

		Pre-intervention				Post-intervention			
Factor	Group	*M*	*SD*	F (3,152)	*p*	*M*	*SD*	F (3,152)	*p*
	1 (n = 38)	2.76_2	3.11			$2.81_{2,4}$	3.20		
	2 (n = 42)	$10.44_{1,4}$	10.34			8.85_1	6.67		
PA_d	3 (n = 38)	6.40	5.89			6.18	4.43		
	4 (n = 39)	6.69_2	6.82	7.86	.00	6.94_1	7.54	7.48	.00
	1 (n = 38)	$1.89_{2,3,4}$	1.25			$1.84_{2,3,4}$	1.24		
	2 (n = 41)	2.73_1	.71			2.78_1	.65		
PA_i	3 (n = 38)	2.76_1	.49			2.71_1	.57		
	4 (n = 39)	2.51_1	.85	8.30	.00	2.85_1	.43	13.96	.00

Note. Means with different subscripts within rows are significantly different at the *p* < .05 based on Bonferroni Correction post hoc paired comparisons. Group 1 = Control group; Group 2 = Physical activity intervention group; Group 3 = Facebook intervention group; Group 4 = Physical activity-Facebook group.

Table 5.6

Summary of groups that showed differences between interventions

Factor	Group	t	p
	Control	2.47	.02
ESIS	Physical activity-Facebook	7.22	.00
SI	Physical activity-Facebook	8.08	.00
PI	Physical activity-Facebook	4.15	.00
	Control	2.71	.01
EI	Physical activity-Facebook	4.38	.00
IMI	Physical activity-Facebook	2.50	.02
	Facebook	-2.16	.04
Ch	Physical activity-Facebook	2.82	.01
PA_i	Physical activity-Facebook	2.31	.03

Note. ESIS = exercise and sport identity; SI = social identity; PI = personal identity; EI = ego identity; IMI = intrinsic motivation; Ch = perceived choice; PA_i = physical activity intensity.

5.4   Discussion

5.4.1   Study design and results from main effects

The purpose of this study was to determine how different environments influence changes in exercise and sport identity, intrinsic motivation and physical activity behaviour. This study chose purposive sampling to simulate a natural exercise group setting. In a natural group setting, the different individuals in each group came with diverse baseline profile. Unlike random sampling, where any biasness would have been accounted for, purposive sampling comes with its bias, as seen in the different

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ESIS, IMI and physical activity profiles between groups at baseline. However, purposive sampling is more representative of a natural setting where individuals in an exercise group comes with his own biasness. The main goal of purposive sampling was to examine the psychosocial and behavioural changes in participants in their respective groups, much like how others would group together in a real world setting. Therefore, this methodology can be extended into practical interventions in similar cases. The study sets out to answer the research question if the physical activity intervention with Facebook influence had a positive and more significant change than an environment that did not have Facebook or physical activity intervention. A control group made up of participants in a class not involved in any physical activity was used to act as control to the experiment. All groups were made up of full time students at Nanyang Technological University.

At baseline, significant difference was found between groups for ESIS scores, IMI scores and physical activity levels. After intervention, there was also significant difference between ESIS scores, IMI scores and physical activity levels. The corresponding partial η^2 for the significant within-group difference in ESIS scores, IMI scores and physical activity levels were .22, .05 and .19, respectively. According to Cohen (1988), a partial η^2 of .01 represents small effect size, .06 represents medium effect size and .14 represents large effect size. The results showed that the intervention produced large effect sizes on ESIS scores and physical activity levels. However, small effect size was observed for IMI scores. This may suggest that physical activity interventions that target exercise and sport identity can produce effective outcomes in physical activity levels. A meta-analysis by Ntoumanis et al. (2020) on health-domain interventions based on self-determination theory showed similar effect sizes to the effect of intrinsic motivation on physical activity level in this study. Out of eleven

identified studies, all but one study reported small effect sizes (mean effect size = .26 ± .27). The similarity of the results may suggest that physical activity interventions based on motivation may produce small effects. Further attention may also been given on how to increase the effectiveness of motivation-based interventions.

Interaction results showed that the combination of physical activity and Facebook in an intervention produced the greatest change in ESIS scores, IMI scores and physical activity intensity. The corresponding partial η^2 for the significant interaction effects between intervention and time were .28, .053 and .064, respectively. They represent small to large effects. The combination of traditional physical activity intervention with social media had the greatest influence on exercise and sport identity as shown from the large effect size while its influence on motivation is small. It seems to point to the potential of using exercise and sport identity as a mediator to influence physical activity. Future research can verify this proposition. Another improvement can be to study the interaction between different types of intervention and the duration of intervention, to ascertain of effect of duration on exercise and sport identity, motivation and physical activity levels.

Internal reliability of ESIS was acceptable. However, perceived choice scores in the IMI were less than .70. In Study 2, AVE score in perceived choice was also less than .50. Hence, this suggests that attention has to be paid to the wording of the IMI-perceived choice items or to consider dropping this subscale for future research.

5.4.2   Interaction effects of intervention on psychosocial and behavioural factors

Post hoc tests showed that control group had lower ESIS scores, IMI scores and physical activity levels than other groups before and after intervention. This meant that at baseline, the control group consisted of participants who were inherently less active and had lower inclination to exercise. Control group was also less active and had lower

identification and motivation towards exercise compared to the other groups after the intervention. Paired sample t-test showed that there was a significant increase in overall exercise and sport identity and ego identity after the intervention period. Although there was significant increase in ESIS score and EI score even though there was no intervention, the mean ESIS scores and EI scores after intervention were significantly lower than all three other groups. There was no increase in physical activity hours, physical activity intensity and corresponding motivation levels to support the change in exercise identity. The increase in the control group could be a random change due to the low baseline.

Before intervention, the physical activity-Facebook group had significantly higher exercise and sport identity and intrinsic motivation than the control group. It had significantly lower exercise and sport identity than the other two intervention groups (physical activity and Facebook groups) but there was no difference in intrinsic motivation with the two intervention groups (physical activity and Facebook). Therefore, at the start, physical activity and Facebook group has similar motivation but lower exercise and sport identity. After intervention, no difference was found in exercise and sport identity and intrinsic motivation in the three intervention groups. In order to examine the change due to the interventions, paired sample t-test was performed and found that only physical activity-Facebook group saw a significant growth in exercise and sport identity and intrinsic motivation. Interaction effects between intervention and time also showed that physical activity and Facebook intervention raised exercise and sport identity and intrinsic motivation the most. Putting the data together, it can be concluded that a combination of physical activity and Facebook intervention can bring about a significant change in identity and motivation toward a physical activity. In a study by Wang and colleagues (2015), they found that

the use of social media in conjunction with physical activity intervention produced some positive psychological change. Drawing similarities from this study, it can be said that social media influence in physical activity intervention has an impact of psychological factors related to physical activity. However, a question remains in this study about whether the lack of change in the physical activity group and Facebook group was a result of the efficacy of the intervention or a plateau effect.

Before intervention, control group reported lower physical activity duration and intensity to the three intervention groups. There was no difference in physical activity intensity between the three intervention groups at the beginning but the physical activity group spent significantly more time a week on physical activity than the Facebook group and physical activity-Facebook group. After intervention, control group remains significantly less active in terms of duration and intensity than the three intervention groups. Physical activity intensity also remained the same for the three intervention groups but there was no longer difference in the number of hours spent on physical activity a week between physical activity-Facebook group and the other two intervention groups. Paired sample t-test showed no change within each group in physical activity duration but the physical activity-Facebook group were exercising harder after the intervention. Interaction effect between the intervention and time also showed that physical activity intensity saw the greatest change with a combination of physical activity and Facebook intervention. The results correspond to Lau et al. (2011) and Sevik et al. (2000) where traditional physical activity interventions alone were not able to produce a significant effect on physical activity behaviour. In a review by Vandelanotte and colleagues (2007) on the effectiveness of website-based physical activity interventions, eight of fifteen studies reported positive behavioural outcomes. This study reinforced the effectiveness of online media and physical activity as

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intervention on physical activity behaviour. In addition, the change in physical activity behaviour took place with corresponding change in exercise and sport identity and intrinsic motivation. The association between these psychosocial factors and change in physical activity behaviour has been established in Study 2. Future studies can make use of these indicators to design physical activity interventions.

Physical activity-Facebook group saw corresponding increases in exercise and sport identity, intrinsic motivation and physical activity intensity. This suggested that the combination of physical activity and Facebook intervention influenced the sense of identification to exercise and motivation to exercise. It also resulted in behavioural change (increase intensity in physical activity participation). Future work can examine modification of factors associated with identity or motivation to change physical activity behaviour or adherence to physical activity behaviour.

5.4.3 Other observations

Facebook group did not see any change in exercise and sport identity, intrinsic motivation or behavioural change. The means of ESIS and IMI scores of the Facebook group was lower than the physical activity-Facebook group, reinforcing that the effect of the Facebook intervention on its own was not as significant as the combination of physical activity and Facebook intervention. There was an increase in mean ESIS score in the Facebook group, although not significant. However, there was a decrease in mean IMI score in the Facebook group towards exercise. This also reinforced that in order for physical activity intervention to produce an effect, intention to exercise is an important factor. Therefore, even with Facebook influence, if the group did not come together for the purpose of exercise, there was no change in physical activity behaviour. The result also suggests that Facebook intervention on its own was ineffective.

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Physical activity group also did not see any significant change in exercise and sport identity, intrinsic motivation or behavioural change. There was an increase in the means of the ESIS and IMI scores in the physical activity group, albeit not significant. On closer examination, the means of ESIS and IMI scores of the physical activity group after intervention were lower than the physical activity-Facebook group, suggesting the effect of the intervention were not as significant as the combination of physical activity and Facebook intervention. There were some possibilities for the result. First, there could be a plateau effect as seen in the high mean PA_d of the group. However, this is not likely as the mean PA_d decreased after the intervention. Corresponding ESIS and IMI scores remained similar while that of the physical activity-Facebook group improved significantly. Examining the social identity scores, there was a positive change for the physical activity-Facebook group but not for the physical activity group. This critical information suggested that the socialization played an important role in not just changing the identity and motivation but also the physical activity behaviour. As such, the physical activity group did not see a change in social identity factor, therefore not resulting in any change in exercise and sport identity, as well as intrinsic motivation. As a result, there was no psychosocial change that led to any behavioural change, rather than being a plateau effect. The result was more likely due to lack of socialization that did not lead to any improvement in physical activity levels. A study by Carvallo and colleagues (2012) found through intervention that over time, participants experienced increases in social support and physical activity. Social constructs such as social support or social identity seemed to be correlated to physical activity as seen both in Carvallo et al. (2012) and this study. Given the promising relationship, efforts to further understand how online social media can be used in physical activity intervention should be pursued.

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Closer examination on the ESIS and IMI component scores in the physical activity-Facebook group showed increase in all components of exercise and sport identity and a corresponding increase perceived choice. While there was an increase in social identity in ESIS, there was no increase in sense of relatedness in the IMI. This disparity could be because the definition of social identity differs from that of perceived relatedness. This could be a topic for future research to examine the association between social identity and its sense of relatedness to the social group.

5.4.4 Strengths and limitations

While there are advantages to the use of purposive sampling in the study design to simulate the setting commonly seen in many institutions, the non-randomized design has its limitations. Purposive sampling is applicable to real life and is repeatable. Researchers and practitioners can use the same method to further study, examine any gaps or perform an intervention. It is also a practical for practitioners because in natural setting, participants come with different baseline and background. However, the lack of control over the baseline factors such as participant physical activity background meant that results cannot be generalized to a population. Researchers and practitioners need to employ appropriate statistical analyses to draw meaningful comparison of the intervention effects.

While the results were not from randomized controlled design, the between-group, within-group and interaction effects provide insight into how social media combined with traditional physical activity intervention can make a difference as compared to traditional physical activity intervention on its own (Lau et al., 2011; Norman et al., 2007; Sevik et al., 2000; Wang et al., 2015). The large effect sizes in comparison with other intervention studies (Ntoumanis et al., 2020) show the potential of integrating social media with physical activity intervention to bring about a change in

exercise and sport identity as well as physical activity behaviour. Future research can extend on this study to see if similar effects can be achieved with other samples, and if so, it presents a new methodology in physical activity intervention.

The study showed positive changes in exercise and sport identity, intrinsic motivation and physical activity behaviour. However, future research should also be critical and open to the use of a range of motivation regulations (including external regulation) in physical activity interventions. This is because contemporary motivation research proposed that people's motivation for physical activity behaviour has shifted from intrinsic to extrinsic motivation (Deci, Koestner, & Ryan, 1999). This is also one limitation that this study did not examine and further research can address the gap.

The research design used Facebook as an intervention media because its networking feature allows forming of communities and identification of individual towards physical activity. Its media sharing features also allow sharing of images, videos and ideas within the community. Researchers should take into account if the features of the social media matches the requirement of the research. However, future research must also take into consideration the region where such research is conducted. This is because each region uses different kinds of social media. Some may even be governed by media laws that has to be taken into consideration when using social media for research. Researchers should also consider the target audience for the social media in use. For example, Instagram may be preferred over Facebook if a younger group of participants are targeted. The use of a single social media also does not generalize the result to the general population. Researchers must be aware of this limitation.

While this study showed the positive effect of social media on physical activity, researchers must also be cognizant of the risks and negative consequences that social media may have on individuals. In a review, Akram and Kumar (2017) listed some

potential negative effects of social media. They include the possibility of false information leading to malpractice or injury and negative comments or cyber harassment by participants affecting the community. On a deeper level, overuse of social media over the intent of the intervention may bring about addiction or distraction from intended activities such as learning or physical activity. Therefore, it is recommended that active monitoring and moderation is required for a safe and positive social media intervention.

From the interaction effect of the various intervention and time, it can also be seen that a possible extension of this study is to see if there is interaction effect with longer or shorter duration; to see if there is an optimal duration to bring about a change in physical activity behaviour or a plateau if the intervention duration is longer. Another limitation is the lack of understanding of the effect of the intervention after it has ended. A recommendation is to study the retention of exercise and sport identity, motivation and physical activity levels after intervention to understand the effects of the intervention on each group after the intervention has ended.

In conclusion, it can be seen from the effect sizes of the analysis and comparison with literature on similar interventions that when social media intervention is combined with physical activity intervention, the effects on exercise and sport identity, intrinsic motivation and physical activity intensity were more significant than physical activity intervention alone. The effectiveness of social media with physical activity intervention also meant that physical activity behaviour can be modified. This also reinforced that social process and identity formation helps to shape the exercise and sport identity and physical activity behaviour (Ryan & Deci, 2007; Vallerand & Losier, 1999). Identification with a social group or activity also plays an important role in the

motivation of physical activity behaviour that encourages further participation in

exercise or sport (Young, 2018).

Chapter 6

General Discussion and Conclusion

6.1 Introduction

Worldwide, the level of physical inactivity is predicted to rise to 70 % due to urbanization, increased use of technology and changing patterns of transportation (WHO, 2018). Physical inactivity has direct impact on noncommunicable diseases such as heart disease, stroke, diabetes, breast cancer and colon cancer. Despite knowing that the lack of physical activity is linked to noncommunicable disease, the incidence of noncommunicable diseases continues to creep upwards in Singapore and globally (Epidemiology & Disease Control Division, 2010; WHO, 2013a; 2013b). Physical activity intervention has not been able to turn the global phenomenon of physical inactivity around. Physical activity interventions have traditionally focused on face-to-face intervention (Lau, Lau, Wong, & Ransdell, 2011). Although this mode of intervention programme has been effective in enhancing physical activity participation, the effects have been small (Lau et al., 2011). This is because such programmes are subjected to time schedules, running costs and limited accessibility (Sevick et al., 2000), which results in high attrition rate.

Some researchers have found that physical activity behaviour and therefore the intervention for it is more complex than a simple face-to-face programme. Physical activity behaviour is influenced by a complex interplay between motivation, self-regulation skills, unique social environment and physical environment (Biddle & Mutrie, 2001; Kalpan et al., 1991; Lacaille et al., 2011; Lorentzen, 2007). Some of these ideas are only beginning to be used to influence physical activity policies (Ng, 2019) and more needs to be done to influence physical activity behaviour on a societal level.

Based on contemporary literature, psychosocial determinants play a key role in influencing physical activity behaviour. Psychosocial change is one of the interventions that has shown to bring about effective change in physical activity behaviour (Lorentzen, 2007). Identity theory has been found to encompass these multidimensional psychosocial factors such as group membership, self-efficacy and personal constructs (Erikson, 1968). Erikson's (1968) Theory of Psychosocial Development covers psychology, social and personal dimensions and its main tenet on sociocultural determinants of development tells us that individuals develop their identity through stages, shaped by the interaction and influence between the psychological self and environment (Berger & Luckmann, 1966; Côté & Levine, 2002). Understanding physical activity behaviour from a multidimensional psychosocial perspective, one can draw the link between development of an identity and one's (social) environment; Psychosocial factors can positively influence physical activity behaviour (Lorentzen, 2007). Secondly, these psychosocial factors are also associated with motivation to engage in physical activity. Motivation research has also proposed that people's motivation for physical activity behaviour has shifted from intrinsic to extrinsic motivation (Deci, Koestner, & Ryan, 1999). Concurrently, identity researchers also documented broad-based and categorical changes in human behaviour attributed to technological changes in societies (Gergen, 1991; Tajfel, 1978). Therefore, there is a need to look the contextual forces that impacts physical activity behaviour and use interventions beyond current practices; and one of the ways is to put together the origins of these contextual forces into a new model to integrate motivation theory and identity theory into practice.

Identity theory has been used as a theoretical framework in physical activity interventions. Bélanger-Gravel and Godin (2010) found that children's physical activity

participation was correlated to self-identity and intention, accounting for 14.9% of the variance of physical activity behaviour. Self-identity has also been found to be a significant predictor of intentions (Armitage & Conner, 1999; Sparks & Guthrie, 1998). In another study, Strachan et al. (2012) found that exercise identity was significantly correlated with self-determined forms of exercise behaviour regulation. It was also found that exercise identity strength and higher forms of regulation interact in their relationship to exercise self-regulation. The results support the use of identity theory in physical activity interventions. SDT on its own has also been used as theoretical framework to study exercise behaviour and more recent studies support the use of identity theory and SDT together (Strachan et al., 2012).

Identity theory and SDT are therefore promising basis to address some of the limitations in physical activity intervention. Several measurements can be used to measure motivation but there was no standardized measurement for exercise identity. Most exercise identity scales focus on a single aspect of identity theory. However, the entire identity theory is multi-faceted and requires these different aspects to be put together into a coherent whole. There is also a need to formulate an exercise identity measurement that is validated against self-determination and exercise behaviour.

This thesis developed and validated an identity scale based on literature that can be used to measure exercise and sport identity. It also found an association with motivation and physical activity. Lastly, an intervention study was done to examine how different social environments can influence the exercise and sport identity, motivation and physical activity behaviour.

6.2 Synthesis and Discussion of Findings

Table 6.1 presents the key findings and contributions of the three studies.

In Study 1, an Exercise and Sport Identity Scale was developed from the model for Exercise and Sport Identity, developed from the work of Adams and others (Adams, 1996; Côté, 1997; Erikson, 1968; Kurtines, 1999), as well as taking reference from identity scales developed by Balistreri et al. and others (Balistreri et al., 1995; Luhtanen and Crocker, 1992; Nario-Redmond et al., 2004; Nozick, 1981; Tajfel, 1981; Tajfel and Turner, 1979). The scale consists of three domains of identity (Social, personal and ego identities). These domains contain seven factors: importance to identity, private self-esteem, public self-esteem, continuity, uniqueness, exploration and commitment.

After the scale items were generated, they were assessed for content adequacy. The next step was to evaluate the global model fit, validity and reliability of the scale. The content analysis showed the scale to have sufficient content validity from Lynn's (1986) criteria. It also had an acceptable scale content validity (with universal agreement among the content experts; S-CVI/UA) and average content validity of individual items (S-CVI/Ave). The scale has met the criteria set by several researchers (Davis, 1992; Grant & Davis, 1997; Lynn, 1986; Polit & Beck, 2004). Exploratory Structural Equation Modeling (ESEM) was used to test the model fit and derived a seven-factor, 22-item Exercise and Sport Identity Scale. The scale also had adequate discriminant validity, construct validity and acceptable internal reliability.

Based on the factor correlations, social identity factors correlated more strongly to personal identity factors than ego identity factors. This suggests that social identity factors have a stronger association or influence on personal identity than ego identity. This is aligned to the theory and model that the social role provides the stimulus to shape one's personal identity, which in turn shapes the ego identity (Berger & Luckmann, 1966).

While the items align with the theoretical constructs, some cross loadings were present. Further research can verify if these cross loadings are reproduced. In addition, further research can also examine the low internal reliability that personal identity factors produced to establish if it was a case of lack of clarity in the items to the survey respondents, the lack of clarity in the operational definition of the construct or that the sample size was too small.

Study 2 addressed the limitations in Study 1 by further validating the ESIS using ESEM and Confirmatory Factor Analysis (CFA). While there were some cross loading in Study 2, the factor loadings clearly showed a dominant factor in the items. The cross loading in Study 2 was also unlike that in Study 1, suggesting that the possible reasons for the cross loading in Study 1 was due to the small sample size or sample profile. The ESEM verified the global model fit and confirmed the seven-factor model of the ESIS from Study 1. CFA further showed that the ESIS had sufficient global model fit, supporting the seven-factor ESIS model. The scale also had acceptable internal reliability, convergent validity and discriminant validity. Three higher order factors were found to fit the theoretical model of the ESIS.

CFA was performed on the adapted IMI verified that the items fitted a four-factor IMI model consisting of interest, perceived competence, perceived choice and perceived relatedness subscale. This component of Study 2 contributed to one of the few studies that used perceived relatedness as a measure of intrinsic motivation (Kooiman et al., 2016). The revised IMI was used to examine the association with ESIS to see if exercise and sport identity and intrinsic motivation have any association that can be used for prediction for physical activity behaviour as found by some researchers (Strachan et al., 2012; Wilson et al., 2006).

Regression analysis showed that exercise and sport identity was found to significantly predict intrinsic motivation. This relationship is also true for the converse. This result agrees with the theory that variation in identity corresponds to the basic growth inclinations of the self that is also influenced by the basic psychological needs for autonomy, competence, and relatedness (Ryan & Deci, 2003). In Study 2, it was found that social aspects such as social identity and perceived relatedness have a strong influence on exercise and sport identity and intrinsic motivation. This supports the model that identity formation is an interactional process between the self and their social and cultural environment (Briones, 1997; Kurtines, 1999). Therefore, practically, a strong sense of belonging can impact the motivation and identification with physical activity and sport.

Physical activity intensity and duration were also positively associated with exercise and sport identity and intrinsic motivation. Social identity was also found to be one of the top influences on physical activity behaviour. This supports Briones (1997) and Kurtines (1999) studies that found identity formation to be a process between individuals and their social environment. This suggests a strong indication of the environmental factor in shaping physical activity behaviour.

Study 3 followed up on Study 2 where social identity was found to be a strong influence on physical activity behaviour. An intervention study where four types of social environments were examined for its effectiveness of physical activity intervention on physical activity behaviour. The four environments were a control group that does not undergo any intervention, a physical activity intervention group, a Facebook intervention group with no physical activity intervention and a physical activity intervention group that also underwent Facebook intervention. It was found that the physical activity-Facebook group saw corresponding increases in exercise and sport

identity, intrinsic motivation and physical activity intensity while no meaningful or significant change has been observed in the other three groups. This suggested that the combination of physical activity and Facebook intervention influenced the sense of identification to exercise and motivation to exercise. It has also resulted in behavioural change (increase intensity in physical activity participation).

In summary, the three studies put together key insights and developed a measurement tool with the potential to address the fundamental issue of effective intervention that may be used to address the rising prevalence of noncommunicable diseases caused by the lack of physical activity.

Table 6.1

Overview of three studies

Study	Purpose	Research Questions /Hypotheses	Key findings	Major contributions
1	To develop and examine the factorial structure of an Exercise and Sport Identity Scale	Does the ESIS have adequate global model fit to the proposed model of identity formation process? Does the ESIS have sufficient internal reliability and discriminant validity?	A seven-factor measurement model with 22 items was developed. Adequate internal consistency and discriminant validity was found.	Theoretical contribution: A multidimensional model based on identity formation process to understand physical activity behaviour was developed.

				Methodological contribution: One of the few studies using ESEM and CFA to determine the factorial structure of a measurement scale.
	To confirm the factorial structure of the Exercise and Sport Identity Scale developed in Study 1.			
	To examine for higher order factors in the Exercise and Sport Identity Scale as proposed in the theoretical model.	Does the seven-factor measurement model of the ESIS fit the proposed theoretical model for ESIS?	A seven-factor measurement model with 22 items was validated using ESEM and CFA.	Theoretical contribution: The results supported a seven-factor with three second-order factor ESIS measurement model with sound psychometric properties.
	To confirm the factorial structure and internal reliability of the Intrinsic Motivation Inventory for use in physical activity and sport	Does the seven-factor measurement model of the ESIS have sufficient internal reliability and factorial validity? Do higher order factors exist in the Exercise and Sport Identity Scale? Does a six-factor IMI has sufficient global model fit and internal reliability for evaluation of intrinsic motivation in physical activity and sport?	Adequate internal consistency and factorial validity was found. Second order factors Social Identity, Personal Identity and Ego Identity were confirmed with CFA and aligned to theoretical model of the ESIS. A four-factor IMI model was validated with CFA and found to have adequate internal reliability	Theoretical contribution: The results supported a four-factor IMI model with adequate internal reliability. One of the few studies that used perceived relatedness subscale in IMI.
2	To test the relationship between exercise and sport identity factors, intrinsic motivation and physical activity behaviour.	Does exercise and sport identity factors have any relationship with intrinsic motivation, physical activity duration and physical activity intensity?	Exercise and sport identity was positively associated with intrinsic motivation, physical activity duration and physical activity intensity.	Theoretical contribution: Supported the relationship between identity, motivation and physical activity behaviour.

3	To examine how different environments (Physical activity and social media intervention) affect the exercise and sport identity, intrinsic motivation and physical activity behaviour.	Does a social media environment such as Facebook influence exercise and sport identity, intrinsic motivation and physical activity behaviour positively? Does a social media environment such as Facebook influence exercise and sport identity, intrinsic motivation and physical activity behaviour in a physical activity intervention more than other environments?	A combination of social media and physical activity intervention has a positive and more significant effect on overall exercise and sport identity, social identity, intrinsic motivation and physical activity intensity.	Methodological contribution: Use of purposive sampling to match the real world environment and issues. Theoretical contribution: The results supported tenet of identity theory and self-determination theory.

6.3   Contributions

The thesis contributed to theory in three areas. Firstly, Study 1 put together literature to formulate a model that explained the contemporary physical activity behaviour. It deciphers the complexity of physical activity behaviour into a model to understand how the environment influences our behaviour and how that reinforces our ego or self. This is part of a larger identity theory where the reiterative process between ego, behaviour and social influences provides a model to understand the complexity of human behaviour.

Secondly, an Exercise and Sport Identity Scale was developed and validated. It shows that exercise and sport identity factors can be measured. This is a potential measurement to understand the multidimensional psychosocial aspect of physical activity to guide physical activity policies and interventions more effectively. Thirdly, the scale and model has positive association to intrinsic motivation and physical activity, further strengthening link between identity, motivation and physical activity found in other literature and the model. It also reinforces the association between identity theory and self-determination theory as found by Strachan et al. (2012) and Wilson et al. (2006). The scale also had the potential to predict physical activity behaviour.

From the methodological perspective, the use of ESEM provides an alternative to EFA to avoid the inherent problem of failure to achieve agreement in model fit between EFA and CFA (Asparouhov & Muthén, 2009; Browne, 2001). EFA has also been shown to be suboptimal and offer little basis in the selection of an EFA solution. (Guay et al., 2015). ESEM has been shown to be able to perform the function of EFA (Asparouhov & Muthén, 2009) and is used in this case to find the model fit.

The use of purposive sampling replicates a real world setting to provide a phenomenological understanding of social environment and its impact on physical activity intervention. While study did not did not use a controlled randomized method, which is the

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ideal methodology to determine the effects in an intervention study, purposive sampling used with appropriate statistical method can provide useful information for practitioners. The use of MANOVA and examination of between-group, within-group and interaction effects have given meaningful results for real world application.

In summary, the contributions are aligned to the current social environment that we live in. It explains the trend of decreasing levels of physical activity (WHO, 2018) and provides a guiding model to how we can understand the phenomenon. In the next section, some of the implications are discussed.

6.4   Implications

The thesis has given several important implications. From a practitioner point of view, the results of Study 3 suggests that integrating social media within a physical activity intervention is more effective than a physical activity intervention on its own. This result corresponds to the work of Lau et al. (2011) and Sevick et al. (2000). The implication is that there has been a fundamental shift in the environment (prevalence of technology in our lives) and how this environment has affected physical activity behaviour and the increasing prevalence of physical inactivity. Practitioners need to understand this shift and adapt to the changing environment.

While there has been a shift in the environment, the results of Studies 1, 2 and 3 suggests that the model and measurement of exercise and sport identity and intrinsic motivation remains relevant today. The positive associations between exercise and sport identity, motivation and physical activity is testament to the relevance of the measurement tools to physical activity. This association was also found earlier by Strachan et al. (2012) and Wilson et al. (2006). This thesis verifies that association.

The exercise and sport identity model depicts the process of identity formation. From Erikson's (1968) Theory of Psychosocial Development, identity formation is a long and

ongoing process. Therefore, the use of the ESIS requires the user to understand that the identity development may take a long time. Expecting a change in personal and ego identity in short interventions such that in Study 3 may not be meaningful in some situations. Longitudinal studies should be used to understand the change in personal and ego identity or the entire exercise and sport identity. This also means that to effect a positive and sustainable change in physical activity behaviour, starting young is imperative. It is because identity formation is not only a long process but change is more difficult when an individual has reaches adolescence.

The reliability and validity of the ESIS provided a viable model and tool for researchers and practitioners to examine the effectiveness of physical activity programmes. The scale can be used to measure and compare levels of identification to exercise and sports on a large scale without measuring physical activity levels. In addition, the scale allows measurement of multiple factors in the psychosocial aspects of physical activity participation. This can provide a deeper insight into the influence of physical activity for targeted intervention.

In summary, the implications are important to understand so that the use of the model can be effective. It is important for practitioners to understand the impact of changing environment and the process of identity formation to increase the chance of an effective physical activity intervention to turn around the increasing prevalence of physical inactivity.

6.5   Limitations and Future Directions

The study has shown that the exercise and sport identity model and scale has adequate validity and reliability to be used. As this is an early exploration of this model, further research should be done to examine the strength and address the limitations. One of the limitations is to replicate the study across different populations and culture to see if the model and scale holds. In addition, multigroup invariance tests should be part of the

examination to address the extent to which scale items convey the same meaning across different participant groups such as male and female participants. This will provide further evidence for the psychometric properties of the scale (Byrne, 2006).

The regression analysis has shown positive associations between exercise and sport identity, intrinsic motivation and physical activity. Interestingly, further regression analysis also showed that social identity and ego identity were associated with higher intrinsic motivation in exercise. Perceived competence was also found to most strongly predict any change in exercise and sport identity. Social identity also consistently stood out as one of the key predictors of physical activity. Perceived relatedness was not significantly associated with physical activity in the group settings although participants reported significant association between social identity and physical activity levels. Further research should examine this to ascertain if it was due to a disparity between the operational definition of social identity and perceived relatedness, the lack of relevance in the items of perceived relatedness or an issue of the experimental design.

These results do not generalize beyond the sample of this study. While the findings show potential of its application to intervention, future study can verify these associations across other samples. While the associations are known, we do not know the mediating factors. Perhaps mediation analysis can be done on future research to provide insight on the mediating factors.

In Study 3, it was difficult to control the baseline measurement and what happens during the intervention. This is seen in the increase in ESIS scores and IMI scores in the control group. This is a limitation of purposive sampling. There was no sure method to eliminate the confounding factors that could affect the results but one suggestion is to take additional measurement that allows us to make inference on the factors affecting the measurement. In Study 3, while there has been increase in exercise and sport identity and

intrinsic motivation in the control group and the physical activity-Facebook group, there was no corresponding increase in physical activity levels in the control group. Therefore, it is important that use of ESIS and IMI should be use in conjunction with physical activity level as it cannot be certain that a change in ESIS and IMI will bring about a change in physical activity level. Future research that uses purposive sampling should also anticipate this and design the research to overcome such issues.

As this study examined a new model and scale, some items in the scale may still require more clarity. Some cross loadings were present in Study 1 and 2 in the social identity-importance to identity (SI) and personal identity-continuity (PCo) factors. Further research can verify if these cross loadings are reproduced. In addition, further research can also examine the internal reliability of the factors across other samples to establish if the items in the scale are clear to survey respondents or if the operational definition of the construct is clear. The wording in these items (such as SI1 and PCo3) should also be examined to enhance the discriminant validity of the scale.

From the theoretical underpinning, the model and findings of this thesis, one of the key themes was that social environment can impact physical activity behaviour. With the ESIS, it can evaluate the types of environment that can best improve motivation and physical activity levels. Therefore, a possible future research is to make use of the ESIS to examine the effectiveness of an environment in raising physical activity levels.

6.6 Conclusion

This study has put together a multidimensional model based on identity theory to understand physical activity behaviour in the current landscape. Physical activity behaviour and belief can be shaped by the environment. The process is iterative between social, personal and ego identities until an identity is established. This meant that the environment is important to shaping of one's identity. In today's environment, online social network forms a

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part of one's environment and that may play an important role in influencing physical activity behaviour.

This study also demonstrated the link between identity theory and self-determination theory. The associations between exercise and sport identity, intrinsic motivation and physical activity gives practitioners a guide on the factors that can influence physical activity behaviour. The set of results serve to inform organization leaders that environment can make an impact to the identity formation and motivation of individuals. Intervention programmes in future should be designed around the social environment to influence a change.

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Appendices

Appendix A: Ethics Approval from Nanyang Technological University

NANYANG TECHNOLOGICAL UNIVERSITY

Research Support Office

Reg. No. 200604393R

IRB-2015-04-014

09 July 2015

Professor Wang Chee Keng, John
National Institute of Education

NTU INSTITUTIONAL REVIEW BOARD APPROVAL
Project Title: Effectiveness of social media intervention on physical activity behaviour: An integration of Exercise Identity and Self-Determination theories.

I refer to your application for ethics approval with respect to the above project.

The Board has deliberated on your application and noted from your application that your research involves collecting behavioral data from participants through intervention program.

You have also confirmed that informed consent will be obtained from the participants and you have guaranteed the confidentiality of your participants' biodata obtained from them.

The documents reviewed are:
   a) NTU IRB application form dated **13 April 2015**
   b) Participant information sheet and consent form: version 1 dated **08 July 2015**
   c) Data collection form: version 1 dated **08 July 2015**

The Board is therefore satisfied with the bioethical consideration for the project and approves the ethics application under **Expedited** review. The approval period is from **09 July 2015** to **31 October 2016**. The NTU IRB reference number for this study is **IRB-2015-04-014**. Please use this reference number for all future correspondence.

The following protocol and compliances are to be observed upon NTU IRB approval
   1. All research involving procedures greater than minimal risk on minors (individuals who are less than the legal age of 21 years old) requires IRB approved written Parental Consent and assent from the participant to be obtained before any research protocols can be administered. Minimal risk refers to an anticipated level of harm and discomfort that is no greater than that ordinarily encountered in daily life, or during the performance of routine educational, physical, or psychological examination.

   2. Only the approved Participants Information Sheet and Consent Form should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject should be given a copy of the signed consent form.

Blk N2.1, B4-01, 76 Nanyang Drive, Singapore 637331 Nanyang Avenue, Singapore 639798
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www.ntu.edu.sg

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NANYANG TECHNOLOGICAL UNIVERSITY

Research Support Office

3. Consent forms are important documents therefore they should be stored in the strictest arrangement. Loss of consent form would result in disciplinary action.

4. No deviation from, or changes of, the protocol should be initiated without prior written NTU IRB approval of an appropriate amendment.

5. The Principal Investigator should report promptly to NTU IRB regarding:
   a. Deviation from, or changes to the protocol.
   b. Changes increasing the risk to the subjects and/or affecting significantly the conduct of the trial
   c. All serious adverse events (SAEs) which are both serious and unexpected.
   d. New information that may affect adversely the safety of the subjects of the conduct of the trial.
   e. Completion of the study.

6. Continuing Review Request/ Notice of Study completion form should be submitted to NTU IRB for the following:
   a. Annual review: Status of the study should be reported to the NTU IRB at least annually using the Continuing Review Request/ Notice of Study completion form.
   b. Study completion or termination: Continuing Review Request/ Notice of Study completion form is to be submitted within 4 to 6 weeks of study completion or termination.

7. All Principal Investigators should comply with existing legislation that would have an impact on the domain of their research.

Professor Lee Sing Kong,
Chair, NTU Institutional Review Board
encl.

cc   Director, National Institute of Education
         Members, NTU Institutional Review Board

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Appendix B: Questionnaire for Study 1 (Content Adequacy Assessment)

Instructions

<u>**Exercise and Sport Identity Scale**</u>

Self has been researched and recognized to be an important factor in understanding exercise adherence and health behaviour (Fox & Wilson, 2008). Identity is one of the self-related variables that has been studied in exercise (Schwartz et al., 2010). The identity construction process in the area of exercise involves the interaction between the Self and the environment. Ideally, every individual forms a coherent identity integrated with the environment.

The Exercise Identity Scale are founded mainly but not exclusively on ideas and identity scales found in the literature of Erikson (1950 & 1968), Marcia (1966) and Balistreri et al. (1995) on ego identity, from Nozick (1981), Nario-Redmond et al. (2004) on personal identity, and Tajfel & Turner (1979), Tajfel (1981) and Luhtanen and Crocker (1992) on social identity. Ego, personal and social identities of an individual interact through the social environment and self to construct one's identity and hence behaviour.

The operational definition of each construct of identity are as below:

1. Social identity is the part of an individual's self-concept which derives from his knowledge of his membership in a social group together with the value and emotional significance attached to that membership (Tajfel, 1981). There are 4 factors to social identity:
   a. Membership self-esteem (M)
   b. Private collective self-esteem (Pr)
   c. Public collective self-esteem (P)
   d. Importance to identity (I)
2. Personal identity is the continuity and uniqueness of one's self-concept perceived over time (Nozick, 1981). Continuity (Co) is the extent that one's future self is causally related to the present self; Uniqueness (U) is the extent that the future self is unique.

3. Ego Identity is the conscious part of identity that influences thoughts and actions. Thoughts and actions can be classified into exploration (E) and commitment (C) (Marcia, 1966).

Section A: Rating the Relevance and Clarity of Items in the Exercise and Sport Identity Scale

Exercise is used as a generic term representing any form of physical activity. You can refer your sport or recreational physical activity to the term exercise used in the following questions. Some of the items are worded negatively (denoted by '-' sign). Questions 1-16 describes one's social identity, 17-26 describes personal identity, 27-42 describes ego identity. Please rate the following items for relevance and clarity.

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Relevance
1- not relevant; 2- somewhat relevant; 3- relevant; 4- very relevant
Clarity
1- strongly disagree; 2- disagree; 3- agree; 4- strongly agree

Social identity

1. I am a worthy member of the exercise group I belong to (M+)
Relevance 1   2   3   4
Clarity 1   2   3   4
2. I feel I don't have much to offer to the exercise group I belong to (M-)
Relevance 1   2   3   4
Clarity 1   2   3   4
3. I am a cooperative participant in the exercise group I belong to (M+)
Relevance 1   2   3   4
Clarity 1   2   3   4
4. I often feel I'm a useless member of my exercise group (M-)
Relevance 1   2   3   4
Clarity 1   2   3   4
5. I often regret that I belong to some of the exercise groups I do (Pr-)
Relevance 1   2   3   4
Clarity 1   2   3   4
6. In general, I'm glad to be a member of the exercise group I belong to (Pr+)
Relevance 1   2   3   4
Clarity 1   2   3   4
7. Overall, I often feel that the exercise groups of which I am a member are not worthwhile (Pr-)
Relevance 1   2   3   4
Clarity 1   2   3   4

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8. I feel good about the exercise groups I belong to (Pr+)
Relevance 1   2   3   4
Clarity 1   2   3   4
9. Overall, my exercise groups are considered good by others (P+)
Relevance 1   2   3   4
Clarity 1   2   3   4
10. Most people consider my exercise groups, on the average, to be more ineffective than other exercise groups (P-)
Relevance 1   2   3   4
Clarity 1   2   3   4
11. In general, others respect the exercise groups that I am a member of (P+)
Relevance 1   2   3   4
Clarity 1   2   3   4
12. In general, others think that the exercise groups I am a member of are unworthy (P-)
Relevance 1   2   3   4
Clarity 1   2   3   4
13. Overall, my group memberships have very little to do with how I feel about myself (I-)
Relevance 1   2   3   4
Clarity 1   2   3   4
14. The exercise groups I belong to are an important reflection of who I am (I+)
Relevance 1   2   3   4
Clarity 1   2   3   4
15. The exercise groups I belong to are unimportant to my sense of what kind of a person I am (I-)
Relevance 1   2   3   4
Clarity 1   2   3   4

16. In general, belonging to exercise groups is an important part of my self-image (I+)
Relevance 1   2   3   4
Clarity 1   2   3   4

Personal identity

1. My personal values regarding exercise are extremely important to who I am (Co+)
Relevance 1   2   3   4
Clarity 1   2   3   4
2. My dreams and imagination on exercise are extremely important to who I am (Co+)
Relevance 1   2   3   4
Clarity 1   2   3   4
3. My personal goals and hopes on exercise are extremely important to who I am (Co+)
Relevance 1   2   3   4
Clarity 1   2   3   4
4. My emotions and feelings on exercise are extremely important to who I am (Co+)
Relevance 1   2   3   4
Clarity 1   2   3   4
5. My thoughts and ideas on exercise are extremely important to who I am (Co+)
Relevance 1   2   3   4
Clarity 1   2   3   4
6. The ways I deal with my fears and anxieties are extremely important to who I am (Co+)
Relevance 1   2   3   4
Clarity 1   2   3   4
7. My feeling of being a unique person, being distinct from others (U+)
Relevance 1   2   3   4
Clarity 1   2   3   4

8. Knowing that I continue to be essentially the same inside even though life involves many external changes are extremely important to who I am (Co+)
Relevance 1   2   3   4
Clarity 1   2   3   4
9. My self-knowledge, skills, experience, my ideas about what kind of person I really am are extremely important to who I am (U+)
Relevance 1   2   3   4
Clarity 1   2   3   4
10. My personal self-evaluation, the private opinion I have of myself are extremely important to who I am (U+)
Relevance 1   2   3   4
Clarity 1   2   3   4

Ego identity

1. I have definitely decided on pursuing the activity for life (C+)
Relevance 1   2   3   4
Clarity 1   2   3   4
2. I don't expect to change my principles and ideals about exercise (C+)
Relevance 1   2   3   4
Clarity 1   2   3   4
3. I have firmly held views concerning my purpose participating in exercise (C+)
Relevance 1   2   3   4
Clarity 1   2   3   4
4. When I talk to people about exercise, I am sure to voice my opinions (C+)
Relevance 1   2   3   4
Clarity 1   2   3   4

5. I am unlikely to alter my exercise goals (C+)			
Relevance			
1	2	3	4
Clarity			
1	2	3	4
6. My values on exercise are likely to change in the future due to circumstances (C-)			
Relevance			
1	2	3	4
Clarity			
1	2	3	4
7. I am not sure that the values I hold on regarding exercise are right for me (C-)			
Relevance			
1	2	3	4
Clarity			
1	2	3	4
8. I have considered adopting different kinds of exercise (E+)			
Relevance			
1	2	3	4
Clarity			
1	2	3	4
9. I have considered different views on exercise thoughtfully (E+)			
Relevance			
1	2	3	4
Clarity			
1	2	3	4
10. I have tried to learn about different exercises to find the best one for me (E+)			
Relevance			
1	2	3	4
Clarity			
1	2	3	4
11. I have experienced different forms of exercise that made me change my views on exercise (E+)			
Relevance			
1	2	3	4
Clarity			
1	2	3	4
12. I have consistently re-examined different values in order to find the exercise that best fits me (E+)			
Relevance			
1	2	3	4
Clarity			
1	2	3	4

13. I have questioned what kind of exercise is best for me (E+)
Relevance 1   2   3   4
Clarity 1   2   3   4

14. I have evaluated many ways in which exercise fits into my life (E+)
Relevance 1   2   3   4
Clarity 1   2   3   4

15. There has never been a need to question my values on exercise (E-)
Relevance 1   2   3   4
Clarity 1   2   3   4

16. I have not felt the need to reflect on the importance of exercise in my life (E-)
Relevance 1   2   3   4
Clarity 1   2   3   4

Please give any comment or suggestion to make the Exercise and Sport Identity Scale more relevant.

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Section B: Personal Particulars

Please fill in the relevant blanks.

1. School: _____ Gender:_____

2. Date of Birth(DD/MM/YYYY) _____

3. Main/Major Sport: _____

4. Number of years trained in sport: _____

5. Number of hours per week spent on training:_____

6. Highest level of competition participated: _____(e.g. national, international)

Thank you very much for your time.

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Appendix C: Questionnaire for Study 1 (Revised Exercise and Sport Identity Scale)

Instructions

Below are questions that refer to you and your participation in exercise or sport. It will take about 10 minutes to complete. Please do not dwell on questions. If you are unsure, go with your gut instinct. There are no right or wrong answers. All answers will be kept confidential. This is to ensure you are comfortable about giving honest responses. Please try to answer the questions as accurately as you can.

Exercise and Sport Identity Scale

Exercise refers to "physical activity that is planned, structured, repetitive and has as a final or an intermediate objective such as for the improvement or maintenance of physical fitness". Sport is a physical activity that involves a set of rules, physical fitness and physical skills. Taking reference to your participation in exercise or sport or non-activity, rate the following statements on a 5-point scale:

1	2	3	4	5
Disagree/ not applicable	Somewhat disagree	Neutral	Somewhat agree	Agree

	Strongly Disagree				Strongly Agree
1. I am a proud member of an exercise/ sport community.	1	2	3	4	5
2. Belonging to an exercise/ sport community is an important reflection of who I am.	1	2	3	4	5
3. Belonging to an exercise/ sport community is an important part of my self-image.	1	2	3	4	5
4. I am happy to belong to an exercise/ sport community.	1	2	3	4	5
5. I fit well into my exercise/ sport community.	1	2	3	4	5
6. I feel good about my exercise/ sport community.	1	2	3	4	5
7. My exercise/ sport community is considered good by others.	1	2	3	4	5
8. People consider my exercise/ sport community to be worthy.	1	2	3	4	5
9. Others respect the exercise/ sport community that I belong to.	1	2	3	4	5
10. My exercise/sport goals has been the same in the past, now and in future.	1	2	3	4	5
11. My beliefs on exercise/ my sport have been the same in the past, now and in future.	1	2	3	4	5

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12. I have participated in similar intensity in exercise/ sport in the past, now and in the future despite of (challenges at) different phases of life.	1	2	3	4	5
13. Being an exerciser/ sport person is important to who I am.	1	2	3	4	5
14. My exercise/ sport defines me as a person.	1	2	3	4	5
15. I see myself as an exerciser/ sports person regardless of other roles I play in life.	1	2	3	4	5
16. I don't expect to change my beliefs about exercise/ sports.	1	2	3	4	5
17. I have firmly held views concerning my purpose participating in exercise/ sports.	1	2	3	4	5
18. I am unlikely to alter my exercise/ sports goals.	1	2	3	4	5
19. I have committed to exercise or participate in sports regularly.	1	2	3	4	5
20. I feel a need to learn about different exercises/ sports to find the best one for me.	1	2	3	4	5
21. I evaluate my views on exercise/ sport through my experiences in various forms of exercises or sports.	1	2	3	4	5
22. I have reflected on the importance of exercise/ sports in my life.	1	2	3	4	5
23. I am open to explore new exercises/ sports if someone introduces it to me.	1	2	3	4	5

Participant information

Name: _____

Gender: M / F (Circle)

Date of birth: _____(yyyy)_____(mm)_____(dd)

Email (For clarification purposes):_____

Physical activity level (Circle the statement that best describes your physical activity participation)

1. No regular exercise for past 1 month

2. Moderate exercise on a regular basis for past 1 month
(Small increase in breathing or heart rate such as brisk walking, cycling, swimming, volleyball for at least 10 minutes continuously)

3. Vigorous exercise on a regular basis for past 1 month
(Large increases in breathing or heart rate like running or football for at least 10 minutes continuously)

Thank you very much for your participation!

Appendix D: Mplus Input Specifications for ESEM and EFA in Study 1

<u>Exploratory Structural Equation Modelling</u>

TITLE: ESEM1;
DATA: FILE IS D:\Research\Data\Study 1\ESEM\ESEM.dat;
VARIABLE:
NAMES ARE I1 I2 I3 Pr1 Pr2 Pr3 P1 P2 P3
Co1 Co2 Co3 U1 U2 U3 C1 C2 C3 C4 E1 E2 E3 E4;
ANALYSIS:
ESTIMATOR IS WLSMV;
ROTATION = GEOMIN(OBLIQUE,.05);
MODEL: F1-F7 BY I1 - E4 (*1);
OUTPUT: TECH1; stand; tech4; mod; sampstat;

<u>Exploratory Factor Analysis</u>

TITLE: EFA7;
DATA: FILE IS D:\Research\Data\Study 1\ESEM\ESEM.dat;
VARIABLE:
NAMES ARE I1 I2 I3 Pr1 Pr2 Pr3 P1 P2 P3
Co1 Co2 Co3 U1 U2 U3 C1 C2 C3 C4 E1 E2 E3 E4;
Categorical are I1-E4;
ANALYSIS:
TYPE = efa 6 7;
ROTATION = GEOMIN(OBLIQUE,.05);
MODEL: F1-F7 BY I1 - E4 (*1);
OUTPUT: TECH1; stand; tech4; mod; sampstat;

Appendix E: Questionnaire for Study 2

Instructions

Below are questions that refer to you and your participation in exercise or sport. It will take about 20 minutes to complete. Please do not dwell on questions. If you are unsure, go with your gut instinct. There are no right or wrong answers. All answers will be kept confidential. This is to ensure you are comfortable about giving honest responses. Please try to answer the questions as accurately as you can.

<u>**Exercise and Sport Identity Scale**</u>

Exercise refers to "physical activity that is planned, structured, repetitive and has as a final or an intermediate objective such as for the improvement or maintenance of physical fitness". Sport is a physical activity that involves a set of rules, physical fitness and physical skills. Taking reference to your participation in exercise or sport or non-activity, rate the following statements on a 5-point scale:

1	2	3	4	5
Disagree/ not applicable	Somewhat disagree	Neutral	Somewhat agree	Agree

	Strongly Disagree				Strongly Agree
1. I am a proud member of an exercise/ sport community.	1	2	3	4	5
2. Belonging to an exercise/ sport community is an important reflection of who I am.	1	2	3	4	5
3. Belonging to an exercise/ sport community is an important part of my self-image.	1	2	3	4	5
4. I am happy to belong to an exercise/ sport community.	1	2	3	4	5
5. I fit well into my exercise/ sport community.	1	2	3	4	5
6. I feel good about my exercise/ sport community.	1	2	3	4	5
7. My exercise/ sport community is considered good by others.	1	2	3	4	5
8. People consider my exercise/ sport community to be worthy.	1	2	3	4	5
9. Others respect the exercise/ sport community that I belong to.	1	2	3	4	5
10. My exercise/sport goals has been the same in the past, now and in future.	1	2	3	4	5

11. My beliefs on exercise/ my sport have been the same in the past, now and in future.	1	2	3	4	5
12. I have participated in similar intensity in exercise/ sport in the past, now and in the future despite of (challenges at) different phases of life.	1	2	3	4	5
13. Being an exerciser/ sport person is important to who I am.	1	2	3	4	5
14. My exercise/ sport defines me as a person.	1	2	3	4	5
15. I see myself as an exerciser/ sports person regardless of other roles I play in life.	1	2	3	4	5
16. I don't expect to change my beliefs about exercise/ sports.	1	2	3	4	5
17. I have firmly held views concerning my purpose participating in exercise/ sports.	1	2	3	4	5
18. I am unlikely to alter my exercise/ sports goals.	1	2	3	4	5
19. I feel a need to learn about different exercises/ sports to find the best one for me.	1	2	3	4	5
20. I evaluate my views on exercise/ sport through my experiences in various forms of exercises or sports.	1	2	3	4	5
21. I have reflected on the importance of exercise/ sports in my life.	1	2	3	4	5
22. I am open to explore new exercises/ sports if someone introduces it to me.	1	2	3	4	5

Physical activity levels

The following questions pertain to sports, fitness and recreational activities (leisure). Indicate the relevant options.

1. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like running or football for at least 10 minutes continuously? (Circle)

   a. Yes

   b. No

2. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?

   _____ days

3. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?

   _____ hrs _____ mins

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4. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as brisk walking (cycling, swimming, volleyball) for at least 10 minutes continuously? (Circle)

    a. Yes

    b. No

5. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?

    _____ days

6. How much time do you spend doing moderate-intensity sports, fitness or recreational activities on a typical day?

    _____ hrs _____ mins

Intrinsic Motivation Inventory

For each of the following statements, please indicate how true it is for you, using the following scale:

1	2	3	4	5	6	7
Not at all true			Somewhat true			Very true

Interest/Enjoyment   **Rating**

	Not at all true					Very true	
1. I enjoy doing exercise/ (my) sport very much	1	2	3	4	5	6	7
2. Exercise/ (my) sport is fun to do.	1	2	3	4	5	6	7
3. I think exercise/ (my) sport is a boring activity.	1	2	3	4	5	6	7
4. Exercise/ (my) sport do not hold my attention at all.	1	2	3	4	5	6	7
5. I would describe exercise/ (my) sport as interesting.	1	2	3	4	5	6	7
6. I think exercise/ (my) sport is quite enjoyable.	1	2	3	4	5	6	7
7. While I am doing exercise/ (my) sport, I am thinking about how much I enjoy it.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
Not at all true			Somewhat true			Very true

Perceived Competence

Rating

	Not at all true					Very true	
1. I think I am good at exercise/ (my) sport.	1	2	3	4	5	6	7
2. I think I do well at exercise/ (my) sport, compared to others.	1	2	3	4	5	6	7
3. I feel competent at exercise/ (my) sport	1	2	3	4	5	6	7
4. I am satisfied with my performance at exercise/ (my) sport.	1	2	3	4	5	6	7
5. I am skilled at exercise/ (my) sport.	1	2	3	4	5	6	7
6. This is an exercise/ (my) sport that I couldn't do well.	1	2	3	4	5	6	7

Effort/Importance

Rating

	Not at all true					Very true	
1. I put a lot of effort into exercise/ (my) sport.	1	2	3	4	5	6	7
2. I do not try hard to do well at exercise/ (my) sport.	1	2	3	4	5	6	7
3. I try hard at exercise/ (my) sport.	1	2	3	4	5	6	7
4. It is important to me to do well at exercise/ (my) sport.	1	2	3	4	5	6	7
5. I do not put much energy into exercise/ (my) sport.	1	2	3	4	5	6	7

Pressure/Tension

Rating

	Not at all true					Very true	
1. I do not feel nervous at all while doing exercise/ (my) sport.	1	2	3	4	5	6	7
2. I feel tense while doing exercise/ (my) sport.	1	2	3	4	5	6	7
3. I am relaxed in doing exercise/ (my) sport.	1	2	3	4	5	6	7
4. I am anxious while working on exercise/ (my) sport.	1	2	3	4	5	6	7
5. I feel pressured while doing exercise/ (my) sport.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
Not at all true			Somewhat true			Very true

Perceived Choice   Rating

	Not at all true						Very true
1. I have some choice about doing exercise/ (my) sport.	1	2	3	4	5	6	7
2. I feel like it is not my own choice to do exercise/ (my) sport.	1	2	3	4	5	6	7
3. I do not have a choice about doing exercise/ (my) sport.	1	2	3	4	5	6	7
4. I feel like I have to do this exercise/ (my) sport.	1	2	3	4	5	6	7
5. I participate in exercise/ (my) sport because I have no choice.	1	2	3	4	5	6	7
6. I participate in exercise/ (my) sport because I want to.	1	2	3	4	5	6	7
7. I participate in exercise/ (my) sport because I have to.	1	2	3	4	5	6	7

Relatedness   Rating

	Not at all true						Very true
1. I feel distant to my exercise/ my sport community.	1	2	3	4	5	6	7
2. I doubt that my exercise/ my sport community and I would ever be friends/ close.	1	2	3	4	5	6	7
3. I feel like I can trust my exercise/ my sport community.	1	2	3	4	5	6	7
4. I'd like a chance to interact with my exercise/ my sport community more often.	1	2	3	4	5	6	7
5. I prefer not to interact with my exercise/ my sport community in the future.	1	2	3	4	5	6	7
6. I don't feel like I can trust my exercise/ my sport community.	1	2	3	4	5	6	7
7. It is likely that my exercise/ my sport community and I can become friends/ close if we interact a lot.	1	2	3	4	5	6	7

Participant information

Name: _____

Gender: M / F (Circle)

Date of birth: _____(yyyy)_____(mm)_____(dd)

Email (For clarification purposes):_____

Thank you very much for your participation!

Appendix F: Mplus Input Specifications for ESEM and EFA in Study 2

<u>Exploratory Structural Equation Modelling</u>

TITLE: ESEM
DATA: FILE IS D:\Research\Data\Study 2\Final\Mplus\study 2.dat;

VARIABLE:
NAMES ARE
ID1 ID2 ID3 PR1 PR2 PR3 PU1 PU2 PU3 CO1 CO2 CO3 UN1 UN2 UN3
C1 C2 C3 C4 E1 E2 E3 E4;
USEVARIABLES ARE ID1 ID2 ID3 PR1 PR2 PR3 PU1 PU2 PU3 CO1 CO2 CO3 UN1
UN2 UN3
C1 C2 C3 C4 E1 E2 E3 E4;
ANALYSIS:
 ESTIMATOR IS WLSMV;
 ROTATION = GEOMIN(OBLIQUE,.5);
 MODEL: F1-F7 BY ID1 - E4 (*1);
 OUTPUT: TECH1; stand; tech4; mod; sampstat;

<u>Exploratory Factor Analysis</u>

TITLE: EFA
DATA: FILE IS D:\Research\Data\Study 2\Final\Mplus\study 2.dat;
VARIABLE:
NAMES ARE
ID1 ID2 ID3 PR1 PR2 PR3 PU1 PU2 PU3 CO1 CO2 CO3 UN1 UN2 UN3
C1 C2 C3 C4 E1 E2 E3 E4;
USEVARIABLES ARE ID1 ID2 ID3 PR1 PR2 PR3 PU1 PU2 PU3 CO1 CO2 CO3 UN1
UN2 UN3
C1 C2 C3 C4 E1 E2 E3 E4;
ANALYSIS:
 TYPE = efa 7 8;
 ROTATION = GEOMIN(OBLIQUE,.05);
 MODEL: F1-F7 BY I1 - E4 (*1);
 OUTPUT: TECH1; stand; tech4; mod; sampstat;

Appendix G: Mplus Input Specifications for CFA in Study 2

First Order CFA on ESIS

TITLE: CFA
DATA: FILE IS D:\Research\Data\Study 2\CFA\Final\Mplus\study 2.dat;

VARIABLE:
NAMES ARE
ID1 ID2 ID3 PR1 PR2 PR3 PU1 PU2 PU3 CO1 CO2 CO3 UN1 UN2 UN3
C1 C2 C3 C4 E1 E2 E3 E4;
USEVARIABLES ARE ID1 ID2 ID3 PR1 PR2 PR3 PU1 PU2 PU3 CO1 CO2 CO3 UN1
UN2 UN3
C1 C2 C3 E1 E2 E3 E4;

ANALYSIS:
 ESTIMATOR IS ML;
 ITERATIONS = 1000;
 CONVERGENCE = 0.00001;
 MODEL:
ID BY ID1 - ID3;
PR BY PR1 - PR3;
PU BY PU1 - PU3;
CO BY CO1 - CO3;
UN BY UN1 - UN3;
C BY C1 - C3;
E BY E1 - E4;
OUTPUT:
STDYX MODINDICES (.5);
RESIDUAL;

Second Order CFA on ESIS

TITLE: CFA L2
DATA: FILE IS D:\Research\Data\Study 2\CFA\Final\Mplus\study 2.dat;

VARIABLE:
NAMES ARE
ID1 ID2 ID3 PR1 PR2 PR3 PU1 PU2 PU3 CO1 CO2 CO3 UN1 UN2 UN3
C1 C2 C3 C4 E1 E2 E3 E4;
USEVARIABLES ARE ID1 ID2 ID3 PR1 PR2 PR3 PU1 PU2 PU3 CO1 CO2 CO3 UN1
UN2 UN3
C1 C2 C3 E1 E2 E3 E4;

ANALYSIS:
 ESTIMATOR IS ML;
 ITERATIONS = 1000;

```
    CONVERGENCE = 0.00001;
 MODEL:
ID BY ID1 - ID3 ;
PR BY PR1 - PR3;
PU BY PU1 - PU3;
CO BY CO1 - CO3;
UN BY UN1 - UN3;
C BY C1 - C3;
E BY E1 - E4;
SOC BY ID PR PU;
PER BY CO UN;
EGO BY C E;
OUTPUT:
STDYX MODINDICES (.5);
RESIDUAL;
```

CFA on IMI

```
TITLE: CFA IMI
DATA: FILE IS D:\Research\Data\Study 2\CFA\Final\Mplus\IMI7f.txt;

VARIABLE:
NAMES ARE
I1 I2 I3 I4 I5 I6 I7 C1 C2 C3 C4 C5 C6 E1 E2 E3 E4 E5 P1 P2 P3 P4 P5
A1 A2 A3 A4 A5 A6 A7 V1 V2 V3 V4 V5 V6 V7 R1 R2 R3 R4 R5 R6 R7;
USEVARIABLES ARE
I1 I2 I5 I6 C1 C2 C3 C5
A3 A5 A6 A7 R1 R2 R5 R6;
ANALYSIS:
ESTIMATOR IS ML;
ITERATIONS = 1000;
CONVERGENCE = 0.00001;
MODEL:
I BY I1 - I6;
C BY C1 - C5;
A BY A3 - A7;
R BY R1 - R6;
```

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Appendix H: Questionnaire for Study 3

Instructions

Below are questions that refer to you and your participation in exercise or sport. It will take about 20 minutes to complete. Please do not dwell on questions. If you are unsure, go with your gut instinct. There are no right or wrong answers. All answers will be kept confidential. This is to ensure you are comfortable about giving honest responses. Please try to answer the questions as accurately as you can.

Exercise and Sport Identity Scale

Exercise refers to physical activity that is planned, structured, repetitive and has as a final or an intermediate objective such as for the improvement or maintenance of physical fitness. Sport is a physical activity that involves a set of rules, physical fitness and physical skills. Taking reference to your participation in exercise or sport or non-activity, rate the following statements on a 5-point scale:

1	2	3	4	5
Disagree/ not applicable	Somewhat disagree	Neutral	Somewhat agree	Agree

		Strongly Disagree				Strongly Agree
1.	I am a proud member of an exercise/ sport community.	1	2	3	4	5
2.	Belonging to an exercise/ sport community is an important reflection of who I am.	1	2	3	4	5
3.	Belonging to an exercise/ sport community is an important part of my self-image.	1	2	3	4	5
4.	I am happy to belong to an exercise/ sport community.	1	2	3	4	5
5.	I fit well into my exercise/ sport community.	1	2	3	4	5
6.	I feel good about my exercise/ sport community.	1	2	3	4	5
7.	My exercise/ sport community is considered good by others.	1	2	3	4	5
8.	People consider my exercise/ sport community to be worthy.	1	2	3	4	5
9.	Others respect the exercise/ sport community that I belong to.	1	2	3	4	5
10.	My exercise/sport goals has been the same in the past, now and in future.	1	2	3	4	5

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11.	My beliefs on exercise/ my sport have been the same in the past, now and in future.	1	2	3	4	5
12.	I have participated in similar intensity in exercise/ sport in the past, now and in the future despite of (challenges at) different phases of life.	1	2	3	4	5
13.	Being an exerciser/ sport person is important to who I am.	1	2	3	4	5
14.	My exercise/ sport defines me as a person.	1	2	3	4	5
15.	I see myself as an exerciser/ sports person regardless of other roles I play in life.	1	2	3	4	5
16.	I don't expect to change my beliefs about exercise/ sports.	1	2	3	4	5
17.	I have firmly held views concerning my purpose participating in exercise/ sports.	1	2	3	4	5
18.	I am unlikely to alter my exercise/ sports goals.	1	2	3	4	5
19.	I feel a need to learn about different exercises/ sports to find the best one for me.	1	2	3	4	5
20.	I evaluate my views on exercise/ sport through my experiences in various forms of exercises or sports.	1	2	3	4	5
21.	I have reflected on the importance of exercise/ sports in my life.	1	2	3	4	5
22.	I am open to explore new exercises/ sports if someone introduces it to me.	1	2	3	4	5

Physical activity levels

The following questions pertain to sports, fitness and recreational activities (leisure). Indicate the relevant options.

7. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like running or football for at least 10 minutes continuously? (Circle)

   c. Yes

   d. No

8. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?

   _____ days

9. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?

   _____ hrs _____ mins

10. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as brisk walking (cycling, swimming, volleyball) for at least 10 minutes continuously? (Circle)

    c. Yes

    d. No

11. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?

    _____ days

12. How much time do you spend doing moderate-intensity sports, fitness or recreational activities on a typical day?

    _____ hrs _____ mins

Intrinsic Motivation Inventory

For each of the following statements, please indicate how true it is for you, using the following scale:

1	2	3	4	5	6	7
Not at all true			Somewhat true			Very true

Interest/Enjoyment   **Rating**

	Not at all true					Very true
1. I enjoy doing exercise/ (my) sport very much	1	2	3	4	5	6	7
2. Exercise/ (my) sport is fun to do.	1	2	3	4	5	6	7
3. I would describe exercise/ (my) sport as interesting.	1	2	3	4	5	6	7
4. I think exercise/ (my) sport is enjoyable.	1	2	3	4	5	6	7

Perceived Competence   Rating

	Not at all true					Very true
1. I think I am good at exercise/ (my) sport.	1	2	3	4	5	6	7
2. I think I do well at exercise/ (my) sport, compared to others.	1	2	3	4	5	6	7
3. I feel competent at exercise/ (my) sport.	1	2	3	4	5	6	7
4. I am skilled at exercise/ (my) sport.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
Not at all true			Somewhat true			Very true

Perceived Choice   Rating

	Not at all true					Very true	
1. I have some choice about doing this exercise/ (my) sport.	1	2	3	4	5	6	7
2. I participate in exercise/ (my) sport because I have no choice.	1	2	3	4	5	6	7
3. I participate in exercise/ (my) sport because I want to.	1	2	3	4	5	6	7
4. I participate in exercise/ (my) sport because I have to.	1	2	3	4	5	6	7

Relatedness   Rating

	Not at all true					Very true	
1. I feel distant to my exercise/ my sport community.	1	2	3	4	5	6	7
2. I doubt that my exercise/ my sport community and I would ever be friends/ close.	1	2	3	4	5	6	7
3. I prefer not to interact with my exercise/ my sport community in the future.	1	2	3	4	5	6	7
4. I don't feel like I can trust my exercise/ my sport community.	1	2	3	4	5	6	7

Participant information

Name: _____

Gender: M / F (Circle)

Date of birth: _____(yyyy)_____(mm)_____(dd)

Email (For clarification purposes):_____

Thank you very much for your participation!