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Can self-guided colouring improve university student wellbeing, mental health, and mindfulness?

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ABSTRACT

Background: Mindfulness-based interventions can successfully improve wellbeing in young adults. Mindful colouring is an applied mindfulness practice and improves short-term wellbeing. Less evidence is available about the effectiveness of regular, self-guided colouring. We investigated a self-guided two-week colouring intervention for university student wellbeing.

Methods: One-hundred and forty university students completed a minimum of 10-min self-guided colouring, six times over two weeks. Participants were assessed at baseline and two-week follow-up using self-report measures of wellbeing, relating to quality of life, perceived stress, anxiety, depression, and mindfulness.

Results: Colouring significantly improved all measures of mental health, wellbeing and mindfulness in students who completed at least six sessions of self-guided colouring.

Conclusion: Colouring is an accessible activity that can improve student wellbeing when carried out regularly over two weeks. Future research should investigate the impact of longer-term colouring practice on wellbeing, and the effect of this intervention in the general adult population.

Background

University students have been identified as a group that are at higher risk of experiencing poor psychological (subjective) hedonic wellbeing and mental health (Dodd et al., 2021; King et al., 2021). This is in part due to social and psychological factors, and change associated with starting a higher education qualification (Dawson et al., 2020), which can subsequently impact academic achievement. Therefore, there is a need for universities to provide appropriate support to improve or protect student wellbeing (King et al., 2021).

Successful student wellbeing interventions have utilised mindfulness-based interventions to improve mindfulness, as well as wellbeing, and markers of mental ill-health such as psychological distress, anxiety, depression, and rumination (Chiodelli et al., 2022; Dawson et al., 2020; Halladay et al., 2019). The psychological definition of mindfulness

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has many variations, but is generally accepted as the awareness of one's internal states and surroundings in-the-moment, and involves non-judgmental acceptance of experiences (Kabat-Zinn, 2003). The effectiveness of mindfulness for improving wellbeing could be attributed to enhanced awareness and attention, improving emotion regulation and reactivity (Cebolla et al., 2018).

Colouring can be used as a mindfulness-based activity, and in recent years has become popular (Nielsen, 2016). Mindful colouring can encourage focus on the present task, regulating awareness and attention, and is thus suggested to induce mindfulness (Holt et al., 2019) as per Bishop et al. (2004) two-component model. It can support psychological wellbeing by preventing rumination or thinking about the future, by acting as a distraction from negative thinking, which is often a symptom of anxiety, stress and depressive symptoms (Curry & Kasser, 2005). Additionally, mindful colouring could be a beneficial "real-world" application of mindfulness (Mantzios & Giannou, 2019) for example, in people who struggle with mindfulness interventions such as meditation. Students who tend to struggle with time management are more likely to commit to mindful colouring as it is less time-consuming than other interventions (Mantzios et al., 2021).

In support of colouring as a mindful activity, Curry and Kasser (2005) found that one session of mindful colouring reduced anxiety in a sample of university students, and subsequent replications found the same (Van Der Vennet & Serice, 2012). Colouring has also shown to be as effective as simple breathing exercises (Cross & Brown, 2019). In hospital settings, colouring was shown to reduce distress in patients receiving chemotherapy (Barnes et al., 2019). More recently, a meta-analysis and systematic review found that colouring mandalas significantly decreased anxiety (Jakobsson Store & Jakobsson, 2022), with evidence that this effect is seen across the adult age range (Koo et al., 2020), and in relation to specific settings, such as test anxiety (Carsley & Heath, 2020).

To date, research has predominantly focussed on the impact of single sessions of activity (Jakobsson Store & Jakobsson, 2022) or short-term colouring that is integrated into guided therapeutic sessions (Hajra & Saleem, 2021; Ozturk & Toruner, 2022). With the help of a mindfulness practitioner guiding participants, single sessions of mindful colouring have also been shown to improve mindfulness (Mantzios et al., 2021). Undertaking short-term colouring interventions (over one-to-two weeks) in university students have proven to be effective at reducing anxiety (Hajra & Saleem, 2021; Ozturk & Toruner, 2022), depression (Flett et al., 2017), reduced burnout and stress in teachers (Czerwinski et al., 2021) and stress in hospital staff during the COVID-19 Pandemic (Fong et al., 2022). Evidence about un-guided practice, with no instructions to colour-in mindfully is mixed, with evidence indicating that colouring can benefit aspects of mindfulness (Campenni & Hartman, 2020; Holt et al., 2019; Mantzios & Giannou, 2019), and that both single and daily (for one week) sessions of self-guided colouring may not improve mindfulness (Flett et al., 2017; Mantzios & Giannou, 2018; Mantzios et al., 2019). Interviews with people who have regularly "[done] colouring" using mindfulness colouring books for at least a year highlighted self-reported benefits of reduced stress and calmness, using the activity as a form of self-care (Dresler & Perera, 2019). However, there is less quantitative evidence exploring the impact of this intervention on positive wellbeing markers such as quality of life.

Research approach and methodology

Aims

We aimed to investigate the impact of "regular" (10 minutes, at least three times a week) self-guided colouring over two weeks by assessing wellbeing, mental health, and mindfulness at baseline and after the two-week intervention was complete. We aimed to utilise a more naturalistic experimental design, where participants were provided with instructions about mindful colouring and asked to incorporate the activity as part of their weekly self-led routine.

We hypothesised that completing the two-week self-guided colouring intervention would improve undergraduate student wellbeing and mental health by reducing levels of self-reported perceived stress, state and trait anxiety, depressive symptoms, and increasing quality of life and dispositional mindfulness. We also explored the role of prior creative hobbies on the effect of colouring, to understand whether a tendency towards creative hobbies might play a role in the activity's effectiveness.

Design

This was a longitudinal online repeated measures experimental study where participants completed the same self-report measures of wellbeing, mental health, and mindfulness at baseline, and again at two-week follow-up after completing the two-week (minimum six session) colouring intervention. The study was approved by The University of Southampton Research Ethics Committee (ERGO: 62815, 11/02/2022).

Public involvement

Before the study was launched, feedback from undergraduate students and members of the general public was sought, via public engagement events, to understand the most appropriate ways to implement our colouring intervention, and what outcome measures would be of interest. Feedback included the types of colouring materials to offer, clarity of instructions, and duration of intervention. This knowledge informed the final version of our study, as outlined below.

Participants

Participants were 18–26 years of age and currently studying at the University of Southampton. Overall, 390 participants consented to participate and provided baseline data.

Measures

The Multicultural Quality of Life Index (MQLI) assesses quality of life (Mezzich et al., 2011). There are 10 statements that can be rated from 1 ("poor") to 10 ("excellent") e.g. "Physical Wellbeing (feeling energetic, free of pain and physical problems)". Scores ranges from 10 to 100, with higher scores indicating better quality of life. The MQLI has good internal consistency ($\alpha = .92$) and test-retest reliability ($r = .87$). This study found it had good internal consistency ($\alpha = .90$).

The Mindful Attention and Awareness Scale (MAAS) measures dispositional mindfulness via attention and awareness (Brown & Rayan, 2003). It has 15 items, rated from 1 ("almost always") to 6 ("almost never"), e.g. "I could be experiencing some emotion and not be conscious of it until some time later.". The score is an average of the 15 items, with higher scores indicating higher levels of dispositional mindfulness. It has good internal consistency (α = .87) and good test-retest reliability (r = .81). The same internal consistency was found in this study (α = .87).

Perceived Stress Scale (PSS) measures stress levels (Cohen et al., 1983). It has 10 items rated 0 ("never") to 4 ("very often"), e.g. "In the last month, how often have you felt nervous and 'stressed'?". The score ranges from 0 to 40, with higher scores indicating higher stress levels. The PSS has a good internal consistency (α = .85) and test-retest reliability (r = .55). This study had a fair internal consistency (α = .61).

Hospital Anxiety and Depression Scale (HADS) measures negative mood, the subscale of depression only was used (Zigmond & Snaith, 1983). There are 7 depression items that are scored 0 to 3, e.g. "I feel as if I am slowed down" with rated 3 ("Nearly all the time") to 0 ("Not at all"). Scores ranges from 0 to 21, with higher scores indicating higher depressive symptoms. The HADS-D has good internal consistency (α = .79) and test-retest reliability (r = .70). In this study, there was an acceptable internal consistency (α = .77).

State Trait Anxiety Inventory-5 (STAI-S, STAI-T) assesses trait (−T) and state (−S) anxiety (Zsido et al., 2020); there are 5 items for each sub-scale, rated 1 ("not at all") to 4 ("very much"). e.g. STAI-S; "I feel upset" and STAI-T; "I feel that difficulties are piling up so that I cannot overcome them". Scores range from 10 to 40, with higher scores indicating higher anxiety. Subscales range from 5 to 20 each, where high scores indicate high state anxiety or trait anxiety. The STAI-S and STAI-T have good internal consistency (α = .91 and .86 respectively) and a good test-retest reliability (r = .88 and .86 respectively). This study found they have good internal consistency (α = .83 for both).

During Follow-up questions, participants were asked whether they were able to complete at least three sessions of colouring, each week; how many sessions of colouring they completed; which materials they used (Study materials – Mandalas, Own Materials – colouring book – Mandalas, Own Materials – colouring book – pictures), and how much did they enjoy engaging with mindful colouring (0= Not at all – 10 -Very much).

Materials

Participants were sent an email with instructions for completing the two-week self-guided colouring intervention (See Supplementary Materials) and provided with five mandala colouring sheets. Participants were also able to use their own colouring materials.

Online study procedure

All participants were recruited from the University of Southampton using an online student research portal between 13 January 2023 and 23 February 2023.

After reading the information sheet, and providing consent and contact details, participants were asked to provide demographic information (age, gender, ethnicity),

and complete validated baseline questionnaires. Following the questionnaires, participants were emailed colouring resources and instructions on how to colour-in mindfully (See Supplementary Materials). The participants were instructed to mindfully colour for 10 min, three times a week, for two weeks. After one week they were emailed a reminder of the study requirements. After two weeks, an email was sent with a link to the follow-up questionnaires. Participants were then debriefed.

Data processing and statistical analysis

All data was normally distributed. Overall, 390 participants consented to participate. Two-hundred and fifty participants were removed from the main analysis: 77 did not successfully complete the intervention (either at all, or did not complete 6 days of 10-min self-guided colouring within the two-week study), 170 did not complete their follow-up assessments, and three were over the age of 26. One-hundred and forty young adult participants (aged 18–26 years) completed the intervention and follow-up assessments and were included in the final analysis. One participant missed one response to one question, so the missing value was replaced with the imputed mean.

Paired sample t-tests were conducted on baseline and follow-up scores of mindfulness (MAAS), wellbeing (MQLI, PSS) and mental health (HADS, STAI-T, STAI-S). Independent sample t-tests compared those who completed at least 6 days of colouring and those who did not. Repeated Measures ANOVAs explored possible interactions with existing creative hobbies. Correlation analyses were used to assess the relationship between participant rated enjoyment of the colouring intervention and change in outcome measures between baseline and follow-up.

A priori power analysis was conducted using G*Power version 3.1.9.7 (Faul et al., 2007) for sample size estimation, based on data from (Hajra & Saleem, 2021) ($N = 60$). The effect size in this study was large. With a significance criterion of $\alpha = .05$ and power $= .95$, the minimum sample size needed with this effect size is $N = 10$ for analysis. Therefore, the obtained final sample size of $N = 140$ is adequate to test the hypotheses.

Data and other supplementary materials are available here: https://osf.io/9qsmd/

Results

Demographics

The mean age of participants was 19.71 ($SD = 1.2$) years, ages ranged from 19 to 26 and were 86.4% female. The sample were predominantly Caucasian (78.6%; See Table 1). Participants reported high mean scores of Stress ($M = 21.6$) at baseline, compared to reported norms (mean ~13 for women and younger adults)(Cohen et al., 1983). Average depression scores ($M = 4.7$) were lower than the cut off (>8) used to indicate clinical levels of depression. Reported state anxiety ($M = 9.7$) just exceeded the cut off (>9.5) but trait anxiety ($M = 12.5$) did not exceed the cut off (>13.5), indicating many of our sample were potentially clinically anxious (See Table 2).

Table 1. Participant demographics.

Demographics		
Gender, % (N)	Female	86.4 (12.1)
	Male	12.1 (17)
	Gender Diverse	1.4 (2)
Ethnicity, % (N)	Caucasian	78.6 (110)
	Asian	8.6 (12)
	Mixed	7.1 (10)
	Black	3.6 (5)
	Other	2.1 (3)
Age (mean, S.D)		19.7 (1.9)

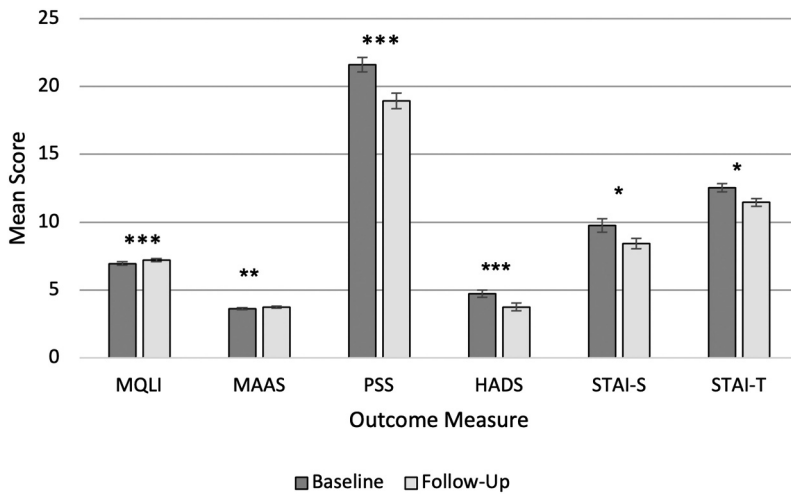**Table 2.** Total outcome measure means, standard deviations, t-statistics, significance levels and Cohen's d.

Measure	Baseline M (SD)	Follow-up M (SD)	Difference Test t (1, 139)	p	Cohen's d
MQLI Average	6.95 (1.43)	7.20(1.32)	−3.38	<.001***	.286
MAAS Average	3.62 (.78)	3.74 (.73)	−2.68	.004**	.226
PSS	21.60 (6.45)	18. 95 (6.75)	6.74	<.001***	.570
HADS	4.73 (3.11)	3.75 (3.38)	4.75	<.001***	.402
STAI-S	9.75 (5.87)	8.41 (4.51)	3.00	.002*	.250
STAI-T	12.55 (3.65)	11.46 (3.45)	4.48	<.001*	.379

$p < .05 = ^*, p < .01 = ^{**}, p < .001 ^{***}$.

Longitudinal analyses

There was a significant improvement in all outcome measures between baseline and follow-up, supporting our hypotheses (see Figure 1). Quality of life increased, $t(1, 139) = 3.38$, $p < .001$; dispositional mindfulness increased $t(1, 139) = −2.68$, $p < .001$; perceived stress decreased $t(1, 139) = 6.74$, $p = .004$; depression symptoms decreased $t(1, 139) = 4.75$, $p < .001$; state anxiety decreased $t(1, 139) = 3.00$, $p = 002$; and trait anxiety decreased $t(1, 139) = 4.48$, $p < .001$. Medium effect sizes (see Table 2), were observed in the reduction of perceived stress ($d = .57$), followed by depression symptoms ($d = .40$), with small effect sizes noted for all other outcome measures.

Considering different facets of Quality of life (see Table 3), significant improvements were noted specifically self-reported Psychological/Emotional Well-being, $t(1, 139) = 5.80$, $p < .001$; Self-Care and Independent Functioning $t(1, 139) = 2.21$, $p < .029$; Social/Emotional support $t(1, 139) = 2.32$, $p = .022$; Personal fulfilment $t(1, 139) = 3.25$, $p < .001$; and overall Global Perception of Quality of Life Personal fulfilment $t(1, 139) = 2.40$, $p = .018$. Small effect sizes were observed for all significant improvements (see Table 3).

Figure 1. Outcome measure scores at baseline and two-week follow-up. Note. $N = 140$. $p < .05 =$*, $p < .01 =$**, $p < .001$***. Error Bars = Standard Error.

Table 3. MQLI sub-scale means, standard deviations, t-statistics, significance levels and Cohen's d.

Measure	Baseline M (SD)	Follow-up M (SD)	Difference Test t (1, 139)	p	Cohen's d
Physical wellbeing	6.84 (2.03)	6.92 (1.85)	−.598	.551	−.051
Psychological/Emotional wellbeing	6.16 (2.01)	6.91 (1.79)	−5.804	<.001***	−.491
Self-Care	7.63 (1.74)	7.88(1.58)	−2.205	.029*	−.491
Occupational Functioning	7.41 (1.79)	7.31 (1.83)	.648	.518	.055
Interpersonal Functioning	7.64 (1.76)	7.62 (1.85)	.106	.916	.009
Social-Emotional Support	7.72 (1.96)	7.99 (1.84)	−2.323	.022*	−.196
Community and Services Support	7.36 (1.95)	7.51 (1.72)	−1.074	.285	−.091
Personal Fulfilment	6.89 (2.06)	7.33 (1.77)	−3.245	.001*	−.274
Spiritual Fulfilment	4.94 (2.53)	5.33 (2.31)	−1.976	.050	−.167
Global Perception of Quality of Life	6.86 (1.94)	7.16 (1.8)	−2.395	.018*	−.202

$p < .05 =$*, $p < .01 =$**, $p < .001$***.

Exploratory analyses

Effect of Hobby

Wellbeing and mental health scores were subjected to an analysis of variance with two levels of time (baseline, follow-up) and two levels of Creative Hobby (Yes, No). Overall, there were (as above) significant within-subjects effects of time, whereby changes from baseline to follow-up scores were significant, however there were no significant interactions with having a creative hobby (See Supplementary Tables).

For the MAAS, the main effect of Time yielded an F ratio of $F(1, 140) = 5.03$, $p = .026$, indicating (as above) that dispositional mindfulness was significantly increased at Follow-up, compared to baseline. However, the interaction effect of Time*Hobby was non-significant, $F(1, 140) = .07$, $p = .786$.

For the MQLI, the main effect of Time yielded an F ratio of $F(1, 140) = 8.60$, $p = .004$, indicating (as above) that quality of life was significantly increased at Follow-up, compared to baseline. However, the interaction effect of Time*Hobby was non-significant, $F(1, 140) = .01$, $p = .929$.

For the PSS, the main effect of Time yielded an F ratio of $F(1, 140) = 40.08$, $p < .001$, indicating (as above) that perceived stress was significantly reduced at Follow-up, compared to baseline. However, the interaction effect of Time*Hobby was non-significant, $F(1, 140) = .31$, $p = .580$.

For the HADS, the main effect of Time yielded an F ratio of $F(1, 140) = 22.25$, $p < .001$, indicating (as above) that depression scores were significantly reduced at Follow-up, compared to baseline. However, the interaction effect of Time*Hobby was non-significant, $F(1, 140) = .07$, $p = .789$.

For the STAI-State, the main effect of Time yielded an F ratio of $F(1, 140) = 9.26$, $p < .001$, indicating (as above) that state anxiety was significantly reduced at Follow-up, compared to baseline. However, the interaction effect of Time*Hobby was non-significant, $F(1, 140) = .56$, $p = .454$.

For the STAI-Trait, the main effect of Time yielded an F ratio of $F(1, 140) = 16.92$, $p < .001$, indicating (as above) that trait anxiety was significantly reduced at Follow-up, compared to baseline. However, the interaction effect of Time*Hobby was non-significant, $F(1, 140) = 1.09$, $p = .299$.

Completers vs non-completers

Independent samples t-tests compared baseline scores between participants who did ($n = 140$) and did not ($n = 77$) complete six sessions of colouring in over two weeks. Results indicated no significant differences in baseline scores of; MQLI, t(385) = .69, $p = .491$; MAAS t (385) = .75, $p = .456$; PSS t (385) = −.46, $p = .647$; HADS t (385) = .28, $p = .778$; STAI-State t(385) = −1.60, $p = .110$; and STAI-Trait t (385) = −.24, $p = .811$ (See Supplementary Tables).

Participant experiences

At follow-up, participants were asked for their feedback on how much they enjoyed the activity (0 Not at all − 10 very much) with responses indicating students enjoyed the activity ($M = 7.7$, SD = 1.6). Further, 71.3% ($n = 102$) of participants indicated they intended to continue this activity after the study has ended.

Association between enjoyment and outcomes

Enjoyment of the colouring intervention was not significantly correlated with change in outcome measures between baseline and follow-up (See Supplementary Table S8); MQLI, r(140) =-.14, $p = .101$; MAAS r(140) = .03, $p = .734$=.; PSS r(140) = −.05, $p = .56$; HADS r(140) = .09, $p = .312$; STAI-State r(140) = −.04, $p = .638$; and STAI-Trait r(140) = .09, $p = .302$

Discussion

This study aimed to investigate the impact of a two-week self-guided, colouring intervention for university students on measures of wellbeing, mental health, and dispositional mindfulness, in a naturalistic setting. Results indicated that, when able to engage in the activity, there was a significant effect of colouring on all outcome measures, whereby wellbeing, mental health and dispositional mindfulness improved. Overall, participants who completed the intervention found the activity to be enjoyable, and intended to continue the activity after the study had finished. Interestingly,

prior experience of creative hobbies made no significant difference to the effectiveness of colouring, meaning this is an activity suitable for people with interests outside creative pursuits. Our study found similar results to previous research in that colouring significantly improved depressive symptoms (Flett et al., 2017) anxiety (Jakobsson Store & Jakobsson, 2022; Van Der Vennet & Serice, 2012) and stress (Tajuddin & Ooi, 2021). Overall, the results supported the notion that students tend to experience lower wellbeing (Dodd et al., 2021; King et al., 2021). Many of our student participants were experiencing heightened levels of stress and anxiety, and general lowering of quality of life before the study began. Engaging in this colouring intervention led to significant improvements in these areas that were small to medium in effect. Our findings therefore demonstrating that simple, self-guided mindful interventions can be effective for young adult and student wellbeing. We also demonstrated that this effect can be seen over multiple sessions.

Research about un-guided colouring is mixed, demonstrating both improvements to mindfulness (Campenni & Hartman, 2020; Holt et al., 2019; Mantzios & Giannou, 2019), and no change (Flett et al., 2017; Mantzios & Giannou, 2018; Mantzios et al., 2019). Further, some studies induced anxiety before the intervention which is not assessing the effect in a naturalistic setting (Jakobsson Store & Jakobsson, 2022). In therapeutic settings, research has demonstrated the short-term effects of colouring (Hajra & Saleem, 2021; Ozturk & Toruner, 2022). The present study demonstrated improvements across a number of markers of wellbeing, mental health and mindfulness can occur outside of therapeutic settings, when self-guided colouring is undertaken regularly (but not every day) in short sessions.

The largest effect was seen in the reduction of stress (d = .57). As this score at baseline (M = 21.5) far exceeded the usual mean scores on the perceived stress scale (13), a significant reduction with medium effect size over a short time highlights the efficacy of this simple colouring intervention for the general student population experiencing heightened feelings of stress. The next largest effect was seen in the reduction of depressive symptoms, whilst the HADS average was not above clinical cut off, this indicates that there is also some impact of colouring on sub-clinical mood symptoms.

This study demonstrates that small improvements in dispositional mindfulness were possible over an unguided two-week period, which can have positive impacts on wellbeing and resilience (Campenni & Hartman, 2020; Holt et al., 2019). We further demonstrated that improvements in hedonic wellbeing, via measures of Quality of Life, were possible across a number of domains after unguided colouring. This was driven by changes in specific aspects of wellbeing, with the largest effect size seen in changes to psychological wellbeing (d = .49), followed by personal fulfilment (d = −.27), and self-care and independent functioning (d = −.19). This highlights that colouring can support, maintain, and improve individual positive wellbeing experiences associated with quality of life, in addition to wellbeing and mental health specifically.

Our quantitative findings align with results from qualitative interviews with women who regularly do colouring (Dresler & Perera, 2019), which centred on colouring being beneficial as a mindful self-care activity that benefits emotional wellbeing. Together, our findings and others suggest that colouring could be recommended to members of the student and young adult population as a way to maintain levels of wellbeing, who do not currently require support for their mental health.

We also investigated the role of previous creative or artistic hobbies on the efficacy of this intervention. Previous research highlighted that colouring, among other artistic interventions, is more impactful at improving psychological wellbeing than non-artistic interventions (Flett et al., 2017; Holt et al., 2019; Lee, 2018) suggesting that art and creativity play an active role in maintaining and improving wellbeing. We investigated whether prior experience of art and creative hobbies would impact the efficacy of the colouring intervention. Contrastingly, the results found that there was no significant difference in changes to wellbeing, mental health or mindfulness in students who had artistic hobbies. These findings therefore indicate that colouring is a useful activity to promote wellbeing regardless of prior experience.

Mindful or mindless?

The intention of this study was to understand whether so-called "mindful colouring" was beneficial outside of controlled, experimental conditions. Whilst participants were instructed to colour mindfully, due to the self-guided nature of this intervention, we had no control over how well participants adhered to the mindful instructions. However, by highlighting how this activity might be done in a focussed manner in a quiet space, we suggest that regardless of whether this was truly a mindful activity, it remained beneficial for wellbeing, and allowed participants to consider and make time to focus on in-the-moment activities, and disengage from otherwise harmful psychological processes, such as rumination.

Recommendations for social prescribing

Findings support the use of regular, short-session colouring activities to support student wellbeing and mental health, and improve mindfulness, which is known to be associated with resilience and coping. These activities are widely accessible and easy for non-therapist settings to implement, such as in student-focused or other community-run spaces. Social prescribing initiatives, and university signposting to student support techniques, could utilise this knowledge to provide simple guides for individual or group colouring activities. Some evidence has demonstrated that non-mindful colouring using digital applications has no impact on mindfulness (Mantzios et al., 2019), so care must be taken to provide appropriate guidance and resources for individuals looking to support their wellbeing through colouring.

Care should be taken not to claim this as a cure-all activity for wellbeing. Whilst we show compelling evidence that self-guided colouring can be beneficial to wellbeing, that is not to say this activity will be suitably engaging for everyone. The high drop-out and non-completion rate between baseline and follow-up also highlight a number of considerations. Whilst most participants who did complete the activity indicated they would like to continue this practice after the study had ended, it may not be enough to simply offer resources and expect the activity to improve or maintain wellbeing. Supporting the development of regular, pleasurable wellbeing habits also takes organisation and discipline from the individual, their support network, and educational or occupational space. Those suggesting colouring activities to improve wellbeing need to ensure that both resources and the opportunity to engage in this activity is in place, to support long-term maintenance of this wellbeing activity.

Limitations

Similar to previous research, participants were predominantly female (Hajra & Saleem, 2021; Jakobsson Store & Jakobsson, 2022; Ozturk & Toruner, 2022). We also note the high drop-out rate between baseline and follow-up. The high dropout rates could be related to the allocation of research credits to students, whereby students did not require any more credits and chose not to participate further, or due to lack of interest in the activity. It should also be noted that this intervention ran during the university term, and as such usual university activities may have interfered with completion of the study within the allotted two weeks. This may also explain both the high drop-out rates, and the number of participants who completed follow-up but did not achieve six sessions over two weeks. Despite this, the final sample size of 140 remained larger than previous studies, and demonstrated a large number of students both engaged and enjoyed the activity. There was no control group, and as such research with control groups is required to better understand the efficacy of this activity over time. Participants were asked how many days they engaged with the activity, but more formal monitoring of when and for how long was not undertaken. Additionally, the majority of participants were Caucasian females. Our sample represents the majority of current undergraduate Psychology courses in the UK, but the findings are less generalisable to other student cohorts, and other community groups.

Future research

Future research should seek to recruit a more diverse sample that represents the wider student body and other general population and community groups. Further, whilst effect sizes were quite large, the overall change in outcome measure scores over two-weeks was small. Longer interventions are required to investigate the impact of longer-term colouring practice on wellbeing, mental health, and mindfulness. Further, longer follow-up times would help to assess the sustainability of improvements over time, particularly when colouring is discontinued.

Conclusion

Overall, colouring was effective at improving students' psychological wellbeing, mental health, and dispositional mindfulness. This simple, accessible activity is easy to implement in higher education student settings, to mitigate decline in wellbeing and mental health, for those who are interested. This knowledge may help to address the noted vulnerability to poor mental health in this population of emerging adults. Results encourage future research in diverse populations and over longer periods of time.

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