Enabling Positive Transition to University: Evaluating an App-Based Positive Psychology Intervention with UK First Year Undergraduate Students.

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Abstract

Background: Starting university is a key life transition, and a potential source of psychological distress in first year university students. Those who manage the university transition effectively report high levels of optimism, hope, self-efficacy, emotional intelligence and self-regulation.

Methodology: This study evaluated the effect of an app-based multi-component positive psychology intervention (MPPI) delivered to undergraduates within the first semester of university. Ninety-two first year university students were randomly allocated to an app-based MPPI (n = 46) or an active control journaling condition (n = 46) for six weeks.

Results: The MPPI condition reported significant increases in life satisfaction after three and six weeks of the intervention; plus, significant increases in positive affect and self-efficacy, and decreases in negative affect after six weeks.

Discussion: The effect of exercise dosage and follow-up period is reviewed. The differential effects of the varied psychological intervention are considered in the light of the Synergistic Change Model.

Conclusions: App-based MPPIs are presented as a scalable cost-effective approach to supporting student transition to university.

Keywords: positive psychology; app-based interventions; student wellbeing; mental health promotion; self-efficacy; subjective wellbeing

Introduction

The First Year at University: A psychological challenge

Starting university is a key life transition (Praharso et al., 2017), and a potential source of psychological distress in first year university students (Yorke, & Longden, 2004) even prior to many additional challenges posed by the COVID-19 pandemic (see Sharp, 2021). Cooke et al. (2006), related declines in student mental health to the transition to university, finding that the wellbeing of first year students in the UK declined upon admission, remained similarly reduced at the end of the first semester, and then improved throughout the second semester. Similarly, Macaskill (2013) assessed 12.9% of first year students as meeting diagnostic criteria for depression and anxiety upon admission, decreasing to 11.9% six months into the first year of study. Whereas, in a Canadian study, almost a third of first year students recorded clinically significant depression and anxiety symptoms at the beginning of the academic year, rising to 36% and 39% by the end of the first year (Duffy et al., 2020). It is possible that the comparably reduced incidence of anxiety and depression in the UK sample may have been a consequence of the more conservative diagnostic thresholds utilised in the British studies. While starting university is an exciting time for many students, there is good evidence for viewing the transition as a significant challenge to psychological wellbeing, which has only been exacerbated by the advent of the global pandemic (Sahu, 2020; Son et al., 2020).

Various factors make the transition to university difficult for some students. Qualitative interviews by Denovan and Macaskill (2013) indicated that first year students experience many sources of stress when starting university, these include: difficulties associated with independent living, finances and employment; stresses associated with establishing and maintaining a support network; and adjusting to the

expectations of university study and life. For many first year students it is their first time living away from home, and this puts many of them at risk of homesickness (English et al., 2017), as they navigate the process of reconciling potentially idealistic expectations with the reality of life at university (Hassel & Ridout, 2018; Lowe & Cook, 2003). Additionally, some students report challenges associated with forming a student identity (Scanlon et al., 2007), and the move from dependent to autonomous learning (Gibson et al., 2018).

Given the challenges facing first year students, it is of little surprise that the first weeks of the first year have been identified as the time when students are most likely to drop out of university (Smith & Hopkins, 2005). Evidence suggests that a poor transition experience and difficulty adjusting to university predict attrition and poor academic performance (Yorke & Longden, 2004). For example, in the 2017/2018 academic year, 6.8% of full time entrants in the UK who completed the first fifty days of study still did not return for a second year (HESA, 2020). These figures pose a significant challenge not just to individual students, but also to Higher Education institutions, both in terms of revenue and league table standing. Teaching students to manage the multiple sources of stress associated with the transition to university life is therefore crucial for both individual and institutional wellbeing.

Protective Psychological Variables

In view of the psychological challenges associated with the transition to university, several studies have sought to identify the protective psychological variables associated with an improved transition into higher education. Subjective wellbeing (SWB), which comprises life satisfaction and the presence of positive affect and absence of negative affect (Diener, 2000), has been identified as one such psychological

variable. More specifically, Frisch et al., (2005) found life satisfaction to be predictive of student retention 1-3 years in advance (Frisch et al., 2005) and Bailey and Phillips (2015) shed further light on this relationship, finding SWB to be associated with improved social adjustment (e.g. the ability to have interpersonal experiences) but not academic adjustment in first year university students in Australia. This suggests that the mechanisms through which SWB supports first year university student adjustment may be social rather than academic. This is of significance as Davis et al., (2019) found social belonging to be predictive of student retention.

A further study conducted in Australia identified a number of other psychological variables associated with an improved transition into university. More specifically, Morton et al., (2014) found that first year students with high levels of optimism, and low levels of depression and anxiety, adapted better when making the transition to university (Morton et al., 2014). Furthermore, those with high levels of self-efficacy and low levels of depression experienced less stress at the beginning of their studies, presumably because they had greater belief in their ability to cope with the demands placed upon them (Morton et al., 2014). Similarly, Nightingale et al., (2013) found that an ability to manage emotions and emotional self-efficacy was associated with improved adjustment in the first year. Further studies underline the importance of psychological strengths such as optimism, hope, self-efficacy, and self-control as facilitating student transition (Denovan & Macaskill, 2013), with a subsequent study particularly emphasising the stress-buffering effect of optimism as a key factor in positive student adjustment (Denovan & Macaskill, 2017).

Positive Psychology Interventions

Needless to say, the psychological factors which aid the transition of first year students into university life are consistent with the original assumptions of positive psychology; that strengths and positive emotions build resilience to stress and enable flourishing (e.g. Fredrickson 2001; Seligman et al., 2005). Over the past 20 years there has been a rapid increase in the development of positive psychological interventions (PPIs), although defining what constitutes a PPI is contentious (Hendricks et al., 2020). Parks and Layous (2016) suggested that PPIs fall into seven main categories: 1) savoring, 2) gratitude, 3) kindness, 4) empathy, 5) optimism, 6) strengths, and 7) meaning. While Hendricks et al., (2020) are less prescriptive, arguing that a PPI can be considered as such if it is, 1) designed with the intention of increasing positive feelings, behaviours, and cognitions and 2) makes use of theoretically and empirically informed pathways or strategies to increase subjective (hedonic) and/or psychological (eudaimonic) well-being. Seligman's (2011) PERMA model (Positive emotions, Engagement, Relationships, Meaning and Accomplishments) is one example of the various pathways to wellbeing that can inform the development of PPIs. PPIs can be delivered as both single and multi-component interventions. Multi-component positive psychology interventions (MPPIs) contain a number of evidence based PPIs that target two or more components of wellbeing (Hendricks et al., 2020). In assisting smooth transition to university, several studies have evaluated the effectiveness of PPIs and MPPIs with first year university cohorts.

Macaskill and Denovan (2013) evaluated the effectiveness of a strength-based intervention. They recruited 214 students on the first day of university and profiled their character strengths as part of a teaching module. After two weeks, participants were informed of their top three strengths, and subsequently scored higher in confidence and autonomous learning, relative to control. One explanation was that students had greater

confidence in their resources and abilities as a result of the intervention. More recently, Duan and Bu (2019) found similar improvements in wellbeing and reductions in depression and anxiety in first year university students in China, one week after they attended a 90-minute character-strength-based cognitive workshop compared with a control.

In contrast, a small study conducted in Turkey examined the effect of a 3-week gratitude intervention with first year university students (Işık & Ergüner-Tekinalp, 2017). Compared with a control group, those who kept a gratitude journal for 3 weeks reported significantly better adjustment to university life, life satisfaction, and positive affect post-intervention.

A number of PPIs used with first year university students have also included elements of mindful practice to facilitate reflection and increase the benefits associated with savouring (Ivtzan et al., 2016). Mindfulness has been combined with strengths-based approaches in programmes such as Mindfulness-Based Strengths Practice (MBSP; Niemiec, 2014), leading to positive increases in psychological wellbeing, resilience and self-efficacy in controlled trials with first-year undergraduates (Park & Bretherton, 2020). Whereas, mindfulness training with first year students, targeting emotion regulation and stress management, led to increased life satisfaction, and significant decreases in depression and anxiety (Dvořáková et al., 2017).

Owing to the inevitable challenges associated with the scalability and cost of face-to-face interventions (Baños et al., 2017), PPIs which support the transition of students into university have started to move to online platforms (OPPIs). Koydemir and Sun-Selışık (2016), for example, reported positive results from an 8-week strength-based OPPI delivered online to 92 students in their first semester of university. Intervention participants were instructed in character strengths use, effective

communication, emotion regulation, problem solving, gratitude and flow, and subsequently reported increases in multiple predictors of successful adjustment to student life: wellbeing and psychological health, happiness and life satisfaction.

Although not specifically described as such, the OPPI study by Koydemir and Sun-Selışık (2016) provides key evidence to support the effectiveness of MPPIs for supporting first year students' transition to university because the intervention targeted two or more components of wellbeing. This study is of particular significance as it looks specifically at supporting first year students' transition to university despite there being only a small number of methodologically weak studies undertaken on MPPIs in general to date (Hendriks et al., 2020).

Although empirical support for MPPIs has been limited to date, some theoretical arguments have been proposed to support the increasing popularity of MPPIs in recent years. The Positive Activity Model (PAM; Lyubomirsky & Layous., 2013) and the Synergistic Change Model (Rusk, Vella-Brodrick and Waters, 2018) argue that there may be longer-term benefits associated with individuals engaging in multiple positive activities rather than focusing their efforts on just one (e.g. Gratitude journalling). More specifically, the Synergistic Change Model (Rusk et al., 2018) suggests that MPPIs may produce longer-term positive outcomes and stability because they facilitate mutually beneficial relationships between several different aspects of psychological and social functioning. The PAM model (Lyubomirsky & Layous., 2013) further suggests that there may be negative dose responses associated with practising just one PPI repeatedly and that there may be benefits in exposing individuals to different positive activities so that they can find what works best for them (e.g. reflective-cognitive activities versus social-behavioural activities). A key study by Schueller & Parks (2012) found that delivering positive psychology activities in packages of two, four or six exercises

resulted in increased exercise usage and larger decreases in depressive symptoms post-intervention when compared to presenting participants with a single exercise at a time. Furthermore, Parks et al., (2012) found some evidence to suggest that the target population for PPIs ('happiness seekers') are more commonly drawn towards practising a variety of activities.

App-based interventions

A natural extension of online MPPIs to support student transition into university, are app-based interventions. Existing research on app-based interventions exclusively for first year students is very limited. Although there are no published studies to date on the effects of app-based MPPIs, a recent study using a mindfulness meditation app reported small improvements in distress and adjustment in first year students, although generally the participants' engagement with the app was poor (Flett et al., 2020).

This is a significant gap in the literature as app-based mobile health interventions have numerous advantages. With an estimated 3.6 billion smartphone users around the world (Statista, 2021), global smartphone market penetration is very high because smartphones are hyper-mobile and hyper-accessible (Villinger et al., 2019). With the additional ability to tailor interactive interventions for the individual needs of their users, apps have the potential to offer effective and efficient MPPIs to a range of different target groups which can easily be scaled up to manage a rapidly increasing number of users (Ali et al., 2016; Heron & Smyth, 2010; Nahum-Shani et al., 2015). Apps also offer the ability to include gamification, which has previously been found to reduce students' drop-out, and improve their academic performance, through

boosting their engagement and motivation with lecture content (Pechenkina et al., 2017).

To address this gap in the literature, the aim of this study was to assess the effectiveness of an app-based MPPI specifically for first year students during their first semester at university during the period of October 2019 - December 2019. In particular, the study examined the impact of this intervention on four psychological variables: life satisfaction, positive and negative affect, and self-efficacy. These variables were selected because the app presented interventions specifically designed to enhance subjective wellbeing (measured by satisfaction and affect) and increased focus on strengths (increasing self-efficacy beliefs). In light of the literature reviewed above, these variables were taken to be theoretically or empirically associated with student adjustment to university: a) life satisfaction, is an indicator of the positive appraisals associated with effective adjustment to university; b) positive affect, affords greater resilience through perception of positive resources, in accordance with the 'broaden and build' theory (Fredrickson, 2001); c) negative affect, is associated with more difficult student transitions on the basis of academic performance (Duffy et al., 2020); and, d) self-efficacy, is recurrently identified as a predictor of improved student adjustment (Denovan & Macaskill, 2013; Morton et al., 2014; Nightingale et al., 2013). Our contention is that an app-based MPPI which facilitates positive transition to the first year of university will exert significant influence on these factors.

Method

Participants

Ninety-two first year university students (Mean age = 18.4 years old, SD = 1.0; Females = 84, Males = 7, Fluid = 1) were recruited from an undergraduate Psychology course at

a UK university. Participants were randomly allocated to either an experimental group (n = 46) or control group (n = 46). See CONSORT Diagram in Figure 1.

[FIGURE 1 here]

Measures

All participants were required to complete a battery of psychometric instruments targeted at psychological variables associated with positive transition to university life.

The Satisfaction with Life Scale (SWLS, Diener, Emmons, Larsen, & Griffin, 1985), is one of the most widely used measures of subjective wellbeing in both the general population and the university student population (Jovanovic & Brdar, 2018; Useche & Serge, 2016; Pavot & Diener, 1993). It is a 5-item measure of global life satisfaction, including items such as 'I am satisfied with my life'. Responses are recorded on a 7-point Likert scale from 1 (strongly disagree), to 7 (strongly agree). The SWLS is psychometrically robust with sound internal consistency (Cronbach's alpha of 0.8), construct validity (Pavot & Diener, 1993) and test retest reliability two months following initial questionnaire completion (r = 0.82) (Diener et al., 1985). This study recorded a Cronbach's alpha of α=0.83 for the SWLS.

The Positive and Negative Affect Schedule (PANAS, Watson et al., 1988), consists of 20 items, scored on a 5-point Likert scale from 1 (very slightly or not at all) to 5 (extremely). 10 items assess positive affect (e.g. happy, strong) and 10 items measure negative affect (e.g. hostile, jittery). Participants record the degree to which they have recently experienced each affective state in the previous week. The PANAS has excellent Cronbach alpha scores for the negative affect (α>0.84) and positive affect

subscales (α>0.86) (Watson et al., 1988). This study recorded a Cronbach's alpha of α=0.83 for positive affect, and α=0.87 for negative affect.

The General Self-Efficacy Scale (GSE, Schwarzer & Jerusalem, 1995), is a 10 item questionnaire answered on a 4-point Likert scale from 1 (not at all true) to 4 (exactly), yielding a total score ranging from 10 to 40. The questionnaire includes items such as, 'I am confident that I could deal efficiently with unexpected events.' Cronbach alpha scores for the GSE have been found to range from 0.86 - 0.94 and the scale has good construct validity as it has been found to correlate with situation-specific self-efficacy (Luszczynska et al., 2005). This study recorded a Cronbach's alpha of α=0.82 for the GSE.

App Allocation

Participants in the experimental group were assigned to the Fika Mental Fitness app (Fika, 2022). The concept of mental fitness is closely aligned with principles of positive psychology (Robinson et al., 2014) and in accordance with previous researchers (Bolier et al., 2013) it was adopted to encourage proactive mental health behaviours because of its analogous nature with physical fitness.

Those in the experimental condition were able to access the entirety of the Fika Mental Fitness app for the duration of the study but were specifically instructed to use the 'daily workout' feature (which was renamed the 7-day challenge midway through the trial) a minimum of three times a week, for six weeks. The 'daily workout' feature randomly presented participants with a new evidence-based 5-minute exercise each day which aligned to one or more of the five pathways to wellbeing proposed in Seligman's PERMA model (2011). There were over 100 variations of 'daily workout' exercises. Example exercise titles included; Being grateful, Finding meaning, Use your strengths,

The art of listening and Taking it slow. Although some exercises were more reflective of traditional PPIs (e.g. Gratitude journalling) than others (e.g. The Power of Laughter), critically each exercise was mapped to theoretically and empirically based pathways to wellbeing.

Randomness and variety are central to app user engagement (Cheng et al., 2019) and so no exercise in the 'daily workout' feature was completed twice. Moreover, although the exercises in the 'daily workout' feature were mapped to the PERMA model, and not the domains of positive functioning detailed in the Synergistic Change Model (Rusk et al., 2018), the feature did draw on the theoretical assumption that consistently 'working' different domains of wellbeing could lead to longer lasting change and stability.

Despite the daily variation in exercise content, there was consistency in the exercise format with all 'daily workout' exercises beginning with a 'Learn' component followed by 'Reflect' and/or 'Act' components. The educational (Learn) component informed participants of the psychological underpinnings and benefits of doing the positive psychology exercise for that day, in accordance with research on mental health literacy as a key predictor of positive psychological functioning (Bjørnsen et al., 2019). Exercises which then went on to include a reflective component encouraged the users to notice the benefits of performing the exercise in the present moment. It dra ws upon the evidence linking savouring positive experience with improved self-confidence and hope (Bryant & Veroff, 2017), by noticing positive assets, skills and strengths, existing resources, positive experiences or positive emotions as they occur. Exercises which included an 'Act' component promoted psychological health by prompting the user to create an implementation intention (Gollwitzer, 1999) for when and how they were to complete the exercise, priming psychological flexibility (Kashdan & Rottenberg, 2010)

by inviting an openness to new experiences and consequently experiential learning (Biswas-Diener & Patterson, 2011) in which the app-user was invited to gain understanding through the performance of the exercise. Both the reflective and action orientated exercises made use of journaling and/or audio guides to support the experience.

The control group was assigned to an active control condition completed through a widely available generic journaling app. Control group participants were instructed to write about the events of their day three times a week, for a minimum of 5 minutes, for a period of six weeks. While placebo activities vary within the literature, daily event journaling is comparable to those previously adopted (e.g. Seligman et al., 2005). The app was a generic journaling app that was free for users, available on all smartphones, and was rated by the researchers as being able to offer an intuitive and non-frustrating user experience.

Procedure

Upon gaining a favourable opinion from the Human Ethics Committee at the University of Lincoln (LEAS Code: 2019-Sep-0753), a call was made for participants in a first year Psychology lecture, within the first two weeks of teaching. Students registered interest, provided informed consent and completed baseline measures of self-efficacy, positive and negative affect, and life satisfaction through an online survey. Participants were then allocated at random to either the experimental condition (The Fika Mental Fitness app, n = 46) or the active control condition (journaling app, n = 46). Participants in both the intervention and active control groups were sent weekly reminders to use their apps for five minutes, three times a week for six weeks. All participants were informed that they were taking part in a study to evaluate different

app-based wellbeing interventions, and were therefore unaware of which group was the experimental group.

The questionnaire battery was administered online again at four weeks (T2, the midpoint of the intervention), and at the completion of the intervention, after seven weeks (T3). Participants who completed measures at all three time points received £15 vouchers to cover their time for participation in the study. Participants failed to complete measures at a given time point were removed from subsequent time points and the overall analysis. See Figure 1.

Data Analysis

Data were blinded to remove bias in the analysis of the results. Z scores for skewness and kurtosis were calculated to assess normality for each group (Fika mental fitness app and active control) on each dependent variable (life satisfaction, negative affect, positive affect and life satisfaction) at each time-point (T1, T2 and T3). Inspection of the data deemed it appropriate to use parametric inferential statistics. Four 2 x 3 ANOVAs were undertaken to determine differences in self-efficacy, positive and negative affect and life satisfaction between the experimental and control groups at T1, T2 and T3.

Results

App Usage

There were significant differences in app-use frequency recorded between participants in the experimental (Fika Mental Fitness) and active control (journaling) conditions. At T2 the experimental group reported using the Fika mental fitness app on more days each week (1-7 days, M = 3.5, SD = 1.3) than the active control group (1-5 days, M = 2.9, SD = .8); a significant statistical difference with a medium effect size (t(75.28) = 2.67 ,

p = .04, d = .56). Similarly at T3 the experimental group continued to use the Fika mental fitness app on more days per week (1-7 days, M = 3.4, SD = 1.1) than the active control group (1-5 days, M = 2.8, SD = .7); also a significant difference with a medium effect size (t(75.26) = 3.24 , p < .001, d = .68).

Psychometric Analysis

Mean and standard deviation for Life Satisfaction, Positive and Negative Affect, and Self-Efficacy over all three test points are presented in Table 1.

[TABLE 1 here]

Life Satisfaction. There was a statistically significant interaction between group and time on life satisfaction (F(1.89, 169.94) = 12.39, p < .001, partial η2 = .12 (medium effect size). Simple main effects for time revealed that there was no statistically significant effect of time on life satisfaction in the control group. However, there was a statistically significant improvement in life satisfaction over time in the experimental group (F(2,90) = 17.20, p < .001, partial η2 = .28). Further Bonferroni adjusted pairwise comparisons revealed that life satisfaction significantly improved in the experimental group between T1 and T2 (p = .01), T2 and T3 (p = .01) and T1 and T3 (p < .001). Further simple main effects for group revealed no significant differences in life satisfaction between the experimental and active control group at baseline (T1), but significant differences in life satisfaction were observed between the experimental group and active control at T2 (F(1, 90) = 5.14, p = .03, partial η2 = .05) and T3 (F(1, 90) = 23.34, p < .001, partial η2 = .21). See Figure 2.

[FIGURE 2 here]

Positive Affect. A statistically significant interaction between group and time was also found for positive affect ($F(2,180) = 4.87$, $p = .01$, partial $\eta 2 = .05$ (small/medium effect size). Simple main effects for time revealed that there was a statistically significant increase in positive affect over time in the experimental (Fika) group ($F(1.83, 82.45) = 6.17$, $p = .004$, partial $\eta 2 = .12$) but not in the control group. Further Bonferroni adjusted pairwise comparisons revealed that positive affect improved in the experimental group between T1 and T3 ($p = .009$) but not between T1 and T2 or T2 and T3. Simple main effects for group revealed that positive affect was not statistically significantly different in the control group compared to the control group at T1 or T2. However, positive affect was statistically significantly greater in the Fika group compared to the control group at T3 ($F(1, 90) = 8.23$, $p = .005$, partial $\eta 2 = .08$). See Figure 3.

[FIGURE 3 here]

Negative Affect. A statistically significant interaction between group and time was also found for negative affect ($F(1.84,165.60) = 3.92$, $p = .025$, partial $\eta 2 = .04$ (small/medium effect size). Simple main effects for time revealed that there was a statistically significant effect of time on negative affect in the Fika group ($F(2, 90) = 4.79$, $p = .011$, partial $\eta 2 = .10$) but not the control group. Further Bonferroni adjusted pairwise comparisons revealed that there were significant reductions in negative affect in the Fika app group between T1 and T3 ($p = .024$) but not between T1 and T2 or T2 and T3. Simple main effects for group revealed that negative affect was not statistically

significantly different between the experimental group and control group at T1 or T2. However, negative affect was statistically significantly lower in the experimental group compared to the control group at T3 ($F(1, 90) = 19.42$, $p < 0.001$, partial $\eta 2 = .18$). See Figure 4.

[FIGURE 4 here]

Self-Efficacy. There was a statistically significant interaction between group and time on self-efficacy, ($F(2, 180) = 14.27$, $p < .001$, partial $\eta 2 = .14$ (large effect size). Simple main effects for time revealed that there was a statistically significant effect of time on self-efficacy in the Fika group ($F(2, 90) = 18.41$, $p < 0.001$, partial $\eta 2 = .29$) but not in the control group. Further Bonferroni adjusted pairwise comparisons revealed that self-efficacy did not significantly increase between T1 and T2 in the Fika group, but did between T1 and T3 ($p < 0.001$) and T2 and T3 ($p < 0.001$). Simple main effects for group revealed that self-efficacy was not statistically significantly different between the control and Fika app group at T1 or T2. Self-efficacy was statistically significantly greater in the Fika group compared to the control group at T3 ($F(1, 90) = 11.96$, $p = .001$, partial $\eta 2 = .12$). See Figure 5.

[FIGURE 5 here]

Discussion

This study aimed to ascertain whether an app-based MPPI would lead to improvements in psychological wellbeing in first year university students during their first semester. Previous research has assessed the effectiveness of similar psychological interventions

in face-to-face and online-based delivery formats to address emotional adjustment (Flett et al., 2020), and loneliness (Bruehlman-Senecal et al., 2020) with university students, but not as part of an app-based intervention.

In this study, first year undergraduates in the first semester of study, who completed a MPPI delivered through the Fika Mental Fitness app, reported higher levels of self-efficacy and positive affect, and lower levels of negative affect after six weeks of intervention, than the active control group completing an app-based journaling task. The experimental group also reported higher levels of life satisfaction after 3- and 6-week app usage, than the active control group.

There were however discrepancies in app-use frequency, with those assigned to the experimental condition utilizing the app more frequently than those assigned to the journaling condition. Both apps were made available free of charge to the participants, and were comparable in elegance of appearance, and intuitive ease of usage. Both groups received weekly email reminders to continue with the assigned task. This difference in usage frequency is in all likelihood attributable to the variety of positive psychology exercises assigned to the experimental group, in comparison to the relatively homogenous journaling task required by the active control. The diversity of MPPI tasks and gamification techniques assigned to the experimental condition may have acted to sustain motivation and excitement over the evaluation period (Cheng et al., 2019; Pechenkina et al., 2017).

It is equally notable that, with the exception of life satisfaction, the intervention group did not report significant increases in the dependent variables until after week six of the trial, suggesting potential dose-response considerations for MPPIs of this nature. Previous research with single PPIs (e.g. Gratitude or Character strengths) have frequently recorded positive effects over shorter periods of time than those recorded in

this study (Seligman et al., 2005; Rash et al., 2011). With this in mind, while 'randomness and variety' are deemed beneficial for app-user interaction and engagement (Cheng et al., 2019), and ensures coverage of all routes to wellbeing in the PERMA model (Seligman., 2011), it is possible that MPPIs require longer duration for positive results to be observed. This accords with previous evaluations of MPPIs in which a minimal dosage of 16 sessions administered over eight weeks was required for significant reductions in levels of anxiety and depression to be observed (Parks et al., 2019); a further confirmation that 'varied' sessions require longer duration for optimal effectiveness. An eight-week intervention however is well-suited to first year university students. Given the established pattern of reduced wellbeing during transition to university, and again towards the end of the first semester (Cooke et al., 2006), an eight-week intervention would allow newly arrived first year students sufficient time to learn the psychological skills required to better cope with the difficulties associated with the end of semester challenge. Moreover, in accordance with the Synergistic Change Model (Rusk et al., 2018) it is possible that although MPPIs may take longer for their psychological benefits to be observed their effects may be more pervasive than single PPIs. This is because they 'work' different aspects of psychological functioning and as a result may be more effective in decreasing the chance of relapse and promoting positive 'spillover' effects into other activities.

It is not clear why life satisfaction improved more quickly than the other dependent variables for the intervention participants. This is more surprising given that the measure of positive and negative affect was more time sensitive (e.g. the past week) than the more general measure of life satisfaction.

It is possible that the 'Learn''Reflect' and/ or 'Act' exercise format used within the Fika Mental Fitness app could have contributed to the significantly improved

wellbeing observed in the experimental group compared with the active control. The nature of the exercise formats meant that each time a Fika user completed an exercise, a number of potentially beneficial psychological mechanisms were at play. As an example, exercises which included all three ‘Learn-Reflect-Act' components could have simultaneously encouraged increases in mental health literacy, positive emotions and strengths identification, and psychological flexibility, all of which have been found to be associated with improved psychological functioning (Bjørnsen et al., 2019; Fredrickson 2001; Kashdan & Rottenberg, 2010; Seligman et al., 2005). In accordance with Lyubomirsky & Layous., 2013 ensuring that exercises contained a mixture of activity features also likely increased the chance that participants found something that worked for them within each exercise experience. These findings offer a potentially fruitful avenue for future research not only in relation to the effectiveness of app-based MPPIs but also in relation to the format through which these app-based MPPIs are delivered.

Finally, it is important to acknowledge that this study was conducted prior to the Covid-19 pandemic (October 2019 - December 2019). Given the disruption that university students have faced over the past two academic years and the ongoing negative effect that this has been found to have on their mental health (Savage et al., 2021), one may question whether the findings from this study are still relevant. While it is a valid concern, it is our belief that app-based MPPIs may be more relevant to first year university students than ever because they are facing such significant transitions in their life with only limited face-to-face contact. Findings from a recent study found that university students were experiencing increased loneliness during the pandemic (Bu et al., 2020) which could place them at even greater risk of drop-out as social belonging is a key predictor of student retention (Davis et al., 2021). App-based MPPIs, which

importantly don't rely on face-to-face delivery, may offer other solutions that improve students' confidence and ability to cope with these difficult transitions.

While this study presents the effectiveness of positive psychology interventions in supporting first year students transitioning to university, it is not without its limitations. Given that the follow-up period of the study was a short 6-week period, the longevity of this intervention is unknown. Admittedly, the participants completed their final psychological assessments towards the end of their first semester which has previously been identified as psychologically problematic (Cooke et al., 2006), and it therefore could be argued that the gains in wellbeing reported by participants in the experimental condition occurred during one of the most difficult periods of university life. Furthermore, it must be acknowledged that although this study measured psychological variables associated with successful adjustment to university life, it did not directly assess adjustment itself. Objective outcome variables such as retention, attrition, teaching attendance and academic performance were also not measured. The study design would have been improved by including these outcome variables, in addition to extending the follow-up period to the ensuing academic year, and gathering qualitative data to capture participants' perceptions of the app.

Conclusion

In conclusion, this study provides the first evidence to date that an app-based MPPI can improve key psychological metrics associated with better adjustment to university in first year students. Previous researchers have found it difficult to engage first year students with app-based psychological interventions (Flett et al., 2020). However, findings from this study appear to suggest that the inherent variability, gamification and accessibility of app-based MPPIs are sufficiently motivating for first year students to

engage with them long enough to experience improvements in wellbeing. The added disruption that the Covid-19 pandemic has brought to many first year university students studying in higher education might make these findings and practical implications more relevant than ever.

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Disclosure Statement

Two co-authors on this paper are employees of Fika Community Ltd, the developers of the intervention app evaluated. The study was entirely funded by the UK Office for Students and data was analysed blind.

Figure 1: CONSORT Flow Chart of Participant Allocation and Attrition.

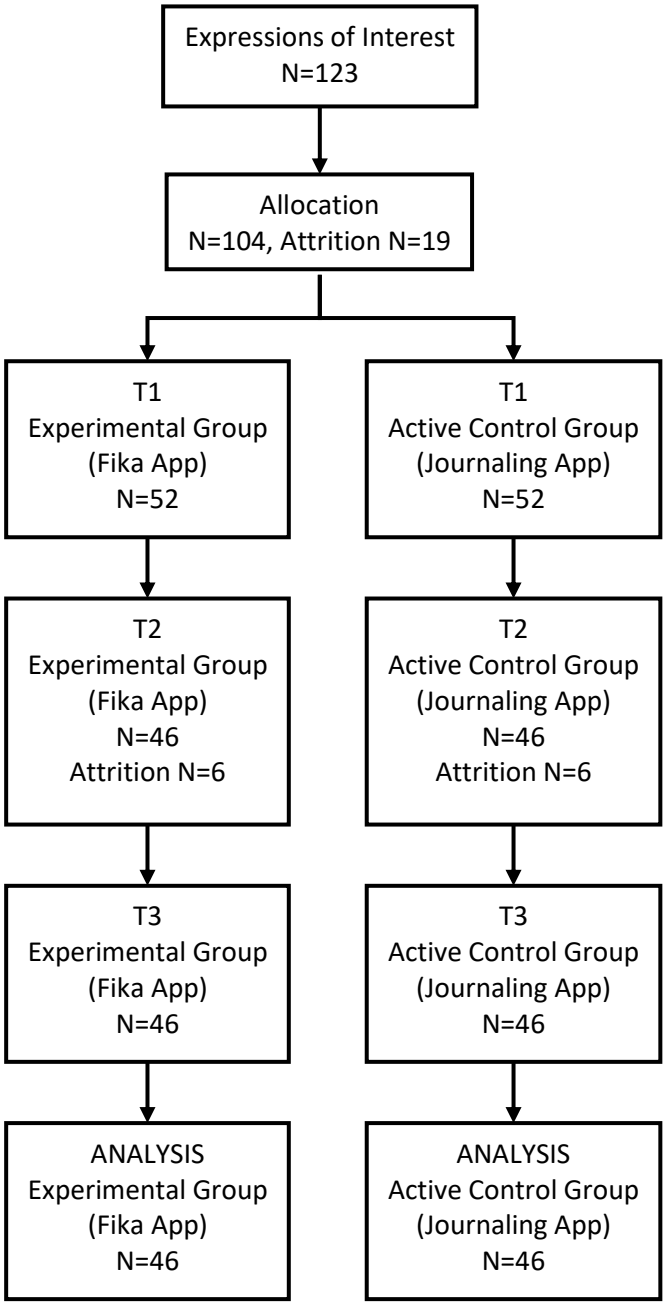
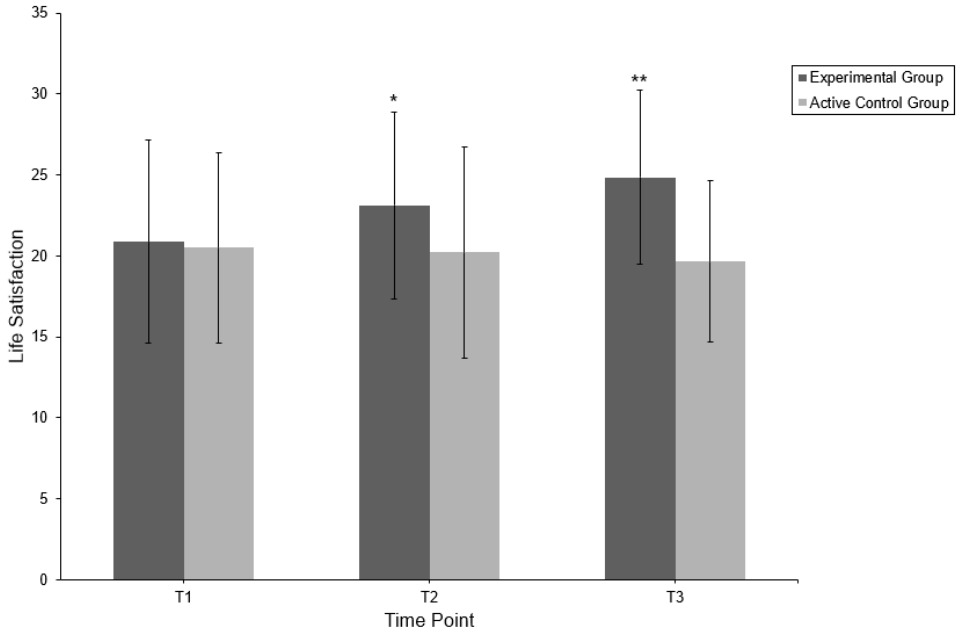


Table 1: Means (SD) for life satisfaction, positive affect, negative affect and self-efficacy for Fika app users and active control users

	T1	T2	T3
Life satisfaction (Mean, SD)			
	T1	**T2**	**T3**
Experimental	20.87, 6.26	23.13, 5.77*	24.85, 5.37**
Control	20.50, 5.88	20.22, 6.54	19.63, 4.98
Positive Affect (Mean, SD)			
	T1	**T2**	**T3**
Experimental	29.39, 8.39	30.98, 8.30	32.50, 8.52*
Control	29.72, 6.16	29.04, 7.47	28.35, 4.87
Negative Affect (Mean, SD)			
	T1	**T2**	**T3**
Experimental	23.89, 7.79	22.00, 8.65	20.87, 8.33**
Control	25.39, 7.56	25.65, 9.39	27.02, 4.50
Self-Efficacy (Mean, SD)			
	T1	**T2**	**T3**
Experimental	27.13, 4.14	27.93, 4.47	30.30, 5.13**
Control	27.59, 4.05	27.09, 4.91	26.96, 4.09

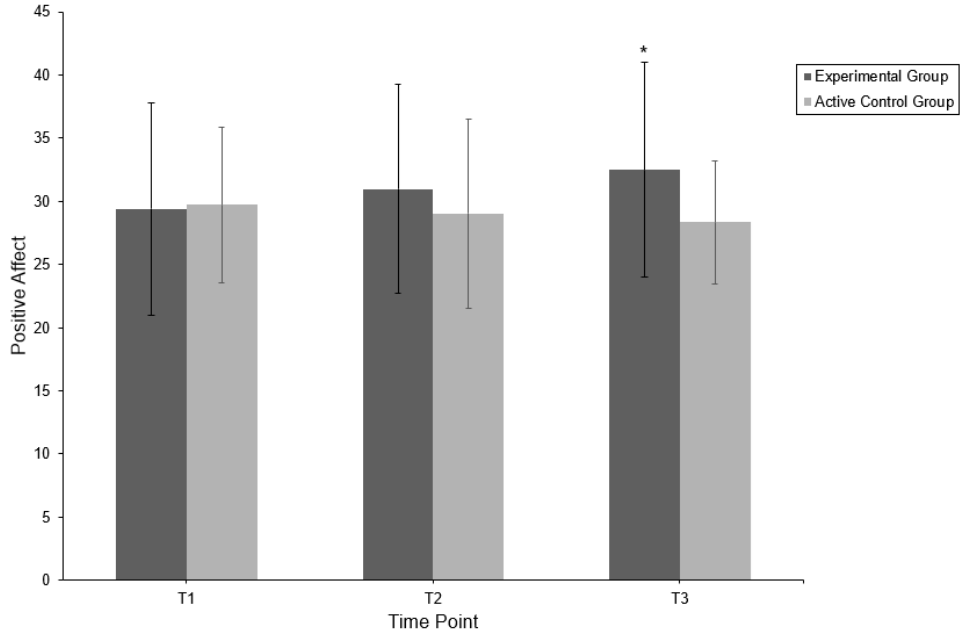
*$p < 0.05$ *, $p < 0.01$***

Figure 2: Mean (SD) Life Satisfaction Scores for the Experimental and Active Control Group by Time



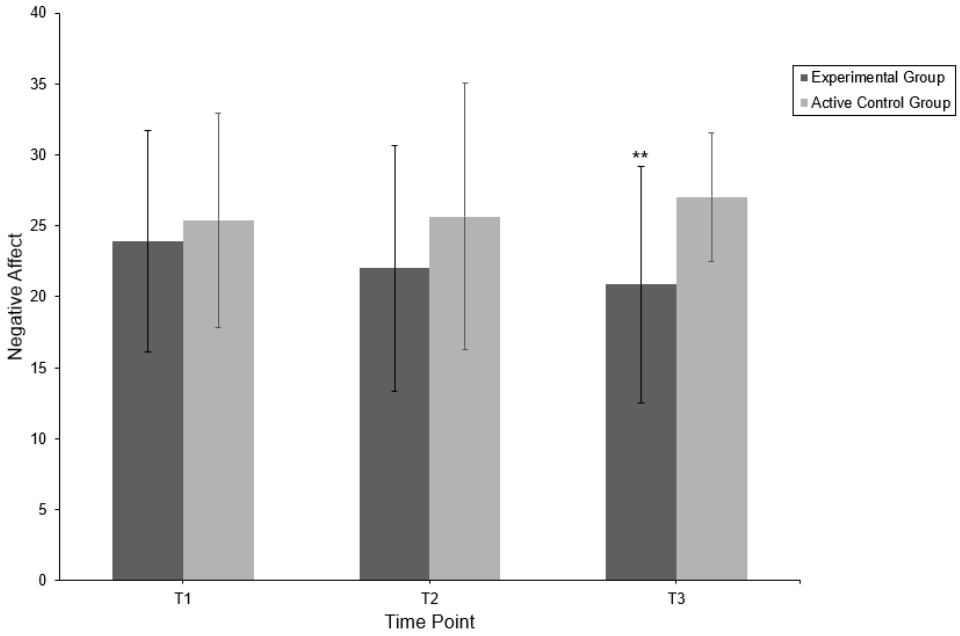
$p < .05$ *, $p < .01$**

Figure 3: Mean (SD) Positive Affect Scores for the Experimental and Active Control Group by Time



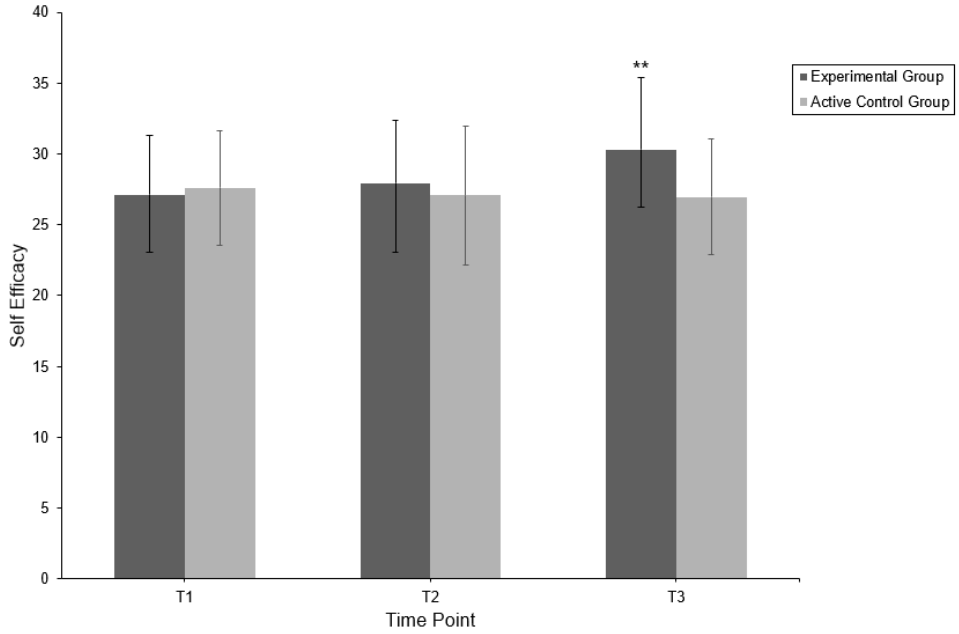
$p < .05$ *, $p < .01$**

Figure 4: Mean (SD) Negative Affect Scores for the Experimental and Active Control Group by Time



p < .05 *, p < .01**

Figure 5: Mean (SD) Self-Efficacy Scores for the Experimental and Active Control Group by Time



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