The Use of Goal Contents Messages via Mobile App for Improving Females' Motivation, Behavior and Performance in Running

by

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Statement of Originality

I, CHOW, Chi Ngan, hereby declare that I am the sole author of the thesis. The material presented in this thesis is my original work except those indicated in the acknowledgment. I further declare that I have followed the University's policies and regulations on Academic Honesty, Copyright, and Plagiarism in writing the thesis, and no material in this thesis has been submitted for a degree in this or other universities.

Abstract

Background/Objective: Physical activity is essential for health and well-being. Most people nowadays lack physical activity, especially female undergraduates aged 18 and 24. Existing studies have shown a significant association between Self-Determination Theory (SDT), Goal Contents, mobile app and exercise motivation. Running is the most common physical activity that is low cost, flexible and easy-to-get. It would be worth knowing the effect of goal contents (intrinsic or extrinsic) delivered through a mobile app on novice female undergraduate runners' motivation, behavior, and performance in running. In this study, running was defined as recreational, with the intensity level of physical activity (40% to 80% heart rate reserve) and at least 20 minutes of continuous easy running. The study looked into the running motivation based on Self-Determination Theory, running behavior was demonstrated by looking at the running frequency and distance per week, and running performance was reflected by 1609m run (minutes).

Methods: This study lasted for 8 weeks with two times 45 minutes' sessions per week. Seventy-seven participants were randomly allocated to three experimental conditions: intrinsic goal content group (N=28), extrinsic goal content group (N=29), and a control group (N=20). Daily messages were sent to the intrinsic goal content group and the extrinsic goal content group by a running mobile app (RunKeeper). A mixed-method was adopted in this study. The quantitative data consisted of three parts. Firstly, questionnaires were conducted before and after the interventions to collect data regarding participants' motivation in running. Secondly, behaviors in running (frequency and distance per week) were recorded via an online platform self-reportedly during the first week, 4th week and final week. Thirdly, data for performance was reflected in a pre-and post 1609m running test.

For qualitative data, a total of twelve female undergraduates formed three focus groups for a semi-structured interview in the last week of the program; each focus group had 4 students.

Results: A two-way mixed repeated measures analysis of variance and LSD pairwise comparisons showed that the interaction effect between time and group was significant on autonomy (p<.001), relatedness (p<.001), amotivation (p<.05), running performance (p<.001), running frequency per week (p<.001) and running distance per week (p<.001), suggesting that intrinsic message was most effective in increasing participants' motivation, behavior, and performance in running. Focus group interviews also revealed that the 8-week training could improve students' motivation in running and the three basic psychological needs based on the Self-Determination Theory.

Conclusion: The study showed intrinsic messages sent via a mobile app was the most effective in enhancing female undergraduates' running motivation, behavior and performance (1609m test). However, a long-term follow-up should to be considered in the future, without the use of a classroom setting nor a teacher's involvement, to examine whether the participants' running behavior will still improve and whether such improvements can be sustained.

Keywords: Self-determination theory, goal contents, mobile app, physical activity, running, exercise motivation, exercise performance

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List of Abbreviations

ACSM	American College of Sports Medicine
BMI	Body Mass Index
BREQ-2	Behavior Regulation in Exercise Questionnaire II (BREQ-2)
CHP	The Centre of Health Protection
CM	Contingency Management
CUHK	The Chinese University of Hong Kong
EdUHK	The Education University of Hong Kong
GCOS	General Causality Orientations Scale
GCT	Goal Content Theory
GS	Graduate School
HDL	High Density Cholesterol level
HRR	Heart Rate Reserve
km	Kilometer
MET	Motivation Enhancement Therapy
min	minutes
PA	Physical Activity
PE	Physical Education
PIA	Physical Inactive
PNSE	Psychological Need Satisfaction in Exercise Scale
SDT	Self-Determination Theory
VO_2	Maximum Oxygen uptake
WHO	World Health Organisation

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Chapter 1: Introduction

This chapter summarized the background and objectives of this proposed research study. The research questions and significance of the study were presented. Motivation, behavior, and performance in running were also examined in the research questions addressed.

1.1 Background

According to well-known health organizations like American College of Sports Medicine (ACSM) and World Health Organization (WHO), there is no doubt that regular physical activity is necessary to maintain good health. It can reduce the risk of heart disease and obesity, increase bone and muscle health, and improve mental health. However, it is well-known that there is low physical level around the world (e.g., World Health Organization, 2018; Mayo et al., 2019; Regina et al., 2018), and females' physical activity worse than boys (e.g., World Health Organization, 2018; Mayo et al., 2019; Samual et al., 2011), and many studies mentioned that undergraduate students have low physical activity (e.g., Filipe et al., 2016; Jorge et al., 2019; Nxumalo et al., 2017; Jesse, 2017 and Dawson et al., 2007). Research (Simona et al., 2015) stated that male students are more active compared with female students. Researches (Racette et al., 2005; Arliss et al., 2007; Small et al., 2013) have reported that university students' physical activity was less than recommended according to established guidelines by ACSM, which stated that healthy adults aged 18-65 years should participate in moderate-intensity aerobic physical activity for a minimum of 30 minutes on five days per week, or vigorous-intensity aerobic exercise for a minimum of 20 minutes on three days per week. Because of the lack of physical activity in the undergraduate female between 18 and 24, Dawson argued that the University's "culture" might negatively impact university students' health, lifestyle, physical activity, and fitness (Dawson et al., 2007). Furthermore, some studies stated that peer pressure, popular culture,

and emerging freedom might also play a significant role in influencing university students' physical activities (Seed et al., 2005; O'Brien et al., 2014). Therefore, it is crucial to examine how to improve female undergraduate students' physical activity level in a higher priority.

In this study, running, defined as recreational, with the intensity level of physical activity (40-80% HRR) and at least 20 minutes continuous easy running, has become very popular in genders and ages. Many studies talked about the benefits of running (e.g., kozlovskaia et al., 2019; Szabo et al., 2013; Shipway & Holloway, 2010; Fordyle et al., 2002). Running is a good exercise in promoting physical activity.

People can carry out running at different distances (Schmid et al., 2012). Studies have proven that running has been steadily increasing in popularity over the past fifteen years, especially amongst women (Griffin, 2010). Women's running participation rate has raised more than men's, with 56.83%, while men's participation rate has grown by 46.91% (Jens, 2020). Moreover, the number of marathon races held worldwide has been on the rise from 2008 to 2018. The worldwide participation growth in marathon was 49.43% (Yeung & Pang, 2017). In Hong Kong, the number of participants in the Hong Kong Marathon from 1997 to 2016 increased (see Figure 1) (Yeung & Pang, 2017). Therefore, running is a trendy physical activity introducing to people, especially for the novice female undergraduate students who have lower physical activity levels. It is meaningful to know how to increase female undergraduates' behavior and performance in running.

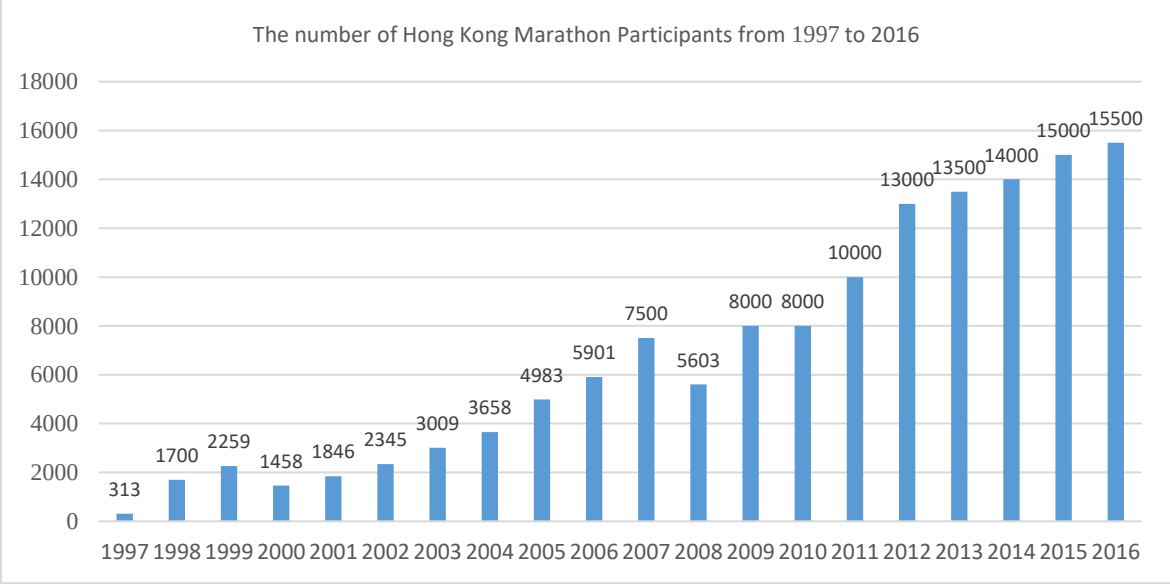

Figure 1. The number of Hong Kong Marathon Participants from 1997 to 2016 (Yeung & Pang, 2017).

Besides, goal contents (intrinsic goal and extrinsic goal) can affect individuals to be physically active, especially intrinsic goals can be an intentional and effective way to motivate individuals to exercise. Research has proven that intrinsic goal contents positively correlate with competence, well-being, and physical activity behavior (Tsz et al., 2020). Research supported the efficacy of goal contents and Self-Determination Theory in describing physical activity behavior and fitness. (Benjamin et al., 2016). Past studies have examined and supported that goal contents act as the antecedent of motivational regulations in exercise contexts, creating a viable means of predicting exercise participation and well-being (Sheldon et al., 2004; Sibley et al., 2016). However, studies have been paid less attention how goal contents (intrinsic vs extrinsic) delivered to individuals or received by individuals like text messages via mobile apps to affect their behavior and performance in running. Explosive growth of mobile device apps worldwide (Martin et al., 2017; Romeo et al., 2019; Muntaner et al., 2016). The previous research showed positive results on mobile apps on exercise motivation that mobile apps can effectively increase exercise behavior (e.g.,

Martin et al., 2017; Melton et al., 2015; Huang et al., 2020). Therefore, this study would like to use mobile apps to deliver text messages with intrinsic and extrinsic goal contents to see the effects on an individual's behavior and performance in running.

This study investigated the effects of goal contents (intrinsic goal and extrinsic goal) as messages delivered through a mobile app named "RunKeeper" to female undergraduate students. This study's outcomes were running motivation, running behavior (running frequency per week and running distance per week), and performance (1609m test). In this study, running motivation was identified by the Basic Psychological Need Satisfaction (competence, relatedness, and autonomy) and Self-Determination Motivation (internal motivation, control motivation, and amotivation). The study hypothesized that goal contents delivered via the app "RunKeeper" could enhance novice female undergraduate runners' motivation based on the Self-Determination Theory. The results' significance of this study would provide insights to physical education teachers on understanding how intrinsic and extrinsic goal contents messages via mobile apps to enhance novice female undergraduates' running motivation, running behavior, and performance.

1.2 Statement of the problem

1.2.1 Purposes and Research Questions

Using mixed research design in quantitative and qualitative, this study would like to look at the effect of goal contents by using mobile apps on running motivation, running behavior, and running performance for female undergraduate students who are new to running. Based on the relevant research findings and the theoretical framework (Self-Determination Theory), the following research questions are formulated. Research question 1: Are both intrinsic and extrinsic goal contents messages sent by mobile apps significantly associated with the outcomes of female undergraduates' motivation, behavior, and performance in running?

Therefore, differences in running motivation, running behavior, and running performance are examined between the intrinsic goal content group, extrinsic goal content group, and control group. Research question 2: how intrinsic and extrinsic goal contents sent by mobile apps affect female undergraduates' motivation (internal motivation, control motivation, and amotivation) and basic psychological needs (competence, relatedness, and autonomy) based on Self-Determination Theory.

1.3 Hypotheses

The following hypotheses are formulated based on the theoretical framework (Self-Determination Theory) and relevant research findings.

Hypothesis 1: There are significant group differences in running motivation, running behaviors, and running performance between intrinsic intervention group, extrinsic intervention groups, and control groups. Based on the studies of Sebire et al.(2009), Willy et al. (2012), Vansteenkiste et al. (2007), and Benjamin et al. (2016), it is found that intrinsic goal contents can positively predict exercising participation, physical self-worth, psychological well-being and quality of life. Therefore, in this study, it is hypothesized that intrinsic intervention group would have significant and positive associations with the three outcomes on running motivation, behaviors, and performance instead of the other two groups (extrinsic intervention groups and control groups). Hypothesis 2: it is hypothesized that intrinsic goal contents sent by mobile apps have positive effect on undergraduate females' motivation (internal motivation, control motivation and amotivation) and basic psychological needs (competence, relatedness and autonomy), whereas extrinsic goal content group do not show any influence.

1.4 Operational Definitions

1.4.1 Undergraduate Students

According to Hong Kong Education System and Policy (2021), the age of students in the education system was summarized as below:

Age	Education System
6-11	Primary school (P.1 to P.6)
12-14	Secondary school (F.1 to – F.3)
15-17	HKDSE (F.4-F.6)
18-21	Undergraduate (Year 1- Year 4)

People aged between 18 and 21 years old are regarded as undergraduate students taking different major studies if follow the Hong Kong Education System (Hong Kong Education System and Policy, 2021). In this study, 18 to 24 years old are in the range of our participants as the overseas or other mature students would be counted. The participants were mainly in late adolescence (Sawyer et al., 2012). They are in the rapid phases of human development. They need to face (i) biological and psychological maturity, (ii) health consequences later in the life course, (iii) influences of environmental and individual factors leading to changes (WHO, 2014).

1.4.2 Physical Education (PE)

PE has been a school curricular subject for most school-aged youth intended to develop skills, knowledge, values, and attitudes for establishing and enjoying an active and healthy lifestyle, and PE also provides opportunities for students to building confidence in facing challenges through a wide range of learning activities (Curriculum Development Council, 2017).

1.4.3 Goal Contents (Intrinsic/Extrinsic)

Goal contents represent the "what" of motivation in the Self-Determination Theory (SDT), which means what you hope by doing physical activity. For example, goals (what) in exercising may be to improve health and fitness or become fitter. (Deci & Ryan, 2000; Sheldon et al., 2004; Benjamin et al., 2016).

Goal contents consist of two types of goal contents — intrinsic goal and extrinsic goal. Intrinsic goal stems from internal factors such as personal interests and enjoyment, whereas extrinsic goal is based upon external factors including recognition and accolades that do not necessarily lead to self-development (Tsz et al., 2020). Intrinsic goal consists of social affiliation, health management, and skill development within the context of exercise, and those extrinsic goals are composed of image (i.e., appearance) and social recognition (Tsz et al., 2020).

1.4.4 Mobile Apps

Mobile apps are defined as technology that can be downloaded and used on smartphones, personal digital assistants (PDAs), tablets, and other wireless devices. Most studies on mobile apps would apply behavioral and psychological interventions (Elias et al., 2014). Martin et al. (2017) mentioned that smartphone use in supporting health behavior change via mobile fitness apps is encouraging and explosively increasing.

1.4.5 Running

In this study, running refers to recreational running, and it is an aerobic exercise for health and pleasurable, not either adventurous or competitive. Recreational running is increasingly widespread and could be an obvious target for those hoping to encourage more excellent public health through exercise (Russell et al., 2017). It is one of the most common physical

activities worldwide, with regular running consistently shown to reduce all-cause and cardiovascular mortality risks (Kozlovskaia et al., 2019). According to the American College of Sports Medicine (ACSM), Linda et al. (2014) recommended an adult to aerobic fitness, the intensity, and duration of aerobic exercise are recommended as the following:

Intensity	**Duration**
Moderate (e.g., 40% to <60% heart rate reserve [HRR] or VO2R) to vigorous (e.g., 60% to <90% HRR or VO2R)	Accumulate 30-60 min per day (≥150 min per week) of moderate-intensity exercise, 20-60min per day (≥75min per week) of vigorous-intensity exercise, or a combination of moderate and vigorous-intensity exercise per day.

According to ACSM, Linda et al. (2014), running in this study would be defined as recreational running at least 20 min continuous running with 40% to 80% HRR.

1.4.6 Self Determination Theory (Basic Psychological Needs and Motivation)

Self-Determination Theory (SDT) (Ryan & Deci, 2017; Deci et al., 2000) is a prominent theoretical framework developed to explain the mechanisms behind motivation and subsequent behavior. SDT is a continuum from intrinsic motivation to extrinsic motivation to amotivation. Intrinsic (internal) motivation is a completely internalized motivation characterized by fun and enjoyment in an activity. In contrast, extrinsic (control) motivation is characterized by separable outcomes instead of intrinsic reasons when engaging in an activity. With control motivation, individuals may engage in exercise because they experience pressure from others to do so and want to reduce negative physical or psychological symptoms. (Deci & Ryan, 2000). Amotivation is the lowest level of motivation in the self-determination continuum (Deci & Ryan, 2000). Amotivated people have no intention or motivation in an activity, which may be due to lack of competence and knowledge (Ommundsen & Kval, 2007; Ryan, 2009).

Another SDT mini-theory — basic psychological needs theory (BPNT) — holds that all individuals have three basic psychological needs that must be satisfied to achieve autonomous motivation. (Deci & Ryan, 2000; Ryan & Deci, 2017). The three psychological needs are autonomy (i.e., a sense of volition), competence (i.e., a sense of effectiveness), and relatedness (i.e., a sense of belonging). The satisfaction of these three psychological needs would have a greater internalization of self-determination and more intrinsic motivation. Psychological need satisfaction plays a significant role in mediating the relationships between exercise participation and psychological well-being.

1.4.7 Running Behavior

Behavior is the way in which a person behaves in response to a particular situation or stimulus.

Exercise behavior can be reported by an individual exercise frequency per week or exercise volume per week (Anderson,1995; Garcis, 1995; Dejong, 2021). In this study, the running frequency was demonstrated by running frequency (times) per week, and the running volume was shown by running distance (km) per week.

1.4.8 Running Performance

Running performance was demonstrated by the running time of 1-mile (1609m) run (minutes). The shorter the running time, the better would be the performance. 1609m run is a common and short test for an endurance test. It is a low-cost and simple test to perform. The test was conducted on a 400m running track, and all the participants could be in view throughout the test. This study would reference the previous research Steven et al. (2009) which conducted a 1-mile run (1609m run) as a performance outcome.

1.5 Significance of the Study

There has been much work related to running exercise, mobile apps, exercise motivation, and goal contents in recent years. However, most of the studies did not look into the goal contents messages sent by using mobile apps to influence exercise motivation, behavior, and performance in running. Therefore, this study aimed to conduct studies focusing on how the goal contents messages using mobile apps on affecting novice female runners' motivation, behavior, and performance.

Due to low activity levels and inactive lifestyles, especially females (the Centre of Health Protection, 2020; Department of Health, 2020), teachers nowadays face challenges in promoting exercise motivation, behavior, or performance. As in the Hong Kong setting, university undergraduate culture changes, undergraduate students have no regular or structured physical education (PE) lesson, extra curriculum for physical activity, or sports team practice, and their lives become busier, and they do less exercise. It is crucial to find effective ways to improve their exercise participation.

Students in Hong Kong was found to have sedentary behaviors like online games or videos or long sitting time (Huang et al., 2018). According to researches (Fordyce et al., 2002; Boudreau et al.; Luiz et al., 2015), running brings many positive influences to individual health, including reducing body fat, improving social relationships, self-confidence, and mental health. It is worthwhile to apply mobile apps in PE class to see the impact on running exercise. Therefore, it is imperative to investigate the goal contents for messages sending to female undergraduates via mobile app to see its effectiveness to improve their motivation, behavior, and performance in running in PE class.

In summary, the study would like to understand which goal contents (intrinsic or extrinsic) received by undergraduate female students who were novice in running, less than twice per

week running exercise can more effectively affect running motivation, running behavior, and running performance. The theoretical and practical significances were:

1. The messages of intrinsic goal contents received can increase running motivation.
2. It was the first empirical study of the goal contents messages via a mobile app on exercise motivation, behavior and performance.
3. This study's findings were likely to inform physical education teachers about the usefulness of mobile app and goal contents messages on promoting running for undergraduate students who are novice in running.

Chapter 2: Literature Review

Benefits of physical activity (PA), physical activity level, the benefit of running, self-determination theory, the empirical studies on a mobile app on exercise motivation, motivational goal content on exercise motivation, and previous motivational interventions to increase college students' physical activity were reviewed in this section. The research questions and hypotheses in this study were presented at the end.

2.1 Physical Activity Level

Physical inactivity was reported in different countries or cities all over the world. According to the Centre for Disease Control and Prevention (2020), there was estimated that 17.3 to 47.4 percent were physically inactive (PIA), while inactivity levels vary among adults by race/ethnicity and location in the United States of American. According to World Health Organization (WHO) (2018), 23% of men and 32% of women aged 18+ years were insufficiently physically active. Over the past 15 years, levels of insufficient activity did not improve (28.5% in 2001; 27.5% in 2016), the WHO Region of the Americas (39%) and the Eastern Mediterranean Region (35%) had the highest prevalence of insufficient physical activity, while the prevalence was lowest in the Western Pacific (19%) and African (22%) Regions.

According to Mayo et al. (2019), physical inactivity (PIA) prevalence showed an overall increase across Europe and for both women and men between 2013 and 2017. Regina et al. (2018) mentioned that the prevalence of insufficient physical activity was 27.5% in 2016. And it noted that if current trends continue, the 2025 global physical activity target (a 10% relative reduction in insufficient physical activity) cannot be met. To increase population levels of physical activity, there was an urgent need to prioritize some policies and measures on this matter.

For Hong Kong, the Behavioural Risk Factor Survey conducted in April 2016 showed that more than a quarter (28.0%) of adult aged 18 - 64 did not engage in any moderate or vigorous physical activity for at least 10 minutes, and only less than half (44.6%) did some vigorous physical exercise during a week. According to the statistics published by the Centre of Health Protection in 2018-2019 (Centre of Health Protection, 2020), about one in six adults (17%) aged 18 or above in Hong Kong had insufficient physical activity based on World Health Organisation's (WHO) recommendation, adults aged 18-64 years should do at least 150-300 minutes of moderate intensity aerobic physical activity or at least 75-150 minutes of vigorous intensity aerobic physical activity; or an equivalent combination of moderate-and vigorous-intensity activity throughout the week (WHO, 2020b). Department of Health, HKSAR (2020) also reported that physical inactivity is common in Hong Kong. Over half of the local population is not physically active. The level of physical activity in females was slightly lower than that in males. In addition, walking was a very common form of physical activity. During the week before enumeration, most (72.0%) of adult aged 18 to 64 had spent at least 10 minutes on walking every day. On the other hand, the survey also revealed that respondents had spent long hours sitting every day. Over half (55.7%) of adult aged 18 to 64 sat for at least 6 hours per day (Monday to Friday) in the week prior to the survey.

2.1.1 Undergraduate Students' Physical Activity Levels

Recent research about undergraduate physical activity from Sarah et al. (2019) showed a significant decline in physical activity participation and increased sedentary behavior during young adulthood in the college years in England. Sarah et al. (2019) found that the most common reason for not participating in exercise was time restrictions, and the most common reason for participating in exercise was to improve body shape. Kemmler et al. (2016) mentioned that the transition from high school to University, a significant decline in

performing physical exercise, in general, has been observed, and university students are at risk for weight gain 5.5 times more than the general population. According to U.S. Department of Health and Human Services (2018), the nationally recommended standard that in order to gain substantial health benefits, adults should do 150 minutes to 300 minutes per week of moderate intensity, or 75 minutes to 150 minutes per week of vigorous intensity aerobic activity, or an equivalent combination of moderate-and vigorous- intensity aerobic activity. Preferably, aerobic activity should be spread throughout the week. According to U.S. Department of Health and Human Services (2018), two-thirds of the students (66.2%) reported adequate vigorous activity levels in high school. In contrast, significantly fewer (44.1%) students met the standard during their first eight weeks at University. Data have shown that one-third of students were active in high school but became insufficiently active once at University, 33% were active at both times, 23% consistently fell short of recommended levels, and only 11% became active once at University. Students who had become insufficiently active reported higher levels of fatigue and lower vigor levels than those who continued to be active. A systematic review in Samuel et al. (2011) mentioned that physical activity level declines during the lifespan, particularly in adolescence. According to Magoc et al. (2011), studies show that physical activity levels drop dramatically from high school to college years and beyond. For example, nearly 65% of high school students engage in vigorous physical activity, compared to 32% of 18-to-24-year-olds and 23% of adults. A similar trend has been reported for moderate physical activity showing that approximately 27% of high school students engage in moderate physical activity, compared to 17% of 18-to-24-year-olds and 15% of adults (Rovniak et al., 2002). According to World Health Organization (2021), current global estimates show one in four adults and 81% of adolescents do not do enough physical activity. Physical activity is essential for general health, and the transition from high school to college will pronounce

lifestyle changes that can severely challenge a students's health status. (Black et al., 2017). And Jorge et al. (2019) mentioned that undergraduate students are in a transitional phase of life with many changes in the daily habits. Students have moved from a structured environment (school) to a relatively unstructured environment (University) that this transition phase lowers the overall physical activity level. And Filipe et al. (2016) highlighted that university students do not meet WHO's recommendations for physical activity levels (WHO, 2020b). Evidences showed that university students were less active compared to children and adolescents whom were even though not physically active enough. A specific characteristic of university students is that they go through emotional, physiological, and environmental changes that influencing their habits and lifestyle, such as physical activity (Filipe et al., 2016). Besides, studies from Booze et al. (2017) mentioned that university students had less physical activity due to new life stressors, including higher academic demands, financial concerns, and social uncertainty. And females have been shown in previous studies to have a stronger correlation to a stressful situation (Booze et al., 2017; Von & Fridlund, 2005). Undergraduate students' health status and lifestyles are in questions. Many studies argued that the University's "culture" may negatively impact university students' health, lifestyle, physical activity, and fitness (Dawson et al., 2007). Furthermore, some studies state that peer pressure, popular culture, and emerging freedom may also play a big part in influencing college students' physical activities (Bell et al., 2005; Seed et al., 2005; O'Brien et al., 2014).

A current study mentioned that college freshmen who were a population most likely to be away from their families for the first time and thus experienced a shift in lifestyle that they might not have enough time to engage in physical activity (Tze et al., 2020). More than half of the college students in the U.S. did not meet the recommended physical activity guidelines. Recent U.S. national health data showed that 41.4% of high school seniors met

the U.S. Department of Health and Human Services' recommended guidelines of at least 60 minutes of moderate-to-vigorous physical activity on five days per week (Kann et al., 2017; U.S. Department of Health and Human Services, 2018), while 43.9% of college students met the lower recommendations for adults—at least 30 minutes of moderate exercise on five days per week or 20 minutes of vigorous exercise on three days per week. Physical inactivity of those students, particularly college freshmen who did not meet the guidelines can be disadvantageous to their health for both the short and long term if this trend continues throughout adulthood. Therefore, in light of these health risks, exercise and health, researchers have advocated enhancing college students' motivation to engage in regular physical activity (Chu et al., 2019; Sibley et al., 2016).

As reported, regular exercise tends to decline dramatically among youth as they move from high school to University (Matthew et al., 2012). The physical activity changes during the transition from late adolescence to early adulthood represented the most dramatic declines in physical activity across a person's life (Matthew et al., 2012). Physical activity is vital in young adults because they become less active as they get older and because habits learned early in life tend to persist into adulthood (Magoc et al., 2011).

Research from Vries et al. (2016) mentioned that university students have a drop in exercises was because of study-related fatigue (i.e., overall fatigue and need for recovery). However, this research conducted an experiment divided into two groups, and one group was introducing low-intensity activity three times per week, the other was the control group. Participants in the exercise condition showed a more considerable decrease in two of the three indicators of study-related fatigue than controls. Additionally, sleep quality and some indicators of cognitive functioning improved more among exercisers than among controls. Another study figured out for those college students who do not exercise to see what factors would let them have the desire to exercise, 88.8% of them mentioned the circumstances

included "more time," "fewer demands," "workout partner or group," "more motivation," and "better facility location." (Ebben et al., 2008). And a study from Kilpatrick et al. (2005) indicated that college students were more likely to report intrinsic motives, such as enjoyment and challenge. In fact, university students should be targeted to reach the standards on physical activity levels recommended by the World Health Organization. It is believed that using proper ways on motivating them in physical activity would be crucial.

2.1.2 Female Physical Activity (PA) Level

According to the Centre for Health Protection (2016), 62.2% of females and 48.8% of males did not meet WHO's recommendations on physical activity levels. Yet, female was worse than male. Gender differences in physical activity levels among youth were well documented. Some studies investigated that why physical activity declined among adolescent females. The research identified that females had less PA than boys because females might receive less social support to engage in PA (Edwardson et al., 2013) or the biological reasons (Rohan et al., 2016). The World Health Organization (2020) mentioned that women were less active than men, with differences in prevalence between men and women of 10% and more remarkable in the Americas, the Eastern Mediterranean Region, and the South-East Asia Region.

According to Mayo et al. (2019), physical inactivity (PIA) prevalence showed higher PIA rates reported for women versus men. In Dawson et al. (2007), it is stated that Canadian female students were less involved in physical activity, and there was also a similar trend in South Africa.

According to Samuel et al. (2011), the study conducted between 2002 and 2004 investigated the prevalence of physical inactivity in 76 countries and comprised almost 300,000 individuals aged 15 years or older. The results showed that the worldwide prevalence of

physical inactivity was 21.4% (95%CI 18.4–24.3), being higher among women (mean =23.7%, 95% CI 20.4–27.1) than men (mean =18.9%, 95% CI 16.2–21.7). The study also concluded that one out of five adults around the world is physically inactive. Physical inactivity was more prevalent among women.

However, more people nowadays are lack of physical activity, especially studies reported that women had lower levels of physical activity. From the viewpoint of physiology, females' muscle per weight ratio was less than boys'; this was because females had a higher body fat percentage. Therefore, their strength ability was relatively low. This specific physiological feature made them dislike exercise as they struggled to overcome their body weight (Xiang, 1999). Furthermore, regarding their psychological perspective, females were easily subject to be shamed during physical activities if they had more body fat; also, they found difficulty in handling skills as they had less strength; this led to lower self-confidence overall (Xiang, 1999; Ida et al., 2020). Kimm et al. (2002) and Sabrina (2016) reported that 60% of the sedentary females mentioned that lack of time was a significant barrier to participating in physical activities. A study about college students' motivation for the physical activity mentioned that males reported higher motivation levels than women (Kilpatrick et al., 2005). More men who did exercise were looking for challenges, competitions, social recognition, strength, and endurance. In contrast, more women who did exercise were looking for weight management (Kilpatrick et al., 2005).

As increasing females' physical activity for achieving health benefits is more crucial, researchers and sports professionals should find effective and sustainable ways to maximize and increase their physical activity levels.

2.2 Benefits of Physical Activity

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure (Barbara, 2017). World Health Organization recommended that adults aged 18-64 years old should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or at least 75 minutes of vigorous aerobic physical activity per week or a combination of moderate and vigorous-intensity activity. Aerobic exercise should do at least 10 minutes in time duration. Additional health can be gained if increased the moderate-intensity aerobic physical activity time to 300 minutes per week or 150 minutes vigorous-intensity aerobic per week or an equivalent combination of moderate and vigorous-intensity activity. And muscular straightening activity should be done involving major muscle groups on two or more days a week. Adults can gain lots of health benefits if they follow this physical activity recommendation.

The benefits of physical activity for all population groups are well-established. There are well-known health organizations worldwide like the World Health Organization, American College of Sports Medicine announced that physical activity led to many benefits (Barbara, 2017). Physical activity can improve muscular and cardiorespiratory fitness; improve bone and functional health; reduce the risk of hypertension, coronary heart disease, stroke, diabetes, various types of cancer and depression; reduce the risk of falls and hip or vertebral fractures and physical activity is fundamental to energy balance and weight control as well (Barbara, 2017). Besides, a longitudinal study from Public Health Agency of Canada showed that physical active was associated with a 20% to 30% lower risk for premature all-cause mortality and multiple diseases (Johnston et al., 2019). Psychological health benefits like improving self-esteem, sense of well-being, the overall quality of life, lowering and controlling anxiety and depression, decreasing one's sense of isolation and loneliness also be noted if doing physical activity (Johnston et al., 2019).

On the other hand, the dangers of physical inactivity were outlined in many studies as it was one of the most critical issue for public health. According to Andersen et al. (2016), physical inactivity induced a higher mortality rate and higher economic burden. And this has been concerned because physical inactivity was recognized to have substantial deleterious impacts on both morbidity and mortality (Knight, 2012, Moore et al., 2012).

In Hong Kong, the Behavioural Risk Factor Survey conducted by the Department of Health revealed that physical inactivity is common in Hong Kong (Department of Health, 2020). Over half of the local population is not physically active that lack of exercise is one of the significant risk factors for heart diseases, cerebrovascular disease, diabetes mellitus, hypertension, some types of cancers, and obesity. In 2007, 6,373 people dying from coronary heart disease; and 1,690 people dying from colorectal cancer (Department of Health, 2020).

To maximize and increase individuals' physical activity, it is necessary to provide concrete information and evidences for understanding the importance and benefits of physical activity by all means for self-endorsed exercise behaviours in long terms.

2.3 Benefits of Running

In this study, running referred to recreational running with the intensity level of physical activity (40-80% HRR), at least 20mins continuous easy running. It was one of the most common physical activities worldwide, with regular running consistently shown to reduce all-cause and cardiovascular mortality risks (Kozlovskaia et al., 2019). Nowadays, running has become more and more popular in both genders and all ages, and people can carry out running at different distances (Schmid et al., 2012), with the number of marathon races held around the world is on the rise since 1990. Running, especially marathon-running, is increasingly prominent in the United States as an active leisure activity (Goodsell et al.,

2013). Many running events are raised around the world from recreational to elite level in different distances, like 5 kilometers (km), 10 km, half marathon (21.097km), and full marathon (42.195km) are common running events for both recreational and elite levels around the world. Everyone can join these running events based on their interests and ability levels. They can set different targets or goals to compete with themselves.

For Hong Kong, Yeung & Pang (2017) showed the number of participants in the Hong Kong marathon from 1997-2016, and the data showed the dramatic increase in participation (see Figure 2).

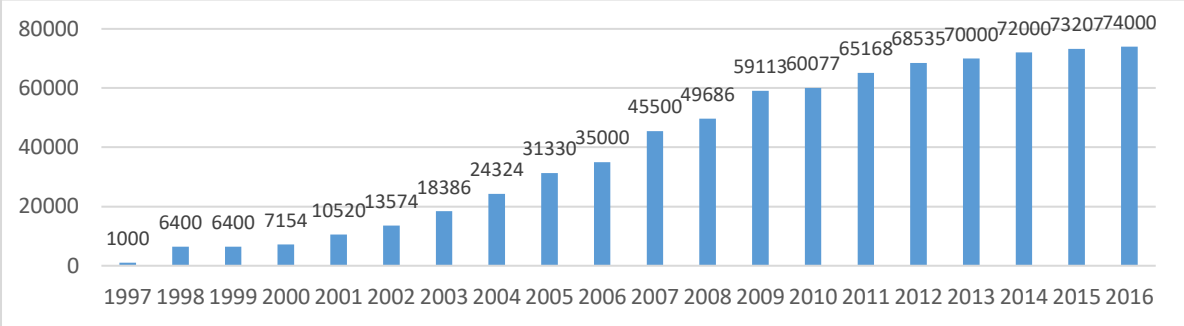

Figure 2. The Number of Participants in the Hong Kong Marathon (including 10k, half marathon, and full marathon) (Yeung & Pang, 2017)

Participation in recreational running has increased dramatically. The most popular distance to compete for runners remains the 5km, which racked up 8.9 million registrations in 2019, and was the only distance recording an increase year-over-year (Detroit, 2020). It is proven that over the past fifteen years, running has been steadily increasing in popularity, especially amongst women (Griffin, 2010).

Running provides a low-cost option without specific equipment or costs of sports club membership (Szabo et al., 2013). And running could be performed anywhere and anytime for increasing physical activity (Szabo et al., 2013). Kimm et al. (2002) reported that

running was an individual easy-to-get physical activity, as the running time was controllable and flexible. Running was affordable. It was an excellent physical activity to increase fitness and health. Running can be a lifelong sport that can be developed and cultivated through habits. Due to the increasing popularity and health benefits of running, people opted to run because it was an "easy and enjoyable leisure activity" (Shipway et al., 2010). Studies reported that recreational running also had psychological benefits which could reduce stress, depression, and anxiety (Fordyce et al., 2002). Studies showed that running was a useful exercise to reduce fat, improving social relationships, self-confidence and providing greater feelings of empowerment (Boudreau et al., 2010). Running was an efficient way to tone up legs and butt muscles quickly, and its cardio nature helps women reduce fat by using lots of calories or energy output. And regular running can improve the state of mind by releasing endorphins, and an easy run can help release endorphins that can alleviate aches and pains during menstruation (Jane, 2019). Running can also stimulate the growth of new nerve cells, which increases learning and memory ability, besides improving the quality of rest and sleep (Basso et al., 2017). Running exercise can help young people and healthy adults build bone, as the pounding action on the ground can aid in the addition of bone mass. Luiz et al. (2015) mentioned that endurance running provided substantial beneficial effects on body mass, body fat, resting heart rate, VO2 max, triglycerides, and HDL cholesterol in physically inactive adults effectively. Among different kinds of exercise, running seemed a light tunnel for females. Since the worldwide participation growth in marathon races worldwide from 2008-2018 is 49.43%, women are picking up faster than men with a gain of 56.83%, while men's participation rate has increased 46.91% (Jens, 2020). Today, women running becomes more popular, and many races or groups are organized only for women, such as women running clubs. Running seems to attract females to participate. Therefore, it is good to introduce running to females who do not have enough physical activity level.

However, less research showed ways to enhance running's motivation, running behavior or running performance for female undergraduates who are new in running. Therefore, it is worthwhile to examine effective ways to motivation females' running motivation, behavior and performance based on their ability and interests to achieve WHO's recommendations on physical activity levels and health benefits.

2.4 Previous Motivational Interventions to Increase College Students' Physical Activity

Wogksch at al. (2011) suggest Motivation Enhancement Therapy (MET, a counseling intervention seeking to increase intrinsic motivation to change) and Contingency Management (CM, a behavioral intervention providing extrinsic motivation for completion of target behaviors) in college students that appears effective in increasing participants' intrinsic motivation and also it concluded that intrinsic motivation is critical for long term physical activity adherence. Matthew et al. (2012) studied brief motivational intervention to increase physical activity among college students. The interventions were conducted using motivational intervention principles such as expressing empathy, rolling with resistance, and using reflections to help participants explore ambivalence about changing behaviors, and the findings from this study provides preliminary support for the efficacy of a brief motivational intervention designed to increase physical activity among college students.

Another similar research from Al-Eisa et al. (2016) investigated the efficacy of using an "Instagram application" with a "home-exercise program" as a motivational stimulus in improving physical activity adherence levels among fifty-eight female college students. It concluded that using Instagram with the home exercise program as a motivational modality could be attractive and useful to reinforce adherence and maintain appropriate physical activity levels among female college students. And Al-Eisa et al. (2016) reported that the most typical factors to improve motivation for exercise in university students are disease

prevention, physical fitness, bodyweight management, and stress management. Besides, females are very often concerned about body weight, and being agile and weight management is the most crucial motive for females' exercise. It also suggested that the extrinsic factors were more often observed as motives for exercise while the intrinsic factors were more related to sports participation.

Giacobbi et al. (2014) examined the effects of a peer-based mental imagery intervention on female university students' self-determined motivation and cardio-respiratory fitness. The results show a significant improvement in cardio-respiratory endurance, ratings of perceived endurance, and self-determined motivation to exercise were observed across both study conditions. Participants assigned to the peer mentored plus mental imagery condition reported more significant increases in self-determined motivation to exercise at post-test than those in the peer-mentored condition. And it concluded that peer-based interventions are a viable way to improve fitness and health outcomes. Simultaneously, mental imagery appears to be associated with increase in autonomous forms of exercise motivation.

Xiaoxia et al. (2015) revealed that mastery-approach goals, which represent a goal of improving competence, learning, and mastery of a task, positively predicted intrinsic regulation and identified regulation. And the performance-approach goal, which refers to the goal of demonstrating competence by outperforming others, was a stronger predictor of external regulation among female students than among male students. And it supported the view that mastery-approach goals are motivationally beneficial, especially among female students, in college physical activity class settings.

Benjamin et al. (2016) examined the relationships among exercise goal contents, behavioral regulation, physical activity, and aerobic fitness within the context of eight-week university physical education courses. Relative intrinsic goal content was found to predict physical activity indirectly and aerobic fitness via behavior regulation. Specific goal contents related

to health management and skill development were found to predict physical activity and aerobic fitness via a fully mediated path through identified and intrinsic regulation.

A research from Egli et al. (2011) examined differences in exercise motivation between age, sex, and race for college students. Significant differences were found in 3 of 14 exercise motivational subscales by age (affiliation, health pressures, and ill health avoidance) ($p < .05$). Males were motivated by intrinsic factors (strength, competition, and challenge) ($p < .05$) and females by extrinsic factors (i.e., weight management and appearance) ($p < .05$); only 2 subscales proved not to be significant by sex. Race differences provided 8 significant differences by exercise motivations ($p < .05$). From this research, understanding these differences in exercise motivations in college-aged population were important for college health professionals for programming strategies and promoting physical activity.

2.5 Self-Determination Theory

2.5.1 Self-Determination Theory Framework

Self-determination theory (SDT) was the basic theory used in this study. SDT (Deci & Ryan, 1985; Deci & Ryan, 2000) is a contemporary framework developed to explain the mechanisms behind motivation and subsequent behavior, frequently and consistently used to understand and study human motivation over the past decades, especially in physical activity (physical education, sport, and exercise). Motivation is very complex and is affected by an individual's internal and external factors, which may be permanent, intermittent, or transient. Many different factors sometimes influence an individual's motivation at the same time. (Goodsell et al., 2013)

Many sports studies incorporate SDT to understand sports participation or motivation (Pelletier et al., 2013). Self-determination theory is a continuum from intrinsic motivation to

amotivation, and SDT focuses on the degree to which human behavior is self-motivated and self-determined. (Ryan & Deci, 2000, Ryan & Deci, 2017, Deci & Ryan, 2012).

Edward Deci and Richard Ryan later expanded on the early work differentiating intrinsic and extrinsic motivation and proposed three main intrinsic needs involved in self-determination which is another SDT mini-theory—Basic Psychological Needs Theory (BPNT) (Deci & Ryan, 1991; Deci & Ryan, 1995; Ryan & Deci, 2017; Deci & Ryan, 2000). These three psychological needs are autonomy (i.e., a sense of volition), competence (i.e., a sense of effectiveness), and relatedness (i.e., a sense of belonging). Psychological need satisfaction plays a significant role in mediating the relationships between exercise participation and psychological well-being. These needs are said to be the universal and explained that all individuals have three basic psychological needs that must be satisfied to achieve autonomous motivation (Deci & Ryan, 2000). The three basic psychological needs satisfaction can foster more autonomous or controlled types of motivation. (Deci & Ryan, 2000). The satisfaction of these three psychological needs of an individual (autonomy, competence, and relatedness) would have a greater internalization of self-determination and more intrinsic motivation. Internalization refers to the active attempt to transform an extrinsic motive into personally endorsed values and thus assimilate behavioral regulations that were initially external. (Deci & Ryan, 1991; Deci & Ryan, 1995).

However, SDT can be divided into two sub-theories, Cognitive Evaluation Theory, and Organismic Integration Theory. With the Cognitive Evaluation Theory, it is mentioned that mental health needs to meet three needs which are three basic psychological needs (Autonomy, Competence, and Relatedness). Autonomy refers to choosing and controlling one's behavior; competence refers to a person's ability to be good at something; relatedness refers to the communication with others under a positive relationship. These three elements are universal and can be applied to describe people in all cultures. (Deci & Ryan, 2000).

Organismic Integration Theory can be demonstrated as a continuum (Figure 3), from intrinsic motivation to extrinsic motivation to amotivation. and motives are stated to be stronger towards the right of the continuum (Deci & Ryan, 1985). And actually, SDT distinguishes two types of motivation: one with higher quality, autonomous or self-determined, the other with less quality, amotivation or controlled. Intrinsic motivation is a completely internalized motivation characterized by fun and enjoyment in an activity. In contrast, extrinsic motivation is characterized by separable outcomes instead of intrinsic reasons when engaging in an activity. It consists of four forms of motivational regulations—integrated, identified, introjected, and external regulations—with descending degrees of internalization in a continuum (Ryan & Deci, 2017; Deci & Ryan, 2000). Figure 3 summarized Deci & Ryan (2000) proposed continuum in which self-regulation changes from amotivation (lower end of motivation throughout the SDT continuum) to intrinsic motivation (higher end of motivation throughout the SDT continuum).

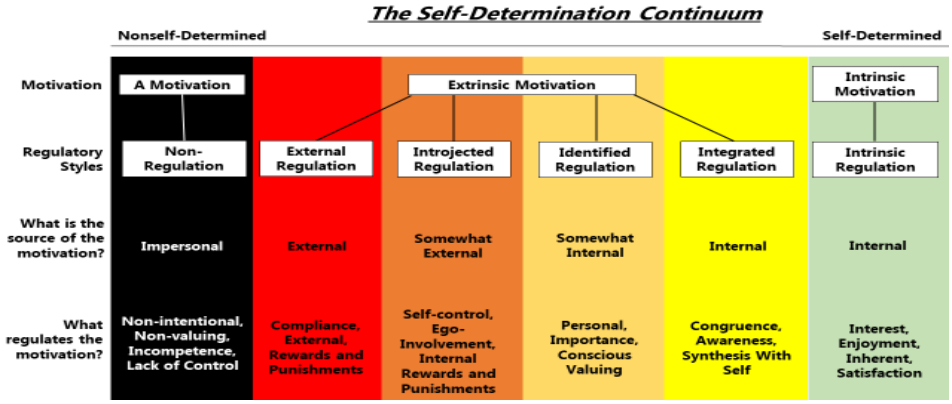

Figure 3: The Self-Determination Continuum: Organismic Integration Theory (Deci & Ryan, 1985) (Ryan & Deci, 2000)

According to Deci & Ryan (1985), amotivation (Non-regulation) refers to the lack of attachment of importance and meaning to activities. External regulation refers to a motive that satisfies external needs, such as a student doing homework to avoid parental

confrontation. Introjected Regulation refers to the avoidance of guilt or anxiety, or the attainment of ego enhancements, such as a student opting for Biology as his/her major subject to prove that he/she can do it. Identified Regulation refers to the consideration of an act to be valued or essential. An individual would like to achieve personal goals, such as a student taking an extra statistics course to understand better statistics and its relation to his/her major. Integrated Regulation refers to the identification of the importance of the behavior, as well as the integration of those identifications with other aspects of self, such as a student taking an extra course even though it is not compulsory because it is consistent with her life goal of being an excellent performer and teacher. Intrinsic motivation (IM) refers to the voluntary participation in individuals' sports without external rewards or gains (Deci & Ryan, 1985). A person with intrinsic motivation is not easy to relapse or give up as the person enjoys what he or she does, such as a student who runs every day and can keep a running habit consistency for a long time. According to Deci & Ryan (2000), the theory of self-determination states that it is desirable to help people develop their autonomous motives, which require volition, choice, endorsement, interest, deep value, and belief. With autonomous motivation, people will show higher creativity, higher skills to solve problems, higher performance, positive emotions, better psychological and physical health. Thus, Deci & Ryan (2000) also mention that through autonomous support, helping people to have the autonomous motivation, motivators need to provide ideas, choices, reasons, self-inspiration, and exploratory elements for their targets. To summarize the self-determination theory, the self-determination model was shown in Figure 4.

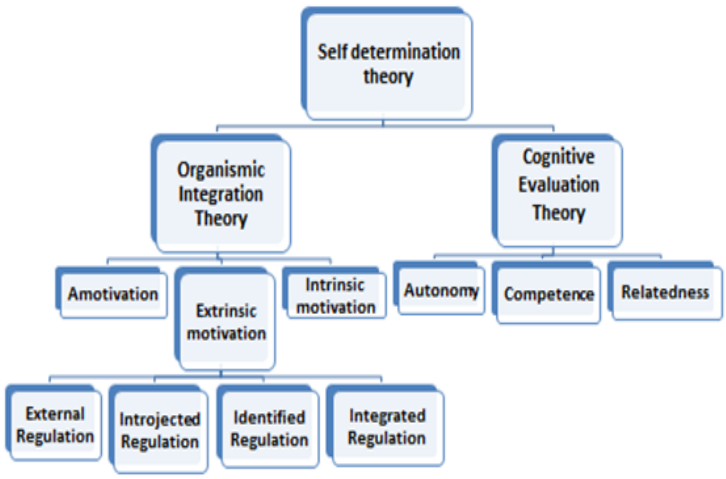

Figure 4. Self-Determination Model, which Summarizes the Theory of Self-Determination

And a study by Collen et al. (2012) mentioned that enhancing intrinsic motivation will lead to long-term behavior change. The systematic review from Pedro et al. (2012) about SDT and exercise behavior provides evidence for the value of SDT in understanding exercise behavior, demonstrating the importance of autonomous (identified and intrinsic) regulations in fostering physical activity. And according to Philipe (2018), there were five ways to increase intrinsic motivation, (1) Sense of Purpose, when we realize our purpose, we can get engaged with our goals (2) Autonomy, people can make decisions on their own (3) Feeling of accomplishment, the feeling of accomplishment is itself a powerful internal reward (4) Progress when we make progress, our brain responds to it, feeling motivated and determined (5) Curiosity, when people are curious about something, people can work hard to learn more about the subject of interest, even if people don't have any external rewards for doing it.

This study discussed the results in terms of Self-Determination Theory and the concept of Three Basic Psychological Needs for autonomy, competence, and relatedness. Self-Determination Theory (SDT) (Ryan & Deci, 2017; Deci & Ryan, 2000) is a prominent theoretical framework developed to explain the mechanisms behind motivation and subsequent behavior. SDT research has shown consistency over the past decades in understanding the relationships between exercise motivation and behavior. The study categorized the intrinsic motivation and integrated/identified regulation as autonomous motivation. With autonomous motivation, individuals participate in exercise due to enjoyment, personal values, and mastery of activities. On the other hand, the study categorized the introjected regulation and external regulation as control motivation. With control motivation, individuals may engage in exercise because they experience pressure from others to do so and want to reduce negative physical or psychological symptoms. (Deci & Ryan, 2000).

2.6 Goal Contents

In this study, based on self-determination theory, three categories of motivation including internal motivation, control, amotivation, and students' three basic psychological needs (autonomy, competence, and relatedness) were analyzed. According to the SDT, intrinsic goals are more adaptive than extrinsic goals that the content of the future goals affects the quality of the motivation to achieve those goals. This was shown in empirical studies in educational psychology and health psychology (Willy et al., 2012). Therefore, this study had another theory called Goal Content Theory (GCT), which is one of the sub-theories that establishes SDT (Ryan & Deci, 2000). GCT was developed to understand how the content of a goal can lead to differential outcomes affecting well-being and behavior. (Deci & Ryan, 2000). GCT distinguishes two types of goal content—intrinsic and extrinsic. Intrinsic goals

stem from internal factors such as personal interests and enjoyment, whereas extrinsic goals are based upon external factors including recognition and accolades that do not necessarily lead to self-development. Intrinsic goals generally focus on greater physical and psychological feelings of wellness (e.g., less physical and depressive symptoms) than extrinsic goals.

The assertion that both the content of goals and the motives behind goals affect psychological well-being has been controversial (Sheldon et al., 2004). Goal contents represent the "what" of motivation in the Self-Determination Theory (SDT), which means what you hope by doing physical activity. If goal contents are the "what," behavioral regulations are the "why", which means reasons of doing physical activity and reasons of setting the goals. For instance, an individual goal (what) in exercising may be to improve health and fitness or become fitter, but the underlying behavioral regulation or motivation (why) might be that the spouse has the concern on the individual's health, and the individual hopes to let the spouse happy for doing exercises (Deci & Ryan, 2000; Sheldon et al., 2004; Benjamin et al., 2016).

During the past decade, SDT also has paid more attention to the "what" of an individual's motivations, that is, to the specific contents, targets, or referents of people's goals (Deci & Ryan, 2000). GCT is one of the sub-theories of SDT that SDT (Deci & Ryan, 2000) postulates the goals a person pursues when doing an activity can explain how he or she goes. Therefore, having different goals when carrying out an activity can condition the well-being and personal development it produces. Recent qualitative approach of motivation in research based on the SDT from Vansteekiste et al. (2006) showed that the quality of motivation depends on the content or type of goals (i.e., intrinsic versus extrinsic goals). Intrinsic future goals create a much better type of motivation than extrinsic future goals do (Willy et al., 2012). And a study concluded that teachers could best promote intrinsic goals, even when

facing students who personally hold a stronger extrinsic than intrinsic goal orientation (Vansteekiste et al., 2008).

Looking into two types of goal contents (intrinsic goals and extrinsic goals) with three basic psychological needs of SDT, Vansteenkiste et al. (2008) experimentally tested two rival hypotheses concerning the positive motivational effects of pursuing intrinsic goals and extrinsic goals. The SDT predicts that pursuing intrinsic goals is always, everywhere, and for everybody better than pursuing extrinsic goals (Deci & Ryan, 2002; Kasser et al., 2002). This difference is explained by the fact that intrinsic goals satisfy and extrinsic goals frustrate the three innate basic psychological human needs proposed by the SDT: the need for autonomy, the need for competence, and the need for relatedness. But the match-perspective or fit-hypothesis from Vansteenkiste et al. (2008) predicts that a match or fit between people's personal goal orientations and the goals that are emphasized or valued in the immediate environment is most adaptive. Pupils with either a dominant intrinsic goal orientation or a dominant extrinsic goal orientation were randomly placed in an experimentally created intrinsic or extrinsic goal condition. The match-perspective predicts a significant interaction between personal and situational goal orientation: intrinsic-intrinsic and extrinsic-extrinsic should be the most optimal combinations. But for none of the dependent measures (i.e., autonomous motivation, conceptual learning, rote learning), the interaction was significant. In line with the SDT, all significant effects were main effects of the individual and the experimentally induced goal content, intrinsic goals being more adaptive than extrinsic goals. Extrinsic life domain goals such as having an appealing appearance, seeking fame, and financial success are more outwardly oriented, externally referenced goals contingent on the approval or analysis of others. As such, extrinsic goals are hypothesized to be less or even unsatisfying of basic psychological needs and consequently considered to hinder optimal human development (Deci & Ryan, 2000; Simon et al., 2008).

2.7 Studies Related to Goal Contents and Exercises

GCT highlights two types of goal content—intrinsic and extrinsic. Within the exercise, intrinsic goals consist of social affiliation, health management, and skill development. Those extrinsic goals are composed of image (i.e., appearance) and social recognition (Tsz et al., 2020). Kasser et al. (1996); Sebire et al. (2009; 2011) and Vansteenkiste et al. (2004) mentioned that intrinsic goals generally evoke greater physical and psychological feelings of wellness (e.g., less physical and depressive symptoms) than extrinsic goals. And research shows that the kind of goals pursued could lead to different consequences not only in life in general but also in particular domains, including physical activity (Kasser et al., 1996; Sebire et al., 2009, 2011; Vansteenkiste et al., 2004).

Before the goal content theory was developed and integrated into the more general SDT structure, previous research had analyzed the effect that the various reasons or motives people undertook exercise had on the way they engaged with the activity. Indeed, within the exercise context, the terms motives or reasons were used synonymously to those which SDT understands today as the goals that a person can pursue when they get involved in a task (Frederick et al., 1993; Ingledew et al., 2008). In this vein, previous research supported the idea that exercising following intrinsic or extrinsic goals results in different outcomes. For example, exercising with motives that could be considered extrinsic goals (e.g. to improve appearance) was positively associated with exercise anxiety, physical social anxiety, and physical discomfort, and negatively associated with self-esteem (Sebire et al., 2009), while exercise motives that could be considered intrinsic goals (e.g., skill-development or interaction with others) were positively related to self-esteem, psychological well-being, satisfying basic psychological needs, attention, and fun (Sebire et al., 2009). Sebire and colleagues provided further support for GCT in a sample of British government employees, whose goals with greater intrinsic than extrinsic contents (i.e., relative intrinsic goals) were

more conducive to not only exercise participation but also physical and psychological well-being (Sebire et al., 2009).

As is true with goal contents, research examining the relationship between behavioral regulation and exercise-related outcomes in general supports that more self-determined regulations lead to more positive behavioural outcomes. For instance, research supports the claim that more autonomous forms of motivation are linked to greater self-reported exercise (Sebire et al., 2011; Benjamin et. al., 2016). And it was mentioned that relative intrinsic goal content could positively predict physical self-worth, self-reported exercise behavior, psychological well-being, and psychological need satisfaction and negatively predict exercise anxiety (Simon et al., 2009).

Furthermore, Vansteenkiste et al. (2004) found in a real-life experiment (physical education classes for pupils in grades 10–12) that framing an exercise activity in terms of future intrinsic goal-attainment (i.e., focusing on health and physical fitness) positively affected effort-expenditure, autonomous exercise motivation, performance, long-term persistence, and even sports club membership. Framing the same physical exercise activity in terms of future extrinsic goal-attainment (i.e., focusing on image and physical attractiveness) undermined those outcomes compared to a no-future goal control group. This research created three-goal content conditions: an intrinsic goal condition (i.e., a clean and healthy environment), an extrinsic goal condition (i.e., saving money), and a condition in which both the intrinsic and the extrinsic goals were presented; based on a quantitative approach, one would expect that the condition with two future goals is more motivating than the conditions with only one goal. But the study argued that one should also take the goal content into account: intrinsic goals (e.g., self-development, health, physical fitness, competence, community contributions, affiliation) create a much better quality of motivation than do extrinsic goals (e.g., financial success, power, status, physical attractiveness). In line with the SDT, the data showed that a

single intrinsic goal led to better performance and persistence than the single extrinsic goal or the double-goal framing condition. The future extrinsic goal condition was the least adaptive. The positive effects of the intrinsic versus the double goal framing on performance and persistence were fully mediated by participants' task-orientation, that is, by the participants' motivation to master and fully understand the learning material. Similarly, the extrinsic goal's negative effect compared with the double-goal framing on academic achievement was also mediated by the degree of task-orientation. In the single extrinsic goal condition, the participants obtained lower achievement scores because they were less oriented towards mastering the learning material. (Vansteenkiste et al., 2004)

Another research by Vansteenkiste et al. (2007), the researcher tried to motivate high school students (grades 10–12) to learn about and exercise Tai Bo during physical education classes by experimentally inducing an intrinsic goal (i.e., doing Tai Bo to remain physically fit and healthy) or an extrinsic goal (i.e., doing Tai Bo to stay physically appealing). In a third control condition, no future goal was induced. They found significant main effects of goal condition on the degree of task versus ego-involvement and test performance level. The intrinsic goal condition was the most optimal, and the extrinsic goal condition the least optimal. Also, in this study, goal content on performance was fully mediated by the degree of being task versus ego-oriented during learning.

Sebire et al. (2009) have shown that how exercise is internalized into a person's identity can be a mediator in this relationship. A construct which reflects the way a person internalizes the value attributed to a particular activity and thus submits to it is that of passion (Parastatidou et al., 2014). The intrinsic goals of self-acceptance, community contribution, affiliation, and health/ fitness were postulated to exist in concordance with the human innate growth tendencies proposed within SDT. Such goals are hypothesized to satisfy the psychological needs for autonomy, competence, and relatedness by intrinsic goals (Deci &

Ryan, 2000). Intrinsic goals, such as physical fitness, personal growth, or social affiliation, are inwardly focused on self-development and are posited to lead to more positive outcomes. Extrinsic goals, such as winning competitions and prizes, fame, or physical appearance, are outwardly focused and related to self-evaluative concerns. Research has also examined the relationship between goal contents and actual behavior. In the exercise domain, Sebire et al. (2009) found that intrinsic exercise-related goals were positively associated with basic need satisfaction, psychological well-being, and physical self-worth, but also self-reported exercise behavior (Benjamin et al., 2016).

Relative intrinsic goal content was found to predict physical activity and aerobic fitness via behavioral regulation indirectly. Specific goal contents related to health management and skill development were found to predict physical activity and aerobic fitness via a fully mediated path through identified and intrinsic regulation. Results supported the efficacy of goal contents and self-determination theory in describing physical activity behavior and fitness. (Benjamin et al., 2016)

According to Tsz et al. (2020), findings expanded current knowledge of goal content, indicating that emphasizing social affiliation, health management, and skill development is conducive to exercise participation, whereas focusing on appearance and social recognition could be detrimental.

It is worthy of note that goal content indirectly, rather than directly, predicts behavior and well-being through other motivational variables (Ryan & Deci, 2017). Past studies have primarily examined and supported that goal content acts as the antecedent of motivational regulations in exercise contexts, creating a viable means of predicting exercise participation and well-being (Sibley et al., 2016; Sebire et al., 2009; Sebire et al., 2011; Gillison et al., 2006; Seghers et al., 2014).

There are extant literatures consistently reporting that goal content and motivational regulations help predict exercise participation and associated psychosocial outcomes. Past studies indicated that (relative) intrinsic goals positively predicted, and extrinsic goals negatively predicted physical activity (Sebire et al., 2011, Seghers et al., 2014; Duncan et al., 2017). Similarly, intrinsic goals are positively predicted, and extrinsic goals are negatively predicted, exercising participation and quality of life. The only study to date that has examined exercise goal content in college students, Sibley and colleagues from Sibley et al. (2016) found that relative intrinsic goals positively predicted physical activity in U.S. college students who were enrolled in university weight training, jogging and conditioning, and aerobic classes.

From the perspectives of three basic psychological need satisfaction and goal contents in exercise-related aspects, psychological need satisfaction has been shown to play a significant role in mediating the relationships between exercise goal content and exercise participation, and psychological well-being. Specifically, Sebire and colleagues from Sebire et al. (2009) demonstrated that relative intrinsic goals positively predicted physical self-worth and psychological well-being and negatively predicted exercise anxiety through psychological need satisfaction. Gunnell et al. (2014) is the only study to examine psychological need satisfaction and motivational regulations, and goal content in an exercise context. This study found that, contrary to Basic Psychological Need Theory assumptions, changes in Canadian adults' psychological need satisfaction did not mediate the relationships between changes in relative intrinsic goals and changes in motivational regulations. Instead, motivational regulations were antecedents of psychological need satisfaction, revealing that changes in autonomous motivation, but not controlled motivation, mediated the positive relationships between changes in relative intrinsic goals and changes in psychological need satisfaction,

which in turn predicted increases in physical activity, subjective vitality, and positive affect, as well as a decrease in negative affect.

Eventually, after the literature reviews, the relationship between motivational content (goal content) and exercise has not been studied so intensively (Standage et al., 2012; Sicilia et al., 2017). More specifically, research evidence has indicated that exercise goal content relate to exercise motivation and participation and thus warrant further investigation (Tsz et al., 2020).

2.8 Mobile Apps on Exercise Motivation

In the past, researchers try to develop different methods to intervene individuals' exercise motivation and behaviors. For instance, Melton et al. (2015) showed that physical activity app in the classroom for university students could significantly increase self-efficacy in doing exercise. However, a systematic review from Buchholz et al. (2013) concluded that using text messaging to promote physical activity has only been studied by a small group of researchers. In fact, current physical activity text messaging literature is characterized by small sample sizes, heterogeneous but positive effect sizes, and a lack of specificity as to the development of the text messages used in these studies. It is suggested that further research in this area is imperative to facilitate the expansion of mobile technology to promote physical activity. An article from Johnson et al. (2010) focuses on the influence of extrinsic and intrinsic benefits and messages on donors' motivation to donate; the article suggested that extrinsic rewards may lessen an individual's intrinsic motivation to engage in a behavior.

One of the purposes of this study is to explore a mobile app on running motivation. This study would look at how mobile apps affect exercise motivation and behavior nowadays and showed the empirical research on the relations between a mobile app and exercise

motivation. Mobile apps are defined as technology that can be downloaded and used on smartphones, personal digital assistants (PDAs), tablets, and other wireless devices. Most studies on mobile apps would apply behavioral and psychological interventions (Elias et al., 2014). Martin et al. (2017) mentioned that smartphone use in supporting health behavior change via mobile fitness apps is encouraging and explosively increasing. An article revealed that the app's use of features that elicit relatedness, autonomy, and competence predicted exercise outcome; however, these relationships were moderated by gender. (Molina et al., 2020)

The benefits of physical activity have been widely recognized. In Voth et al. (2016), participants used a fitness app engaged in more exercise a week compared to those who did not use the app. Similarly, in Litman et al.(2015), approximately three-quarters of those using a fitness app reported being more active than half of the non-users and past users. A previous study provided encouraging evidence for the positive effects of using a fitness-tracking app in promoting healthy behavior (Gabbiadini et al., 2019), and mobile phone interventions can positively affect health (Direito et al., 2015). And the previous review provided modest evidence that app-based interventions to improve diet, physical activity, and sedentary behaviors can be useful (Schoeppe et al., 2016). And nowadays, not only using mobile technologies can also use to enhance learning (Goad et al., 2019), but also generally be used for patients' health and fitness as well. Patrick (2015) introduced evidence that apps can better help patients reach their health and fitness goals. Similarly, a recent meta-analysis of randomized controlled trials from Williams et al. (2014) reported that social media might provide certain advantages for public health interventions. It can be suggested that using social media to motivate people to perform an exercise program could have a positive influence on an individual's adherence to regular physical activity.

According to Martin et al. (2017), it reviewed that motivation is considered to be the most important to make a mobile app successful in supporting health behavior change. Martin et al. (2017) suggested four keys features that are deemed significant for app adoption. (1) Quality (2) acceptability of use (3) role of theory in informing development (4) ensuring privacy and data protection. Quality was being monitored that mobile apps rating scale was developed and the rates apps according to their engagement, functionality, aesthetics, information quality, and subject quality. Acceptability of use can be suggested by three dimensions (a) utility (the system does what it is supposed to do), (b) usability (the user can work the system successfully), (c) likeability (the user thinks the system is usable). The role of theory in informing development suggested that apps developed need to use theory to promote behavior change; from a systematic review, those who incorporated more behavior change techniques did better than those who had fewer techniques. And security issue was found that is a prime concern of users and health care professionals. Another research also indicated that increases in physical activity occurred because of the self-surveillant practices promoted by the mobile app through; (i) the monitoring and recording of steps and calories burned and (ii) peer comparison (or monitoring) (Goodyear et al., 2019).

Besides, a systematic review in Hosseinpour et al. (2019) about mobile phone applications aiming at increasing physical activity proposed the following descending rank order for the effectiveness of application techniques to foster physical activity: (1) feedback, (2) goal setting and its sub-forms, (3) competition, social sharing with familiar users in both segregated and social network groups, and (4) social sharing with strangers in segregated groups, reward, and social sharing with strangers in social network groups.

Furthermore, Huang et al. (2020) mentioned that mobile apps could take an important role in exercise self-efficacy. Four technological functions: (1) instruction provision, (2) self-monitoring, (3) self-regulation, and (4) goal attainment had an indirect effect on continence

intention through perceived usefulness. This indirect effect was moderated by exercise self-efficacy such that the association between perceived usefulness and continence intention was more robust for those with low exercise self-efficacy. And Melton (2015) showed that physical activity app in the classroom for university students could significantly increase self-efficacy in doing exercise.

A systematic review from Muntaner et al. (2016) searched the inclusion of 11 studies that gave rise to 12 publications. Six of the articles included in this review reported significant increases in physical activity levels. The number of studies using mobile devices for intervention has increased exponentially in the last few years, but future investigations with better methodological quality are needed to draw more vital conclusions regarding how to increase physical activity through mobile device interventions.

Besides, a systematic review and meta-analysis from Romeo et al. (2019) provided modest evidence supporting the effectiveness of smartphone apps to increase physical activity. To date, apps have been most effective in the short term (e.g., up to 3 months). It suggested that future research is needed to understand the time course of intervention effects and investigate strategies to sustain intervention effects.

There is an explosive growth of mobile apps usage worldwide, especially in promoting running; however, after systematic reviews, it is surprising no studies investigating the relationship between running apps, running motivation, running performance, or running habit. Furthermore, no studies have shown that mobile apps can effectively generate higher motivation and enhance running performance and running habit in long-distance running. In this study, "RunKeeper" was chosen as it was available via iPhone or Android phone. It can help share workout information and target beginner exerciser, and the function is diversified. It is simple, inexpensive, and accessible. "RunKeeper " is a very well-known fitness app. "RunKeeper" is an application developed by Boston's Fitness trainer and its founder Jason

Jacobs. "RunKeeper" can be used worldwide through Apple App Store or on Android. As of June 2011, "RunKeeper" has 6 million users in its online community. "RunKeeper" is free of charge and is on Apple App Store's bestseller list. As of 1st December 2010, "RunKeeper" has been downloaded 171,000 times from the Apple App Store, which is ten times more than the normal distribution (Vickey et al., 2013).

Researches showed the effectiveness of mobile apps in improving individuals' motivation or behaviors. With limited studies on examining goal contents via mobile apps in improving individuals' motivation or behaviors, it is worthwhile to find out their relationships for the targeted group in this study.

2.9 Previous Study about Outcome on Exercise Motivation, Behavior and Performance

A study from Lenny & Jacqueline (2008) examined the relation between weight stigma, exercise motivation and exercise behavior among college-aged females. It showed that exercise avoidance was in turn related to less frequent strenuous and moderate exercise. The findings suggested that weight stigma (through its impact on avoidance motivation) could potentially decrease physical activity levels. The Exercise- Avoidance motivation scale questionnaire was used for the purpose of the study, while the exercise behavior was reported on the frequency and duration of mild (e.g. easy walking), moderate (e.g. easy cycling) and strenuous (e.g. basketball) exercise over the past week. For each level of exercise (i.e. mild, moderate and strenuous), participants indicated the frequency of exercise on an eight-point scale (1 = None; 8 = seven times or more) and the average duration of exercise on a seven-point scale (1 = 0–15 mins; 7 = 91+ mins) at that level. The total amount of exercise at each level was computed by multiplying the reported frequency by the reported duration.

McMichael et al. (2019) was to investigate the effects of sport career termination and postsecondary transition on self-determined exercise motivation and athletic identity of

college-aged female students who were competitive athletes in high school. The results of the study indicated a positive correlation between athletic identity and self-determined exercise motivations for female students who had recently transitioned from high school to college and were participating at various level of competitive athletics. For the exercise motivation, this study collected the data through the Behavior Regulations in Exercise Questionnaire.

1-mile or 1609m test as a research study performance outcome were demonstrated in many studies. Steven et al. (2009) used a 1-mile (1609m) as a performance outcome. The purpose of this study was to determine the physical and physiologic changes induced by nine weeks of equivalent amounts of high-intensity running and cycle ergometer training. Daniel et al. (2013) examined whether a treadmill mile is an acceptable FitnessGram Test substitute for the traditional one-mile run (1609m) for middle school boys and girls. It mentioned that the one-mile (1609m) test was one of the six subtests of the FitnessGram that to assess whether a student has achieved a time within the healthy zoon, a criterion-based standard that varies by age, gender, and body composition (Cooper, 2010). Performance on the one-mile run has been shown to have a strong correlation with VO2max (Burono et al., 1991; George et al., 1993; Hunt, 1995) (Daneil et al., 2013).

A research from Capdevila et al. (2007) results suggested that a combination of behavioral and psychological techniques is an efficient strategy for increasing exercise level. In addition, the results showed that extrinsic motivation predominates the early stages of change-of-exercise behaviour, and that intrinsic motivation is important for progression towards maintenance. These findings indicate that, in order to facilitate exercise adherence, feedback about motives for undertaking exercise is needed, combined with advice about how to improve physical condition. This combination could help eliminate certain barriers that hinder engaging in an active and healthy life-style.

A study from Kristin & Tracy (2014) studied appearance-based exercise motivation moderates the relationship between exercise frequency and positive body image among female college students. It showed that exercise frequency was related to higher positive body image, but high levels of appearance-based exercise motivation weakened these relationships. Thus, messages promoting exercise need to de-emphasize weight loss and appearance for positive body image. This study's primary measure was exercise frequency. It used the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985). Participants report how many times a week, on average, they perform strenuous ("heart beats rapidly"), moderate ("not exhausting"), and mild ("minimal effort") exercise for more than 15 min. Only the strenuous and moderate activities were computed because mild exercise is more ambiguous (Godin, 2011) and unreliable (Sallis & Saelens, 2000). This study was according to the suggestion by Godin (2011), it computed participants' exercise frequency score by multiplying their strenuous exercise total by nine and moderate exercise total by 5, and summing these scores. The study also used a 3-item composite consisting of two items from the Obligatory Exercise Questionnaire (OEQ; Thompson & Pasman, 1991): "I engage in physical exercise on a daily basis" and "I exercise more than three days a week" as well as the only item asked within the second part of the Godin, "During a typical week, how often do you engage in exercise long enough to work up a sweat (heart beats rapidly)?" Respondents indicated agreement using a scale ranging from 1 (never) to 4 (always) for the first two items and 1 (often) to 3 (never/rarely) for the third item. After the third item was reverse-scored, the items were averaged to create a total score. Alpha for this 3-item composite was .86.

2.10 Summary

To summarize, there have been studies exploring the association between goal contents and exercise motivation and some research about exercise apps and exercise motivation. However, no studies explore using goal content as a message via a mobile app to improve running motivation, running behaviour, and running performance by literature reviews. This study examines the difference between intrinsic and extrinsic goal contents messages via a mobile app to enhance undergraduate female students' running motivation, running behavior and running performance.

Chapter 3: Methods

This chapter would introduce the research procedure and design. The study aimed to examine which type of goal contents (intrinsic or extrinsic) via a mobile app could effectively help female undergraduates' motivation, behavior and performance in running. Demographic characteristics, the research questionnaires looked for the running motivation based on Self-Determination Theory, procedures including the goal contents messages setting, the messages sending method, the 8-week lesson plan, running behavior records (frequency per week and running distance per week), 1609m running performance test and the interview procedure would be demonstrated.

3.1 Experimental Design

A mixed-method design would be used to collect quantitative and qualitative data. In order to understand the research questions thoroughly, Creswell (2011) suggested a mixed-method which can provide a better understanding of the study result and give complete evidence of the research conclusion; the investigator can gain both breadth and depth in the research questions and findings.

This research design was referenced from similar researches Al-Eisa et al. (2016) and Melton et al. (2015). Al-Eisa et al. (2016) demonstrated the effect of motivation by "Instagram" on adherence to physical activity among female college students. Melton et al. (2015) was another similar research shown a mixed-method to evaluate a physical activity app in the classroom among university students. The statistical analysis for quantitative data in this study used the statistical package for the social sciences (SPSS) program version 22.0 and Microsoft Office Excel 2006 as Melton et al. (2015).

The quantitative method would be used to assess running motivation, behaviors and performance. Nine significant variables (running frequency, running distance, 1609m

running test, internal motivation, control motivation, amotivation, competence, relatedness and autonomy) were measured in pre-and post-interventions for the 2 intervention groups and 1 control group. Individual changes on these measured items from the pre-test to the post-test could be reflected during this 8-week study with two PE classes per week. The quantitative data were analyzed by 2-way repeated-measures ANOVA and LSD pairwise comparisons. Alpha level for statistical significance was set at 0.05.

A qualitative approach would be implemented to collect detailed information about participants' experiences that may help to supplement more information on present findings from the experimental design of this study, and also participants' views on their actual experiences on how receiving mobile messages with intrinsic goal contents and extrinsic goal contents affect their motivation, behaviour and performance in running and three psychological needs (competence, relatedness and autonomy) of SDT. It could explore more individual experiences from a more in-depth and comprehensive perspective (Cope, 2014; Creswell, 2007). A qualitative approach can also enrich the study from a practical perspective and provides insights into the actual experiences of the informants (Braun & Clarke, 2014). A deductive approach as similar to the study of Hassandra et al. (2003) was used for generation and categorization of codes resulted from established theory and prior study findings (i.e. Self-Determination Theory). Semi-structured focused group interviews with intervention intrinsic goal content group, intervention extrinsic goal content group and control group were adopted separately. Data themes from the transcribed interviews were identified and coded.

3.2 Participants and Procedures

Participants of this study were recruited from a regional university in Hong Kong. The year 1 female undergraduates who chose physical conditioning course were randomly assigned

into 3 classes (each class would receive maximum number of 27 students). Some of the female undergraduates dropped out or cannot get access the screening procedure, finally a total of 77 female undergraduates participated in this study for completing a set of questionnaires in pre- and post-tests consisting of questions related running motivation (internal motivation, control motivation and amotivation) and three psychological needs (competence, relatedness and autonomy) based on SDT. This study was last for eight weeks held in PE undergraduate courses with three groups: the intrinsic goal content group, the extrinsic goal content group, and the control group. The intrinsic goal content group would receive the message with intrinsic goal content and the extrinsic goal content group would receive the message of extrinsic goal content through the mobile app " RunKeeper" every day for eight weeks. The control group did not receive any message. The number of participants and the 1609m of this study were references by Al-Eisa et al. (2016) and Melton et al. (2015). This was a blinded experiment design, and students did not know they belong to which experimental group. To delimit the effect of general causality orientation (GCO) on individual differences in motivation orientation towards initiating and regulating behaviors (Deci & Ryan, 1985b), the participants also needed to finish a GCO scale via online.

The participants who were undergraduate year one female students were recruited through three undergraduate PE courses. Each student needed to take one credit PE course per semester, which was part of the general education requirements of the university. Before starting the study, students needed to under some criteria screening: (i) students were between 18-24 years old; (ii) participants were a novice in the running who did not have enough running knowledge and had less than twice per month running habit; (iii) student's body mass index (BMI) between 18.5 kg/ m^2 to 22.9 kg/ m^2, which was referenced by World Health Organisation (2004), it stated that for the Asian population, BMI within the range of

18.5-22.9 kg/m² could be classified as normal range; and (iv) they were no medical problem. After determining eligibility, students were invited to join the study. The demographic characteristics overall and by experimental condition were shown in Table 1.

Table 1. Demographic Characteristics Overall and by Experimental Condition in Pre-Test (n =77)

	Overall (n=77)		**Intrinsic goal content group (n=29)**		**Extrinsic goal content group (n=28)**		**Control group (n=20)**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age (year)	18.31	0.77	18.28	0.36	18.14	0.59	18.60	1.23
Height (m)	1.61	0.06	1.60	0.62	1.62	0.54	1.62	0.33
Weight (kg)	53.39	8.10	52.77	8.44	54.33	8.85	52.96	6.63
BMI (kg/m²)	20.64	2.96	20.72	3.32	20.83	3.09	20.26	2.28
Running frequency (times) per week	0.34	0.64	0.34	0.61	0.25	0.59	0.45	0.76
Running distance (km) per week	0.63	1.22	0.53	0.94	0.59	1.27	0.83	1.48

The number of students recruited in each group (see Table 2). The number of students in each group was not the same as the students were randomly assigned to the classes, students who chose the PE classes were randomly allocated to three different groups, the allocation was not evenly distributed, as five students dropped out of the course before starting the lesson. The flow diagram of group allocation was shown in Figure 5.

Table 2. The Number of Students Recruited in Each Group

Group	Intrinsic goal content	Extrinsic goal content	Control group (without goal content)
No. of Students	28	29	20

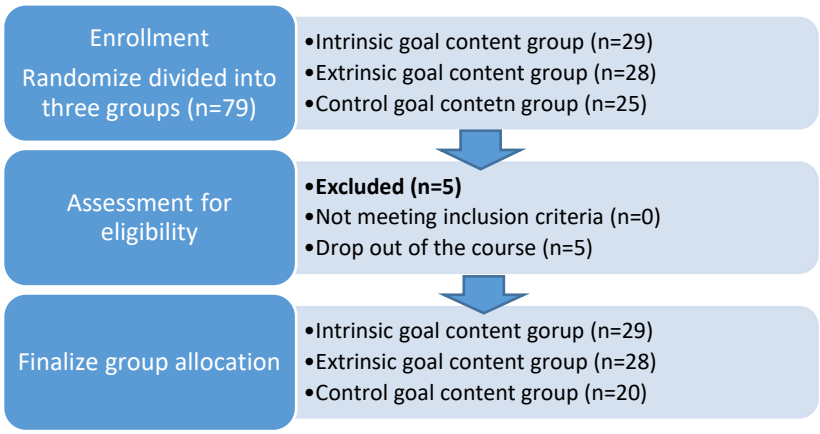

Figure 5. Flow Diagram of Group Allocation

Research approval was being given from the Ethics Committee of the Education University of Hong Kong (see appendix I), and the informed consent forms (see appendix F) were distributed and administered in a classroom setting on campus. Participants were all be voluntary, and informed consent was obtained prior to the study. Participants who received the information sheet (see appendix E) were briefed on the objectives and their ethical rights of the project, and students were reminded not obliged to respond to any of the questions if not felt comfortable doing so. Participants would be free to withdraw at any time and were told that their withdrawal did not result in any penalty. The researcher and student assistants collected the informed consent forms immediately when the participant completed the forms. And the questionnaires were completed online, and every student did the questionnaires via mobile phone in the class. The range of questionnaires completion time was between 15-20 minutes. Students were not required to put their names on the questionnaires, and a code number was assigned to each anonymous questionnaire. All the information related to the study was kept in a secure location.

Anthropometric parameters, including body weight, height, and body mass index (BMI) were measured. The participants wore simple clothing and had no footwear. Height was measured using a fixed stadiometer (resolution of 0.5 cm). The weight was measured with

Beurer glass diagnostic scale (resolution of 0.1 kg). The BMI was estimated using the formula: weight (kg)/height $(m)^2$.

In this study, the scales of Behaviour Regulation in Exercise Questionnaire II (BREQ-2) (Markland et al., 2004), Psychological Need Satisfaction in Exercise Scale (PNSE) (Gunnell et al., 2012; Mack et al., 2012), General Causality Orientations Scale (GCOS) (Edward et al., 1985) were used. The data was collected during the first term of the 2016-2017 academic years. Students had a running test (1609m) on the 2nd week and the 8th week that was used to reflect the running performance, students were asked to eat two hours before the test and the pre- and post-test were done at the same time period (09:30-10:00 for the intrinsic group, 10:15 to 10:45 for the extrinsic group, 15:00 to15:30 for the control group). The test was conducted in the university sports ground with a 400m track loop, wherein the students were monitored by the PE teacher. The students worked in pairs, and the pairs were chosen by students, where the first participant was in charge of the second participant's timing, and vice versa. Simultaneously, the PE teacher monitored all participants' running time and count laps to ensure the results' accuracy and precision. And at the 4th and 8th week, students needed to give information about running habit (running frequency and running distance) online during class. The result of the running test performance and running habit was recorded and analyzed. The intrinsic goal content group and extrinsic goal content group would receive goal content messages via running app every day for eight weeks. The goal content messages received by intrinsic goal content group and extrinsic goal content group were with same wordings each day of the week for their groups, and a new phrase would appear weekly.

This study analyzed the motivation that was based on the self-determination theory. The motivation was analyzed by six categories. Three of the categories were from organismic integration theory; they were internal motivation, control, and external motivation, and the

other three categories from cognitive evaluation theory; they were autonomous, competency and relatedness.

The study was conducted on 2017, from September to October, the 8-week lesson plan for teaching running exercises with date of the data collection and the test implementation time were shown in Table 3. The test procedure was shown in Figure 6. During the 8-week lesson plan, the teacher taught the knowledge about the benefit of running, demonstrated how to breathe during running, running rhythm, and running pose, introduced the method in running training, such as tempo run, interval run, and long run. Also, fitness training specific to running was presented, such as circuit training and weight training. Each week had two lessons; each lasted for 45minutes. The teacher would remind the students of the goal content set on the week at the beginning of each lesson, and the 1609m running test was conducted on the 2nd week and the 8th week.

Table 3. 8-Week Lesson Plan, Date of Data Collection and Study Measurements

Week	Date	Content	Test
1	4/9 6/9	Introduction: • Read the information sheet • Filled the consent form • Told about the research procedure • Taught them how to use the running app and how to receive motivational goal content • Talked about the benefit of running • 1609m running test • Asked running habit (distance ran and frequency of running) last week by checking the app	• Questionnaire BREQ-2 (Online) • Questionnaire of Psychological Need Satisfaction in Exercise Scale PNSE (Online) • and asked about the running habit last week (Online) • 1609m running test
2	11/9 13/9	• Revised how to use the app	
3	18/9 20/9	• Taught breathing, rhythm, running pose like arm swing, landing • Easy run by using the app for 20mins	
4	25/9 27/9	• Taught running drills • Introducing tempo run • 10mins x 2, 2mins easy running between and using the app	• asked about the running level last week (Online)
5	2/10 4/10	• Running drills, agility ladder • Introducing interval training • 10 mins running using the app	
6	9/10 11/10	• Circuit training specific for running core • 15mins easy running using the app	
7	16/10 18/10	• Long run • Weight training specific for running • 15mins easy running using the app	
8	23/10 25/10	• 1609m test	• 1609m test (23/10) • Questionnaire BREQ-2 (online), • Asked the running level last week (online) • Questionnaire of PNSE (online) • Focus group Interview (after lesson) • Questionnaire of General Causality Orientations Scale (GCOS) (online)

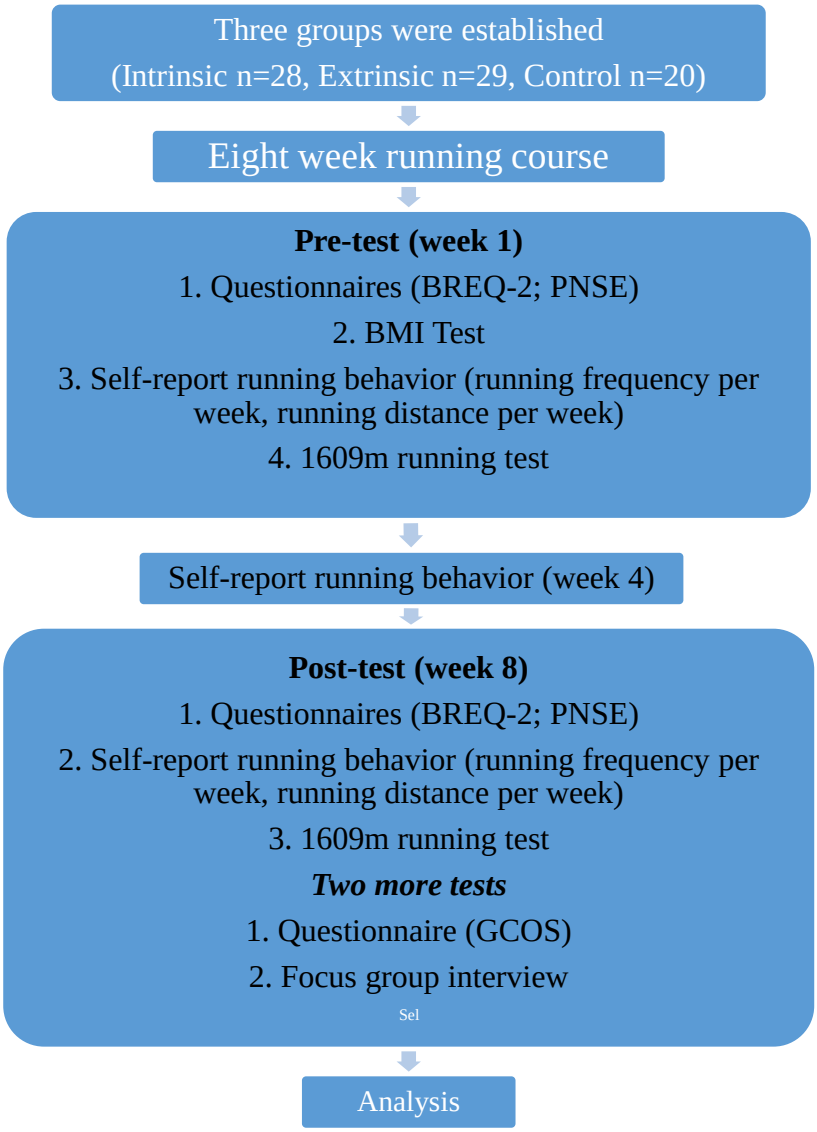

Figure 6. Flow Diagram of the Test Procedure

The messages set were according to several researches. Maarten et al. (2007), which stated that the autonomy-supportive instructions used language such as "you can" and "we suggest that you," and the controlling instructions used language such as "you have to" and "you should." Therefore, every message in the intrinsic goal content group started with "I can," and in the extrinsic goal content group started with "I should" or "I have to." The content of the messages sent were based on the intrinsic and extrinsic goal content of Gallagher et al. (2011) and Sebire et al. (2008). The intrinsic motivations messages set provided no obvious

external incentives and were pursued solely for the inherent rewards that activity offers, such as the personal satisfaction, challenge, or enjoyment that physical activity may offer. On the other hand, the extrinsic motivations message set were performed for reasons other than inherent rewards and satisfaction, such as fitting in or please others, not looking fat in a bathing suit, or achieving physical health benefits (Mullan et al., 1997). According to Kristel et al. (2011), this review concluded that gain-framed messages alone are most effective than loss-framed to influence physical activity behavior. Therefore, the gain-framed message was used in this study. A study from Kristin & Tracy (2014) suggested messages promoting exercise need to de-emphasize weight loss and appearance for positive body image. Therefore, in this study, message about weight loss was not demonstrated. The content of the message set was shown in Table 4.

Table 4. The Content of the Message Sent Each Week for Two Different Groups in 8-Weeks

Week	Intrinsic goal content group	Extrinsic goal content group
1	I can gain happiness if I run.	I should be appreciated by others if I run.
2	I can feel pleasure and gain fun if I run.	I have to gain muscle if I run.
3	I can grow up and be a better person if I run.	I should gain recognition from others if I run.
4	I can gain self-worth if I run.	I have to improve my running performance if I run.
5	I can gain personal satisfaction if I run.	I should increase my health and live a longer life if I run.
6	I can improve my life if I run.	I should be better than others if I run.
7	I can gain accomplishment if I run.	I have to get rid of guilty feelings if I run.
8	I can gain pleasurable physical feeling if I run.	I have to meet other people's expectations if I run.

The process of focus group interviews was deductive and encompassed three aims:

1) Identifying how the constructs of competence, autonomy, relatedness, internal

motivation, control, and amotivation existed in the qualitative data.

2) Understanding how the goal content messages affected the participants.
3) Understanding how the app affected the participants.

These three aims ensured that the authors remained focused on the overarching objective of the articles: To evaluate how the impact of an 8-week goal content message via a mobile application on female undergraduates' motivation behaviour and performance in the running. There were three target groups for this study. For each target group, four students would be randomly selected from the classes, and the students voluntarily agreed to join the interview. The group interviews were conducted in Cantonese, and each interview lasts about 60 minutes. The number of participants in each focus group and the interview duration time were referenced by Krueger (1994) and Fatemeh et al. (2004). Krueger (1994) suggested that for a simple research question, the number of participants in each focus group might only be three or four, the number of students recruited shown in Table 5. Fatemeh et al. (2004) mentioned that focus group interview better last 60-120 minutes as participants would suffer from fatigue if the discussion was last too long. The focus group interview technique was described in Figure 7.

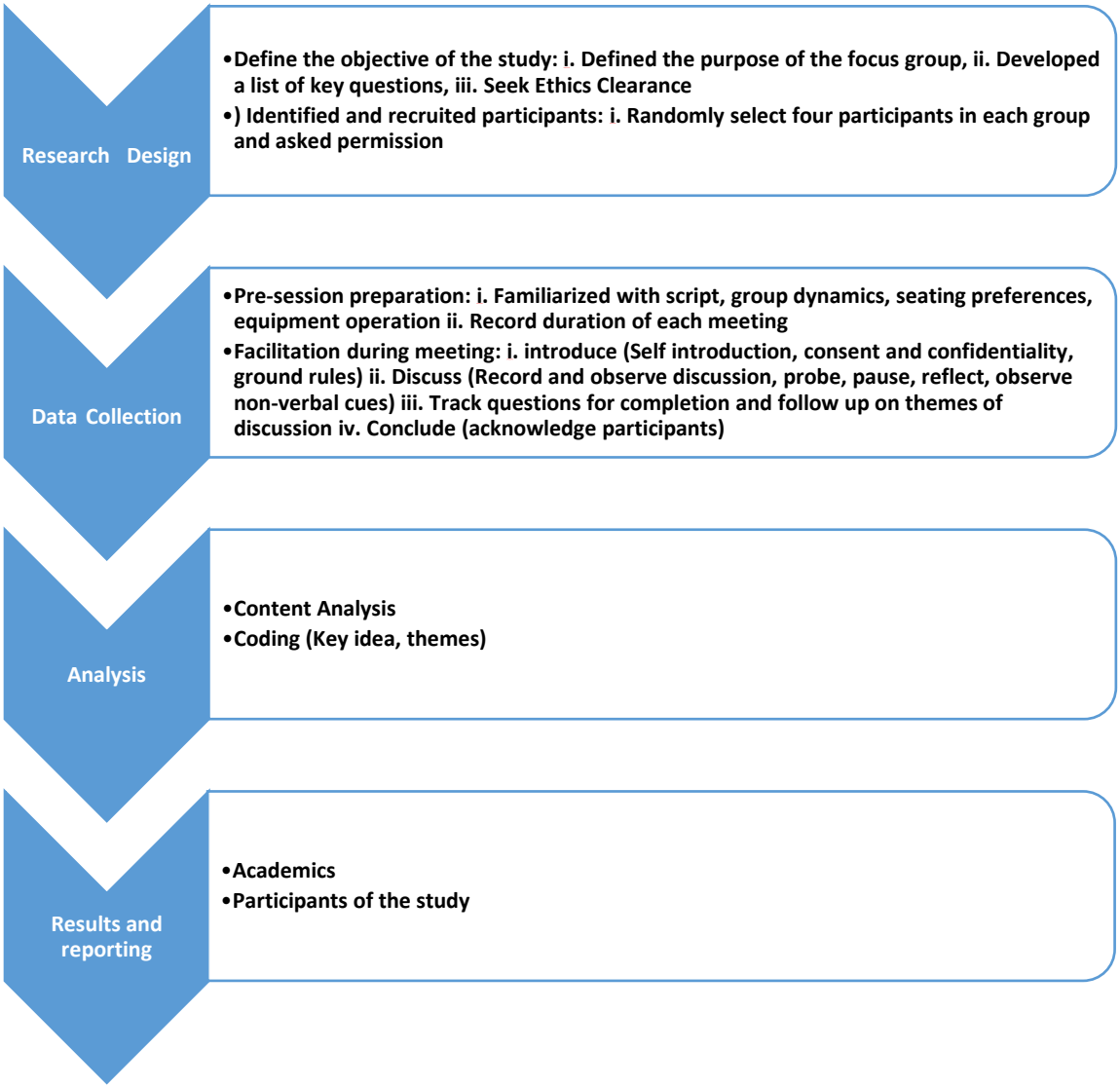

Figure 7. Flow Chart of the Steps of the Focus Group Discussion Technique.

All of the group interviews were audio-taped, and a professional expert transcribes all recorded discussions and questions in the same field (see Appendix D). The interviews were conducted by a qualified interviewer who passed the course "Qualitative Research Method" in the Doctor of Education Program in the Hong Kong University of Education.

Table 5. The Number of Students in Each Focus Group

Group	Number of students
Intrinsic goal content group	4
Extrinsic goal content group	4
Control group (without any goal content)	4
Total participants	12

This study would undertake an interview as a qualitative approach helping to answer our research questions. As Creswell (2007) suggested, a qualitative approach was advantageous for gaining insights into a topic that had received limited attention from previous researches, when researchers had interests in revealing empirical aspects of the individual being investigated, or when the researchers wanted to obtain detailed insights, opinions, and perspectives from those with first-hand knowledge of a particular phenomenon. Given the lack of research on examining female undergraduates' views, experiences, and insights regarding the characteristics of running motivation and three basic psychological needs (competence, relatedness and autonomy), therefore a qualitative methodology was appropriate for this current study. The reason for using a group interview was to explore the common understanding and experiences of the participants and to develop further and refine their own ideas. Flowers et al. (2001) and Palmer et al. (2010) found that due to common experiences, new insights into the phenomenon might arise, which would not have occurred in one-on-one interviews. The study's group interview aimed to explore the use of mobile applications by goal content messages to improve running motivation, behaviour and performance of female undergraduate students. The focus group interviews were conducted by a researcher who played the following roles: (a) facilitated discussions (e.g. asking questions), (b) supervised discussion (e.g., listening, asking for more information, guiding more quiet participants) (c) maintained appropriate and moral environment (e.g., ensuring that all participants express their views and prevent other members of the community from

reaching a consensus on silence or pressure). These roles were practiced and refined during a pilot focus group, which took place on the university campus and lasted for 1 hour. The questions were focused on the influence of goal content setting (Intrinsic goal content/ Extrinsic goal content) by using the app "RunKeeper" on the influence of students' running motivation, behaviors performance in running. The interview questions were shown in appendix G. In doing so, the researchers took a deductive approach. The researchers recorded all the codes; then developed and combined similar codes and deleted irrelevant ones. From these codes, categories were developed. After generating the categories, the data would be validated and crosschecked by another researcher in related field. After the categories were developed, researchers established connections between categories and formed themes. The qualitative analysis resulted in the following themes: internal motivation, control motivation, amotivation, competence, relatedness, and autonomy of SDT (see Appendix H).

3.3 Measures

In this study, the analysis of running motivation was based on Edward Deci and Richard Ryan's self-determination theory and the concept of three basic psychological needs, which was formally introduced in 1985; the six categories were identified, namely internal motivation, control, amotivation, and the three basic psychological needs for autonomy, competence, and relatedness. Behavior Regulation in Exercise Questionnaire II (BREQ-2) (Markland et al., 1997) was used to assess internal motivation, control, and amotivation. Questionnaire of Psychological Need Satisfaction in Exercise Scale (PNSE) (Wilson et al., 2006) (Gunnell et al., 2012) was used to assess autonomy, competence, and relatedness.

3.3.1 The Behaviour Regulation in Exercise Questionnaire II (BREQ-2) (Mullan et al., 1997) (Markland et al., 2004)

The BREQ-2 questionnaire would be used to assess motivation in physical activity. The BREQ-2 questionnaire was based on self-determination theory, and before BREQ-2, BREQ was first developed by Mullan et al. (1997), and it was used to measure the continuum of behavioral regulation in physical activity or exercise. The modified BREQ -2 was developed by Markland et al. (2004), which included a set of amotivational items, while BREQ did not contain the amotivational items. Thus, BREQ-2 is useful for researchers who wish to evaluate amotivation in order to gain a better understanding of motivation in doing exercise. The BREQ-2 questionnaire contains 19 items that represented five different subscales (Appendix B). The five different subscales include amotivation (e.g., I do not understand why I should do physical activity), external regulation (e.g., I feel under stress from my friends / family if I do not do physical activity), introjected regulation (e.g., when I do not do physical activity, I will feel guilty), identified regulation (e.g., I value the benefits of physical activity) and intrinsic regulation (e.g., I do physical activity because it is fun). There were some modifications that replacing the word “exercise/physical activity” by “running activity.” The participants would answer to each item on a 5-point scale ranging from 0 (not true for me) to 5 (very true for me). BREQ-2 questionnaire was proved to have high reliability and validity (Markland et al., 2004). In the study, Murcia et al. (2007), the Cronbach's reliability coefficient of intrinsic regulation, identified regulation, introjected regulation, external regulation, and amotivation were 0.89, 0.81, 0.82, 0.86, and 0.85, respectively. (See Appendix A).

3.3.2 Questionnaire of Psychological Need Satisfaction in Exercise Scale (PNSE) (Wilson et al., 2006) (Gunnell et al., 2012)

Participants completed a modified version of the Psychological Need Satisfaction in Exercise Scale (PNSE) (Wilson et al., 2006) designed to capture feelings of competence relatedness and autonomy during running (Gunnell et al., 2012). The questionnaire contained 18 items. The modifications were made by replacing the word "exercise/physical activity" by "running activity" in all instances. First, the instructional stem was modified to read as follows: "please answer the following questions by considering how you typically feel when you engage in running activity." An example of this modification is as follows: "I feel confident I can do even the most challenging running activity." Participants were asked to rate each item from 1 (false) to 6 (true). Initial validity and reliability for scores of the PNSE have been demonstrated (Gunnell et al., 2012; Mack et al., 2012). High internal consistency estimates (Cronbach $\alpha > 0.90$) (Wilson et al., 2006b). (See Appendix C).

3.3.3 The General Causality Orientations Scale (GCOS) (Deci & Ryan, 1985b).

Deci and Ryan's causality orientations theory (Deci & Ryan, 1985b) suggested individual differences in motivational orientation towards initiating and regulating behavior. GCOS used to test the strength of three motivational orientations, these orientations are Autonomy, Controlled, and Impersonal, which were recognized as relatively enduring aspects of personality, and each orientation was theorized to exist within each individual to some degree.

The Autonomy Orientation assessed the extent to which a person is oriented toward aspects of the environment that stimulated intrinsic motivation, were optimally challenging, and provide informational feedback. A person high in the autonomy orientation tended to display greater self-initiation, seek activities that were interesting and challenging, and took

greater responsibility for his or her own behavior. The Controlled Orientation assessed the extent to which a person was oriented toward being controlled by rewards, deadlines, structures, ego-involvements, and the directives of others. A person with high controlled orientation was likely to be dependent on rewards or other controls, and might be more attuned to what others demand than to what they wanted for themselves. The Impersonal Orientation assessed the extent to which a person believed that attaining desired outcomes was beyond his or her control and that achievement was largely a matter of luck or fate. People were high on this orientation likely to be anxious and to feel very ineffective. They had no sense of being able to affect outcomes or cope with demands or changes. They tended to be amotivated and to want things to be as they always were." At the end of the intervention, students were required to do the questionnaire GCOS to see any difference in their causality or personality so as to affect the result. The GCOS was a 12-vignette, 36-item questionnaire that provided responses on a 7-point Likert-type scale. The three scales were the autonomy, controlled and impersonal orientation that had been demonstrated with validity and reliability. In the study Elaine et al. (2001) , Cronbach's alphas for the three subscales were 0.69 (autonomy), 0.59 (control) and 0.77 (impersonal). See Appendix B.

Chapter 4: Data Analysis and Results

One-way ANOVA was conducted on the body mass index (BMI) and the general causality orientation scale (GCOS) score to determine any significant differences in BMI and GCOS among the three groups (control, extrinsic, and intrinsic).

4.1 Body Mass Index (BMI) result

There was no significant difference between groups in BMI scores (all *p*s > .05, see Table 6 for the exact F and *p* values).

Table 6. One-Way Analysis of Variance Summary Table about the Body Mass Index

Source	*df*	*SS*	*MS*	F	*p*	η^2
Between-group	2	4.05	2.02	.23	.80	.01
Within Group	74	663.32	8.96			
Total	76	667.37				

4.2 General Causality Orientations Scale

All three groups did not show any significant differences on three dependent variables (Impersonal, Control and Autonomy), the simple effect of group on Impersonal, Control and Autonomy was not significant, $F(2,74)=0.07$, $p= 0.933$, $\eta^2p=0.002$; $F(2,74)=0.67$, $p=0.51$, $\eta^2p =0.018$; $F(2,74)=0.70$, $p=0.50$, , $\eta^2p =0.019$ respectively. (all *p*s > .05, see Table 7 for the exact F and *p* values).

Table 7. One-Way Analysis of Variance Summary Table about the General Causality Orientations Scale (GCOS)

Source	*df*	*SS*	*MS*	F	*p*	η^2
Between-group	2	11.64	5.82	.17	.84	.01
Within Group	74	2487.61	33.62			
Total	76	2499.25				

4.3 Running Habit: Running Frequency per Week

Mauchly's test indicated that the assumption of sphericity had been violated, F (2) =5.094, p=0.078, therefore Greenhouse-Geisser corrected tests are reported (Ɛ=0.937).

The main effect of time on frequency of running was significant, F (1.874,138.65) =81.72, $\eta^2 p$ =0.525, p<0.001. In addition, the main effect of the group was significant too, F(2,74) =5.06, p=0.009. Furthermore, the interaction effect between group and time was also significant, F (3.75, 138.65) =4.44, p=0.003, $\eta^2 p$ =0.107. Therefore, follow-up analysis was conducted to test the simple effect of the group within each period of time.

At both phase 1 (week 1) and phase 2(week 4) of the study. All three groups did not show any significant differences, F (2,74) =0.56, p=0.571, $\eta^2 p$ = 0.015 (phase 1) and F (2,74) =2.21, p=0.117, $\eta^2 p$ =0.056 (phase2). At phase 3(week 8), the simple effect of group on frequency of running was significant, F (2,74) =7.48, p= 0.001, $\eta^2 p$ =0.168. Pairwise comparisons revealed that the intrinsic goal content group was significant difference from the control and extrinsic goal content group, p=0.02 and p=0.01 respectively. However, the extrinsic goal content group was not significantly different from the control group, p=0.915.

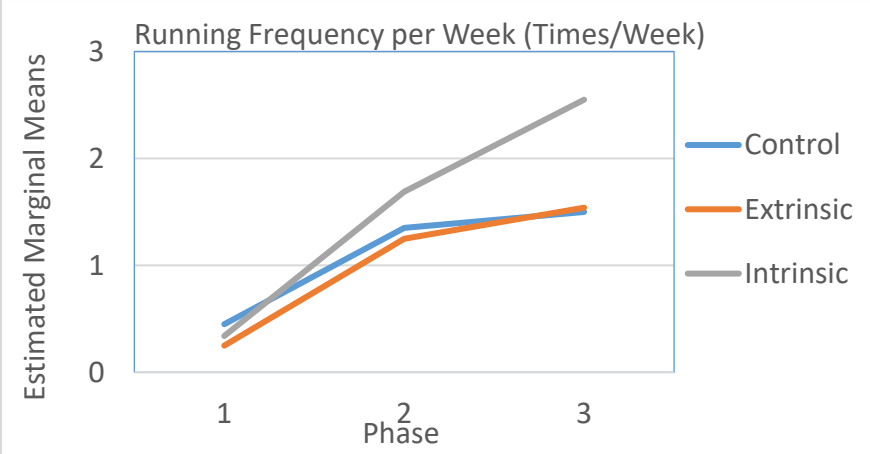

Figure 8. Running Frequency per Week

4.4 Running Habit: Running Distance per Week

Mauchly's test indicated that the assumption of sphericity had been violated, $\chi 2(2) = 21.189$, $p<0.001$, therefore Greenhouse-Geisser corrected tests are reported ($\varepsilon=0.799$).

The main effect of time on distance of running was significant, F (1.598,118.22) =105.90, h2p =0.59, $p<0.001$. In addition, the main effect of the group was significant too, F (2,74) =3.80, p=0.027. Furthermore, the interaction effect between group and time was also significant, F (3.20, 118.21) =11, $p<0.001$, $\eta^2 p$ =0.23. Therefore, follow-up analysis was conducted to test the simple effect of the group within each period of time.

At both phase 1 (week 1) and phase 2(week 4) of the study. All three groups did not show any significant differences, F (2,74) =0.36, p=0.70, $\eta^2 p$ = 0.10 (phase 1) and F (2,74) =0.233, p=0.79, $\eta^2 p$ =0.006 (phase 2). At phase 3(week 8), the simple effect of group on frequency of running was significant, F (2,74) =10.19, $p< 0.001$, $\eta^2 p$ =0.216. Pairwise comparisons revealed that the intrinsic goal content group was significantly different from the control and extrinsic goal content group, $p<0.001$ and $p<0.001$, respectively. However, the extrinsic goal content group was not significantly different from the control group, p=0.861.

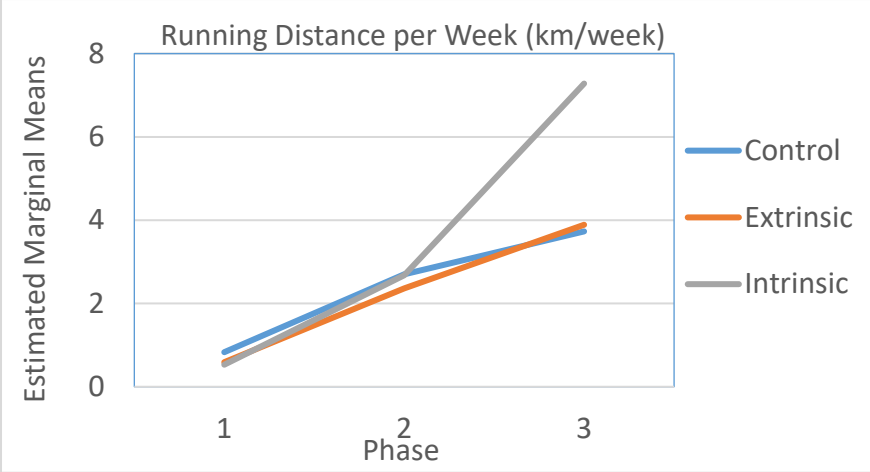

Figure 9. Running Distance per Week

4.5 Running Performance: 1609m Running Test

Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(0) = 0$, $p<0.001$, therefore Greenhouse-Geisser corrected tests are reported ($\varepsilon=1.00$).

The main effect of time on the test was significant, F (1,74) =180.40.30, $\eta^2 p$ =0.709, $p<0.001$. However, the main effect of the group was not significant, F (2,74) =2.044, p=0.137. Furthermore, the interaction effect between group and time was significant, F(2, 74)=7.36, $\eta^2 p$ =0.166, p=0.001. Therefore, follow-up analysis was conducted to test the simple effect of the group within each period of time.

At phase 1 (week 1) of the study. All three groups did not show any significant differences, F (2,74) =0.93, p=0.40. At phase 2(week 8), the simple effect of the group on the 1609m test was significant, F (2,74) =4.55, p= 0.014. Pairwise comparisons revealed that the intrinsic goal content group was significantly different from the control and extrinsic goal content group, p=0.012 and p=0.013, respectively. However, the extrinsic goal content group was not significantly different from the control group, p=0.795.

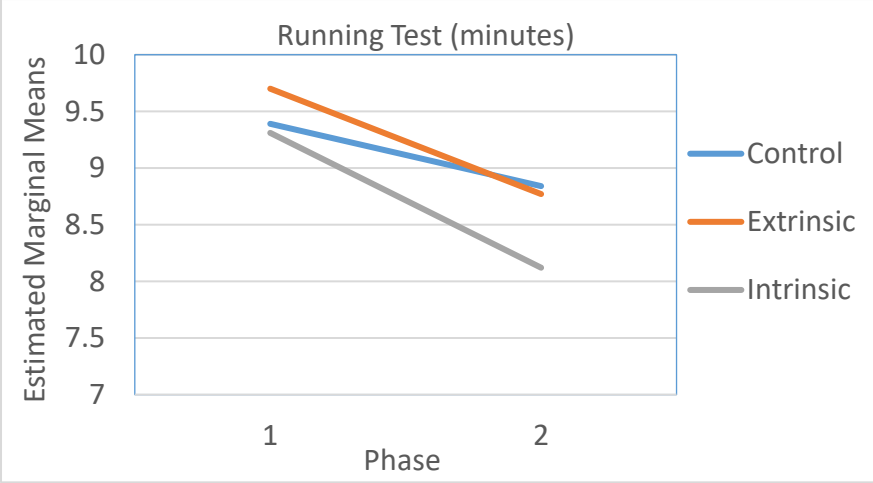

Figure 10. Running Performance: 1609m Running Test

4.6 Running Motivation Scale by Psychological Need Satisfaction in Exercise Scale (PNSE)

4.6.1 Autonomy

Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(0) = 0$, $p<0.001$, therefore Greenhouse-Geisser corrected tests are reported ($\varepsilon=1$).

The main effect of time on autonomy was significant, $F(1,74) = 27.76$, $\eta^2 p = 0.27$, $p<0.001$. In addition, the main effect of the group on autonomy was significant too, $F(2,74) = 12.27$, $p<0.001$. Furthermore, the interaction effect between group and time was significant as well, $F(2, 74)=7.01$, $p=0.002$, $\eta^2 p = 0.16$. Therefore, follow-up analysis was conducted to test the simple effect of the group within each period of time.

At phase 1 (week 1), the simple effect of group on competence did not show any significant differences, $F(2,74)=3.04$, $p=0.054$, $\eta^2 p = 0.076$ (phase 1), however at phase 2(week 8), the simple effect of group on autonomy shows significant differences, $F(2,74)=25.15$, $p<0.001$, $\eta^2 p = 0.40$ (time 2). Pairwise comparisons revealed that all three groups showed significant

differences at phase 2. And at phase 1, the only intrinsic goal content group was significantly different with control group. At phase 2, the intrinsic goal content group was significantly difference from the control and extrinsic goal content group, $p<0.001$ and $p<0.001$, respectively. In addition, the extrinsic goal content group was significantly different from the control group, $p=0.006$.

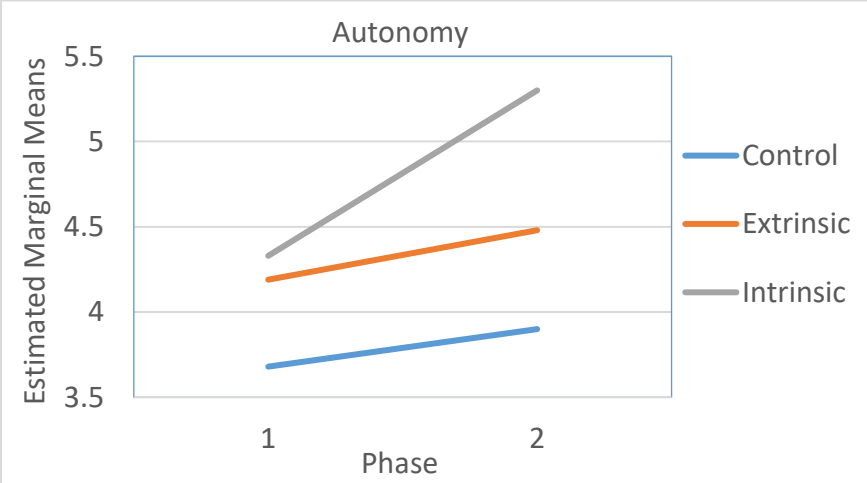

Figure 11. Autonomy

4.6.2 Competence

Mauchly's test indicated that the assumption of sphericity had been violated, χ^2 (0) =0, $p<0.001$, therefore Greenhouse-Geisser corrected tests are reported (Ɛ=1).

The main effect of time on competence was significant, F (1,74) =32.65, $\eta^2 p$ =0.31, $p<0.001$. In addition, the main effect of the group on competence was significant too, F (2,74) =9.96, $p<0.001$. However, the interaction effect between group and time was not significant, F (2, 74) =2.035, $p=0.138$, $\eta^2 p$ =0.052. Therefore, follow-up analysis was conducted to test the simple effect of the group within each period of time.

At phase 1 (week 1), the simple effect of group on competence show significant differences, F (2,74) =3.41, p=0.038, $\eta^2 p$ = 0.084 (phase 1), addition at phase 2(week 8), the simple effect of group on competence shows significant differences as well, F (2,74) =17.59, p<0.001, $\eta^2 p$ = 0.32 (time 2). Pairwise comparisons revealed that at phase 1, only intrinsic goal content group and control group was significantly different, p=0.014; others did not show any significant difference. At phase 2, the intrinsic goal content group was significantly different from the control and extrinsic goal content group, p<0.001 and p<0.001, respectively. And the extrinsic goal content group was significantly different from the control group as well, p=0.021.

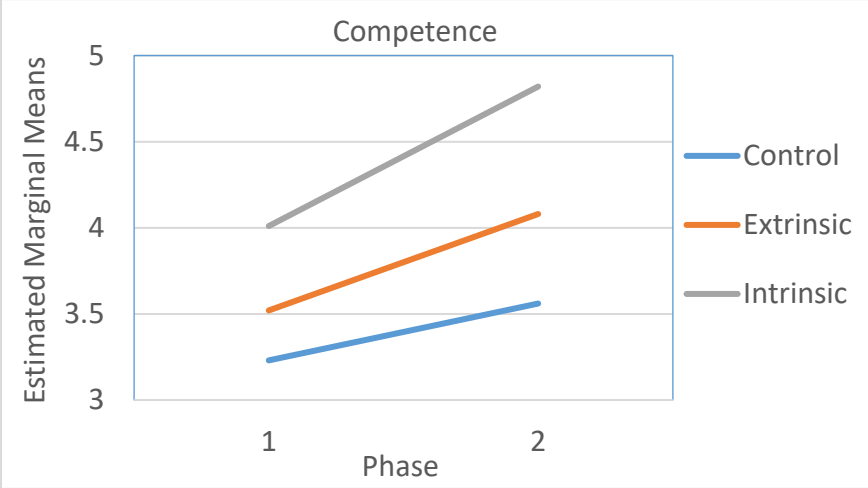

Figure 12. Competence

4.6.3 Relatedness

Mauchly's test indicated that the assumption of sphericity had been violated, χ^2 (0) =0, p<0.001, therefore Greenhouse-Geisser corrected tests are reported (Ɛ=1).

The main effect of time on relatedness was significant, F (1,74) =40.97, $\eta^2 p$ =0.36, p<0.001. And the main effect of the group on relatedness was significant too, F (2,74) =3.46, p=0.037.

Furthermore, the interaction effect between group and time was significant as well, F(2, 74)=6.39, p=0.003, η^2p =0.15. Therefore, follow-up analysis was conducted to test the simple effect of the group within each period of time.

At phase 1 (week 1), the simple effect of group on relatedness did not show any significant differences, F (2,74) =0.68, p=0.51, η^2p =0 .02 (phase 1), however at phase 2(week 8), the simple effect of group on relatedness shows significant differences, F (2,74) =10.77, p<0.001, η^2p = 0.23 (phase 2). Pairwise comparisons revealed that the intrinsic goal content group was a significant difference from the control group and extrinsic goal content group, p<0.001 and p=0.046 respectively, and there was a significantly different between extrinsic goal content group and control group as well, p=0.007.

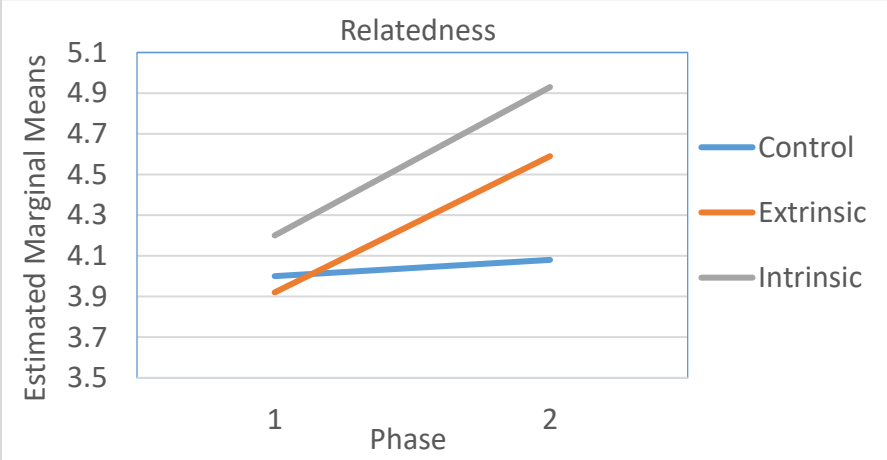

Figure 13. Relatedness

4.7 Running Motivation Scale by Behaviour Regulation in Exercise Questionnaire II (BREQ-II)

4.7.1 Internal Motivation

Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(0) = 0$, $p<0.001$, therefore Greenhouse-Geisser corrected tests are reported ($\varepsilon=1$).

The main effect of time on internal motivation was significant, $F(1,74) = 52.65$, $\eta^2 p = 0.416$, $p<0.001$. In addition, the main effect of group on internal motivation was significant too, $F(2,74) = 5.20$, $p=0.008$. Furthermore, the interaction effect between group and time was not significant, $F(2, 74) = 2.59$, $p=0.082$, $\eta^2 p = 0.065$. Therefore, follow-up analysis was conducted to test the simple effect of the group within each period of time.

At phase 1 (week 1), the simple effect of group on internal motivation did not show any significant differences, $F(2,74) = 1.077$, $p=0.346$, $\eta^2 p = 0 .028$ (phase 1), however at phase 2(week 8), the simple effect of group on internal motivation shows significant differences, $F(2,74) = 11.782$, $p<0.001$, $\eta^2 p = 0.242$ (phase 2). Pairwise comparisons revealed that at phase 2, the intrinsic goal content group was significantly different from the control group and extrinsic goal content group, $p<0.001$ and $p=0.001$ respectively, and there was no significant difference between control and extrinsic goal content groups $p=0.141$.

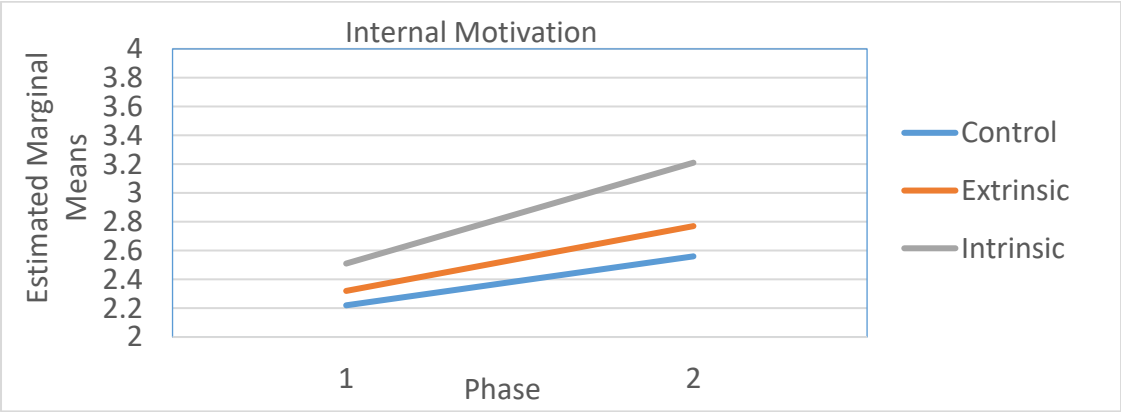

Figure 14. Internal Motivation

4.7.2 Control

Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(0) = 0$, $p<0.001$, therefore Greenhouse-Geisser corrected tests are reported ($\varepsilon=1$).

The main effect of time on control was significant, $F(1,74) = 79.89$, $\eta^2 p = 0.52$, $p<0.001$. In addition, the main effect of the group on control was significant, $F(2,74) = 10.91$, $p<0.001$. Furthermore, the interaction effect between group and time was not significant, $F(2, 74) = 2.40$, $p=0.097$, $\eta^2 p = 0.061$. Therefore, follow-up analysis was conducted to test the simple effect of the group within each period of time.

At phase 1 (week 1), the simple effect of group on control show significant differences, $F(2,74)=4.00$, $p=0.022$, $\eta^2 p = .098$ (phase 1), and at phase 2(week 8), the simple effect of group on control shows significant differences as well, $F(2,74)=13.36$, $p<0.001$, $\eta^2 p = 0.27$ (phase 2). Pairwise comparisons revealed at phase 1 (week 1), there is only a significant difference between control group and intrinsic goal content group, $p=0.006$. At phase 2(week 8), the intrinsic goal content group was significantly different from the control group and extrinsic goal content group, $p<0.001$ and $p=0.012$, respectively, and there was a significant difference between control group and extrinsic goal content group, $p=0.07$.

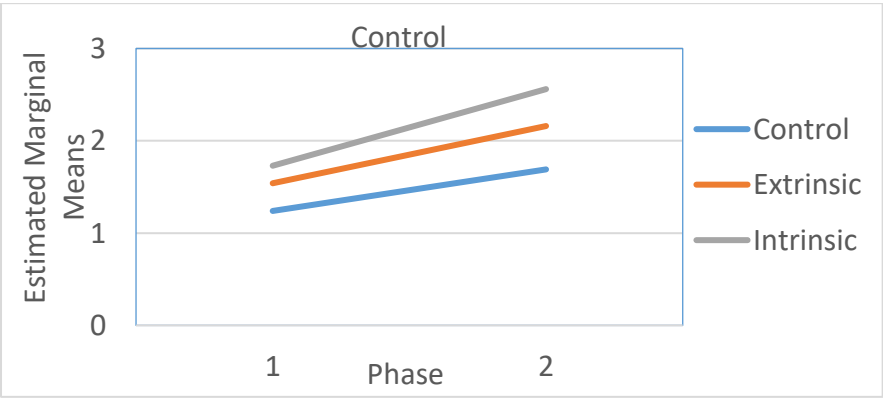

Figure 15. Control

4.7.3 Amotivation

Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(0) = 0$, $p<0.001$, therefore Greenhouse-Geisser corrected tests are reported ($\varepsilon=1$).

The main effect of time on amotivation was significant, $F(1,74) = 8.93$, $\eta^2 p = 0.108$, $p=0.004$. In addition, the main effect of the group on amotivation was not significant, $F(2,74) = 2.368$, $p=0.101$. Furthermore, the interaction effect between group and time was significant, $F(2, 74) = 4.89$, $p=0.01$, $\eta^2 p = 0.117$. Therefore, follow-up analysis was conducted to test the simple effect of the group within each period of time.

At phase 1 (week 1), the simple effect of group on amotivation did not show any significant differences, $F(2,74) = 1.48$, $p=0.233$, $\eta^2 p = 0.039$ (phase 1), however at phase 2(week 8), the simple effect of group on amotivation shows significant differences, $F(2,74) = 7.445$, $p=0.001$, $\eta^2 p = 0.168$ (phase 2). Pairwise comparisons revealed that the intrinsic goal content group was significantly different from the control group and, $p=0.033$ and $p<0.001$ respectively. There was no significant difference between control group and extrinsic goal content group, $p=0.197$.

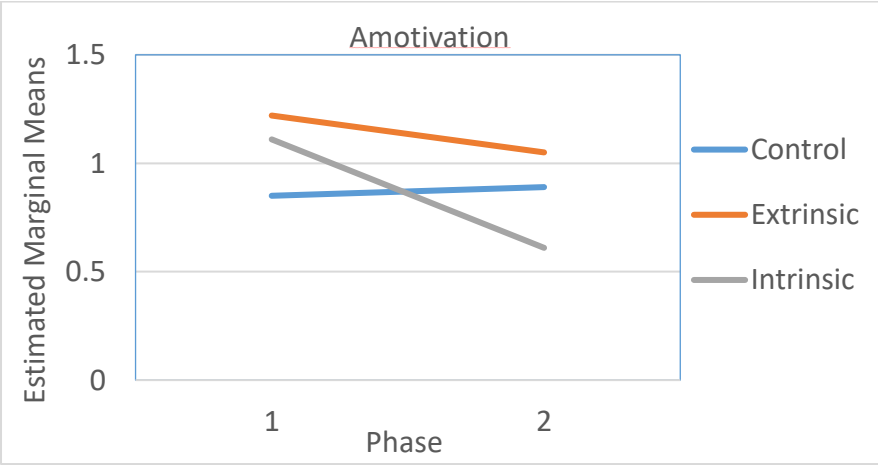

Figure 16. Amotivation

4.8 The Means and Standard Deviations of the Six Domains

Tables 8 to 11 showed the means and standard deviations of running behavior, running performance, three basics psychological needs, and three domains of self-determination theory, respectively.

Table 8 showed the difference of mean scores and standard deviations of running habit (running frequency and running distance) in three different phases.

Tables 9, 10, 11 showed the difference of mean scores and standard deviations of running performance (1609m test), three basic psychological needs (autonomous, control, and relatedness), and self-determination (internal motivation, control and amotivation) in two phases (pre and post-test) respectively.

Table 8. Mean Scores and Standard Deviations of Running Behavior (running frequency and running distance per week)

Measures	Participant group					
	Intrinsic goal content Group		Extrinsic goal content Group		Control group	
	M	*SD*	*M*	*SD*	*M*	*SD*
	Time 1					
Running Frequency (Times/week)	.34	.61	.25	.59	.45	.76
Running Distance (Km/week)	.53	.94	.59	1.27	.83	1.50
	Time 2					
Running Frequency (Times/week)	1.69	.97	1.25	.59	1.35	.88
Running Distance (Km/week)	2.68	1.80	2.36	1.67	2.70	2.77
	Time 3					
Running Frequency (Times/week)	2.55	1.50	1.54	.92	1.50	.69
Running Distance (Km/week)	7.28	3.56	3.89	2.67	3.73	3.52

Table 9. Mean Scores and Standard Deviations of Running Performance

Measures	Participant group					
	Intrinsic goal content Group		Extrinsic goal content Group		Control group	
	M	*SD*	*M*	*SD*	*M*	*SD*
	Time 1					
Running test (minutes)	9.31	.88	9.70	1.38	9.39	1.07
	Time 2					
Running test (minutes)	8.12	.71	8.77	1.15	8.84	.98

Table 10. Mean Scores and Standard Deviations of Three Basic Psychological Needs

Measures	Participant group					
	Intrinsic goal content Group		Extrinsic goal content Group		Control group	
	M	*SD*	*M*	*SD*	*M*	*SD*
	Time 1					
Competence (1-6)	4.01	.91	3.52	1.00	3.23	1.30
Relatedness (1-6)	4.20	.68	3.92	0.94	4.00	1.13
Autonomous (1-6)	4.33	.86	4.19	0.97	3.68	.97
	Time 2					
Competence (1-6)	4.82	.50	4.08	.75	3.56	1.03
Relatedness (1-6)	4.93	.36	4.59	.62	4.08	.91
Autonomous (1-6)	5.30	.58	4.48	.71	3.90	.83

Table 11. Mean Scores and Standard Deviations of Three Domains of Self-Determination Theory

Measures	Participant group					
	Intrinsic goal content Group		Extrinsic goal content Group		Control group	
	M	*SD*	*M*	*SD*	*M*	*SD*
	Time 1					
Internal Motivation (0-4)	2.51	.77	2.32	.58	2.22	.73
Control (0-4)	1.73	.71	1.54	.42	1.24	.61
Amotivation (0-4)	1.11	.67	1.22	.74	.85	.85
	Time 2					
Internal Motivation (0-4)	3.21	.47	2.77	.47	2.56	.53
Control (0-4)	2.56	.61	2.16	.57	1.69	.55
Amotivation (0-4)	.61	.39	1.05	.47	0.89	.45

To compare the mean differences across the groups, a two-way repeated-measures analysis of variance (ANOVA) with time as within-subjects factor and group as a between-subjects factor was conducted on each measure. Table 12 summarizes the results of the two-way ANOVA for the running frequency and running distance, running test, competence, relatedness, autonomous, internal motivation, control, and amotivation. Generally speaking, the main effects of time on all measures were significant (all *ps* < .001), revealing a significant change in students' running behavior, running motivation, and running performance, after the intervention as hypothesized. The main effects of group on all measures (all *p*s < .05) except 1609m running test scores ($p = .14$) and amotivation ($p = .10$) were also significant. In addition, the interaction effect between time and group on running behaviour (frequency and distance) (*p*s< .001), 1609m running test ($p<.001$), relatedness ($p< .001$), autonomous ($p< .001$), and amotivation ($p = .01$) were significant, suggesting the effect of intervention were different among 3 groups (intrinsic goal content group, extrinsic goal content group, and control group). To further examine the interaction effect between time and group, follow-up tests were conducted on running behavior (frequency and distance), 1609m running test, relatedness, autonomy, and amotivation.

Table 12. Two-Way (Time and Group) Analyses of Variance for the Running Frequency and Running Distance, Running Test, Competence, Relatedness, Autonomy, Internal Motivation, Control and Amotivation

Variable and source	*MS*	*F*	*p*	η^2
Running frequency per week				
Time [a]	45.55	81.72	.00	.53
Group [b]	2.13	5.06	.01	.12
Time x Group [c]	2.48	4.44	.00	.11
Running Distance per week				
Time [a]	349.79	105.90	.00	.59
Group [b]	12.26	3.80	.03	.09
Time x Group [c]	36.33	11.00	.00	.23
Running test				
Time [d]	29.54	180.40	.00	.71
Group [b]	2.09	2.04	.14	.05
Time x Group [b]	1.21	7.36	.00	.17
Competence				
Time [d]	12.03	32.67	.00	.31
Group [b]	6.52	9.96	.00	.21
Time x Group [b]	0.75	2.04	.14	.05
Relatedness				
Time [d]	9.18	40.97	.00	.36
Group [b]	1.74	3.46	.04	.09
Time x Group [b]	1.43	6.39	.00	.15
Autonomous				
Time [d]	9.11	27.76	.00	.27
Group [b]	6.28	12.27	.00	.25
Time x Group [b]	2.30	7.01	.00	.16
Internal motivation				
Time [d]	9.06	52.65	.00	.42
Group [b]	1.43	5.20	.01	.12
Time x Group [b]	0.45	2.59	.08	.07
Control				
Time [d]	14.91	79.89	.00	.52
Group [b]	2.73	10.91	.00	.23
Time x Group [b]	0.45	2.40	.10	.06
Amotivation				
Time [d]	1.66	8.93	.00	.11
Group [b]	0.67	2.37	.10	.06
Time x Group [b]	0.91	4.89	.01	.12

[a] df=2,148. [b]df=2,74. [c]df=4,148. [d]df=1,74

Autonomy

The simple effect of the group at time 1 was the same; however, there was a significant difference at time 2 (p<.001). At time 2, the intrinsic goal content group was significantly higher than that of the extrinsic goal content group (p<.001) and the control group (p<.001). The extrinsic goal content group was significantly higher than that of the control group (p<.05). The simple effect of time 2 was significantly higher than that of time 1 in the intrinsic goal content group (p<.001) except for the extrinsic and control groups.

Relatedness

The simple effect of the group at time 1 was the same. However, there was a significant difference at time 2 (p<.001). At time 2, the intrinsic goal content group was significantly higher than that of the control (p<.001) and the extrinsic goal content group (p<.05). The extrinsic goal content group was significantly higher than that of the control (p<.05). The simple effect at time 2 was significantly higher than that at time 1 of the extrinsic goal content group (p< .001) and the intrinsic goal content group (p<.001) except for the control.

Amotivation

The simple effect of group at time 1 was the same. However, there was a significant difference at time 2 (p<.05). At time 2, the intrinsic goal content group was significantly lower than that of the extrinsic goal content group (p<.001) and the control (p<.05) and there was no significant difference between the control and the extrinsic g goal content roup. The simple effect at time 2 was significantly lower than that at time 1 of the intrinsic goal content group (p<.001) except for the extrinsic goal content group and the control.

Running Behavior (distance in kilometer per week)

The simple effect of the group at time 1 and time 2 were the same. However, there was a significant difference at time 3 (p<.001). At time 3, the intrinsic goal content group was significantly higher than that of the control(p<.001) and extrinsic goal content group (p<.001) and not significantly different in the control and the extrinsic goal content group.

Running Behavior (frequency per week)

The simple effect of the group at time 1 and time 2 were the same. However, there was a significant difference at time 3 (p<.05). At time 3, the intrinsic goal content group was significantly higher than that of the control (p<.05) and extrinsic goal content group (p<.05) and not significantly different in the control and the extrinsic goal content group.

Performance (1609m running test)

The simple effect of the group at time 1 was the same. However, there was a significant difference at time 2 (p<.05). At time 2, the intrinsic goal content group was significantly lower than that of the control (p<.001) and the extrinsic goal content group (p<.05). The extrinsic goal content group was significantly lower than that of the control (p<.001) and the extrinsic goal content group (p<.001). There was no significant difference between the control and the extrinsic goal content group. The simple effect at time 2 was significantly lower than that at time 1 of the extrinsic goal content group (p< .001), intrinsic goal content group (p<.001), and the control (p< .001).

Summary of Quantitative Result

Table 13: Two-way (Time and group) Analyses of Variance for the Running Frequency and Running Distance, Running Test, Internal Motivation, Control, Amotivation, Autonomy, Competence, and Relatedness

	Running frequency	Running distance	1609m test	Internal motivation	Control	Amotivation	Autonomy	Competence	Relatedness
Time	*p*<.001	*p*<.001	*p*<.001	*p*<.001	*p*<.001	*p*<.001	*p*<.001	*p*<.001	*p*<.001
Group	*p*<.001	*p*<.001	*p*=014	*p*<.001	*p*<.001	*p*=.10	*p*<.001	*p*<.001	*p*<.001
Time x Group	*p*<.001	*p*<.001	*p*<.001	*p*=.08	*p*=.10	*p*<.001	*p*<.001	*p*=.14	*p*<.001

From Table 13, generally speaking, the main effects of time on all measures were significant (all *ps* < .001), revealing a significant change in students' running behavior, running motivation, and running performance, after the intervention as hypothesized.

The interaction effect between time and group on running behaviour (frequency and distance) (*ps*< .001), 1609m running test (*p*<.001), relatedness (*p*< .001), autonomy (*p*< .001), and amotivation (*p* = .01) were significant, suggesting the effect of intervention were different in different groups.

The main effects of group on all measures (all *ps* < .05) except 1609m running test scores (*p* = .14) and amotivation (*p* = .10) were also significant.

Table 14. Follow up Tests on Running Behavior (frequency and distance), 1609m Running Test, Relatedness, Autonomous, and Amotivation

	Running frequency	Running distance	1609m running test	Amotivation	Autonomy	Relatedness
Simple effect of group	T 1: No T 2: No T 3: *p*<.05	T 1: No T 2: No T 3: *p*<.001	T 1: No T 2: *p*<.05	T 1: No T 2: : *p*<.05	T 1: No T 2: : *p*<.001	T 1: No T 2: : *p*<.001
Group pairwise comparison (Final Phase)	INT. > CON./EXT. No difference (CON. vs EXT.)	INT. > CON./EXT. No difference (CON. vs EXT.)	INT. > CON./EXT. EXT.>CON.	INT. > CON./EXT. No difference (CON. vs EXT.)	INT. > CON./EXT. No difference (CON. vs EXT.)	INT. > CON./EXT. EXT.>CON.

Remarks: Time (T); intrinsic goal content group (INT.); Extrinsic goal content group (EXT.); Control group (CON.); Better than (>)

From Table 14, to further examine the interaction effect between Time x Group, follow-up tests were conducted on running behavior (frequency and distance), 1609m running test, amotivation, autonomous, and relatedness.

Generally, simple effect of group in phase 1 showed no significant difference and there was significant difference showed in final phase (e.g. Time 3 in running behavior and Time 2 in 1609m test, amotivation, autonomy and relatedness).

For group pairwise comparison: All items showed intrinsic goal content group was significantly better than extrinsic goal content group and control group. Except 1609m running time and relatedness that extrinsic goal content group showed significantly better than control group.

4.9 Internal Consistency Reliability

In order to show the reliability and validity of utilizing the parametric statistics. The valid data from 77 samples of female undergraduates (mean age = 18.31, SD = 0.77) were used to examine the internal consistency reliability of the subscales (autonomy, competence and relatedness) of Psychological Need Satisfaction in Exercise Scale (PNSE) and (internal motivation, control and amotivation) of Behaviour Regulation in Exercise Questionnaire II (BREQ-2). Reliability analysis was run by SPSS Statistics 23 (George & Mallery, 2016) to assess the internal consistency reliability of each subscale (competence, autonomy and relatedness) of the 18-item PNSE scale and 19-item BREQ-2 scale. The internal consistency was evaluated with Cronbach's Alpha. All the subscales (competence, autonomy, relatedness, internal motivation, control, amotivation) of the two scales (PNSE and BREQ-2) indicated good internal consistency reliability with Cronbach's Alpha scale ranging from 0.64 to 0.93 (Table 15).

Table 15. The Internal Consistency for Subscales of the Two Scales

Scales	Subscales	Cronbach alpha α
Psychological Need	Autonomy	.93
Satisfaction in Exercise	Competence	.93
Scale (PNSE)	Relatedness	.93
Behavior Regulation in	Internal motivation	.87
Exercise Questionnaire II	Control	.64
(BREQ-2)	Amotivation	.70

4.10 Test-Retest Reliability

This study examined the test–retest reliability of the two scales (PNSE, BREQ-2). The participants consisted of 77 female undergraduates (mean age = 18.31, SD = 0.77) of an independent Hong Kong University. The sample size was similar to that of other studies (Al-Eisa et al., 2016). The students were asked to complete the same set of English questionnaires with the PNSE, and BREQ-2 scales during class periods or PE lessons through online. These questionnaires were completed on two occasions (Tests 1 and 2) with two weeks apart (Neumark-Sztainer et al., 2004; Scott et al., 2015; 101 Wang, 2017). Any inconsistencies between the scores of both tests indicated a lack of test–retest reliability of scale scores (Pedhazur & Schmelkin, 2013). The test–retest reliability for each scale was calculated by using intraclass correlation coefficients (ICCs) with 95% confidence interval (CI) obtained from a two-way mixed and single measure model. The range of ICCs was between 0 and 1, but ICCs above 0.70 had good internal reliability (Nunnally & Bernstein, 1994). The analysis of ICC revealed that the average item measure (n = 77) demonstrated an overall reliability of subscales ranging from 0.60 to 0.87 (Table 16). Therefore, the ICCs in this study shown fairly good internal reliability.

Table 16. ICCs from Two-Way Mixed and Single Measure for the Test-Retest Reliability of Different Subscales of the Two Scales

Scale	Subscales	Single Measures (ICC)	Confidence Interval	
			Lower Bound	Upper Bound
Psychological Need Satisfaction in Exercise Scale (PNSE)	Competence	.66	.10	.90
	Autonomy	.73	.23	.93
	Relatedness	.60	.00	.88
Behavior Regulation in Exercise Questionnaire II (BREQ-2)	Internal Motivation	.72	.20	.92
	Control	.76	.29	.94
	Amotivation	.87	.57	.97

4.11 Qualitative Findings

This study used focus group interviews. The process was deductive and identified how the six domains of competence, autonomy, and relatedness, internal motivation, control and amotivation existed in the qualitative data. The app's influence on their running motivation was also be analyzed to explore the influence of utilizing an app.

Competency

Competency refers to the subjective perception of students in being able to complete the task during the intervention. During the interview, all three groups mentioned that after the 8-week lessons, they acquired knowledge in running technique, they were able to see improvements in running, and they have gained confidence in running. In addition, a student from the intrinsic goal content group reported the experience enabled her to explore ways to reduce running injuries.

> I know more about running knowledge; I will not be scared of running anymore; I have never imagined that I can run.
>
> (Interviewee 1, Control group)

I think this lesson was more practical and helpful. I know running is easy to get an injury, after this course, I know how to do exercise at home to reduce injury.

(Interviewee 7, Intrinsic goal content group)

I know how to run. I will not run messily.

(Interviewee 11, Extrinsic goal content group)

Autonomy

Autonomy is the ability to self-govern, to feel in control of different aspects of one's life such as behavior, goals and to be able to make choices. During the interview, participants from the control group could not mention any thoughts or feelings related to autonomy. On the other hand, students from both the intrinsic and extrinsic goal content group reported that the ability to use several functions in the app, such as choosing one's running pace and distance, allowed them to feel a sense of freedom during their run. Additionally, a student from the intrinsic goal content group mentioned she could choose to stop running at any time. As for the extrinsic goal content group, a student noted that she was able to set any goal freely using the app.

I can choose to use different functions in the apps.

(Interviewee 5, intrinsic goal content group)

I know running is a good exercise; I feel free during running and improve my standard of life.

(Interviewee 7, intrinsic goal content group)

I want to adjust different targets, speeds, distances, and times. All these can motivate me to run.

(Interviewee12, extrinsic goal content group)

Relatedness

Relatedness is the state of being connected and to experience care for others. Participants from all three groups mentioned that they desired to run with their friends and showed that their motivation to run was affected. A student from the control group pointed out that she experienced a sense of guilt and pressure when they did not run. In contrast, another student mentioned that she felt appreciative that she had companions to run together. On the other hand, a student from the intrinsic goal content group said that she would be motivated to join her classmates in running whenever her classmates ran.

> It would motivate me to run when I saw my friends ran and I thought they are fantastic to insist on running.
>
> (Interviewee 4, control group)
>
> I want to run with a group of friends.
>
> (Interviewee 5, intrinsic goal content group)
>
> When I saw other people ran, I would be affected by them.
>
> (Interviewee 10, extrinsic goal content group)

Internal Motivation

Internal motivation refers to the individual's self-motivation and self-determination, which is driven by interest, enjoyment, and the satisfaction inherent in the behavior or activity they are engaging in.

Participants in all three groups reported feeling happy, satisfied and felt positive emotions such as feeling refreshed or more comfortable after running. In the control group, a few students mentioned "feeling fruitful" after running. One student, in particular, recognized how running helped her with self-actualization. She noted that "Running is a good time to listen to my body and to give time to myself and talked to myself." In the intrinsic goal

content group, students mentioned that they felt free during their run and enjoyed running. They also recognized the importance of running. One student revealed that running improved her living standard as she felt healthier and gained self-confidence. She even learned the importance of running in her life.

Similarly, another student also revealed that she was keen to accept challenges faced during running, as that it made her felt good. On the other hand, students from the extrinsic goal content group enjoyed running. In contrast, one student believed running is meaningful, and it was satisfying to witness improvement in running whenever efforts were made.

> I feel enriched and found a sense of meaning in life.
>
> (Interviewee 1, control group)
>
> I would think about the sentence every time I ran and would feel happier.
>
> (Interviewee 5, intrinsic goal content group)
>
> When I am free, I would go for a run and feel better after the run.
>
> (Interviewee 11, extrinsic goal content group)

Control

In the self-determination theory, control is between amotivation and intrinsic motivation. Controlled motivation is comprised of external regulation—a type of motivation where an individual act out of the desire for external rewards or fear of punishment. On the other hand, introjected regulation is motivation from "partially internalized activities and values" such as avoiding shame, seeking approval, and protecting the ego. All three groups mentioned external reasons for running, such as having a good result in the running test, the desire to reduce body fat, and staying healthy. Students reported group pressure and the sense of guilt in the control group if they did not run. In particular, one student mentioned she ran because she wanted to train herself up to be more perseverant. In the intrinsic goal

content group, a student said she did not want to disappoint her teacher. In contrast, a student from the extrinsic goal content group mentioned that she felt positively different from others after running.

I started to run more in preparation for the running test.

(Interviewee 1, control group)

I believe consistent running requires much passion, and I did not want to disappoint my teacher and waste her efforts.

(Interviewee 5, intrinsic goal content group)

Simply to stay fit.

(Interviewee 12, extrinsic goal content group)

Amotivation

Amotivation is the condition in which an individual is entirely non-autonomous, lacks drive or direction, and struggles to have any of his or her needs met. Participants from all three groups complained not wanting to run as they felt lazy and lacked time to do so. In the control group, a student mentioned that she did not have the habit of running and felt pain in her legs and stated that she had no running company. A student believed that running is hard work in the intrinsic goal content group, inconvenient and preferred indoor exercise. Another student also mentioned that as running was a mandatory exam, the pressure of having to complete it puts her off. Similarly, a student from the extrinsic goal content group thought running was boring and that she felt tired and did not have good health to conduct such exercise.

I was too busy to run.

(Interviewee 1, control group)

I was too lazy to exercise

(Interviewee 7, intrinsic goal content group)

I do not like running; I believe my health is subpar; running feels tough. I enjoy group exercise more, such as participating in ball games, as it is more competitive and fun.

(interviewee 12, extrinsic goal content group)

Goal Contents Messages

The effect of goal contents messages was explored, looking into students' running motivation, behaviour, and performance. In the intrinsic goal content group, students reported after receiving the message, they would think about the meaning behind the words and rethink them during running. They often agreed with the sentence and the meaning behind it; thus these words acted as a reminder and empowered them to go running. It was reported that the message received enabled them to change their view; for example, a student stated, "I received a message about how running can make one happy. As I have recently been unhappy, I went for a run found myself feeling better afterward." As for the extrinsic goal content group, students agreed that the message received had a reminder effect; however, they did not have any strong feelings or emotions towards the message as they were already aware of the benefits of running stated in the messages.

I would like to help myself, try to feel the meaning of the message, and change my habit.

(Interviewee 5, intrinsic goal content group)

The message can act as a reminder, remind me to keep fit and look better.

(Interviewee 11, extrinsic goal content group)

Mobile App Influence

This part explored the influence of the app on students' running motivation, performance, or running behavior. All three groups mentioned that the app's functions, such as the record of running history, setting running target, display of calorie burned, pacing, the distance ran and the GPS function were able to motivate them to run. They all agreed that the app was great, convenient, and useful, and was also very user-friendly. Moreover, the app was good as it acted as a reminder; it also showed how other classmates ran. A student from the intrinsic goal content group said, "when I knew a classmate ran through the app, I would think I should try to run as well, and I knew the teacher would give a 'like' when we ran." A student from the extrinsic goal content group said, "I set every 1k alert during running, so I know how long I ran, and when I felt tough, I would persuade myself to persist until I hear the alert - it works."

> The app's record function can let me understand myself more and see the running improvement that let me have satisfaction in the running.
>
> (Interviewee 2, control group)
>
> I think the app is helpful, as it can keep track of my running time and running distance and can look back of my running history, and I know the teacher or classmates would know I ran or not through the app, and sometimes I gained "like" from classmates or teachers.
>
> (Interviewee 6, intrinsic goal content group)
>
> The app can help to set a challenge, and it can set targets and let me know how long should I run,
>
> (Interviewee 11, extrinsic goal content group)

4.12 Summary of Results

The first purpose of this study was to examine the main effects of motivational goal content on female undergraduates' running motivation, running behavior, and performance. The second purpose of this study was to explore the impact of mobile apps on running motivation. The results were summarized as follows.

The main effects of time on all measures were significant (all *p*s < .001), revealing a significant change in students' running behavior, running performance, and running motivation after the intervention as hypothesized.

The main effects of group on all measures (all *p*s < .05) except running test scores ($p = .14$) and amotivation ($p = .10$) were also significant. In addition, the interaction effect between time and group on running behavior (frequency and distance) (*p*s< .001), running test (1609m) ($p<.001$), relatedness ($p< .001$), autonomous ($p< .001$), and amotivation ($p = .01$) were significant, suggesting the effect of intervention were different in different groups.

Our findings highlighted that sending of intrinsic goal content message through a mobile app can help in running behavior effectively. Intrinsic goal content message was viewed in significantly more effective in running motivation, running performance, and running habit compare with two other groups. However, the extrinsic goal content group had a similar result with the control group by comparing with the three groups.

From the group interview, the extrinsic goal content group students mentioned that the extrinsic goal content message was not so useful, as they all knew about the behind meaning of the message already and the message cannot change their mind. On the other hand, the intrinsic goal content group student mentioned the intrinsic goal content message can let them feel the worth and meaning about running, which can inspire them internalized. Besides, the interview provided a new insight that the app was easy and convenient to use, it could let students know how long they ran, how many calories they spent, and the running

intensity by showing running pace, and the app could automatically record their result, all these functions could arise their curiosity and motivate to run.

Chapter 5: Discussion

The purpose of this study aimed to investigate how the two types of goal contents (intrinsic or extrinsic) messages delivered via a mobile app could affect female undergraduates' motivation, behavior, and performance in running based on Self-Determination Theory. In this chapter, study's findings will be discussed and examined guided by the literature reviews and research questions. The findings serve as basis to identify the underlying reasons why the use of goal contents messages via mobile apps would be useful to affect female undergraduates' running motivation, behaviour and performance. Moreover, these findings can assist future research and programme planning for the sake of undergraduate female students' health benefits through running or exercises.

According to previous studies shown that physical activity is essential for health (Barbara, 2017; Johnston et al., 2019); however, university freshmen's physical activity dramatically decreased while this is a critical period to create long-life exercise habit (Tze et al., 2020) and female undergraduate's physical activity is even worse (Edwardson et al., 2013). However, running is a convenient, effective, and less time consuming physical activity (Szabo et al., 2013), and female running participation in the world is increasing (Jens, 2020); therefore, the first ideal of this study was to motivate and increase university year one female (university freshmen) to participate in running, and there was an explosive growth of mobile apps in sports participation (Martin et al.,2017) and the goal contents (intrinsic or extrinsic message) was shown a positive effect on exercise behavior or motivation (Kasser et al., 1996; Sebire et al., 2009, 2011; Vansteenkiste et al., 2004) and research supported the claim that more autonomous forms of motivation were linked to greater self-reported exercise (Wilson et al., 2004) and objectively assessed physical activity (Sebire et al., 2011) and led to more positive behavioral outcomes (Wilson et al., 2006). Based on the findings of a similar study from Matthew et al. (2008), it showed three weeks of sending positive frame messages

that can improve exercise level. And a research gap about the effect of receiving the goal contents message through a mobile app on exercise motivation, behaviour and performance. Therefore, this study was to find out whether the intrinsic or extrinsic goal contents sent via the mobile app could increase female undergraduates' running motivation, running behaviour and running performance.

In this study, data findings suggested that the main effects among three groups (intrinsic goal content group, extrinsic goal content group and control group) from time 1 (Week 1) to time 2 (Week 8) on running motivation (internal motivation, control, amotivation, autonomy, competence and relatedness), running behavior (frequency and distance) and running performance (1609m running test) had shown significantly higher after the 8-week program. However, it was highlighted that intrinsic goal content group was significantly higher among the three groups on the outcomes of female undergraduates' running motivation, behavior and performance. The results matched with the ideas of Kasser et al. (1996); Sebire et al. (2009; 2011) and Vansteenkiste et al. (2004) that intrinsic exercise-related goals were positively associated with basic need satisfaction and exercise behaviour, intrinsic goal contents could increase physical and psychological feelings of wellness (e.g., less physical and depressive symptoms) than extrinsic goal contents and exercise motives that were considered intrinsic goal contents (e.g., skill-development or interaction with others) were positively related to self-esteem, psychological well-being, satisfying basic psychological needs, attention, and fun. Besides, previous research from Simon et al. (2009) stated more intrinsic motivated students would have a higher quality of learning and creativity and less drop out an intention and it was true with goal contents, a study examined the relationship between behavioral regulation and exercise-related outcomes in general supported that more self-determined regulations led to more positive behavioral outcomes (Simon et al., 2009). For instance, this research supported the idea that the intrinsic goal content group was

effectively linked to greater self-reported exercise shown in running behavior that students ran more frequent and more distance per week. Sebire et al. (2009) also stated that intrinsic goal content was posited to lead to more positive outcomes, which could positively predict physical self-worth, self-reported exercise behavior, psychological well-being, and psychological need satisfaction negatively predicted exercise anxiety (Simon et al., 2009). In this study, we used goal contents messages to examine the influence on the running motivation, running behavior, and running performance but not to investigate the prediction of goal contents in exercise behavior and exercise motivation. Even the methodology was different from Sebire et al. (2009), this study could have shown a similar result that the intrinsic goal content led to more positive outcomes.

In this study, it was found that extrinsic goal content group was significantly higher than control group in three domains only (competence, autonomous, and relatedness), but not in internal motivation, control motivation, running behavior, and running performance. However, extrinsic goal content group did not show any better results than intrinsic goal content group in all outcomes of running motivation, running behavior, and running performance. According to Deci & Ryan (2000) and Simon et al. (2008), extrinsic goal contents were hypothesized to be less or even unsatisfying of basic psychological needs and even considered to hinder optimal human development. In this study, by comparing with the three groups, we found out that the extrinsic goal content group had a similar result with the control group, which could fit with the previous research that extrinsic goal contents were hypothesized to be less satisfying of basic psychological needs (Deci & Ryan, 2000; Simon et al., 2008). Previous research has found that framing an exercise activity in terms of the attainment of an extrinsic goal impairs performance compared to framing the exercise activity in terms of the attainment of an intrinsic goal (Vansteenkiste et al., 2004; Simons et al., 2003; Maarteen et al., 2007). However, the results contradict the claims of Deci & Ryan

(2000); Simon et al. (2003; 2008) and Maateen et al. (2007) that extrinsic content would be unsatisfied with basic psychological needs and even considered to hinder optimal human development. In this study, after identifying correlations, patterns, and relationships among the data, extrinsic goal content group did not show any influence by the message contents sent. Our findings, apart from highlighting that sending of intrinsic goal content messages through a mobile app can effectively help in increase running motivation, running behavior, and running performance, but also there was not much difference between control and extrinsic goal content group, and the extrinsic goal content did not find any bad influence on the exercise behavior. In addition, in this study the students from the extrinsic goal content group in the interview mentioned that the extrinsic goal content messages were not so effective, as they all knew about the behind meaning of the message already, and the message cannot change their mind. To support and get more in-depth of the result, the group interview from this study contributed a clearer understanding of why intrinsic goal content group showed significantly higher running motivation running behavior, and running performance in this study; student mentioned the intrinsic motivation goal content messages could let them feel the worth and meaningful about running, which could inspire them internalized therefore intrinsic group shown higher self-reflection and stronger influence by the message content sent.

The findings from interviews provided a new insight that the app could motivate female undergraduates to run. The previous study also supported that mobile apps could motivate the users to use them in everyday life in many ways, like curiosity, convenience, fanship, interpersonal communication, expression, and technical knowledge (Sun et al., 2015). The past 20 years have seen significant growth in the use of mobile apps, and more and more exercise apps have been arising to increase exercise behavior. (Sun et al., 2015). And from the interview in this study, students mentioned that the app could motivate them to run

because it was easy and convenient to use, it could let them to know how long they ran, how many calories they spent and knew the pacing and could automatically record their result, all these functions could arise their curiosity and motivation to run. A systematic review in Hosseinpower et al. (2019) identified the effectiveness of mobile apps on exercise motivation by descending rank order as below: (1) Feedback (2) Goal Setting (3) Competition (4) Social Sharing. Hosseinpour et al. (2019) about mobile phone applications aiming at increasing physical activity proposed the first rank order for the effectiveness of application techniques to foster physical activity is feedback. In this study, from the focus group interviews, most students mentioned the app's features of 1km alert, knowing the pacing and distance ran, workout history and shown the improvement by highlighting the fastest workout could increase their running motivation, that is the most effectiveness feedback feature of the mobile app mentioned by Hosseinpower et al. (2019). Huang et al. (2020) mentioned that mobile apps could take an important role in exercise self-efficacy. Four technological functions: (1) instruction provision, (2) self-monitoring, (3) self-regulation, and (4) goal attainment had an indirect effect on continence intention through perceived usefulness. This indirect effect was moderated by exercise self-efficacy such that the association between perceived usefulness and continence intention was more robust for those with low exercise self-efficacy. This study did not examine the exercise self-efficacy effect on using the mobile app RunKeeper. It would be an insight to see if there is any difference by comparing the result with different exercise self-efficacy groups. According to Kristel et al. (2011), this review concluded that gain-framed messages alone are most effective than loss-framed to influence physical activity behavior. The content of the message set was shown in Table 4. From Kristel et al. (2011), a systematic review revealed a need for continued research in the area with improved method quality and consistency across message characteristics. To draw conclusions about what message characteristics are

most appropriate, there needs to be more research conducted of higher quality (Kristel et al., 2011). In this study, the goal contents messagse sent were referenced by Maarten (2006), intrinsic message would start with “I can,” and extrinsic message would begin with “I have” to or “I should.” And the content sent was based on the meaning of intrinsic and extrinsic content of Gallagher et al. (2011), Sebire (2008), and Mullan et al. (1997). Gain-framed messages suggested by Kristel et al (2011) were also used in this study. I agreed that the characteristics of the messages should be examined to gain a deep insight into how the messages can influence the participants.

Previous research argued that the body mass index would affect exercise motives (David et al., 2002). And studies suggested lower levels of motivation to exercise in overweight and obesity (Krystal et al., 2018). These results build on existing evidence of no significant difference between groups in BMI scores.

Deci and Ryan's causality orientations theory (Deci & Ryan, 1985b) suggested individual differences in motivational orientation towards initiating and regulating behavior. They described three causality orientations: autonomy, control, and impersonal. If a person with higher autonomy orientation, an intrinsic motivation message may affect the person more; otherwise, if a person with higher control orientation, an extrinsic motivation message may affect the person more. In this study, at the end of the intervention, students were required to do the questionnaire GCOS to see any difference in their causality orientations to affect the result. The data showed that the simple effect of group on Impersonal, Control, and Autonomy was not significant. Therefore, the results have already taken into account when considering to avoid these confounding factors.

5.1 Implications

Results from this study indicated that the goal contents message sent via mobile app in physical education class setting is workable and easy to handle no matter in or outside the classroom.

From this study, two-way mixed repeated measures analysis of variance revealed that the interaction effect between time and group was significant on autonomous ($p<0.001$), relatedness ($p<0.001$), amotivation ($p<0.05$), running performance ($p<0.001$) and running habits ($p<0.001$), suggesting that the intrinsic motivational goal content was important in promoting running motivation. The motivational goal content supported not only the running motivation but also the running behavior and running performance.

As discussed before, mobile apps are trends in everyday life. Learning by mobile apps should be developed. Motivation in doing exercise is a vital topic in physical education, so using mobile apps to increase students' motivation in exercise should be taken concern by physical education teachers. This result explored the effect of intrinsic or extrinsic motivation goal content in a physical education class setting.

Nowadays, because of the COVIN-19 pandemic, it is challenging to conduct physical education. This study, showing that in PE teaching, rather than using face to face teaching method, virtual context also can help in PE practice, as goal contents via mobile app can bring positive influence to undergraduate females' motivation, behavior, and performance in running

For learning environments, motivational climate refers to how students perceive the context or structure of their learning environment, which gives them relevant motivation throughout their learning (Jaakkola et al., 2015). According to Reeve (2009), autonomy-supportive motivational climate encouraged students' engagement through inner motivational resources which facilitated internal/intrinsic motivation, such as interests, preferences and personal

goals; whereas controlling motivational environment hindered students to think and act and made them behave under pressure. Therefore, supportive learning environment to motivate undergraduate female students in running or exercises is essential. According to the findings of this study, mobile apps with intrinsic goal content messages were a kind of effective method to maximize female undergraduates' running motivation, running behavior, and running performance. It could be concluded that mobile apps with intrinsic goal content messages would be regarded as a supportive way or environment to promote running exercise to novice female runners in a physical education class setting and foster female undergraduates' physical activity.

Chapter 6: Conclusion

This chapter would review the thesis's critical points, explain the future directions and the research limitations, and the findings' importance.

6.1 Future Directions

The present study has provided exploration with empirical support to the question concerning the effects of motivational goal contents on running motivation, performance, and running habit. This study raised some new questions to be answered in future studies, which are related to what are the best motivational goal content messages and how often these should be sent to the users. Thus, in future research, it will be essential to continue examining the applicability of motivation goal content messages and how to send through the running apps, and how often to send the message. It may also be useful to identify and examine the influences if the time of receiving the messages can be set by the participants or the message can be chosen by themselves.

For instance, Huang et al. (2020) mentioned that mobile apps could take an important role in exercise self-efficacy that would have an indirect effect on the perceived usefulness and continence intention. Perceived usefulness and continence intention was stronger for those with low exercise self-efficacy, and higher self-efficacy and passion on sports are more affected by intrinsic goal content. In this study, the subjects were novice runners and had low physical activity levels; it is recommended to count on exercise self-efficacy and running passion in future research as well.

The other area which needs more attention is the relative importance of teachers or classmates can affect the results, and it is meaningful to identify the effect without a teacher or student interaction, therefore further research can investigate to what extent the support from these people would promote the result.

Previous researches mentioned that peers influence was a crucial factor to increase exercise motivation, adherence, duration, or intensity (Carnes et al., 2016; Dolan, 2008 & Kravitz, 2011). This study design was that teacher sent the goal contents messages to the students; however, it is interesting to know is there any difference if the messages sent within the peers.

In addition, a systematic review and meta-analysis from Romeo et al. (2019) provided modest evidence supporting the effectiveness

of smartphone apps to increase physical activity. To date, apps have been most effective in the short term (e.g., up to 3 months). It suggested that future research is needed to understand the time course of intervention effects and to investigate strategies to sustain intervention effects over time. However, this study only lasted for eight weeks, which exclusively focused on short-term results. Long-term follows up investigation can be done in the future to understand the consistent effects.

It seems that all the students can understand the English content in this study.

Addition, a modified Chinese content message can be designed in the future to explore whether the same result would be obtained.

Molina et al. (2020) revealed that the use of features of the app that elicit relatedness, autonomy, and competence predicted exercise outcome. However, these relationships were moderated by gender. This study was only done in a female population; thus, further research may explore the role of motivational goal contents on running motivation, performance, and running behavior in both male and female participants.

COVID-19 provided a new set of challenges in translating traditional face-to-face courses into a digital space, especially for Physical Education; physical educators must use the online platform to help students in the promotion of the physical activity. Therefore, it is worthy for the application of setting motivational goal content messages, the features, functions, and

potential applications of physical activity/fitness trackers, mobile fitness applications to be further developed and explored. Furthermore, a future study can be suggested to consider with the Technology Acceptance Model (TAM). Research has confirmed the Technology Acceptance Model's (TAM) validity in the mobile health context by showing that perceived enjoyment, perceived usefulness, and perceived ease of use jointly contribute to users' continuance intentions to use healthcare apps with different specialties, such as medication information, weight management, and chronic disease information management (Cho, 2016, Wang et al., 2014). Therefore, the TAM model can also be applied to explore any difference between these three groups after the intervention, to examine the relationship between the TAM model and females' motivation, behavior, and performance in running and predicting the students' intention using the apps.

To conclude, future research may investigate the optimal number and combination of app features, level of participant contact, and behavior change techniques to maximize user engagement and intervention efficacy.

6.2 Limitations

The study only lasted for eight weeks; long-term effects of the role of motivational goal contents on running motivation, performance, and running behavior were not explored. There may have been induced research bias since the researcher also took on the role of the physical education teacher in the experiment.

This study was done in the weekly physical education class setting, which allowed routine monitoring of attendance and goal setting. The results obtained from this study may not be replicated in the absence of such PE classes. There were also individual differences across participants; for example, some students enjoyed running, whereas some students did not. Peer influence may have affect participants' motivation as students were running together in

class; such behavior may not persist after class. The students were not confirmed not to recognize each other in the class and this might create peer influence. There was also a difference in each individual's ability; for example, some students found it easier to manage the run, whereas others were less capable of running. Moreover, our data was the only representative of one university in Hong Kong; thus, the findings may not be generalizable to universities in other geographical areas. The use of a self-report measure of running frequency and running distance per week may have led to less accurate physical activity data than the use of an objective measure, such as accelerometry, would have produced. A more extensive and more diverse sample is necessary to examine the validity and replicability of the results in this study and any differences across different genders, different ages, ethnicities, socioeconomic statuses, and other demographic areas.

6.3 Delimitations

To delimitate the individual differences in motivational orientation (Autonomy, Controlled, and Impersonal) towards initiating and regulating behavior. A questionnaire GCOS was done at the end of this study. The data showed no significant difference between the three groups (intrinsic goal content group, extrinsic goal content group, and control group).

According to a study from Kaukab & Varghese et al. (2018) explored the exercise motivation of university students at different levels of Body Mass Index (BMI); this study concluded that university students showed high intrinsic and identified regulation that reflected as better autonomous motivation or self-determined motivation. The normal weight students (18.5-24.9 kg/m^2) had higher autonomous motivation than underweight (<18.5kg/m^2) and obese students (≥30.0 kg/m^2). Obese class students exhibited a higher degree of extrinsic motivation and amotivation. Therefore, in this study, Body Mass Index (BMI) was restricted between 18.5 kg/m^2 -22.9 kg/m^2 before the test and BMI data was also be

analysed to see any significant difference at the beginning so to delimit the influence by body composition and the data showed no significant difference between the three groups.

6.4 Conclusion:

This research aimed to identify the motivational goal (intrinsic and extrinsic) via mobile app in helping female undergraduates' running motivation, performance, and habit. Based on a quantitative and qualitative analysis of the six motivation domains (internal motivation, control, amotivation, autonomous, relatedness, and competence), running performance, and running habit, it can be concluded that the use of a mobile app in PE teaching to send intrinsic goal content messages may have a positive effect on promoting running exercise to novice female runners in a PE class setting. The results indicate that intrinsic motivational goal contents can be used as an accelerant to enhance exercise behavior online. Further studies may explore the long-term effects of using a mobile application to send intrinsic goal content messages on the promotion of running without the presence of a PE teacher or peers.

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Appendix A

EXERCISE REGULATIONS QUESTIONNAIRE-II (BREQ-2)

Why do you engage in running?

Please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about running. Your responses will be held in confidence and only used for our research purposes.

1: not true for me, 2-3: sometimes true for me, 4: very true for me

1	I run because other people say I should	0	1	2	3	4
2	I feel guilty when I don't run	0	1	2	3	4
3	I value the benefits of running	0	1	2	3	4
4	I run because it's fun	0	1	2	3	4
5	I don't see why I should have to run	0	1	2	3	4
6	I take part in running because my friends/family/partner say I should	0	1	2	3	4
7	I feel ashamed when I miss a running session	0	1	2	3	4
8	It's important to me to run regularly	0	1	2	3	4
9	I can't see why I should bother running	0	1	2	3	4
10	I enjoy my running sessions	0	1	2	3	4
11	I run because others will not be pleased with me if I don't	0	1	2	3	4
12	I don't see the point in running	0	1	2	3	4
13	I feel like a failure when I haven't run in a while	0	1	2	3	4
14	I think it is important to make the effort to run regularly	0	1	2	3	4
15	I find running a pleasurable activity	0	1	2	3	4
16	I feel under pressure from my friends/family to run	0	1	2	3	4
17	I get restless if I don't run regularly	0	1	2	3	4
18	I get pleasure and satisfaction from participating in running	0	1	2	3	4
19	I think running is a waste of time	0	1	2	3	4

Thanks you for taking part in our research

Appendix B

The General Causality Orientations Scale (GCOS)

These items pertain to a series of hypothetical sketches. Each sketch describes an incident and lists three ways of responding to it. Please read each sketch, imagine yourself in that situation, and then consider each of the possible responses. Think of each response option in terms of how likely it is that you would respond that way. We all respond in a variety of ways to situations, and probably most or all responses are at least slightly likely for you.

If it is very unlikely that you would respond the way described in a given response, you should circle answer 1 or 2. If it is moderately likely, you would select a number in the mid-range, and if it is very likely that you would respond as described, you would circle answer 6 or 7.

1. You have been offered a new position in a company where you have worked for some time. The first question that is likely to come to mind is:

a.	What if I can't live up to the new responsibility?	1 2 3 4 5 6 7
b.	Will I make more at this position?	1 2 3 4 5 6 7
c.	I wonder if the new work will be interesting.	1 2 3 4 5 6 7

2. You have a school-age daughter. On parents' night the teacher tells you that your daughter is doing poorly and doesn't seem involved in the work. You are likely to:

a.	Talk it over with your daughter to understand further what the problem is.	1 2 3 4 5 6 7
b.	Scold her and hope she does better.	1 2 3 4 5 6 7
c.	Make sure she does the assignments, because she should be working harder.	1 2 3 4 5 6 7

3. You had a job interview several weeks ago. In the mail you received a form letter which states that the position has been filled. It is likely that you might think:

a.	It's not what you know, but who you know.	1 2 3 4 5 6 7
b.	I'm probably not good enough for the job.	1 2 3 4 5 6 7
c.	Somehow they didn't see my qualifications as matching their needs.	1 2 3 4 5 6 7

4. You are a plant supervisor and have been charged with the task of allotting coffee breaks to three workers who cannot all break at once. You would likely handle this by:

a. Telling the three workers the situation and having them work with you on the schedule. 1 2 3 4 5 6 7
b. Simply assigning times that each can break to avoid any problems. 1 2 3 4 5 6 7
c. Find out from someone in authority what to do or do what was done in the past. 1 2 3 4 5 6 7

5. A close (same-sex) friend of yours has been moody lately, and a couple of times has become very angry with you over "nothing." You might:

a. Share your observations with him/her and try to find out what is going on for him/her. 1 2 3 4 5 6 7
b. Ignore it because there's not much you can do about it anyway. 1 2 3 4 5 6 7
c. Tell him/her that you're willing to spend time together if and only if he/she makes more effort to control him/herself. 1 2 3 4 5 6 7

6. You have just received the results of a test you took, and you discovered that you did very poorly. Your initial reaction is likely to be:

a. "I can't do anything right," and feel sad. 1 2 3 4 5 6 7
b. "I wonder how it is I did so poorly," and feel disappointed. 1 2 3 4 5 6 7
c. "That stupid test doesn't show anything," and feel angry. 1 2 3 4 5 6 7

7. You have been invited to a large party where you know very few people. As you look forward to the evening, you would likely expect that:

a. You'll try to fit in with whatever is happening in order to have a good time and not look bad. 1 2 3 4 5 6 7
b. You'll find some people with whom you can relate. 1 2 3 4 5 6 7
c. You'll probably feel somewhat isolated and unnoticed. 1 2 3 4 5 6 7

8. You are asked to plan a picnic for yourself and your fellow employees. Your style for approaching this project could most likely be characterized as:

a. Take charge: that is, you would make most of the major decisions yourself. 1 2 3 4 5 6 7

b. Follow precedent: you're not really up to the task so you'd do it the way it's been done before. 1 2 3 4 5 6 7
c. Seek participation: get inputs from others who want to make them before you make the final plans. 1 2 3 4 5 6 7

9. Recently a position opened up at your place of work that could have meant a promotion for you. However, a person you work with was offered the job rather than you. In evaluating the situation, you're likely to think:

a. You didn't really expect the job; you frequently get passed over. 1 2 3 4 5 6 7
b. The other person probably "did the right things" politically to get the job. 1 2 3 4 5 6 7
c. You would probably take a look at factors in your own performance that led you to be passed over. 1 2 3 4 5 6 7

10. You are embarking on a new career. The most important consideration is likely to be:

a. Whether you can do the work without getting in over your head. 1 2 3 4 5 6 7
b. How interested you are in that kind of work. 1 2 3 4 5 6 7
c. Whether there are good possibilities for advancement. 1 2 3 4 5 6 7

11. A woman who works for you has generally done an adequate job. However, for the past two weeks her work has not been up to par and she appears to be less actively interested in her work. Your reaction is likely to be:

a. Tell her that her work is below what is expected and that she should start working harder. 1 2 3 4 5 6 7
b. Ask her about the problem and let her know you are available to help work it out. 1 2 3 4 5 6 7
c. It's hard to know what to do to get her straightened out. 1 2 3 4 5 6 7

12. Your company has promoted you to a position in a city far from your present location. As you think about the move you would probably:

a. Feel interested in the new challenge and a little nervous at the same time. 1 2 3 4 5 6 7
b. Feel excited about the higher status and salary that is involved 1 2 3 4 5 6 7
c. Feel stressed and anxious about the upcoming changes. 1 2 3 4 5 6 7

Thanks you for taking part in our research

The General Causality Orientations Scale (GCOS)

Code: _____

1.	a _____	b _____	c _____
2.	a _____	b _____	c _____
3.	a _____	b _____	c _____
4.	a _____	b _____	c _____
5.	a _____	b _____	c _____
6.	a _____	b _____	c _____
7.	a _____	b _____	c _____
8.	a _____	b _____	c _____
9.	a _____	b _____	c _____
10.	a _____	b _____	c _____
11.	a _____	b _____	c _____
12.	a _____	b _____	c _____

Name or Code: _____KEY_____

Individual Styles Response Form - 12 Vignettes

1.	a I	b C	c A
2.	a A	b I	c C
3.	a C	b I	c C
4.	a A	b C	c I
5.	a A	b I	c C
6.	a I	b A	c C
7.	a C	b A	c I
8.	a C	b I	c A
9.	a I	b C	c A
10.	a I	b A	c C
11.	a C	b A	c I
12.	a A	b C	c I

KEY: A = Autonomy C = Control I = Impersonal

Appendix C

Psychological Need Satisfaction in Exercise Scale (PNSE)

Please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about running. Your responses will be held in confidential and only used for our research purposes. 1: not true for me, 2-5: sometimes true for me, 6: very true for me

PNSE-PA-competence satisfaction

I feel that I am able to complete running that are personally challenging.

I feel confident I can do even the most challenging running.

I feel confident in my ability to perform running that personally challenge me.

I feel good about the way I am able to complete challenging running.

I feel like I am capable of doing even the most challenging running.

I feel capable of completing running that are challenging to me.

PNSE-PA-autonomy satisfaction

I feel like I am in charge of my running program decisions.

I feel free to make my own running program decisions.

I feel free to do running in my own way.

I feel like I have a say in choosing the running that I do.

I feel free to choose which running I participate in.

I feel like I am the one who decide what running I do.

PNSE-PA-relatedness satisfaction

I feel attached to my running companions because they accept me for who I am.

I feel I share a common bond with people who are important to me when we do running together.

I feel close to my physical activity companions who appreciate how difficult running can be.

I feel a sense of camaraderie with my physical activity companions because we do running for the same reason.

I feel connected to the people who I interact with while we do running together.

I feel like I get along well with other people who I interact with while we do running together.

Appendix D

Interview Script

Control Group

雁: 介紹

雁: 之前上課介紹過用 RUNKEEPER，妳地有沒用過?

那: 我除左上課用過之外就沒有再用

雁: 點解唔再用呢?

那: 因為我都沒有跑步習慣，所以都沒什麼機會用到 (Amotivation)

雁: 但是過左呢 8 禮拜，有沒有幫助到妳陪養跑步習慣呢?

那: 其實都有些少，因為識多了跑步既野，我不會再怕跑，估唔到原來自己都能跑到 (Competence)

雁: 咁係上課時用，用的時候有什麼感受?

那: 覺得拿著電話唔太方便，如果可以放在手臂上是會 OK 些 (inconvenience) (amotivation)

雁: 點樣先會令妳用電話既 app 去跑步呢?

那: 如果送手帶我就會用

雁: 咁妳跑步的次數多嗎?

那: 不多，只追巴士時才跑步，哈哈(amotivation)

雁: 如果要跑步妳會否用呢?

那: 會，因想知道自己跑多遠和用幾多卡路里 (Feature)

雁: 咁點解知道跑多遠或用幾多卡路里就會用呢?

那: 因為可以了解自己既能力和看到自己用左幾多卡路里，咁樣就會覺得充實有意義(internal motivation)

雁: 咁用 RUNKEEPER 有沒有提升動機?

那: 暫時沒有

雁: 點解沒有?

那: 因為都未能推動我上完課後繼續跑(Amotivation)，我這個 sem 跑多了都是因為要考跑步。(Control)

雁: 希，咁你有用 RUNKEEPER 嗎?

希: 有

雁: 什麼時候用?

希: 跑步，踩單車和行山時都有用，我會用來記錄路線和時間等(feature)

雁: 用時有什麼感受?

希: 好似秘書咁記錄我全部的運動紀錄(feature)

雁: 咁紀錄有什麼好處呢?

希: 看了就了解多了自己(internal motivation)，看到自己有沒有進步(internal motivation)，和會讓我有些滿足感。(internal motivation)

雁: 是否課堂介紹才用?

希: 是，之前都唔知道

雁: 咁這 app 有沒有幫到妳動機去做運動

希: 都有，看到有消了卡路里就會開心 (internal motivation)

雁: 你對這 app 的整體感覺好還是不好?

希: 好，因追縱這功能好和準確, 但太食電 (feature)

雁: 為什麼追縱這功能好和準確就覺得整體好?

希: 因紀錄自己跑到那和跑多少，紀錄了自己有訓練 (feature)

雁: 藍有沒有用這個 app?

藍: 有，為了體育分數，跑了幾次都有用 (Control)

雁: 有什麼感受?

藍: 我想有跑步習慣的人就好，因可以監察住跑多久, 跑多快，消了多少卡路里(feature)，雖不知是否準，但也有推動力去跑，因知道消了幾百個卡路里，個人會開心點(internal motivation)。

雁: 咁你用的原因會係什麼呢?

藍: 能看到自己有沒有進步(internal motivation)

雁: 你會繼續用嗎?

藍: 會，因可免費看到自己跑了多少次，寫下了跑多久和多次，作一紀錄 (feature)

雁: 其實有沒推動到你去跑步?

藍: 有，看到自己有進步(internal motivation)，比之前跑多左 (internal motivation)

雁: 整體感受係?

藍: 好的，因免費，哈哈 (feature)

雁: 你可唔可以講多些? 除左免費讓你感到好外，仲有怎樣好?

藍: 就是有紀錄，可以看到自己跑多遠和去了那跑，也能看到同學跑多少，有互動作用(relatedness)，有些影響力。這個 app 也有關於跑步的知識和幫到目標的設定(feature)，這些功能是有幫助到跑步的，這些我都覺係好。

雁: 兵?

兵: 我有用，頭一個月有用, 一星期一至兩次，之後就少用了

雁: 點解?

兵: 因我開始時不坐校巴，好奇想知道自己行多快, 就試用, 之後因坐多了校巴，沒行路，就沒用了。

雁: 咁你之前用後有推動你做運動嗎?

兵: 只跑過一次有用過，感受到好方便。(feature) 還可以見到身邊人跑，好有趣 (internal motivation) ，其實有少少推動，因看到身邊人跑(relatedness)，看到佢地跑，會覺人地好堅持好勁(relatedness)。

雁: 那，妳喜歡跑步嗎?

那: 我不喜歡，因我有做其他運動，其他運動會偏向喜歡跳舞，而且自己不喜歡出街，所以不喜歡跑步(amotivation)

雁: 有沒其他原因不喜歡跑?

那: 沒有，但如果想跑也會跑，但近排忙就沒有跑了。(amotivation)

雁: 希，你喜歡跑步?

希: 普通，是沒反感

雁: 點解?

希: 跑完是會舒服(internal motivation)，但不會迫自己一星期跑多少次，可能見自己好久沒做運動，就落街跑下。冬天跑時喉嚨會干，這是我最不喜歡的。

雁: 藍?

藍: 我憎跑步，其他運動，好似踩單車我是可以接受，但跑步就…第一跑步無聊，浪費時間，跑步也是最辛苦的運動，我沒動力去維持(amotivation)，其實是因有考試我才去跑下(control)，如果無故去跑我係唔會的。

雁: 有沒感受到跑步的好處?

藍: 感受不大，只覺得好累好辛苦(amotivation)

雁: 兵?

兵: 我不喜歡，因跑完會好累，腳會痛一整日(amotivation)，跑步是為左考試分(control)，我也沒有跑步既習慣。

雁: 有沒想過跑步會對你有幫助呢?

兵: 可能都會，見到自己差一點點衝線，自己也會堅持一下，意志力係有幫助的 (internal motivation)。

雁: 那?

那: 我想有目標跑會好些，例如跑到最後一圈，都能快完成，其實都幾爽，會喘氣但都爽，有時望住個天跑，心情都會好和開心些(internal motivation)。

雁: 希?

希: 跑完會精神些，做事會專心些，如不運動，做事好像沒什麼動力，跑完後是會有舒服感覺(internal motivation)

雁: 多久出外跑?

希: 一星期一兩次

雁: 那?

那: 我沒太多次數出外跑，因我喜歡自己一個有一大段時間才做運動，但現在沒太多時間, 實在好忙(amotivation)，但我又不喜歡晚上做運動，只有晚上才有時間。但如有時間都會去跑 。

雁: 藍?

藍: 我覺得跑步好處和其他運動好處一樣，我情願做其他運動都不會跑步。 (amotivation)

雁: 那藍和兵的跑步次數?

藍: 一個月一次

兵: 兩個月一次

雁: 完成了課堂，有沒對大家對跑步或其他有什麼改變?

那: 有，我覺得自己跑的距離長左，和時間耐左，以前跑 1500 米是為了挑戰自己，現在覺得自己做到(competence)，所以想跑多少少， 因為課堂有 1609 米測試，所以有這感覺，不是由於其他。

希: 反而少了，因課堂也教到做體能訓練，所以放多左時間在體能訓練上(amotivation)

藍: 沒影響

兵: 沒影響力

雁: 為何沒影響?

藍: 因內心仍然不愛跑步 (amotivation)

兵: 做運動其實傾向和朋友一齊做 (reletedness)，但現在沒有什麼朋友一齊做，所以少了(amotivation)，以前反而多少少

雁: 教學用 app，有什麼感受?

那: 可以準確，知跑多遠多久，因有記錄，所以知道自己有沒進步或退步，有一堂出外跑沒用 app，這樣覺得沒記錄，不太好。

希: app 能比動力我，看到自己一直進步，這讓我有動力一直跑下去，沒用前，自己亂跑，反而覺得自己沒什麼動力，有時一累，就給自己藉口不跑 (internal motivation)

藍: 有群眾壓力，見到別人做，自己心虛就做下，會推使人跑多些 (reletedness)

兵: 有個記錄，可以看到數字上進步 (internal motivation)

雁: 所以大部份都覺得用 app 在跑步教學上應用是好的，是嗎?

那，希，藍，兵: 是

雁: 面試完了，有沒其他問題?

那，希，藍，兵: 都沒有

Intrinsic goal content group

雁: 介紹

雁: Crystal, 妳有沒用過 RUNKEEPER?

Crystal: 上課用過, 一次後我就沒用過了。

雁: 點解呢?

Crystal: 因為懶沒做運動，所以沒開來用，如有做運動，我都會開來用 (amotivation)

雁: 整體用 APP 跑步有什麼感受?

Crystal: 好用，容易和放便 (feature)

雁: 怎好用，容易和放便呢?

Crystal: 我可以容易掌握，能決定自己想用什麼功能。(autonomous)

雁: 用 APP 教跑步會有幫助?

Crystal: 會有幫助，有記錄(feature), 鼓勵我跑多些，見到自己做到會好叻(competence)

雁: Lisa?

Lisa: 考試前有用過，用了一天

雁: 為何用?

Lisa: 想看自己跑步時間和速度，希望考試時控制到跑速，不鬆懈，因考試要計時，所以在考試時調節速度。(competence)

雁: 對用 app 這有什麼感覺?

Lisa: 好用，清楚，有 GPS 可以記錄在那跑和路線(feature)，還有每隔一時間會提醒跑多久跑多米，但有時聲音突然爆出來，會嚇一下，聽到自己在這分鐘跑多少距離，會睇下自己應跑快些還是跑慢些。

雁: 在課堂用 app，有幫助?

Lisa: 有，keep track 時間(feature)，看回自己跑過的 experience, 看到自己進步 (internal motivation)

雁: 有沒幫到動機?

Lisa: 也有推動作用，因知道老師和同學看到我有沒跑，跑了就會上載。(relatedness), 加上有老師和同學的贊賞和鼓勵，也想自己瘦些，好看些。(control)

雁: Nancy?

Nancy: 我就是比較懶(amotivation)，少跑步，因為這是戶外用，我可能比較喜歡室內(amotivation)，所以用的比較少。

雁: 為什麼不在外面跑?

Nancy: 因為我住在 WYS，如何下來平的地方跑比較遠，還有要上課，反正比較懶。但去 GYM 的話，晚上也可以(amotivation)，所以時間比較好用。

雁: 在上課時用，用時有什麼感覺?

Nancy: 我覺得廷好，因可看到跑的時間跟距離, 會看到自己進步 (internal motivation) ，因看到這天跑多少，第二天可能會去比較，會跑多了還是跑快了，其實我也用過其他 APP，例如我跑了多少就給什麼獎勵(control)，就會比較有動力去跑，會想堅持，例如再堅持多兩天就會給你什麼什麼，還有排行什麼(control)，會有推動力。但是現在太懶，住的地方太遠所以少用(amotivation)。

雁: 喜歡在課堂用 app 嗎?

Nancy: 但要拿著，就感覺有影響 (amotivation)

雁: Ashley?

Ashley: 我就在上課之外沒有用，比較懶(amotivation)，如相對於戶外跑步，我就比較喜歡室內，因為如果下午跑步，外面可能很曬，跑步可能也有蚊子，所以在 gym 內面會好一點。(amotivation)

雁 ： 在課堂用過有什麼感受?

Ashley: 如果在於跑步，用 app 其實會好一點，因為你可以看到自己跑多久，盡力會跑完(competence)，如果一開始就定一目標要跑多少(competence)，就會去完成。如果長期使用，也可以看到自己的進步 (internal motivation) ，可能會激勵每天都跑一下，只是我比較懶不喜歡跑步。

雁，但是如果妳真的出外跑，妳會用 app ?

Ashley: 如果我跑我會用

雁: 其他人呢?

Crystal, Lisa, Nancy: 會

雁:crystal, 在於接受句子信息，有什麼感受?

雁: 看過多少次?

Crystal: 會望一眼

雁: 望了後對跑步有沒任何影響?

Crystal: 沒有話見到就想出去跑，因其實這些句子都知道，但都是懶得動，就算這句子都未能促使我去跑，但走去跑時想一想這句子，是會開心些 (internal motivation) 。其實都會嘗試跑時想一想內在動機，嘗試改變自己 (internal motivation) ，想一想開心去跑，感受下跑步的開心 (internal motivation)

雁: 會否想天天收到這句子?

Crystal: 不介意。

雁: 那接受這句子，共同訂這目標，有沒有什麼想分享一下?

Crystal: 我想是由於句子好正面，加上是老師在課上一起定下，每天都由老師傳給我們收到，有點提醒(feature)，也覺得這行為很用心，於是都會想去跑，不想令老師失望和浪費心機(control)，我也會試試跑時想下這星期的目標。

雁: Lisa, 有沒影響到?

Lisa: 都不是很大影響，例如今期是這句句子，看了退出去我就沒理到。

雁: 會否想天天收到這句子?

Lisa: 都可以，天天收就有點提醒，潛意識知道跑步這件事在

雁: 會否想句子意思

Lisa: 其實看到這句子會知道這意思，但這句子也未能強到促使我有這行動(amotivation)，不是我最大動機，最大動機對我來說是要考好個試(control)。

雁: 那接受這句子，共同訂這目標，妳有什麼想分享一下?

Lisa: 都會想下這些目標設定，感覺對自己都有一定意義 (internal motivation) ，也會有些衝動去跑。也有提醒。(feature)

雁: Nancy?

Nancy: 我覺得這個句子，其實不是不知道，都是知道的，但是不會因為看到這信息就會想去跑。我覺得這句子對於他已經養成這習慣的可能有加強他們的動機，但是在於培養動機可能還未到。(amotivation)但我也會在跑時感受跑步對自己的重要性 (internal motivation) ，我也會想一下我們訂的目標。

雁: Ashley?

Ashley: 每天看到的時間會想到跑步是什麼回事，其實跑的時間會想到會不會感覺到相同的感受，也希望這些目標能幫助到我去跑。

雁: 我想問 crystal 喜歡跑步嗎?

Crystal: 未去到喜歡，但不抗拒，但如果要做運動要我選擇，我都是會選跑步，因為方便，換了衫，落掛跑，跑完就算，不用準備什麼，所以做運動我會跑步，但我也不是喜歡跑步的。

Lisa: 對我來說，跑步算是最簡單的運動，換件衫和拿手機就可以跑(competence)，比較其他球類運動不用技考，如果跑步不痛苦我會喜歡，跑得長程我就會覺得痛苦。(amotivation)

雁: 一星期跑多少?

Lisa: 這 8 星期是跑多了，最少兩次，但現在跑少了。

雁:為什麼跑少了?

Lisa: 因為懶(amotivation)，沒人陪，在課堂有一班人(relatedness)，平時在 app 也看到別人跑就想自己要跑，加上想知道了跑步的意義，天天有提醒(feature)，現在沒了，就跑少了。

雁: Nancy,喜歡跑步嗎?

Nancy: 還可以，如果要考試或有任務的去完成，就不喜歡(amotivation)，如果可以自由，感覺累的可以停下來，這樣跑步是不錯的。

雁: 現在都不用考試，妳還會跑嗎?

Nancy: 會的，因我覺得跑步其實好好，好自由(autonomous)和能提升自己生活水平，fit 些(control)，有自信些 (internal motivation) 。

雁: Ashley?

Ashley: 如果跑步會讓我變得更 fit 會想(control)，但是跑步本身實在太累了和痛苦(amotivation)，所以不喜歡跑步本身，但是我現在也開始跑步，因其實可以自由一點(autonomour)，聽音樂，可能會好一點(internal motivation) 。

雁: 那你們跑步次數有沒有增加?

Crystal: 暫時沒有，可能遲些會有改變，不用上課，就會去跑(amotivation)，上午抽時間跑，因我喜歡早上做運動，遲些有時間就會用 app 去做運動。

Lisa: 通常我的課堂都是 9 點開始，如果真的換衫出外跑，跑完步又成身汗，然後又沖涼，沖完涼又要出來上課，這對我來說有些困擾，如果上午沒課堂，時間控制上會好些。(amotivation)

雁: Nancy?

Nancy: 我也感覺，如果放假，可能時門有彈性一點，平時上課，有點麻煩，因要洗澡，換衣服。(amotivation)

雁: Ashley?

Ashley: 暫時沒有，我需要動機，例如想減肥(control)，但現在比較懶，沒動機

雁:上完課，有沒影響或改變?

Crystal: 上課體能訓練有用，跟著做，比之前有做多了，一組組不一定落街，在家做會好些，落街好麻煩，在家想停就停。也試了跑步，原來自己能跑到(competence)，都想試下培養跑步習慣。

Lisa: 動機好左，因上了這課，我會將來做運動，鍛練多些，體段課靠自己(competence)和努力成績不會差

Nancy: 我覺得課堂比較實用，因跑步會容易受傷，上了課知道有些訓練可在家做減少受傷(competence)。

Ashley: 我覺得相對來說，體鍛學的運動比較簡單的鍛練，不用場地的租用。

雁:完了課堂 有沒有對跑步動機有所提升?

Crystal: 有小小，我有跑多了小小，因覺得跑步簡單，和朋友一起跑動機會大些(relatedness)，上課時為了考試作準備也會跑多了 (control)

Nancy: 都有愛上了跑步 (internal motivation) ，就是因為這課堂我就沒可能連續跑過這麼長的距離，現在知道自己能，將來也會嘗試挑戰一下(competence)，我會開心去排戰 (internal motivation) 。

Crystal: 自從上高中，體育課課節 cut 了，我們只圍羽毛球場跑兩個圈，運動量好小，加上公開考試，很少運動，所以這課給了我機會運動 (competence)。

雁: 我想問對這 program 有沒什麼意見?

Crystal: 我想最大動機是有人一起陪跑(relatedness)，上體育課一班人跑會好好多

Nancy: 對，如沒有人部我跑，我絕對不會跑 (relatedness)

雁: 完了面試，有沒其他問題?

Crystal, Lisa, Nancy, Ashley: 沒有

Extrinsic goal content group

雁: 介紹

雁: Andrea:,有沒用過 runkeeper?

Andrea: 有用過，在家付近自己跑的時候用。

雁: 為何會用?

Andrea: 因為聽過說跑步要跑 30 分鐘才有用，所以就試下用。跑完後也有人會 like 下。

雁: 用了什麼感覺?

Andrea: 感覺是可以的，我都會用的。

雁: 有什麼讓你會用?

Andrea: 清晰，和容易用 (feature)

雁: 通常點用?

Andrea: 我通常用作計時，量度速度和距離，看看跑多久和多遠，也用作記錄 (feature)

雁: 在教跑時用好不好?

Andrea: 沒特別。

雁: Isabel 有沒用過?

Isabel: 在上課時用過，平時沒跑，所以沒用

雁: 用時有什麼感想?

Isabel: 用時可以看到自己跑多久，看到一里需時多少 (feature)

雁，如妳要跑步會用這 app 嗎?

Isabel: 如果有時間跑我都會用

雁: 為什麼?

Isabel: 能設立目標，有時看到別人跑，自己也受到些感染 (relatedness)

雁: Vanessa,在課時用 app 有什麼感覺?

Vanessa: 方便，可以計到我跑多遠，(feature)

雁: 在課時用好嗎?

Vanessa: 好，因考試要跑一里，這也可以看到自己跑一里的時間，向這目標跑 (control)，也可看到同學們跑的速度，能有一些比較。(relatedness)

雁: 有其他功能有用?

Vanessa: 這 app 有挑戰 (internal motivation) ，有幫助訂目標，先訂短目標，再之後訂目標跑長些距離，這也可以知道自己怎跑，不會亂跑 (competence)

雁: Gloria , 有用這 app 嗎?

Gloria: 上課時有用，考試前練習時用了其他 app (control)，沒用 runkeeper 因沒用開

雁: 用 app 跑步的整體感覺?

Gloria: 喜歡用一個能調教不同目標，速度，距離，時間，自訂目標的功能，推動去完成。(competence) (autonomous)

雁: 在課堂用好不好?

Gloria: 有，如記錄時間，有地圖，可知道跑了那都不錯。(feature)

雁: 那 app 有沒有推動跑步的動機?

Gloria: app 有個功能看到朋友跑了步，這朋友的推動也想自己應該去跑 (relatedness)

雁: crystal 有沒看過這信息?

Crystal: 有

雁: 在那接收?

Crystal: WhatsApp

雁: 有沒想過這些信息意思?

Crystal: 有想過，但沒什麼感受，沒有任何影響，當普通信息看，但唔多唔少都有提醒作用 (feature)

雁: Isabell?

Isabell: 都是 WhatsApp 看，看了也沒有什麼感受，可能覺得好像名言金句，看完後就想這都是每人都知道的，是一些道理，但沒有貼身的感覺。(amotivation)

Vanessa: 有用，提自己去做運動，有這 awareness，但都是忙沒去，但感受上是有幫助想去運動。(feature)

雁: 那些句子會好正?

Vanessa: Keep fit. (control) 這對我有提醒作用(feature)，要減肥 (control)，想自己變得好看些 (control)

雁: Gloria?

Gloria: WhatsApp 見到，一開始收到都有衝動想去做運動，但一看到自己時間表就沒法(amotivation)。而且看完又忘記了，就沒了這件事。 但後期因要考試為了跑快些(control)，希望有好成績，看到信息都要去跑下。

雁: 對推動有作用?

Gloria: 都有點，因如去了跑會覺得自己是和別人不同 (control), 自己也想瘦些 (control)

雁: 什麼句子有深刻?

Gloria: 都是 keep fit (control)

雁: Crystal，你喜歡運動嗎?

Crystal: 不憎但不特別喜歡，我可以跑，但要我主動當是一興趣就不是

雁: 有沒什麼讓妳真想跑?

Crystal: 沒有什麼讓我真想跑，惟一是練好體能(control)，而最大動機是考試 (control)

雁: Isabell?

Isabell: 我不喜歡跑，因為跑步只是向前，沒什麼目標或達成什麼，好像無止景的做一件事 (amotivation)

雁: 那上完這課後對妳有什麼影響?

Crystal: 至少知道不用衝就是跑步，知道了自己怎樣自己去調節呼吸，因為懂得去做這件事，所以覺得這件事有些意義 (internal motivation)

雁: Vanessa, 喜歡跑步嗎?

Vanessa: 喜歡的，因為不是過程，過程是悶(amotivation)，跑步對個人精神好了 (internal motivation) 。以前沒事做，就去跑，心情會好些 (internal motivation) ，因體育課堂要考試(control)，所以跑多了，這幫到我喜歡了跑步，也留意了自己應多些去跑步 (internal motivation)

雁: Gloria?

Gloria: 好不喜歡跑步，因本身體能不好，好吃力，另外喜歡多些群體活動，例如打波，有比賽，趣味性會多些。(amotivation) 但跑步也帶給我一種挑戰，這麼辛苦都能完成，受到同學和老師都鼓勵和贊賞。(control)

雁: 這時段大家跑步的次數多不多?

Crystal: 為了考試，一星期跑一次，維持了兩星期，但現沒有什麼跑 (control)

Isabell: 沒跑，除了課堂

Vanessa: 斷斷續續的跑，考試前一個月都有，但不是每日，總之得閒有時間就去跑，一星期兩三次。

雁: Gloria 一星期有沒跑步習慣?

Gloria: 沒有

雁: 上完這課，有沒提升了你們的跑步動機?

Andrea: 沒有太大變化，因原本不是太喜歡跑步

Gloria: 有，因現在知道怎樣跑步才不跑傷，知道什麼才是合適的動作，不會浪費氣力 feature

Vanessa: 有，好似 Gloria 說，technique 好重要，如呼吸，學懂怎樣跑，讓自己動機也會提高了。(feature)

Isabell: 我上完課堂後沒之前抗拒跑步，因課堂迫住我要跑一次，學動作，讓我習慣了些跑步。(feature)

雁: 面試完了，有其他問題?

共同答沒有

Appendix E

Information sheet

The Use of Goal Contents Messages via Mobile App for Improving Females' Motivation, Behavior and Performance in Running

You are invited to participate in a project conducted by Miss Chow Chi Ngan. I am postgraduate of the Graduate School in The Education University of Hong Kong.

Main goal of the research aims to find a way to enhance running motivation by studying on motivational goal content through mobile app. 2 questionnaires will be provided online with 19 questions from Exercise Regulations Questionnaire (BREQ-2) and 18 questions from Psychological Need Satisfaction in Exercise Scale (PNSE). The 2 questionnaires will be finished within 20 minutes. The sample size is around 70 students. The study will last for 8 weeks. There will have two 45-minute lessons each week during the 8-weeks study. After 4th week, running behavior (running frequency and distance ran) will be asked through online. A questionnaire of the General Causality Orientations Scale (GCOS) will be conducted at the 8th week during lesson by using paper and 1609m running test will be conducted on 1st week and the 8th week. Focus group interview will be conducted on the 8th week as well. And the focus group interview will last for 1 hour and will be audio-taped.

You have every right and freedom to withdraw from the study at any time without negative consequences. All information related to you will remain confidential and will be identifiable by codes known only to the researcher. The study does not involve potential risks.

The results will potentially be disseminated by a final thesis of the Doctor of Education Programme in the Hong Kong University of Education.

If you have any concerns about the conduct of this research study, please do not hesitate to contact the Human Research Ethics Committee by email at hrec@eduhk.hk or by mail to Research and Development Office, The Education University of Hong Kong (Tel: 852-2948-6318).

If you would like to obtain more information about this study, please contact Miss, Chow Chi Ngan at telephone number or Professor Chow, Hung Kay Daniel at telephone number

Thank you for your interest in participating in this study.

Chow Chi Ngan
(Investigators)

Appendix F

The Education University of Hong Kong
Graduate School:

CONSENT TO PARTICIPATE IN RESEARCH

The Use of Goal Contents Messages via Mobile App for Improving Females' Motivation, Behavior and Performance in Running

I _____hereby consent to participate in the captioned research supervised by Professor Chow, Hung Kay Daniel and conducted by Miss Chow, Chi Ngan.

I understand that information obtained from this research may be used in future research and may be published. However, my right to privacy will be retained, i.e. my personal details will not be revealed.

The procedure as set out in the attached information sheet has been fully explained. I understand the benefits and risks involved. My participation in the project is voluntary.

I acknowledge that I have the right to question any part of the procedure and can withdraw at any time without negative consequences.

Name of participant

_____

Signature of participant

_____

Date

_____

Appendix G

Interview questions

Research questions	Interview questions
1.What are the influences of intrinsic or extrinsic goal setting through receiving sentence in app on students' running motivation running, running performance and running behavior? 接受內在或外在目標設定信息會影響同學們的跑步動機、跑步表現和跑步行為嗎?	1.What is the influence of receiving message by using app on your running level? And why? 運用 app 接收目標設定的句子會影響同學們的跑步行為嗎? 怎樣影響? 2.What is the influence of receiving message by using app on your running performance? And why? 運用 app 接收目標設定句子會影響同學們的跑步表現嗎? 怎樣影響? 3.What is the influence of receiving goal setting sentence by using app on your running motivation? And why? 運用 app 接收目標設定句子會影響同學們的跑步動機嗎?怎樣影響?
2.What is their running motivation? 什麼是他們的跑步動機?	1.Do you like running? Why do you like or not like running? 你喜歡跑步嗎? 2.How often do you run? 你跑步的次數多少? 3.Why do you run or not run? 為何你想跑步或不跑步? 4.What makes you run more or is there no change after the class? And why? 完成這課後，有什麼讓你改變? 為什麼？

3.Perceptions on the messages 接受句子的感受	1.How often did you check / read the messages? Why? 多久會接受信息，為什麼? 2.And in which platform did you receive the message? Why? 在那接受信息, 為什麼? 3.Will you think about the message content? 會否想一想信息內容?
4.Overall impression about the program 對這接受信息的計劃的感受	1.What is your impression of the program? 你對接受信息有什麼感受? 2.Can the program help you in other ways? How? 這計劃能對你有其他幫助嗎? 怎樣?
5.Mobile app effect on running motivation. 電話程式對跑步動機的影響	1.Did you use RunKeeper when running? Why? 妳跑步時有用 RunKeeper 嗎？為什麼？ 2.What is your feeling when you were using RunKeeper? 用 RunKeeper 時有什麼感覺？ 3.Any effect on running motivation when using RunKeeper? 用 RunKeeper 對跑步動機有沒有什麼影響？

Appendix H

Interview Analysis

Autonomous

Control	Intrinsic goal content Group	Extrinsic goal content group
	I am able to choose which function to use on the app 能決定自己想用什麼功能	I was able to set goals using the app. First, a goal was set, then the running distance. This helped me monitor my run in a structure manner. 有幫助訂目標，先訂短目標，再之後訂目標跑長些距離，這也可以知道自己怎跑，不會亂跑
	Can choose to use which function on the app 我感到自由，感覺累時可以停下來，這樣跑步是不錯的。	I like to use the self-setting function as I can set the speed, distance and time, which motivates me to complete my run. 喜歡用一個能調教不同目標，速度，距離，時間，自訂目標的功能，推動去完成
	I can hear the distance I ran on the spot and know how fast or how slow I should run 聽到自己在這分鐘跑多少距離，睇下自己應跑快些還是跑慢些	

Relatedness

Control	Intrinsic goal content Group	Extrinsic goal content group
I am eager to exercise with my friends 做運動其實傾向和朋友一起做	During the lesson, as we are running together as a group, it really motivates me to run. It is also very motivating to see others run during the weekdays. 在課堂有一班人，平時在 app 也看到別人跑就想自己要跑	App has a function that I can see my friend running, this can motivate me to run 電話程式有個功能讓我看到朋友跑了步，這推動我想我也應該去跑步
I can feel the group pressure, if I see other people run, I will feel guilty if I weren't running, this motivates me to run more	When I run with friends, my running motivation is elevated. 和朋友一起跑步動機會大些	

我感到有群眾壓力，見到別人做，自己心虛就做下，推使我跑多些		
I can see the distance ran by my classmates and this elevated my running motivation 也能看到同學跑多少，有互動作用，有些影響力	If no one ran with me, I would not run 如果沒人部我跑，我絕對不會跑	
When I saw people run, I would appreciate their efforts and perseverance. 當我看到其他人跑，我會欣賞他們的用功和毅力	My strongest motivation is running with a group, during the lesson I would feel more motivated as it was a group activity 我想最大動機是有人一起陪跑，上體育課一班人跑會好好多	

Competence

Control	Intrinsic goal content Group	Extrinsic goal content group
I knew more about running and I felt less intimidated, and realized I had the ability do it. 認識多了跑步的東西，也不太害怕，原來自己也能跑到	When I realised I can do it, I felt really proud of myself. 見到自己做到會好叻	Clear and easy to use 清晰，和容易用
I was able to understand my own ability 我能了解自己的能力	When I looked back at my running experience, I saw improvements. 看回自己跑過的 experience, 看到自己進步	It is important to have good technique, like breathing, I leant how to run, and this increased my motivation to run 跑步技巧好重要，例如呼吸，我學懂怎樣跑，讓自己跑步動機也會提高了。
I felt I could run further and for a longer period of time. Previously, I challenged myself to run 1500m, now I am able to achieve this and am I motivated to run a bit more 我覺得自己跑的距離長了和時間耐左，以前跑 1500 米是為了挑戰自己，現在覺得自己做到，所以想跑多少少	I felt great, because I could see how long and how far I ran, and I could see my improvement 我覺得延好，因可看到跑的時間跟距離, 會看到自己進步	As I am aware of how to run without injury and what running style is most suitable for me, I can run efficiently 因現在知道怎樣跑步才不跑傷，知道什麼才是合適的動作，不會浪費氣力
I know whether I have improved or not 知道自己有沒進步或退步	The longer I use the app, the more I improve in running that this may inspire me to run daily	After taking running lessons, I no longer reject the idea of running, as the lessons have taught me the right running form and has allowed me to adapt to running

	如果長期使用，也可以看到自己的進步，可能會激勵每天都跑一下	我上完課堂後沒之前抗拒跑步，因課堂迫住我要跑一次，學動作，讓我習慣了些跑步。
I can see that I am improving and this makes me continue to run 看到自己一直進步，這讓我有動力一直跑下去	My attempt to run has made me realise I am capable to run 也試了跑步，原來自己能跑到	
From observing my running data, I can see improvements 有個記錄，可以看到數字上進步	I feel capable of running 我可以容易掌握跑步	
I am able to track my improvements 看自己有沒有進步	If I were to choose an exercise, I will choose running, because it is convenient wherein I can just get changed and start. There is not much to prepare thus I like to choose running as a type of exercise. 如果要做運動要我選擇，我都是會選跑步，因為方便，換了衫，落掛跑，跑完就算，不用準備什麼，所以做運動我會跑步	
I can observe how many calories I have burnt 看到消了卡路里	I realized I am capable of running 原來自己能跑到	
I will strive on, as it improves my persistence. 自己也會堅持一下。意志力有幫助	Running is an injury-prone sport. Through this lesson, I learnt few home exercises to reduce injury 因跑步會容易受傷，上了課知道有些訓練可在家做減少受傷	
Have target is better, like when I run the last lap, I can finish fast 有目標跑會好些，例如跑到最後一圈，能快完成		

Internal motivation

Control	Intrinsic goal content Group	Extrinsic goal content group
I feel enriched and found a sense of meaning in life 覺得充實有意義	I would think about the sentence every time I ran and would feel happier 走去跑時想一想這句子，是會開心些	This app provides me challenges 這 app 有挑戰性

I understand myself better 了解自己	I have attempted to focus on my internal motivation to run alter my thinking by reminding myself to run happily and feel the happiness during running 其實都會嘗試跑時想一想內在動機，嘗試改變自己，想一想開心去跑，感受下跑步的開心	I find running meaningful 覺得這件事有些意義
I can observe any improvement and monitor my satisfaction 看到有沒進步，和有些滿足感	I set targets and goals for myself as I feel that it makes what I do more meaningful 都會想下這些目標設定，感覺對自己都有一定意義	I like running not because of the process as it is boring, I like is because it makes me feel fresh after 我喜歡跑步，不是因為過程，過程是悶，我喜歡跑步是因為我感到精神好了。
I feel happy 會開心	I feel the importance of the exercise during running and I would focus on the set target. 我也會在跑時感受跑步對自己的重要性，我也會想一下我們訂的目標。	When I am free, I would go for a run, and feel better after 以前沒事做，就去跑，心情會好些
I feel happier 我感到開心些	I would like explore the meaning of running, this is a daily reminder to myself 想知道了跑步的意義，天天有提醒	I have realized that there is no need to go all out each time I run. I have learnt to pace my breath; through this realization I find running meaningful. 至少知道不用衝就是跑步，知道了自己怎樣自己去調節呼吸，因為懂得去做這件事，所以覺得這件事有些意義
I feel good after running 其實都幾爽	I feel a sense of freedom when I start running, especially when I am listening to music. 但是我現在也開始跑步，因其實可以自由一點，聽音樂，可能會好一點	I feel special after running 如去了跑會覺得自己是和別人不同
I feel comfortable after running 跑完是會舒服	I have developed a passion for running 愛上了跑步	

Though running may make my breathing difficult, I feel good to run 會喘氣但都爽	I think running is great as it creates a sense of freedom, in turn I feel my self-confidence and quality of life has increased. 因我覺得跑步其實好好，好自由和能提升自己生活水平，有自信些。
When I gaze at the sky during my run, my mood is lifted and feel happy 有時望住個天跑，心情都會好和開心	I enjoy running as a sport, it provides a sense of freedom and increases my quality of life, fitness level and self-confidence 我覺得跑步其實好好，好自由和能提升自己生活水平，fit 些，有自信些
To have a target is more motivating. It feels good to push myself more during the last lap to complete my run in a quicker pace. 有目標跑會好些，例如跑到最後一圈，能快完成，其實都幾爽	I embrace challenges 也會嘗試挑戰一下，我會開心去挑戰
Have comfortable feeling 有舒服感覺	
It is interesting how observing others run and to witness their perseverance increases my self-motivation. 好有趣，其實有少少推動，因看到身邊人跑，看到佢地會覺人地好堅持好勁	
I have improved in running and run more frequently than I did before 看到自己有進步, 比之前跑多左	

Control

Control	Intrinsic goal content Group	Extrinsic goal content group
I started to run more in preparation for the running test 跑多了都是因為要考跑步	I am interested to know my timing during the running examination. I am aware that I have to control and keep my pace during the exam.	As we need to run 1 mile for the exam, I can observe how long it takes for me to complete the distance / goal.

	想看自己時間，希望考試時控制到跑速，不鬆懈，因考試要計時，所以在考試時調節速度	好，因考試要跑一里，這也可以看到自己跑一里的時間，向這目標跑
I ran several times because the grade I get for running contributes to my overall PE grade. 為了體育分數，跑了幾次	I rewarded myself according to how much I ran, this motivates me to run further and with my persistence, for example, if I ran daily for two days, I would arrange a reward to motivate myself, and can observe where I am ranked in the app. 我跑了多少就給什麼獎勵，就會比較有動力去跑，會想堅持，例如再堅持多兩天就會給你什麼什麼，還有排行什麼	Before the exam, I used other running app during practice 考試前練習時用了其他 app
I ran because of the upcoming exam. 有考試我才去跑	I believe consistent running requires much passion, and I did not want to disappoint my teacher and waste her efforts. During my run, I would also think about next week's target and aim for that. 也覺得這行為很用心，於是都會想去跑，不想令老師失望和浪費心機，我也會試試跑時想下這星期的目標。	To stay fit, to reduce fat, and to look better. 維持良好體段, 要減肥, 想自己變得好看些
I ran because there is an exam. 跑步是為了考試分	I want to have good result in examination 要考好個試	I ran faster as in hopes of having a good result in the running test. Reading the messages sent from the app also motivates me to run. 但後期因要考試為了跑快些，希望有好成績，看到信息都要去跑下。
Running makes me feel refreshed and focused. 跑完會精神些，做事會專心些	To be healthier. 健康些	When I run, I feel special, distinctive from others. 如去了跑會覺得自己是和別人不同
The act of seeing others run, I can feel the pressure to do so too. I would feel guilty if I did not run thus this motivates me to run further.	I will attempt to run since running allows me to become fitter.	Simply to stay fit. 都是維持健康

有群眾壓力，見到別人做，自己心虛就做下，推使人跑多些	如果跑步會讓我變得更 fit 會想	
	I ran more in preparation for the running exam. 為了考試作準備也會跑多了	To build physical fitness and mostly, my motivation comes from the upcoming examination. 練好體能，而最大動機是考試
	I want to reduce fat 想滅肥	Since there is an examination in the PE lesson, I started to run more, and this led me to fall in love with running. I also realized the need to run more frequently 因體育課堂要考試，所以跑多了，這幫到我喜歡了跑步，也留意了自己應多些去跑步
		I ran once a week because of the examination. 為了考試，一星期跑一次

Amotivation

Control	Intrinsic goal content Group	Extrinsic goal content group
I did not use the app because I do not have a habit of running. 因為沒跑步習慣，所以沒機會用到	I was too lazy to exercise. 因為懶沒做運動	After looking at the sentence, I did not have any special feeling – it just felt like some cliché message that is known to everybody. I felt as though it was not personal and unrelated to me. 看了也沒有什麼感受，可能覺得好像名言金句，看完後就想這都是每人都知道的，是一些道理，但沒有貼身的感覺。
Feel inconvenience to take the mobile 覺得拿著電話不太方便	I am rather lazy, I rarely run. I prefer staying indoors whereas running is an outdoor activity hence I barely used the app. 我就是比較懶，少跑步，因為這是戶外用，我可能比較喜歡室內，所以用的比較少	Initially when I received the message, I would have the urge to exercise. However, checking my daily schedule made me realise I did not have the time and I will forget about the message. 一開始收到都有衝動想去做運動，但一看到自己時間表就沒法(amotivation)。而且看完又忘記了，就沒了這件事

If I run, I will only for chasing bus 只追巴士時才跑步	I live in WYS which is far away from the track. It takes time and effort to travel from where I live classes and I am lazy. If I were to exercise I would rather go to the gym as I can do it in the evening. 因為我住在 WYS，比較遠，如果下來平的地方跑，還有要上課，反正比較懶，去 GYM 的話，晚上也可以，所以時間比較好	I do not like running, because the only action is moving forwards, it feels like it gets nowhere, with no end point nor specific target. 我不喜歡跑，因為跑步只是向前，沒什麼目標或達成什麼，好像無止景的做一件事
The app is unable to motivate me to continue running after class 都未能推動我上完課後繼續跑	I am lazy and live far away hence I rarely use the app. 現在太懶，住的地方太遠所以少用	I don't like running; I believe my health is subpar, running feels tough. I enjoy group exercises more, such as participating in ball games as it is more competitive and more fun. 好不喜歡跑步，因本身體能不好，好吃力，另外喜歡多些群體活動，例如打波，有比賽，趣味性會多些。
I was too busy to run 近排忙就沒有	It was inconvenient to run whilst holding my phone 但要拿著，就感覺有影響	
I hate running, other sports like cycling is more enjoyable. Running is so meaningless, a waste of time and is so tough. I am not motivated to run at all. 我憎跑步，其他運動踩單車是可以，但跑步是第一無聊，浪費時間，跑步也是最辛苦的運動，沒動力去維持	I did not use the app outside of classes. I am rather lazy. 我就在上課之外沒有用，比較懶	
The app drains my phone battery 但太食電	I prefer being indoors as opposed to running outdoors. Running in afternoon causes sunburn, and there are mosquitoes, so I think exercising at the gym is better. 相對於戶外跑步，我就比較喜歡室內，因為如果下午跑步，外面	

	可能很曬，跑步可能也有蚊子，所以在 gym 內面會好一點。
I don't like running, as I don't enjoy going outside. I prefer other forms of exercise such as dancing. 我不喜歡，因我有做其他運動，其他運動會偏向喜歡跳舞，而且自己不喜歡出街，所以不喜歡跑步	I am lazy so I don't like running 比較懶不喜歡跑步
After running, I feel tired, and my legs will ache for a whole day. 跑完會好累，腳會痛一整天	If running weren't so tough, I would enjoy it. Running such long distances is really harsh on me. 如果跑步不痛苦我會喜歡，跑得長程我就會覺得痛苦
I've been very busy recently and I do not enjoy exercising in the evening, however the only free time I have lately is the evening. If I had the time I may go running. 現在沒太多時間好忙，但我又不喜歡晚上做運動，只有晚上才有時間。但如有時間都會去跑	I am lazy, and I have no one to run with 因為懶，沒人陪
I feel like running has similar benefits as other sports and I would rather engage in other activities. 覺得跑步好處和其他運動好處一樣，我情願做其他運動都不會跑步	I don't like to be forced to accomplish something just because there is an examination down the line or that it is my duty to do so. 如果要考試或有任務的去完成，就不喜歡
I focused on fitness training 放多了時間在體能訓練	Running is really tiring and tough, so I don't like running, but I have started to run. 但是跑步本身實在太累了和痛苦(amotivation)，所以不喜歡跑步本身，但是我現在也開始跑步
I do not have much time to exercises with friends, so exercise less 現在沒有什麼朋友一起做，所以少了	If I didn't have to attend classes, I would go running 不用上課，就會去跑

Deep inside, I still don't like running 內心仍然不愛跑步	To run, I need to change, and I get really sweaty after running which means I must take a shower and rush to class thereafter. I struggle with the time management - if there were no classes in the morning, running would be more feasible. 換衫出外跑，跑完步又成身汗，然後又沖涼，沖完涼又要出來上課，這對我來說有些困擾，如果上午沒課堂，時間控制上會好些。	
I just feel very tired and tough 只覺得好累好辛苦	Having lesson is troublesome, as I need to shower and change my clothes 平時上課，有點麻煩，因要洗澡，換衣服。	

Mobile app feature

Control	Intrinsic goal content Group	Extrinsic goal content group
Really convenient 好方便	Good to use, easy and convenient 好用，容易和放便	Clear and easy to use 清晰，和容易用
I wanted to know how far I ran and how many calories I burnt during the run 想知道自己跑多遠和用多少卡路里	If I were to choose a sports, I would choose running, as it is convenient – I can just change and start running, there is no need to prepare anything. 如果要做運動要我選擇，我都是會選跑步，因為方便，換了衫，落掛跑，跑完就算，不用準備什麼，所以做運動我會跑步	Convenient 方便
The function of GPS was good and accurate 追縱這功能好和準確	Actually running is the simplest sports, it only requires a change of clothes and to take my mobile phone, Running does not require as much skill as other sports. 對我來說，跑步算是最簡單的運動，換件衫和拿手機就可以跑，比較其他球類運動不用技考	I usually use the app as a stop watch, understanding my running pace and the distance ran, to look into how far and the duration ran, to be used as a self-record 我通常用作計時，量度速度和距離，看看跑多久和多遠，也用作記錄
Can record where and how many kilometre I ran and record my training 紀錄自己跑到那和跑多少，紀錄了自己有訓練	The app is helpful as I can record my running 會有幫助，有記錄	I can monitor the time I've used to run and to see how long I took to run 1 mile 用時可以看到自己跑多久，看到一里需時多少

Can record running route and time 記錄路徑，時間	Easy to use, there is a GPS function which can record running location and route, and every few minutes, it sends you alerts on how long you have run 好用，清楚，有 GPS 可以記錄那跑和路線(feature)，還有每隔一時間會提醒跑多久跑多	Keeps track of my running distance 可以計到我跑多遠
Thatt app is like a secretary; it records all the exercise I have done 好像秘書記錄全部運動紀錄	The app keeps track of time keep track 時間	The app records time, there is a map function - it was good to know where I ran 記錄時間，有地圖，可知道跑了那都不錯
Can see the amount of calories burnt 看到消了卡路里	Reminds me of the duration and distance I've ran 提醒跑多久跑多	The app has an alert function 有提醒作用
Can monitor how long, how fast and the number calories burnt 可以監察住跑多久, 跑多快，消了多少卡路里	The app occasionally gives off alerts 有點提醒	The app prompt self-awareness to exercise 提自己去做運動
Can write down how long and how many time I ran, as a record 寫下了跑多久和多次，作一紀錄	Motivates me to run; acts as a reminder 也會有些衝動去跑。也有提醒。	The app acted as a reminder to exercise 這對我有提醒作用
Accurately recorded how long I ran for my own reference 可以準確，知跑多遠多久，因有記錄	Reminded me everyday 天天有提醒	
Can know how many calories I burnt 知消了幾百個卡路里		
Great, because it was free of charge 好，因免費		
The app was free to use 可免費看到		

Appendix I

香港教育大學
The Education University of Hong Kong

26 July 2018

Ms CHOW Chi Ngan
Doctor of Education Programme
Graduate School

Dear Ms. Chow,

Application for Ethical Review <Ref. no. 2017-2018-0431>

I am pleased to inform you that approval has been given by the Human Research Ethics Committee (HREC) for your research project:

Project title: Goal Setting Programs through App in the Effect on Running Motivation, Running Level and Running Performance of Novice Undergraduate Female Runners

Ethical approval is granted for the project period from 1 September 2018 to 30 September 2020. If a project extension is applied for lasting more than 3 months, HREC should be contacted with information regarding the nature of and the reason for the extension. If any substantial changes have been made to the project, a new HREC application will be required.

Please note that you are responsible for informing the HREC in advance of any proposed substantive changes to the research proposal or procedures which may affect the validity of this ethical approval. You will receive separate notification should a fresh approval be required.

Thank you for your kind attention and we wish you well with your research.

Yours sincerely,

Patsy Chung (Ms)
Secretary
Human Research Ethics Committee

c.c. Professor CHOU Kee Lee, Chairperson, Human Research Ethics Committee

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