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A randomised controlled trial of brief web-based acceptance and commitment Therapy on the general mental health, depression, anxiety and stress of college Students[☆],[☆☆],[☆☆☆]

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ABSTRACT

The college years are frequently understood as being a carefree time in a young person's life, however, research suggests that these are formative and challenging times for many. The purpose of the study was to examine the effectiveness of a brief internet intervention based on Acceptance and Commitment Therapy (ACT) for promoting general mental health among college students. As far as can be determined, the impact of an online guided self-help version of (i) contact with the present moment, (ii) cognitive defusion and (iii) self-as-context processes of ACT on mental health has never been tested in a student-based randomized trial. The current study was a randomized controlled wait-list trial consisting of a 3-week intervention and a 3-week follow-up phase. Out of 174 participants, 113 were included in the analysis. Inclusion criteria were: (1) no formal diagnosis of mental health disorders, (2) no previous experience of ACT, mindfulness or mindfulness-based exercises, (3) over 18 years of age, and (4) currently registered as a university or college student. Participants were randomly assigned to an ACT-based intervention (N = 87) or a wait-list control (N = 87). Neither investigators nor participants were blinded to group assignment. The primary outcome measure was general mental health (GHQ-12). Depression, Anxiety and Stress were also measured (DASS-21) as well as psychological flexibility (AAQ-2) at pre- and post-intervention, and 3-week follow-up. The results indicated significant improvements in general mental health in the ACT processes group compared with the wait-list control group ($p = .005$, $d = 0.48$) at post treatment but not at follow-up. There were no significant differences between the groups on any other outcome measures. The results from this study provide some support for the effectiveness of a brief web-based ACT intervention to enhance general mental health. However, there were no significant comparative improvements, but trends, for depression, anxiety or stress.

Recent research from the UK (Tabor et al., 2021) shows that both general mental health and odds of being diagnosable with a psychiatric disorder has increased among 17–24-year-olds. In fact, almost 75% of all serious mental health difficulties seemingly first emerge between the ages of 15 and 25 (Hickie, 2004; Kessler et al., 2005; Kim-Cohen et al., 2003). Although the research by Tabor and colleagues also showed these indicators were lower in students than in non-students of similar age, previous research by Houghton and colleagues indicated that college students may be at particular risk of mental health problems (2012).

According to the Royal College of Psychiatrists (RCP) in the UK (2003), the level of mental health problems among third-level students was estimated to continue to rise as a result of stressors such as financial concerns, pressures to excel in their studies, and meeting ever increasing social and personal expectations (Connell et al., 2007; Houghton et al., 2012). This profile of the emergence of mental health difficulties highlights the importance of early intervention, and the provision of a broad range of support services both in student health services and in the wider community.

Most mental health support programs offered in universities emphasize physical methods such as exercise or relaxation over cognitive behavior therapy or other empirically supported methods focused more directly on mental health (Jeffcoat & Hayes, 2012). In addition, counselling services face the challenge of serving a widely diverse range of psychological difficulties such as depression, suicidality, self-harm, substance abuse, and eating disorders (Liu et al., 2019). The counsellor-student ratio can sometimes be as high as 1:5500, and help-seeking behavior is low (Eisenberg et al., 2009; Hope et al., 2005, pp. 1–53). Moreover, the availability of a well-staffed counselling center, the time-intensive nature of treatments coupled with evidence of low help-seeking behavior among college students (Hope et al., 2005, pp. 1–53; Hunt & Eisenberg, 2010), means that only a minority of people receive the treatment and support they need (Doherty et al., 2012).

Given the large number of students who experience psychological difficulties and the high demand on student counselling services, web-based interventions have practical advantages as part of a university well-being program. Since materials can be delivered at low cost, it could reduce or eliminate potential stigmatization as resources could be accessible without pre-identifying students at risk of mental health problems, (Doherty et al., 2012; Jeffcoat & Hayes, 2012). This might both help lower barriers to treatment and be a preventive approach by delivering broad-based psychological interventions that teach coping skills, promote individual self-care, and self-management at low cost if effective processes of mental health promotion can be targeted effectively. One promising process is psychological flexibility (Biglan et al., 2008; Hayes, Villatte, et al., 2011; Houghton et al., 2012). In many forms of psychopathology, psychological flexibility processes are diminished (Boulanger et al., 2010; Levin et al., 2014).

Psychological flexibility has been described as the willingness to be mindful of, and come into fuller contact with, experiences in the present moment in an accepting and non-judgmental way, while recognizing and behaving consistently with personal values, even when thoughts and feelings oppose taking valued action (Hayes, Strosahl, & Wilson, 2011). It has been argued that psychological flexibility is a key ingredient to psychological health as it enables individuals to cope in an uncertain, unpredictable world in which they live where novelty and change are the norm rather than the exception (Kashdan & Rottenberg, 2010). There is a substantial literature base indicating psychological flexibility as a protective factor in the development, and exacerbation of a variety of psychological problems including depression, anxiety, substance abuse, eating disorders, stress, adjustment to traumatic experiences, adjustment to chronic medical conditions, school performance, employment performance, and burnout (Biglan et al., 2008; Hayes et al., 2006; Hayes et al., 2012; Hooper & Larsson, 2015 for a book-length review).

The most well-known model used to target Psychological flexibility is Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 2011). The approach is *trans*-diagnostic and can help develop resilience skills in the prevention and amelioration of a diverse range of psychological difficulties (Hooper & Larsson, 2015; Ruiz, 2010). Furthermore, ACT has proven to be a flexible approach which can be carried out in classes or in therapy rooms, over the internet or in person (Hayes et al., 2013).

ACT consists of six "core processes" (Fletcher and Hayes, 2005) which together foster the core concept of psychological flexibility. These processes are also recognized as processes in process-based CBT (Hayes & Hofmann, 2018). These are *contact with the present moment/self-a-s-process* (the on-going non-judgmental contact with psychological and environmental events as they arise), *acceptance* (opening up to all experiences), *cognitive defusion* (non-judgmental approach to thoughts, and aims to increase the ability of participants to take a perspective of "looking at" rather than "looking from" their thoughts), *self as context* (a unique perspective of the self as the perspective from which one's entire life has been lived, that is larger than and distinct from thoughts and feelings), *values* (reflections of what is important), and *committed action*

(patterns of effective action linked to values). A recent study found that acceptance (r = .52), and defusion (r = 0.59) both correlate significantly with general mental health in a college student population (Duff, Larsson, & McHugh, 2016).

ACT is empirically supported in the treatment of several disorders, including depression, anxiety, chronic pain, substance abuse, eating disorders, suicidality, self-harm, and psychosis (Hooper & Larsson, 2015; Keng et al., 2011; Powers et al., 2009). In addition, several studies focusing on mechanisms of change have suggested that the effect of ACT on clinical outcomes is mediated by its impact on psychological flexibility and it's core processes (Hayes et al., 2006; Ruiz, 2010).

ACT's effectiveness does not appear to be limited to people suffering with psychological disorders. A series of studies have found that ACT can improve general mental health and positive functioning in the context of worksite wellness programs (Bond & Bunce, 2000; Flaxman & Bond, 2010), and recent randomized controlled trials evidenced ACT reducing depression and anxiety symptoms among at-risk individuals with mild to moderate depression (Bohlmeijer et al., 2011; Fledderus et al., 2012).

1. Web-based ACT interventions for college students

Low help-seeking behavior among students may be due to the stigma associated with "seeing a therapist" (Eisenberg et al., 2009; Hope et al., 2005, pp. 1–53). This, as well as the chance to disseminate online interventions broadly, especially in times when students are away from campus for distance learning as during the COVID-19 pandemic is driving an interest in online delivery of Acceptance and Commitment Therapy. In an interactive multimedia online package focusing on values and acceptance, Levin et al. (2014) conducted a randomized trial comparing a web-based ACT program to a wait-list control among 76 first-year college students. Overall, initial results were promising with significant and large improvements in depression ($p = .001, d = 0.97$), anxiety ($p = .003, d = 0.95$) and stress ($p = .001, d = 0.81$) symptoms for those exposed to the intervention compared to the control group. Räsänen et al. (2020) similarly used a mixture of self-help text, audio and video in conjunction with online interaction with clinically trained student therapists in comparison with wait-list for 68 students in Finland. The results showed comparative gains in wellbeing ($p = .008, d = 0.46$), stress ($p = .028, d = 0.54$), and depression ($p = .003, d = 0.69$) for the ACT condition.

2. The present study

The aforementioned research has begun the process of accumulating important evidence for indirect and self-help modes of ACT interventions targeting all or individual core processes. After thorough literature review, the combination of defusion, self as context and contact with the present moment have not been investigated by way of a brief web-based mental health intervention within a student population. ACT is most commonly delivered as a whole package, as in the aforementioned study by Levin et al. (2014) or singular processes have been tested on students. The complete review of all process studies is beyond the scope of this article but in a meta analysis of ACT core process studies in laboratory settings, 45 studies using student populations were identified and effectiveness of the ACT processes showing significant results ($ps = .05–.001$) and medium to large effect sizes (Hedge's $gs = 0.41 - 0.81$; Levin et al., 2012). The purpose of the present study was to assess the efficacy of a brief web-based ACT intervention that targets a subset of ACT processes: *contact with the present moment, cognitive defusion,* and *self as context*, on the mental health of college students. Investigating the potential of this type of intervention in student populations is particularly relevant given the high levels of psychological distress and the low rates of health seeking behavior within this group. Audio exercises targeting these processes could be used as prevention in a student counselling service or it could be part in a staged approach for university students wherein those that do not respond to the reduced number can

access all of the processes. Based on previous research it was predicted that the ACT intervention would show superior effects in increasing general mental health and reducing psychological distress and reducing experiential avoidance compared with a waiting list control group.

3. Methods

3.1. Participants

A power calculation performed using G*Power indicated that a repeated measures MANOVA would need a sample size of 102 in order to have an 90% chance of detecting an effect size of $d = 0.4$ (the smaller effect size in the meta analysis of Levin et al., 2012). In all 224 presumptive participants were recruited through advertisements (social media, posters, and flyers) around the University College Dublin campus in Dublin, Ireland. The message on the posters read as "Peace of mind … Most of us want it but few of us can find it. Interested in taking part in mindfulness-based research? Learn how to manage unwanted thoughts and feelings". Additionally, direct group invitations took place in a number of lectures, where the study was introduced and students were invited to participate. Those interested in taking part added their email addresses and were subsequently emailed with participation information. Posters, flyers, emails and online notices provided a link to a website, hosted by the university, where comprehensive details of the research were presented. On the information homepage participants could give consent to potentially participate and to be forwarded to an online survey tool where they were assessed for eligibility. Inclusion criteria: (1) no formal diagnosis of a psychiatric disorder, (2) no previous experience of mindfulness or mindfulness-based exercises, (3) over 18 years of age, and (4) currently registered as a university or college student (i.e., at third-level education). Throughout the recruitment process the acronym 'ACT' referred to Acceptance and Commitment *Training*, an established method to avoid the inference that participants necessarily needed therapy or had a psychological disorder (Jeffcoat & Hayes, 2012).

4. Materials

4.1. Primary outcome measure: general mental health

The primary outcome measure was general mental health as assessed using the 12-item version of the General Health Questionnaire (GHQ-12; Goldberg et al., 1997). GHQ-12 is a 12-item self-report scale widely used and well validated for the screening of mental health problems in the general population. Participants respond on a 4-point Likert rating scale typically ranging from "better than usual" to "much worse than usual" resulting in scores from 0 to 36, with higher scores indicating greater psychological distress (Goldberg & Williams, 1988). A score of 12 or higher has been reported as being the most sensitive with approximately 85% of people who score that high exhibiting an Axis 1 disorder (Donath, 2001). GHQ-12 is valid when used with late adolescents and young adults (Banks, 1983; Tait et al., 2002), and has demonstrated very good internal consistency with Cronbach's alpha ranging from 0.82 to 0.88 (Goldberg et al., 1997; Goldberg & Williams, 1988; Muto et al., 2011). Furthermore, its psychometric properties were satisfactory when administered via the internet (Vallejo et al., 2007). Studies have reported a stable factor structure and the predictive validity of the GHQ is also good (Goldberg et al., 1997; Vallejo et al., 2007). In addition, satisfactory test-retest reliability coefficients (0.72 - 0.79) have been demonstrated. GHQ was considered the primary outcome measure because it fit the broad focus on the intervention. Cronbach's alpha in the current sample was .88 at all three time points.

4.2. Secondary outcome measure: psychological distress

The secondary outcome measure was psychological distress. This was measured using the Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 is a set of three distinct 7-item self-reported measures in which participants rate the frequency and severity of experiencing negative emotions over the previous week. Each item is scored on a 4-point Likert scale from 0 (did not apply to be at all over the last week) to 3 (applied to me very much or most of the time over the last week). Higher scores indicate higher symptom severity. (Lovibond & Lovibond, 1995). The scales have shown high reliability and validity across settings (Crawford & Henry, 2003; Dooley & Fitzgerald, 2012; Muto et al., 2011). Previous research with college students indicated adequate internal consistency with a Cronbach's alpha of .81, .70 and 0.75 for the depression, anxiety and stress subscales respectively (Levin et al., 2014). The DASS has also been supported by results of exploratory and confirmatory factor analyses, and has also shown very good convergent, discriminative and construct validity (Crawford & Henry, 2003; Lovibond & Lovibond, 1995). Adequate test-retest reliability coefficients of 0.71 for depression, 0.79 for anxiety and 0.81 for stress have also been reported (Dooley & Fitzgerald, 2012). Cronbach's alpha in the current sample ranged from 0.80 to 0.89 for depression, anxiety and stress subscales, at pre-, post-, and follow-up.

4.3. Process measure: psychological inflexibility

The Acceptance and Action Questionnaire (AAQ-2; Hayes et al., 2004) is the most widely used measure of psychological inflexibility and experiential avoidance. The AAQ-2 is a 7-item measure assessing the ability to accept difficult or painful internal experiences in the pursuit of personal values in the presence of these experiences. Measured on a 7-point Likert scale, ranging from "never true" (1), to "always true" (7). Lower scores indicative of psychological flexibility and higher scores indicative of experiential avoidance (Bond et al., 2011). The AAQ-2 has demonstrated high internal consistency in validation studies with Cronbach's alpha ranging from 0.86 to 0.90 (Bond et al., 2011; Fledderus et al., 2010). Test-retest reliability coefficients of 0.81 and 0.79 have also been reported over a three- and twelve-month period respectively (Bond et al., 2011). AAQ-2 has also confirmed appropriate predictive and discriminative validity (Bond et al., 2011). Cronbach's alpha in the current sample ranged from 0.90 to 0.92 at all three time points.

4.4. Intervention material: ACT-Based audio exercises

The audio exercises, adapted and narrated by internationally-renowned ACT trainer, Dr. Russ Harris (see actmindfully.com.au), were based on three of the core processes of ACT. Audio one contained "*contact with the present moment*"; Audio two "*cognitive defusion*"; Audio three, "*self as context*".

5. Procedure

The research carried out adhered to the principles of the Psychology Society of Ireland Code of Professional Ethics and the British Psychological Society and was vetted by the Department of psychology's Human Research Ethics Committee at University College Dublin. Participants who met the inclusion criteria completed baseline measures before being randomized to the intervention group or the wait-list control group. Treatment assignment was determined by the lead investigator using a random numbers table to assign conditions to participants. At the time of randomization, the investigator did not know the identity of participants or their baseline scores. Directly following randomization, participants were emailed details as to what group they had been assigned to and the associated tasks. Both groups completed all measures (GHQ-12, DASS-21, AAQ-2) on three occasions: at pre-treatment/baseline, at post-treatment (one week after the 3-week intervention), and at follow-up (three weeks after post-treatment responses). All questionnaires were administered online and the average

time to complete questionnaires was 8 min 11 s (including some very long durations of over 1 h). Median time was 6 min 14 s.

The online system allowed the researchers to track the "dose" of ACT intervention, i.e. did some participants listen to the same audio recordings more than once or to each only one time. However, there was no way of knowing if participants actually listened to the audio recordings as per the instructions or whether they were doing chores, for example, while the recording played in the background.

6. Intervention

6.1. Treatment group

Those in the Intervention group were required to listen to a sequence of three online ACT -based audios at least once over a 3-week period (see Supplementary file 2, for instructions given). The first exercise, *Awareness of breathing* (23 min), aimed to promote the ACT process known as Self as Process or Contact with the present moment, the second ACT exercise, *Leaves on a stream* (13 min), targeted the ACT-process of Defusion. The third exercise, "*The observing self*" (16 min), targeted the ACT process of Self as Context. One week following the intervention, all study participants were emailed and asked to complete post-treatment questionnaires via a direct link. Three-week follow-up questionnaires were administered via an emailed direct link to all participants once post-treatment measures were completed. Participation in the study was concluded for those in the treatment condition once 3-week follow-up responses were received.

6.2. Wait-list control group

Simultaneously, those randomized to the wait-list control group were required to answer post-treatment, and three-week follow-up questionnaires at the same time as the Intervention group. The Wait-list control group was given access to an identical treatment condition after the experimental group had concluded the study.

6.3. Statistical analyses

Prior to analysis, frequency distributions and plots were examined for outliers and unusual data distributions. When homogeneity of variance was not observed, degrees of freedom were adjusted to account for the inequality and maintain α at .05. Preliminary examinations of Cronbach's alpha reliability for all measures were also conducted and indicated high internal consistencies. Subsequently, baseline characteristics were investigated with independent samples t-tests revealing no significant between group baseline differences on outcome or process variables, indicating successful randomization. Comparisons were two-tailed and effects were interpreted with a significance of $p < .05$, unless otherwise indicated. Intent-to-treat analysis (ITT) was conducted using linear mixed models for the group changes across all three time points using the GAMLj 2.6.1 module for Jamovi 2.2.5 for Windows 10. Mixed models has the advantage for ITT analyses over methods such as using last post carried forward in that it enables using even data from those that did not complete all time-points. In order to calculate *p*-values Satterthwaite method for degrees of freedom was employed. Effect sizes at post-intervention and follow-up were calculated using the formula

$$d = \frac{(mean_1 - mean_2)}{SD_{pooled}} \text{ where } SD_{pooled} = \sqrt{\left(\frac{(SD_1^2 - SD_2^2)}{2}\right)}.$$ A result of over .2

was considered a small effect, over 0.5 as a moderate effect and over 0.8 as a large effect (Cohen, 1988).

7. Results

7.1. Characterization of the sample

An initial sample of 224 people was assessed for eligibility and 50 (22%) were excluded based on inclusion criteria. A further 61 participants (35%) did not respond following randomization. The informed consent letter told participants that they would not be challenged if they withdrew their participation so no analysis of these post-randomization dropouts is possible as their data was deleted. The resulting 113 participants were included in the study and were asked to complete both pre-treatment and post-treatment measures. At follow-up, 101 participants (89% of the final sample) responded to questionnaires. Drop-out analysis revealed no significant differences between drop-outs and completers on any outcome variable at baseline or as time and group interaction between the pre- and post-measure.

At baseline sixty-six participants (58%) met the clinical cut-off of 12 or higher on the GHQ-12. Large percentages in the sample also exceeded clinical cut-offs on each of the DASS-21, 58% ($n = 63$) exceeded the cut-off for mild or above levels of depression (≥ 9), 50% ($n = 56$) exceeded the cut-off for mild or above levels of anxiety (≥ 7), and 42% ($n = 47$) exceeded the cut-off for mild or above levels of stress (≥ 14). Overall, 76% exceeded clinical cut-off scores on one or more measures of general mental health, depression, anxiety or stress.

Primary Outcome Results: General Mental Health.

7.2. Between group analyses

Mixed models analysis of the GHQ-12 results revealed significant effects of time $F(1,212) = 15.07$, $p < .001$, group $F(1149.51) = 359.90$, $p < .001$ and of group and time, $F(1,212) = 5.34$, $p = .005$ (Fig. 1.). Moderate effect sizes were calculated at post-treatment ($d = 0.48$) and at follow-up ($d = 0.34$).

7.3. Post-hoc analyses

Fixed effects estimates showed that the ACT group decreased GHQ-12 scores from pre to post significantly more than the Control group $t(209.58) = -3.07$, $p = .002$ but not for post to follow-up $t(213.91) = 0.49$, $p = .62$ (see Table 1). Post-hoc analyses showed that there was a significant difference between the groups general mental health scores at post-treatment, $t(237) = -2.41$, $p = .02$, with the Intervention group ($M = 10.56$, $SD = 6.12$) scoring significantly lower than the control group ($M = 13.13$, $SD = 4.94$; Table 2). but not at follow-up, $t(256) = -1.72$, $p = .08$.

Post-hoc analyses also showed a large ($d = 0.96$) and statistically significant decrease in GHQ-12 scores from pre-treatment to post-treatment, and from pre-treatment to follow-up in the Intervention group. This effect was then maintained from post-treatment to follow-up but not further improved. The results suggested that the Intervention group's GHQ scores significantly decreased from pre-treatment to post-treatment and from pre-treatment to follow-up (lower scores are indicative of better general mental health). Scores from post-treatment to follow-up were maintained but not improved on. Results are illustrated in Table 3.

Secondary Outcome Results: DASS-21.

Mixed model analysis of the Depression sub-scale showed a significant effect of time $F(2, 213) = 5.32$, $p = .006$, but not of group $F(1,110) = 0.004$, $p = .95$ or time and group interaction, $F(2,213) = 2.20$, $p = .11$. The results of the mixed models analysis of the Anxiety sub-scale was non-significant for time $F(2,213) = 1.55$, $p = .22$, group $F(1,110) = 0.35$, $p = .56$ or time and group interaction, $F(2,213) = 0.43$, $p = .65$. The mixed model analysis for the Stress sub-scale of the DASS was also non-significant vis-a-vis time, $F(2,212) = 1.46$, $p = .24$, group $F(2,109) = 0.08$, $p = .8$ and time and group interaction, $F(2,212) = 0.71$, $p = .49$. This shows that there was no statistically significant effect of the
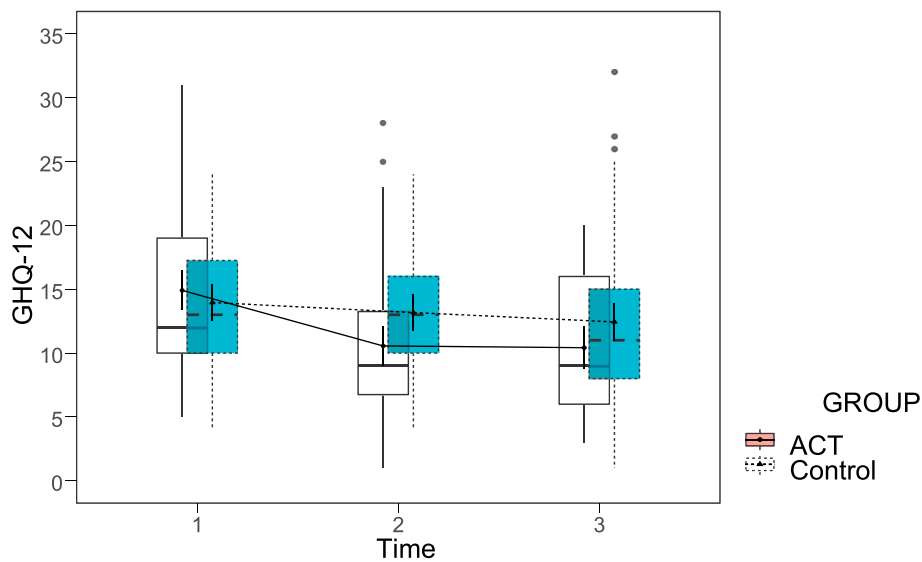
Fig. 1. GHQ-12 scores of the groups at all three time-points.

Table 1

Participant characteristics. Values are numbers (percentages) of participants unless otherwise indicated.

	ACT (N = 52)	Control (N = 61)	Total Sample (N = 113)	Difference
Male	13 (25%)	11 (18%)	24 (21%)	$\chi^2 = .81$
Female	39 (75%)	50 (82%)	89 (79%)	
Mean age, years (SD)	27.79 (11.52)	22.74 (8.02)	25.06 (10.06)	$t = 1.61$
Irish	40 (77%)	53 (87%)	93 (82%)	$\chi^2 = 1.91$
Other	12 (23%)	8 (13%)	20 (18%)	
Undergraduate	42 (81%)	55 (90%)	97 (86%)	$\chi^2 = 2.04$
Postgraduate	10 (19%)	6 (10%)	16 (14%)	

Note: None of the comparisons were statistically significant at the 0.05 level.

Table 2

Descriptive statistics and Post-hoc comparison of pre-, post- and follow-up scores for both ACT- and Control-groups on the primary dependent variable, GHQ-12.

		ACT	Control	*t*	df
Pre-treatment	M	14.90	13.92	0.87	237
	SD	6.54	5.09		
	N	52	61		
Post-treatment	M	10.56	13.13	−2.47*	237
	SD	6.12	4.94		
	N	52	61		
Follow-up	M	10.48	12.47	−1.71	237
	SD	5.21	6.24		
	N	44	57		

Note: "*" = $p < .05$.

Table 3

Post-hoc comparisons of GHQ at different phases of the study in the ACT and Control groups.

Group	Phase	*t*	df	*p*	*d*
ACT	Pre – Post	5.10	211	<.001	.70
	Pre – Follow-Up	4.98	217	<.001	.67
	Post – Follow-Up	0.16	217	.88	
Control	Pre – Post	1.00	211	.32	
	Pre – Follow-Up	1.89	213	.06	
	Post – Follow-Up	0.91	213	.36	

Note: Effect sizes were only calculated for statistically significant effects.

intervention for any of the DASS-subscales.

8. Process outcome results: experiential avoidance

8.1. Between group analysis

AAQ-2 mixed models analysis showed a significant effect of time F $(2,211) = 6.92$, $p = .001$, but did not show a significant effect of group F $(2,109) < 0.001$, $p > .99$ or time and group interaction F(1, 113.30) = 0.94, $p = .33$.

8.2. Within group analysis

Due to the importance of experiential avoidance in the ACT model, a within group analysis was conducted. This indicated a significant effect for the Intervention group between pre-intervention and follow-up *t* $(213) = 3.12$, $p = .03$, $d = 0.59$ (Fig. 2), no other within group comparisons were significant (pre-to post-intervention up $t(211) = 2.01$, $p = .69$, and post-intervention to follow-up up $t(213) = 0.95$, $p = 1.00$).

9. Discussion

The primary purpose of this randomized controlled study was to investigate the efficacy of a web-based ACT intervention on the general mental health of college students. The study also sought to examine effects of the intervention on students' Depression, Anxiety and Stress, and to measure the effect on psychological flexibility. Three exercises derived from the ACT components *contact with the present moment, defusion,* and *self as context* were tested.

The findings suggested that a brief web-based intervention focusing on these processes of ACT has potential beneficial effects on general mental health, and thus may be useful in an approach to student psychological health. Participants who received the ACT self-help intervention reported significantly better general mental health at post-treatment compared to the wait-list control group participants, who did not report significantly improvements in general mental health. The outcome is interesting in light of information that 98% of participants listened to each of the three ACT recordings just once over the treatment period, which translates into a total exposure time of just under 1 h per student. However, at follow up the differences were no longer significant.

The post-hoc analysis suggested that participants in the Intervention group had significantly better general mental health after the
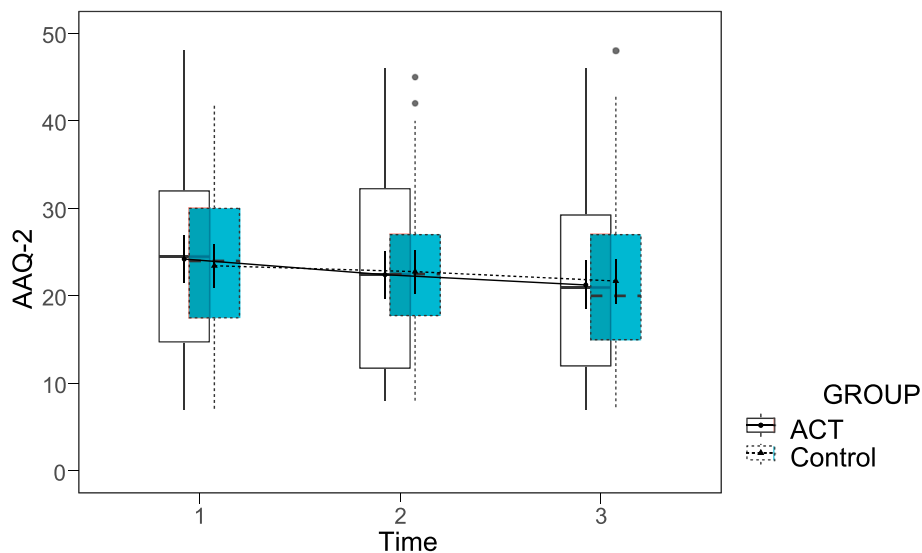
Fig. 2. Results on AAQ-2 at the three timepoints for the Intervention group and the control group.

intervention and at 3-week follow-up compared to their general mental health prior to the intervention. There was no significantly different change observed in general mental health from post-treatment to 3-week follow-up. This indicates that gains in general mental health were maintained, but not better at follow-up. No significant difference was observed for participants in the control group.

The findings corroborate post-treatment outcomes of recent studies among non-clinical populations, which showed the efficacy of ACT self-help interventions in increasing general mental health compared to a wait-list condition (Jeffcoat & Hayes, 2012; Levin et al., 2014; Pots et al., 2016). However, in contrast to these studies where general mental health gains were improved at both post-treatment and follow-up, the present study did not observe these improvements at follow-up. Nonetheless, it is important to note that the aforementioned intervention studies used the full ACT model and had considerably longer follow-up periods. The remaining processes that were included in those studies are also the ones that target the longevity of behavior change through infusing it with purpose.

The secondary outcome of on symptoms of depression, anxiety and stress showed that the brief web-based ACT interventions did not improve significantly compared to the wait-list control group. These results are largely inconsistent with recent research among non-clinical samples, which reported the efficacy of ACT self-help interventions in significantly improving depression, anxiety and stress in distressed participants compared to wait-list (Jeffcoat & Hayes, 2012; Pots et al., 2016). A possible reason for this is again that these studies all involved all components of ACT, however even one process alone has been shown to improve depression (Larsson, Hooper, Osborne, Bennett, & McHugh, 2016). If considered previous research has already shown ACT processes impact on depression, anxiety and stress (Ruiz, 2010), indicating that the former has been addressed, although arguably not in self-help delivery. It is clear that more research is needed on how which process can be used to its highest effect for which problem as suggested in the recent drive for Process-Based Therapy (Hayes & Hofmann, 2018). Using the ACT processes of Values and Committed Action for or principes from Behavioral Activation depression or Acceptance and Exposure for anxiety may have resulted in better impacts for these measures and could support a flexible and modular mental health support program.

Finally, the study sought to examine psychological inflexibility and emotional avoidance. Within the Intervention group a significant continual decrease in emotional avoidance was observed. The increase in reported psychological flexibility did not reach statistical significance from pre-treatment to post-treatment nor from post-treatment to follow-

up. However, at 3-week follow-up the changes were significantly large, with participants reporting considerably higher levels of psychological flexibility and conversely, lower levels of experiential avoidance, compared to pre-treatment measures. Nonetheless, the lack of condition effects on psychological flexibility/emotional avoidance at post-treatment raises a concern, given that extensive research showing that ACT significantly impacts this process (Bond et al., 2011). This may suggest that the AAQ-2 might not be sufficiently sensitive to only the part of the ACT model in such a brief intervention. Results may also be attributable to the limitation of a single treatment component in the intervention. In fact, research suggests that in addition to acceptance of experiences, value-based behavior is important for the development of psychological flexibility (Hayes et al., 2006). No value-based or specific acceptance component was included in the current intervention. The full ACT model is composed of considerably more elements, including a focus on values, and committed action. Thus, this trial design, incorporated just half of the processes of the ACT model, may have compromised the potential impact on psychological flexibility. Perhaps another more recent measure of psychological flexibility focusing less on experiential avoidance might have been useful.

The limited impact on outcomes in this study, especially in comparison with recent research among college students evaluating web-based *trans*-diagnostic prevention programs based on ACT (Levin et al., 2014; Räsänen et al., 2020) can possibly be explained by the limited amount of included processes as well as the amount of work spent on each process, the aforementioned studies also utilized more coherent treatment packages. This study only directed participants to the three audio exercises and did not give any more context, thus limiting both the width and depth of intervention in the interest of ease of dissemination. It is also possible that the exercises were ineffective in facilitating the core processes they aimed at facilitating or that the way they were delivered somehow limited their impact, suggesting possible future research more closely follow the process impact of exercises and varying the voice in which they are delivered.

An interesting find is that such large proportions of the sample scored over the cut-off for the included measures and yet did not say they had a psychiatric diagnosis. This can certainly be an example to the described unwillingness to seek help mentioned in the introduction. Since no contact with health care professionals means no diagnosis. It could also be due to problems in self-report such as social desirability, but also that cut-offs are often based on group level statistical analysis. Finally it can show that there is a difference between meeting criteria for diagnosis and self-report. Specifically, that diagnostic criteria that often includes

the criterion of "clinically significant distress" which is difficult to assess through self-report.

10. Limitations

Perhaps the biggest methodological weakness is the use of a wait-list control group and not active control group, consequently demand characteristics might somewhat account for the results. This type of design is also more likely to result in higher effect sizes than an active control group. This is a general drawback with all wait-list control conditions. Nonetheless, there is an argument for the role of wait-list designs (Rounsaville et al., 2001). Indeed, some issues of process changes are better considered at the outset in wait-list studies (Muto et al., 2011).

Another limitation is the usage of the AAQ-2 as a measure of psychological flexibility. It was selected as it is the most used measure within ACT research and is often cited as measuring psychological flexibility (e.g. Järvelä-Reijonen et al., 2020) or psychological inflexibility (e.g. Bond et al., 2011). It has come under criticism lately as a measure primarily of distress (e.g. Wolgast, 2014). The AAQ-2 has also been criticized for lacking discriminative validity (Tyndall et al., 2019). In the future other measures might yield a better understanding of the processes involved. Such as the CompACT (Francis et al., 2016), the MPFI (Rolffs et al., 2016) or the Psy-Flex (Gloster et al., 2021). One might also include more specific measures of the components, the Self Experiences Questionnaire (Yu, McCracken, & Norton, 2016), the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) or Cognitive Fusion Questionnaire (CFQ-13, Gillanders et al., 2014).

Further limitations to the generalizability are the limited geographic focus of the study, data collection was conducted at University College Dublin, the high proportion of female participants, coupled with the exclusive reliance on self-report. The high drop-out rate following randomization might indicate a bias in the participants that stayed in the study. In addition, as with most exercises and interventions offered online, there was no way to confirm that participants in the experimental group followed the intervention instructions and completed the intervention tasks as instructed. Finally, given the broad focus of the intervention and the limited incentive to partake, the burden of participation had to be kept minimal. Consequently, no data was collected on academic performance, treatment seeking, use of medications, diagnoses per se, and other potentially important variables. Academic demands, linked to the university calendar also complicated the examination, and the intervention period was neither lengthy nor intensive.

Despite these limitations, the present study provides encouragement that online exercises based on core processes of ACT are potentially helpful to general mental health. The efficacy of the study's online intervention in improving post intervention general mental health was a promising result, considering the Intervention group was exposed to just under 60 min of exercises over a 3-week period. The present study does not provide evidence to suggests that just using audio exercises specifically targeting contact with the present moment, self as context and defusion, will result in durable enhancements in psychological well-being for college students. Considering the effectiveness of laboratory based research on ACT processes (i.e. Levin et al., 2012) it is likely that more structure and guidance in contextualizing these exercises is needed.

For future research a better control of adherence to the intervention and guidande before or after the intervention would be advised, along with an examination of the relationship between intervention engagement and mental health outcomes. Also more robust measures of the included processes should be utilized. Likewise, the moderating effects of level of depression, anxiety and stress on the effect of the ACT interventions on the DASS 21-scales, which were non-significant in the present study, should also be investigated in a larger sample. Addressing the comparison of a web-based ACT program with an active control, for example, a web-based relaxation program or other processes in the ACT-

model would also be warranted. The results of this study are a preliminary step in investigating the benefit of web-based ACT interventions.

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