Behavioural economics, motivating psycho-education improvements; a mobile technology initiative in South Africa

Abstract

Here we report on a health behavioural support project, using incentivised behaviour on a mobile platform through M4JAM. This was a proof of concept study to support further developments, more specifically targeted at the management of Tuberculosis and Human Immunodeficiency Virus. As a proof of concept that app engagement may be a useful tool for improving mental health outcomes in South Africa, the study reported here examines the impact of financial rewards in increasing app engagement, with the overall aim in increasing mindfulness behaviour. Participants were recruited from a micro-jobbing platform. Interested participants were then divided into two groups based on their self-reported levels of self-determination (the extent to which person is self-motivated and feels able to make decisions for themselves) and offered either an incentive, or no incentive to take part in a mindfulness training app over a period of 10 days. Results highlighted that personal financial incentives have a role in motivating behaviour, over and above the extent to which individuals feel they had the capacity to make decisions for themselves. The findings are discussed in light of the usefulness of an incentivized mobile platform in real-world practice to encourage mental health improvements in low to middle-income countries.

Key words: financial incentive, mobile app engagement, self-determination, mindfulness

Mental health in South Africa

The World Health Organization (WHO) maintains that the financial burden of neurological and mental health disorders is universal, with low and middle-income countries (LAMICs) the most challenged (2014; 2015). South Africa is no exception; it faces lack of community resources, human resources obstacles, limited funding and a population where over 40% of people are living with Human Immunodeficiency Virus and/or a diagnosable mental disorder. Cape Mental Health (2015) purports that one in six of the general population will experience a mental health problem, that there is an increased risk of depression, anxiety and stress at middle age (35-59), and that more women than men will seek help. Bloomberg ranked South Africa as the second most stressed nation in the world, describing it as a in a sick state of mental health, with an escalating rate of anxiety, depression, substance abuse and suicide (The South African Federation for Mental Health, 2015; Chiumia, & van Wyk, 2014). As a stopgap to the exigency of worldwide mental, neurological and substance abuse disorders, WHO launched the Mental Health Gap Action Programme (mhGAP) in 2008 followed by the WHO's Comprehensive Mental Health Action Plan 2013- 2020.

Considering the mental health perplexity in South Africa and following WHO recommendations in regard to income generation and educational opportunities, this study investigates whether an incentivised initiative on a mobile device could have a positive effect with regard to the improvement and promotion of personal wellbeing, and, what role can incentives play in encouraging engagement in health initiatives.

Mobile technology, a real-world vehicle for psychology delivery

Mobile phone penetration in South Africa is 133% (suggesting that individuals have more than one device) and smart phone penetration is 47%. This exponential growth is similar to the mobile revolution in other low-and-middle-income countries and supports the argument that the reach of phone technology, should now be harnessed to improve mental health care (Davey & Davey, 2014).

Despite the cost of mobile technologies, the potential loss of internet connectivity and the risk of privacy violations, the self-managed, convenient and non-judgmental nature of computerised therapy mean that it can be as effective, if not in fact more effective, than face-to-face therapy (Epstein and Bequette, 2013). Interactive mobile technologies have been demonstrated as successful in communicating health behaviour risks and accelerate behaviour change (Cohn, Hunter-Reel, Hagman and Mitchell, 2011), in psychoeducation (Cohn et al., 2011), stress management (Serino, Cipresso, Gaggiolo, Pallavicini, Cipresso, Campanaro and Riva, 2014) and brief evidence-based positive psychology interventions (Howells, Ivtzan, and Eiroa-Orosa, 2014). The evidence from such studies has led to arguments for the expansion of mobile technology in the European Union's public health care strategy (Lalmas, O'Brien, & Yom- Tov, 2015).

The rapid growth of mobile telephony technology and the exponential increase of smartphone users specifically in LAMICs, has meant that cell phones are now generally considered as a logical extension for clinical practice and a useful tool for underserved persons who might not necessarily have access to psychotherapy (Aguilera & Muñoz, 2011; Lu, 2015; Morris et al, 2010; Svoboda & Richards, 2009). Mobile health (m-health) technology is a high reach, low-cost solution for improving health outcomes in underserved locations (Davey and Davey, 2014). However, the attrition rate in e-studies remains as much of a challenge as in the field of behavioural economics generally. Recent work of Sonntag and Zizzo's (2015), and earlier work

by Frick, Bachtiger and Reips (2001) consistently found a higher attrition rate in e-studies compared with traditional settings.

Here we seek to combine behaviour economic principles and positive psychology, for the promotion of mental health in South Africa using advanced mobile software application. The current study replicates and extends existing smartphone-based research by Howells, et al. (2014) who demonstrated the viability of delivering brief, evidence-based, positive psychology interventions on a mobile platform using a smartphone application, with the aim of boosting happiness and improving wellbeing. Their real-world approach was an attempt to showcase smartphone methodologies as a feasible tool and valid platform to deliver positive interventions.

Financial incentives to support behaviour modification

There is compelling evidence for the effectiveness of the integration of incentivised based or pay-for-performance programmes in healthcare. Studies suggest that such initiatives can modify health-damaging behaviour, alcohol consumption, diet, physical activity, sexual behaviour and smoking (Stephens, 2014; Betty, 2013; Cahill & Perera, 2011; Dadich, 2010; Lagarde, Haines, & Palmer, 2007; Violino, 2012; Vlopp et al., 2011). However, such studies are not without their challenges. For example, Abraham, Feldman, Nyman and Barleen (2011) report that low response rates typically make the interpretation of findings subjective at best. Incentivised Based Programmes have the potential to influence human decision-making, however, such programmes may undermine autonomous and intrinsic motivation.

The early work of Lepper, Greene and Nisbett (1973) on this subject reflects the traditional, broad-based assumption that extrinsic motivation is secondary to instinctive motivation and that outcomes motivated by intrinsic rather than extrinsic forces, are always more valued, concluding that there can be an '*undesirable consequence of the unnecessary use of extrinsic rewards*' (p. 135). Arguments that were subsequently echoed by Kohn (1993) and Pfeffer (1998). Further studies investigating the undermining-effect (also referred to as motivation crowding-out effect), showed less volitional engagement for incentivised behaviour (Deci & Ryan, 1985; Kirk, 1995; Deci, Koestner, & Ryan, 1999). However, Camerer and Hogarth's (1999) meta-analysis of performance-based incentives challenged such opinions and found that the effect of incentives was inconsistent and complicated. Fang & Gerhart (2012) found no conclusive evidence to support arguments for the detrimental consequences of providing financial incentives to improve motivation. Under certain conditions, incentives had a positive effect rather than a negative impact on levels of perceived autonomy, perceived competence and intrinsic interest.

In an attempt to bestow some finality, Cerasoli, Nicklin and Ford (2014), undertook 9 meta-analyses, expanding 40 years of research involving ($k = 183$, $N = 212, 468$). They focused on the interrelationships of motivation and performance in organisations, education and physical domains and concluded that the impact of incentives was not consistent and proposed that intrinsic motivation and incentives influence performance together. That, there is a joint contribution of intrinsic and extrinsic motivation on performance; motivation is multifaceted; intrinsic motivation is deemed a superior performance determinant; and that, incentives can positively affect intrinsic motivation depending on the perceived value of the incentive. The authors

recommended that policymakers consider compensation strategy designs in the future and incentivise less enjoyable tasks.

A broader investigation of the effectiveness of incentives for influencing behaviour change identified that the type of incentive, incentive size and the impact of timing of a stimulus, are related to target population (Lynagh, Sanson-Fisher and Bonevski, 2013). Evidence was drawn from a careful review of published literature (2009 – 2013) and suggested that negative incentive (or penalties) are less efficacious in changing behaviour than positive reinforcement.

Roberts and Bailey's (2013) ethnographic study, using qualitative methods, found that individuals with severe mental illness are less likely to be motivated by financial incentives compared to the general population. In a larger study Joice & Mercer, 2010) report efficacy, at least in the short-term for those with mild to moderate mental health problems. The most extensive study to date evaluated multiple sources of data from seven studies (Haff et al., 2015) and suggested that the role of financial incentives in behaviour modification are in line with what other authors had predicted; there was a definite incentive effect on health behaviour, yet no consistent relationship between financial incentive and observable demographic characteristics. It is unlikely that there is a one size fits all, when it comes to the utility of financial incentives (Sutherland, Christianson, and Leatherman, 2008). Nonetheless, financial incentives, combined with mobile phone technology, does present opportunities to scaffold improvements in health-related behaviour.

Methodology

Research materials: Mindfulness

As a proof of concept, the subject matter for the incentivised behaviour for this study was mindfulness practice. There is strong empirical support for the application of positive psychology and mindfulness in self-regulation and wellness (Ryan & Deci, 2000a; 200b; 2001; Brown & Ryan, 2003; Ryan, 2009). Past research by Keune and Forintos (2010) on the usefulness of mindfulness meditation on subjective wellbeing, found that mindfulness correlated with positive affect and vitality, and demonstrated that a relationship existed between mindfulness and psychological wellbeing.

Mindfulness training has recently emerged as a therapeutic modality for behaviour modification and has become a mainstream psychological construct. Mindfulness pertains to subjective conscious awareness and promotes moment-to-moment attentiveness (Schuman-Olivier et al. 2014). MT is considered as popular and has proven useful for helping people disengage from unhealthy habits and thought patterns through meditative practice and Headspace 'take-10' is a positive psychology intervention introducing the concept of mindfulness meditation practice in a practical ten-day, ten-minute podcast session per day programme. The decision to use Headspace take-10 as the evidence-based self-help mobile intervention was two-fold. In an effort to replicate empirically based happiness research by Howells et al. (2014) and secondly, as a beneficial mental health strategy in the promotion of human flourishing and wellbeing. In addition, data was collected using the Mindful Attention Awareness Scale (MAAS) which is a valid self-report instrument consisting of 15 items, to assess dispositional mindfulness in daily life and unique quality of consciousness. With $\alpha = .96$, MAAS has demonstrated reliability and validity in numerous studies (Brown & Ryan, 2003).

Research materials: Motivation

Self-determination theory is a macro theory of human motivation and assumes that autonomy competence and relatedness are necessary for positive human functioning. Self-determination is a characteristic of internally motived behaviour, and, at a basic level, it is defined as an individual's capacity to choose and have choices to engage in activities without external influence, control or reinforcement (Deci and Ryan, 1985; Ryan & Deci, 2017). The optimal type of motivation is that which is derived from the self, with autonomous regulation and functioning correlates with more positive consequences than controlled functioning and an external locus of control. It is maintained within Self-Determination Theory that autonomy, competence and relatedness combined, are fundamental psychological needs that energize behaviour (Sheldon & Niemiec, 2006; Vansteenkiste, Williams, & Resnicow, 2012). The perceived choice awareness scale (formally the self-determination scale, Sheldon & Deci, 1996) consists of a 10-item scale, with two 5-item subscales, to assess participant's self-awareness, perceived choice and self-determination functioning (α.85 to .93). See also Sheldon, Ryan & Reiss (1996) for the full psychometric report on this measure.

Population

The population sampling closely replicated the selection of sample sizes in a previous randomised controlled trial of smartphone-based mindfulness intervention by Howells, et al. (2014) and Joice and Mercer (2010). Volunteer participants in the present study were recruited from the existing database of registered members with Money for jam (M4JAM). M4JAM is an accredited micro-jobbing mobile technology platform in South Africa. Typically, micro-jobs involve market research surveys, mystery shopping, merchandising, brand activation, brand engagement and point of interest validations. Registered users are able to earn money and vouchers on smartphone devices by completing micro jobs which they can convert to money, food, airtime and other commodities. The nature of the jobbing platform means that registered users tend to be from populations of poorer economic backgrounds, or those who have been as yet unable to obtain permanent employment.

M4JAM was launched on the weChat platform in South Africa in 2014 and its support for the current study was based on a preliminary proof of concept to test the effect of incentivised health behaviour to support their interaction with the Gates Foundation in the screening and management of Tuberculosis and Human Immunodeficiency Virus. M4JAM had the technological expertise to develop the software required for the current study strategy and provided an access point for the recruitment of potential participants. Further information about M4JAM can be found at http://www.m4jam.com

The membership of 80,000 plus, was rated as broad-based and thus an appropriate and convenient platform to recruit population sample. Key demographic information relating to M4JAM users indicated that 68% were between the ages of 25- 34 years, 53% were males, 47% were females, less than < 4% were unemployed, and 40% preferred English.

All registered M4JAM users were invited to participate in the research project via the M4JAM platform. Potential participants were directed to the essential information sheet detailing research facts, eligibility criteria: to be over the age of 18 with a valid South African identity number; registered on M4JAM compliant with South African legislative requirements and the Financial Intelligence Centre Act 38 of 2001;

have daily access to a smartphone device; be able to read and write in English, and not be currently attending therapy.

M4JAM uploaded all relevant research documents and instructions to the mobile platform, these included: the invitation to participate, essential information on how to participate, instructions and set up daily prompts and the participant satisfaction survey. Real-time reporting and data quality validation was enabled. Participants were required to give written informed consent; they were informed of the right to withdraw at any time. Once prospective participants volunteered and accepted the research "job" and were eligible in terms of inclusion criteria and were then asked to complete the Self-determination Scale to ascertain the potential participant's self-awareness, perceived choice and self-determination functioning.

The invitation to participate in research on M4JAM mobile platform returned a total of 817 non-duplicated volunteers within a seven-day period, from a database of 82 000 registered members. 1000 questionnaires were posted on the mobile platform with a return of 817. A response rate of 81.7% was considered as good. Based on the cumulative scores of self-reported measures, the volunteers (N=817) were apportioned into two groups by applying a process of allocation concealment, whereby, the research team were unaware of the characteristics of the participants being allocated into each group (Kim & Shin, 2014; Dettoir, 2010): Group 1, High self-determination (HSD) and Group 2, Low self-determination (LSD). 47% of respondents were female (n= 382) and 53% were male (n=435). Respondents ranged in age between 18 – 66 years, (*M age*= 29.63, *SD* = 8.3). 46 % of respondents were between the ages of 25 – 34 years and only 1% was between 55 – 64 years. Of the total 817 respondents, 16.64 % (n=136) scored less than 30 to constitute the heteronomous group and 83.36% (n=681) rated themselves above 30 to constitute the self-determined group. Participants were then randomly drawn and allocated from the HSD group (n= 68) and from the LSD group (n=68).

The demographic characteristics of recruited potential sample population were assessed in terms of age and gender. To hold research conditions constant, sample groups were matched in composition based on self-determination score, age and gender. An independent team member allocated the participants into each either (A) the experiment group with financial incentive condition or (B), the control group without incentive. They were asked to ensure an equal gender distribution in each group. The mean age in LSD group was 30.89 years with 46% males and 54 % females and the mean age in HSD group was 30.76 years with 46% males and 54% females.

Participants

Based on self-determination scale scores, all prospective participants (N=817) were divided into either the low self-determination group or the high self-determination group. A sample of (N=136), (n=68) for low self-determination and (n=68) for high self-determination, were drawn and randomly assigned to either group A, with the experimental condition treatment, that was with a R10.00 incentive per session for correctly answering two questions pertaining to task, or group B, a control group, without an experimental condition, that was without any financial incentive for correctly answering two questions pertaining to task. Participants with HSD score were randomly assigned to the HSD group A and group B, and participants with LSD score were randomly assigned to Heteronomy group A and B (Table 1).

Table 1: Study Groups

High Self Determination		Heteronomy	
HSDA	HSDB	LSDA	LSDB
High Self Determination & No Incentive (n=34)	High Self Determination & Incentive (n=34)	Low Self Determination & No Financial reward (n=34)	Low Self Determination & Incentive (n=34)

Procedure

Groups were asked to complete the Mindful Attention Awareness Scale (MAAS) which is a valid 15-item self-report instrument to assess dispositional mindfulness in daily life. Baseline tests were not incentivized in any group. Scores were recorded at baseline to measure any dispositional mindfulness effect post intervention and no financial incentive was offered to any group to complete pre and post MAAS test.

Participants were instructed on how to download Headspace take-10 app and instructed to follow a 10-day programme. M4JAM sent all participants, in all groups, daily prompts and two-question authentications. They were requested to complete a follow-up post-intervention questionnaire. The Mindful Attention Awareness Scale established a measurement of change (if any) in dispositional mindfulness in daily life.

User Engagement

User engagement differs from user experience, in that user engagement represents not only the quality of the interaction but also volitional choice. The current study measured user engagement in terms of the number of answers and did not account for the user repeating a session at a future point in time or digitally sharing experiences with others or returning to a session. Thus, for the purpose of quantified data collection, engagement was operationalised in measured units. With a R10.00 (approx. 69 US cents) per session in the incentive group for correctly answering two questions pertaining to task.

Ethical approval

To meet the British Psychological Society ethical requirements for conducting research with human participants, including issues of consent and confidentiality, risk and benefit, the proposal for this research study was scrutinised and approved by the University of Liverpool's Research Ethics Committee, for the Institute of Psychology, Health and Society. All participants were provided with detailed study information in advance to inform their decisions to take part, those that agreed to participate gave written consent and were assured of their right to withdraw at any time.

Results

Analysis of user app engagement

Total user app engagement averaged (*Mdays*= 2.60, *SD*= 4.10). Levene's test of equality of error variances indicated that homogeneity of variance had been satisfied and that the error variance of the dependent variable, user app engagement, was equal across groups ($p < .05$).

Table 2. User App Engagement (the number of intervention days completed out of ten)

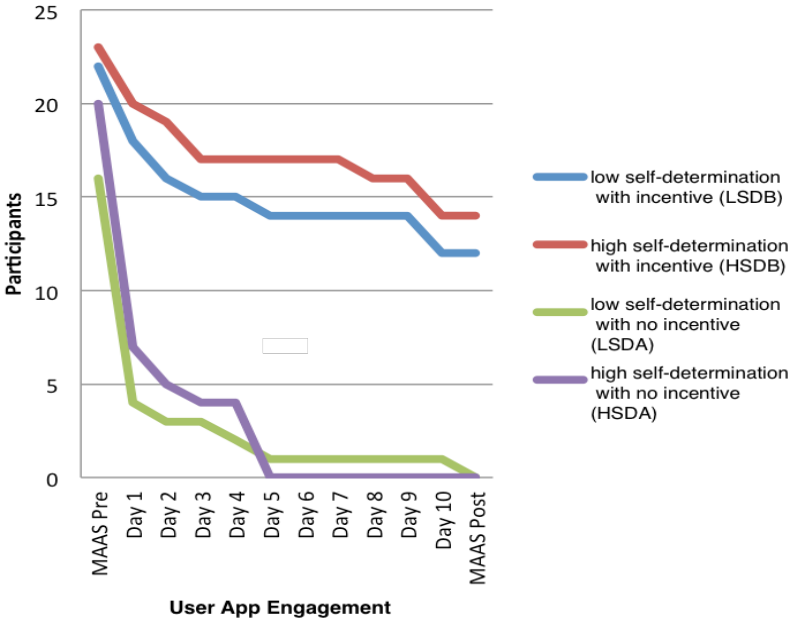
Groups	M	SD
Low self-determination no incentive	0.53	1.88
Low self-determination with incentive	4.29	4.79
High self-determination no incentive	0.59	1.33
High self-determination with incentive	5.00	4.83
Total	2.60	4.11

Table 3. Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk test of Normality		
Self Determination	**Statistic**	**df**	**Sig**	**Statistic**	**df**	**Sig**
Low with no incentive	.49	34	.00	.32	34	.00
Low with incentive	.29	34	.00	.69	34	.00
High with no incentive	.47	34	.00	.49	34	.00
High with incentive	.27	34	.00	.70	34	.00

Shapiro-Wilk normality test (see Table 3) was used as a numerical test of normality. Results across groups ($p < .05$) indicated that variable distribution deviated from normal distribution. Figure 1 illustrates the drop off in participation within the four groups and explains why only two groups were analysed for the change in the dependent variable, dispositional mindfulness.

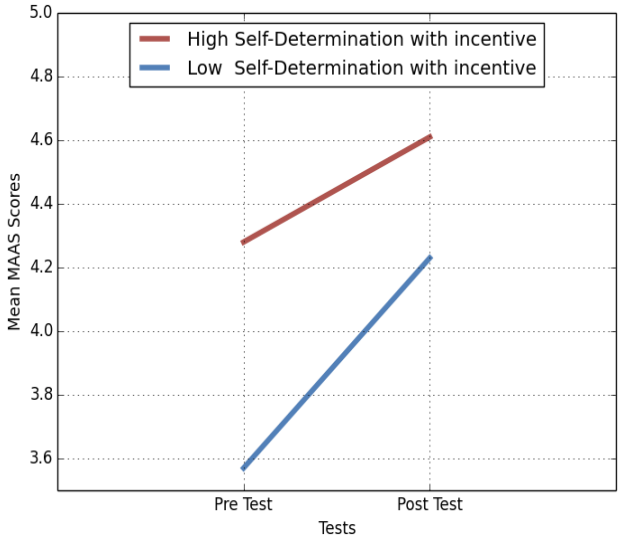
Figure 1. Participation over time



The total number of participants who completed the Headspace take-10 intervention, with pre-test and post-test Mindful Attention Awareness Scale (MAAS) = (N= 26), distributed across the groups as follows: LSDA (n = 0), LSDB (n=12), HSDA (n = 0) and HSDB (n=14). Financial incentives drove user app

engagement, over and above self-determination. Almost no participants in the group without financial incentive continued with the study and, as such, non-parametric analysis was performed only on the remaining participants in the HSDB and LSDB samples. For those participants that completed the study, an increase in mindfulness awareness was reported: post-test ranks were significantly higher than the median pre-test ranks, Z=-2.96, P<.01 (Figure 2).

Figure 2. Mean Mindful Attention Awareness Scale scores of group participants



A Kruskal-Wallis Test was conducted to measure the change in the dependent variable, dispositional mindfulness. Pre-test and post-test, Mindful Attention Awareness Scale (MAAS) mean scores revealed that there was a difference between group means and within groups, as illustrated in Figure 2. However, the results were not significant in the high self-determination with incentive (HSDB) group. At completion of the study, a post hoc power analysis was conducted and (r = 0.1) and (*observed* p = .191) was obtained, supporting low power "after the fact" (Pezzullo, 2015) which means that the sample size needed to be larger for meaningful analysis.

Discussion

According to Lu (2015) internet-delivered psychological interventions, aimed at mental health and behavioural improvements, have become an acceptable alternative to traditional methods of therapy, in particular, because young adults are more likely to search for online interventions than seek professional help. Given the exponential growth of cellular usage worldwide, and in particular, the increase in mobile users in sub-Saharan Africa, positive psychology interventions on a mobile platform have the potential to become an essential part of primary care in mental health services. With the convenience of use, the economic viability and accessibility, internet-delivered therapy has an advantage over other forms of mental health care. Convenience and accessibility are specifically relevant for vulnerable populations in developing countries, disadvantaged by geographical isolation, and a fundamental lack of resources.

Mobile devices could be used to overcome some of the barriers to accessing, sustaining, and benefiting from health education resources, and incentivised psychoeducation interventions with mobile technology

requires further investigation, particularly within low and middle-income countries. This study was an opportunity to explore the viability of incentivised mobile psychology on mental health issues in South Africa and builds on papers reporting on the function of other mobile electronic device projects reported. Overall the findings supported the argument that financial incentives significantly increased user app engagement, over and above the impact of individual self-regulation tendencies. Supporting arguments that pay-for performance is an effective intervention for reaching disadvantaged groups (Lynagh, et al., 2011).

Results reported here demonstrate a change in dispositional mindfulness for the low self-determination group. Self-determination is vital to psychological well-being and individuals with low self-determination are more likely to feel less in control of their lives, feel greater levels of shame, and engage in approval seeking behaviours (Ryan & Deci, 2008). It is therefore encouraging to note that participants in this group reported an increase in dispositional mindfulness at the end of the trail. A change which suggests an improvement in paying attention, non-judgementally, to the present moment.

Of course, the self-reported measures of mindfulness were based on subjective interpretation and the mindfulness intervention was brief and introductory. It can, therefore, be assumed that any predicted change in dispositional mindfulness was also potentially limited. However, as a preliminary proof of concept study the results do support building evidence in the field that incentivised mobile psychology, as a mental health initiative, has merits.

Attrition

Attrition was common in all four groups and followed similar disengagement trends in each group. Research drop out is a perennial problem in psychological studies, understandably individuals may become bored and find activities that more closely align with their interests.

Whilst, attrition rate was comparable with common trends in other incentive-based programmes (See for example, Patel et al. 2011), attrition rate, where no incentive was apparent was quite substantial. Most participants had left the study by day two. The participant pool will to some extent explain this rapid drop off. The participants were subscribed to the platform with the express motivation of earning money for micro-jobbing. It may therefore be advantageous to perform further testing on groups representative of the wider population. Nonetheless, because micro-jobbing enables payments to be collected at major supermarkets, in cash, airtime, electricity or as data downloads, such platforms remain vital tools to access young people, remote workers and disadvantaged groups.

Attrition from the incentive group was much smaller in nature, but still noteworthy. Sonntag and Zizzo (2015) suggest that the size of the financial incentive should be correct in order to motivate engagement and reduce attrition. Here R10.00 per engagement, may not have been a realistic commensurate for task activity. Future research may further evaluate different incentive features and structures, the influence on engagement in relation to socio-economic status, and, consider the impact of realistic differential rewards in order to tailor alternative strategies.

Conclusion

Income generation and educational opportunities are considered salient strategic solutions to address the issues of global mental health in developing economies (World Health Organization, 2014; 2015). With this in mind, this study investigated whether or not an incentivized psychoeducational initiative in a real-world setting, could make a difference in the South -African context. Following the work of Howells et al. (2014) we investigated the impact of a financial rewards on mobile user app engagement to demonstrate the viability of incentivised mobile psychology initiative to drive mental health improvements. Results support arguments that internet-delivered psychological interventions combined with behavioural economics can improve and sustain user engagement over time. In this instance, participants with lower levels of self-determined motivation, also reported an improvement in dispositional mindfulness. Taken together, there is building evidence for the integration of incentivised based or pay-for-performance programmes with mobile technology in healthcare.

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